

IMPACT OF JAPANESE AID TO INDIA: AN ECONOMETRIC STUDY OF BILATERAL AID

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1. Introduction

This paper attempts to unravel the impact of bilateral aid by focusing on Japan's aid to India. Though the question of the impact of aid has received a great deal of attention [Please (1967)], Griffin and Enos (1970), Papanek (1973), and Weisskoff (1972)], systematic modeling and econometric testing are of more recent origin. Much of the earlier literature also focused on the aid-saving relationship whereas the later work asks the related but separate question: does aid go to government investment or consumption? A complementary question has also been raised regarding the effect, if any, of foreign aid on the revenue raising efforts of LDC governments receiving such aid. Does aid raise or lower taxation and borrowing from domestic sources?

Heller (1975) was the first to formulate a behavioural economic model in which these questions could be raised consistently. Interesting empirical results have since then been obtained in cross-country setting by Khan (1986), Mosley, Hudson and Horrel (1987) and Khan and Hoshino. Recently Pack and Pack (1988) have also addressed the fungibility issue. Gang and Khan (1991) departed from the cross-country tradition and used a time-series data set for a single recipient country. However in all cases all the donors were aggregated as a group.¹

The present paper continues the tradition of posing the question of the impact of aid rigorously in a behavioural model. At the same time it also departs from the tradition by posing this question *bilaterally*. For the first time, it had been possible to use a Heller-type model for a single donor (Japan) and a single recipient (India). Total aid is divided up into loans and grants so that the differential impacts, if any, of these two types of aid could also be investigated.

A two-stage strategy is required in trying to understand the links between bilateral aid and development. The first step would involve determining the effect of aid on public investment, taxation, government consumption etc. The second step would require relating public investment and consumption to developmental variables such as growth and income distribution. I attempt to carry out the first part of this research agenda in this paper.

¹Gang and Khan (1991) divided up donors to India in several groups. However each group contained many countries.

One precursor of this work, Gang and Khan (1991) found interesting positive relationships between aggregate aid to India and investment. While the results of the bilateral study confirm this, the link is somewhat weaker than before. A detailed comparison of the results of aggregate and the bilateral study forms the empirical core of the present paper.

The remainder of the paper is divided into four parts. After looking at Japan's aid to India in historical perspective in the next part, a model is introduced. Then in part III, I describe the data and estimation procedures. This is followed up with the interpretation of the findings and a comparison of these with the case where all donors are lumped together. Concluding remarks follow.

2. Japan's Foreign Aid to India

In this section the general pattern of economic assistance to India is described first. Next the pattern of Japan's aid to India is taken up. India has been a singularly large recipient of foreign aid.² Few countries have received so much aid from such varied sources.³ Figure 1 shows the general trends of aid over time. It should be noted that there has been change in the composition of types of aid given. In the early sixties grants comprised over 30% of the total, whereas the corresponding figure is about 15% for more recent years. In per capita terms aid peaked at Rs. 61 in 1966 and declined gradually to Rs. 23 in 1972 which was the

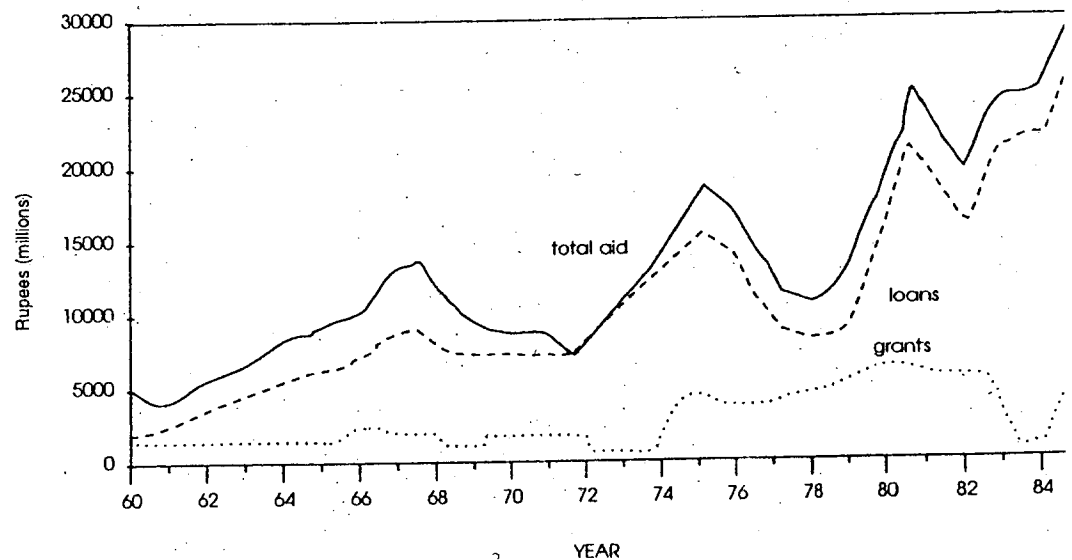


Fig. 1 Total aid, Grants and Loans to India 1960–1985 (in nominal rupees)

²India received approximately one billion dollars annually in the 60's and early 70's and two to three billions per annum the late 70's and early 80's.

³For an analysis of aid by sources see I. Gang and H.A.. Khan, Some determinants of foreign aid to India, 1960–1985, *World Development*.

lowest. As a percentage of GDP aid reached the highest and lowest figures of 4.5% in 1966 and 1.25% in 1984 respectively.

Attention has largely been given to big donors from the West and the politically rival donors from the Eastern block countries. Recent work by Gang and Khan tried to classify these various donors more systematically by using principal components and factor analytic methods. Judged by the factor scores in a rotated factor matrix Japan falls in a group of countries including U.S. and U.K. and some Scandinavian countries.⁴ It is interesting to consider the volume and trends of Japanese aid to India over time. Table 1 shows Japan's aid to India from 1960 to 1985 in dollars.

TABLE 1
JAPAN'S AID (GRANTS AND LOANS) TO INDIA (BY MILLIONS OF US \$)

	Total bilateral	Japan's aid	Jpn/total (%)
1960	8107.6290	510.1695	6.3
1961	8779.0133	297.5309	3.4
1962	11025.3013	303.5573	2.8
1963	12610.152	650.362294	5.2
1964	14265.4496	817.60793	5.7
1965	12726.7418	938.601754	7.4
1966	16391.418	809.6515	4.9
1967	16310.173	1158.809	7.1
1968	16264.851	1683.168	10.3
1969	13504.7523	1078.571	8.0
1970	14198.164	841.0138	5.9
1971	13426.703	914.6608	6.8
1972	9757.8734	1220.472	12.5
1973	11864.2384	1584.437	13.4
1974	10556.1799	1342.697	12.7
1975	11525.326	1293.777	11.2
1976	13354.621	1763.587	13.2
1977	10477.065	994.7575	9.5
1978	9865.04	1235.219	12.5
1979	8048.999	734.9666	9.1
1980	8701.000	902.0000	10.4
1981	6453.299	326.92304	5.1
1982	6148.557	1088.2852	17.7
1983	6014.753	1082.29815	18.0
1984	6824.561	498.538	7.3

⁴*Ibid.*, pp. 9-17.

During the sixties Japan's contribution was modest—about 5% of the total bilateral aid. At the lowest it was 297.5309 million U.S. dollars or 3.4% of total for 1961. It reached a maximum of 1683.168 million U.S. dollars exceeding 10% of the total bilateral aid to India in 1968 before falling off for the next two years. Starting in 1971 Japan's aid began to rise reaching an all time high of 1763.587 million dollars in 1976. In that year Japanese aid comprised 13.2% of all bilateral aid. Even though the volume never rose to that level, in the early eighties Japan's aid to India came to make up almost one-fifth of all bilateral aid. In the seventies more than 80% of Japanese aid went to Asia. India was the third largest recipient after Indonesia and S. Korea⁵.

In 1983, India dropped off to the fifth place but still received 8.3% of total bilateral aid given by Japan⁶. Thus Japan is an important donor for India. India, by the same token, has become one of the important target countries for Japan. It is, therefore, quite appropriate to inquire about the impact of this aid which we now proceed to do. The model used is a behavioral one described in the following section.

3. The Model

The variables of the model include the budgetary categories which are relevant for determining the effect of Japanese aid on investment, taxation and consumption by the public sector in India. The same model has been used by Gang and Khan (forthcoming, a) to estimate the impact of total aid (from all sources) flow on India. The theoretical model takes into account development and nondevelopment expenditures in both the current and the capital budget. The government finances these expenditures from both domestic and foreign resources.

The Indian policymakers are assumed to consider alternative uses of public resources including foreign aid. These alternative uses of resources are public investment (I_g), socio-economic services (G_s), and bureaucratic expenditures (G_c). The policy makers are also assumed to choose a combination of revenue instruments such as taxes, borrowing and foreign financing.

The budgeting procedure involves setting of targets for categories of expenditures and revenues from domestic sources. The goal is to meet these targets. However, in practice undershooting or overshooting may occur. Therefore, the policymakers are supposed to have the following objective function:

$$\begin{aligned}
 U = & \alpha_0 + \alpha_1(I_g - I_g^*) - (\alpha_2/2)(I_g - I_g^*)^2 + \alpha_3(G_c - G_c^*) \\
 & - (\alpha_4/2)(G_c - G_c^*)^2 + \alpha_5(G_s - G_s^*) - (\alpha_6/2)(G_s - G_s^*)^2 \\
 & - \alpha_7(T - T^*) - (\alpha_8/2)(T - T^*)^2 - \alpha_9(B - B^*) - (\alpha_{10}/2)(B - B^*)^2 \quad (1)
 \end{aligned}$$

⁵For example, in 1973, 88.1% of the total ODA went to Asia. Indonesia received about 22.9%, followed by South Korea (19.8%) and India (10.2%) computed from OECD report 1986.

⁶W.L. Brooks and R.M. Orr, Japan's foreign economic assistance, *Asian Survey*, XXV(3) (March 1985), 330.

where I_g is public investment expenditure for development purposes by the government, G_c is civil expenditure by the government, G_s is socioeconomic expenditure by the government, T is total tax revenues, B is borrowing by the government from domestic sources, $\alpha_i > 0$, and the "*" variables represent target levels for the variables we have just defined.

The economic and institutional constraints to which this maximization problem is subjected are the following:

$$I_g = B + (1 - \rho_1)T + (1 - \rho_2)A_1 + (1 - \rho_3)A_2 \quad (2)$$

and

$$G_s + G_c = \rho_1 T + \rho_2 A_1 + \rho_3 A_2 \quad (3)$$

where $0 \leq \rho_i \leq 1$, $i = 1, 2, 3$.

ρ_1 , ρ_2 and ρ_3 are the fractions of taxes, foreign grants (A_1) and foreign loans (A_2), respectively, going to either bureaucratic consumption or socio-economic expenditures. The two constraints, therefore, capture alternative uses of government receipts. The first constraint allows investment to be funded partially or totally from *all* sources of revenue. The second constraint allows for fungibility of tax revenues and foreign aid by letting government consumption to be financed out of these receipts as well.

How will the Indian policy makers respond to an increased flow of Japanese foreign aid in this model? The comparative static results can be summarized as follows:⁷

- (1) Aid can be used in part to reduce taxes and borrowing,
- (2) Aid will lead to increased public investment if the fraction of aid used to finance public investment projects exceeds the fraction of taxes and borrowing used to do the same. The reason for this is clear. Since the presence of aid results in a reduction of taxes and borrowing, for such aid to lead to a net increase in public investment the proportion of increased aid going to investment must be greater than the proportion by which investment is decreased because of a decline in revenues from taxes and borrowing.
- (3) In an analogous manner, civil and socioeconomic expenditure by the government increases only when the fraction of taxes financing noninvestment items in the government budget is less than the fraction of aid which is used to finance the same items.

These comparative static results establish qualitatively the proposition that there is a trade-off between public investment and other spending by the government. In general, such a trade-off exists between more or less productive (in terms of growth) uses of government revenues. The reason for this is quite intuitive. Foreign aid, regardless of its source, always enlarges the consumption possibilities frontier. At the same time, such flows from outside make possible a reduction in

⁷For a formal derivation of these results see I.N. Gang and H.A. Khan, Foreign Aid and Public Expenditures in LDCs, *Atlantic Economic Journal*, 14, 1986 pp. 56-58.

domestic financing of investment projects, leaving room for further consumption. These qualitative results are valuable. However, in the rest of the paper I estimate the quantitative effects of two different types of aid given to India by Japan. It is assumed that having allocated aid from non-Japanese sources the Indian policymakers then allocate Japanese aid according to the behavioral rules prescribed by the model.

The estimating equations are the result of solving the first order conditions of the optimization problem of the Indian policymaker. (Please see the appendix for their derivation.) They give us a system of simultaneous equations which are non-linear in some of the parameters.

$$G_s = \beta_1 - (1 - \beta_2)G_c^* + \beta_2 G_s^* + \rho_1(1 - \beta_2)T + \rho_2(1 - \beta_2)A_1 + \mu_1 - \rho_3(1 - \beta_3)A_2 \quad (4)$$

$$G_c = -\beta_1 + (1 - \beta_2)G_c^* - \beta_2 G_s^* + \beta_2 \rho_1 T + \beta_2 \rho_2 A_1 + \beta_2 \rho_3 A_2 + \mu_2 \quad (5)$$

$$T = \beta_3 + \rho_1 \beta_4 (G_c^* - G_c) + \beta_5 T^* + \beta_6 (1 - \rho_1) \{I_g - (1 - \rho_2)A_1 + \mu_3 - (1 - \rho_3)A_2\} \quad (6)$$

$$I_g = \beta_7 + (1 - \beta_8)I_g^* + \beta_8 \{(1 - \rho_1)T + (1 - \rho_2)A_1 + (1 - \rho_3)A_2\} + \mu_4 \quad (7)$$

4. Data and Estimation

The data set employed is unique in the sense that it enables us to examine the impact of aid from one single donor country to a recipient country over time.⁸ The period covered is from 1960 to 1984. All the data including foreign aid statistics are in millions of rupees in terms of the 1980–81 gross domestic product deflator. Most of the series are drawn from *Indian Economic Statistics—Public Finance*, published annually by the Ministry of Finance. These are supplemented by several series drawn from the *National Accounts Statistics*, the *Reserve Bank of India Bulletin*, *Economic Survey*, and H.L. Chandhok's *Database of the India Economy* (New Delhi: The Policy Group, forthcoming). One of the great advantages of the data from the *Indian Economics Statistics—Public Finance* is its degree of disaggregation.

Indian budgetary data are divided into 4 parts: revenue receipts and expenditures, and capital receipts and expenditures. Expenditures are further divided into development and nondevelopment categories. The revenue budget consists of the revenue receipts of the government (tax and other revenues) and the expenditure met from these receipts. Broadly speaking, expenditure which does not result in the creation of assets is treated as revenue expenditure. The capital budget consists of capital receipts and payments. The main items of capital receipts are loans

⁸This data set has been compiled by Gang and Khan. The above description draws on Gang and Khan (1991), Foreign aid, taxes and public investment, *Journal of Development Economics*.

raised by the Government from the public, borrowing from the Reserve Bank and other parties through the Treasury Bills, and so on. Capital expenditures consist of expenditure on the acquisition of assets such as land, building, and equipment.

Revenue expenditures, both developmental and nondevelopmental, reflect current consumption by the government, i.e., expenditure on the recurrent budget. Revenue receipts include both tax and nontax revenues. Capital expenditure reflects nonconsumption expenditures by the government, i.e., expenditure with some investment motives. The above categorization allows us to isolate investment spending for development purposes from other expenditures. However, the budgetary categories do not completely correspond to economic variables. The degree of disaggregation of the data allows us to 'adjust' the series so that the empirical categories reflect more accurately the theoretical variables.⁹

Determining the values of the planned variables requires some work. While in an ideal world we would know what these targets are, we are forced to approximate these targets by estimating the actual values on a series of instrumental variables and forecasting the target values, that is the planned variables. Heller, and Mosley, Hudson and Horrell, did not estimate the values of their target variables but rather defined them to be linear combinations of the instrumental variables. However, we estimate these planned variables independently of the equation system.

To estimate each target variable we specify an equation relating the actual variable to some instruments. We then regress the actual variable on the instruments using the Cochrane-Orcutt procedure to correct for first-order autocorrelation. To obtain planned I_g we regress actual I_g on a constant, lagged GDP and total gross domestic capital formation from the private sector. We then use the fitted values of the dependent variable as the planned or targeted variable. We find planned T , in the same manner, by regressing T on a constant, GDP and lagged imports and again using the fitted values of the dependent variables as the targeted variables. Planned G_c is obtained by regressing G_c on a constant and lagged G_c , while planned G_s is arrived at by regressing G_s on primary school enrollment, GDP and the change in GDP. In both of these latter cases we also use the fitted values of the dependent variable as the targeted variable.¹⁰ In addition, we also assume that planned borrowing is zero.¹¹

⁹These variables correspond, at least in spirit, to those of Heller. However, the data for India generally do not include public sector (as opposed to government) expenditures, with the exception of the railways and posts and telegraphs. For our purpose, investment by the enterprises out of retained profit is not relevant since we are interested in only that part of investment which is financed by the government.

¹⁰This procedure is similar to that used in Sargent (1976). For a discussion of the rationale for choosing the particular functional relationships see Heller (1975) and Mosley, Hudson, and Horrell (1987).

¹¹See Minhas (1987) for a discussion of the recent behavior of Indian policymakers. Minhas points out that while deficit financing (mainly via money creation) has occurred in the past, it was unplanned for. It is only under the 7th plan (1985-90) that $B^* > 0$.

All the data on foreign aid is taken from the annual editions of *Economic Survey*.¹² Since we are interested in the budgetary effects of aid, we look at disbursements of aid rather than authorizations. Furthermore, in this paper we look at Japan's aid to India by distinguishing between grants and loans. Grants imply there are no repayments. Loans, as foreign aid, imply that they were given on concessional terms, i.e., they were cheaper than loans taken from commercial establishments would have been.

In estimating the four equation system (4)–(7) with four endogenous variables we note that the system is overidentified. Hence a two stage least squares procedure is necessary at the minimum. Furthermore, there are non-linearities in some parameters. The use of non-linear full information maximum likelihood estimation procedure leads to a smaller asymptotic variance-covariance matrix than single equation methods.

5. The Impact of Japanese Aid on India

In this section results are presented from the estimated model. In Table 2, the impact of loans and grants from Japan to India on the fiscal behavior of the government is summarized. Later on, the efficacy (or lack of it) of aid from Japan is compared and contrasted with the performance of foreign aid to India from all sources, as given in Table 3.

TABLE 2
THE IMPACT OF JAPANESE FOREIGN AID ON THE GOVERNMENT'S FISCAL
BEHAVIOR IN INDIA

Parameter	Coefficient	Standard error	T-ratio
P1	0.81	0.20380	3.98
P2	0.58	0.26822	2.16
P3	0.23	0.34354	32.83
B1	1.04	1.00000	1.03
B2	1.07	0.78047	13.76
B3	1.00	1.00000	1.00
B4	-0.38	0.90326	-0.42
B5	0.35	0.34259	0.10
B6	28.11	0.70153	400.62
B7	1.01	0.99993	1.01
B8	1.00	0.17117	584.24

Note: All co-efficients have been rounded up to two decimals.

¹²Data for latter years is exclusive of suppliers' credits and commercial borrowing; however, for earlier years this is not clear.

TABLE 3
THE IMPACT OF FOREIGN AID ON INDIA FROM ALL DONORS

Parameter	Estimate	Standard.error	T-ratio
P1	1.08	0.03	32.26
P2	-0.79	0.52	-1.53
P3	-0.03	0.41	-0.07
B1	-125.57	2616.82	-0.05
B2	0.72	0.06	12.52
B3	2162.67	6260.71	0.35
B4	-0.43	0.24	-1.80
B5	0.98	0.06	15.24
B6	-2.17	2.74	-0.79
B7	214.53	876.62	0.24
B8	0.00	0.06	0.04

The model was constructed in order to focus specifically on the four endogenous variables, I_g , G_c , G_s and T . We investigate now the impact on these variables of any change in the type and level of aid from Japan.

Three parameters from the budget constraints, ρ_1 , ρ_2 , ρ_3 reflect the fungibility of aid. Most of tax revenues remain in the current budget. ρ_1 has a value of .81 and is significant at .0001 level. In other words, *ceteris paribus*, if Japan were the only donor, the Indian government would devote 81% of tax revenue to its current expenditures. The value of the same parameter when other sources of aid are taken into account, is 1.08 as can be seen from Table 3. Thus Japanese aid by itself is more effective in funnelling some tax revenue into capital expenditure than aggregate aid.

Both ρ_2 and ρ_3 turn out to be statistically significant. This contrasts with the results for India in the aggregate. One look at Table 3 will show in the aggregate they were insignificant for India. However, in the Japanese case there is some leakage from both grants and loans into consumption. The extent of leakage varies depending on whether one looks at grants or loans. In the former case, 58% of the grants are used for consumption purposes.

For loans, however, 77% ends up in public investment, and the rest goes towards 'civil' and socio-economic consumption. Thus in the Indian case, in going from the aggregate to the bilateral data on a single country (in this case Japan) basis we do observe differences in the behavior of the government. These results also accord qualitatively with the findings of Heller (1975) and Khan (1986) and Khan and Hoshino (1988) that aid is fungible. Quantitatively, however, these results put India more at the investment end of the investment-consumption frontier. Of course, all the other studies except Gang and Khan (forthcoming, a) mentioned used pooled cross-section time-series data and hence are not strictly comparable with the current study which uses time-series data for a single donor and a single recipient.

Scrutinizing the parameter estimates further we are led to consider the various " β " terms. These estimates reveal some aspects of the functioning of the public sector in India. β_2 connects government socioeconomic consumption to the current revenue and to targeted expenditures. A positive β_2 with a value of 1.07 which is statistically significant indicates that setting a higher targeted G_s will mean an allocation of proportionately more funds to G_s and less to G_c . Thus, to the extent that G_s contains investment in human resources and infrastructure, raising that target will help move funds away from bureaucratic consumption into the socioeconomic categories. In an analogous way, in equation (5) β_2 designates the proportion of aid and taxes going to G_c as opposed to G_s . Thus, G_c and G_s are clearly competing expenditures and the government has some flexibility in choosing how to allocate tax revenue and foreign aid among them. In fact, in this case the value of β_2 clearly favors G_s over G_c . If G_s is valued more than G_c in establishing welfare then this can be said to be a salutary effect of Japanese aid to India.

* The parameters β_4 and β_5 bring out the link between targeted and actual expenditures and the tax burden. Equation (6) shows the linkages. To illustrate the links further, let us assume G_c^* exceeds G_c , or targeted expenditure on civil consumption is more than the actual expenditure on this category. With $p_1 > 0$, $\beta_4 < 0$ (-0.38) indicates that in this case tax burden will be reduced. If $\beta_4 < 0$ and $G_c^* < G_c$ then the authorities would need to increase the tax burden to cover the unplanned portion of G_c . So far these results agree qualitatively with those contained in Table 3. Quantitatively, there is one important difference to be noted. In all cases discussed so far the Japanese foreign aid by itself offers the government more flexibility in shifting expenditures and sources of revenue than do all the donors combined.

The value of β_5 in Table 2 is smaller than that in Table 3. A value of β_5 close to 1 would have meant that higher targeted taxes translate directly into equivalent rupees of higher actual taxes for the Indian government. Indeed, this is so when *all* aid to India is concerned. However, for Japanese aid by itself not only is the estimate for β_5 small, but it is also statistically not significant at .05 level. This implies that Japanese aid does not force the Indian tax authorities to behave in this manner. By contrast with Table 3, β_6 (28.1) is a large, positive, statistically significant number. This means that if we just consider Japanese aid alone, domestic revenue raising decision is not influenced as heavily by the need to meet civil consumption as it is when all aid is taken into account. This is an interesting finding and can be explained in two complementary ways. First, the Japanese aid has been given less lavishly and more conservatively than is the case with some other donors (e.g. the U.S.). Secondly, Japanese aid, though substantial, has never been more than 5% of the total aid received by India. Thus the rational Indian policymakers could not perceive the presence of Japanese aid as a factor in deciding about domestic sources of revenue. However, as Japan's importance as a donor increases this may very well change. This looms as an issue for further empirical research.

6. Summary and Conclusions

The question, does bilateral aid influence the fiscal behavior of an LDC government, can be answered affirmatively in the case studies here. At the same time the approach taken here reveals quantitatively which aspects of fiscal behavior are affected. It turns out that taxation, public investment and government bureaucratic as well as socio-economic consumption in India have been affected by foreign aid from Japan. Thus, the fungibility of bilateral foreign aid in this case can be determined precisely.

By dividing up total aid into the loan and grant categories the aforementioned fungibility issue can be explored in more detail. It was found for example that 58% of the grants go for public consumption as opposed to only 23% of the loans. Both grants and loans affect the spending of tax revenues. About 19% of the tax revenues is diverted to the capital budget in the presence of Japanese foreign aid.

In general, these results confirm qualitatively the findings of previous studies using aid data from all sources. At the same time, there are some differences regarding the precise effects of foreign aid which emerge only in the context of bilateralism. For example, it was observed that India turned out to be more at the investment end of the investment-consumption frontier among the governments receiving foreign aid. However, in the bilateral case there is more flexibility in the allocation of aid between consumption and investment than in the aggregate study of Gang and Khan (1991). On the revenue side the finding that Japanese aid pulls tax revenues away from current to capital budget also contrasts with previous findings.

Given that bilateral aid is such an important component of total aid giving, the results here should motivate more studies involving pairs of donors and recipients. Since Japan has become one of the major donors of aid in general the results from the Indian case may suggest similar effects in other cases as well. In any case the relevance of Japanese aid for Indian public sector behavior is underlined by the present study.

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