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FOREIGN EXCHANGE AND FISCAL IMPACT OF A PROJECT: A METHODOLOGICAL FRAMEWORK FOR ESTIMATION

by

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FOREWORD

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I. INTRODUCTION

1. An issue of considerable concern in some Asian developing countries is the steady erosion of public sector resources available for development. While the burden of debt from domestic and external borrowing has grown, the incomes that have accrued from investments financed by these borrowings, have been small and in some cases negative. In addition, the recurrent expenditure resulting from past investments has continued to mount. The net result has been that internally generated resources available for development are steadily declining. In fact, in some developing countries, a stage has now been reached where virtually the entire public sector development expenditure is being financed by domestic and external borrowing. A recent study on the performance of the public sector in South and Southeast Asian countries indicates that the net rate of return on investment of many public sector enterprises is very low or even negative.[1] Urgent action is necessary to increase the efficiency and profitability of public sector enterprises and divest those which can be better managed by the private sector.

2. In the judgement of experts, the sharp fall in real commodity prices signifies a long-run trend and cannot be considered as a temporary phenomenon. Thus, while the low commodity prices have aggravated the balance of payments problems, the poor performance of the public sector enterprises has worsened the budget deficits of some governments. These two constraints have reached crisis proportions in some developing countries and are threatening the development process. The feasibility of any strategic response to ensuring growth with equity will be greatly influenced by how these constraints are removed.

3. With the emergence of balance of payments and budgetary deficits as major macroeconomic constraints facing many Asian developing countries, there is concern that new investment projects should, to the extent possible, alleviate rather than aggravate these macroeconomic constraints. Alternatively, the foreign exchange and fiscal impact of a proposed project should be explicitly considered. Two approaches are possible. First, these issues could be explicitly incorporated in the methodology used in the economic analysis of projects by the adoption of social cost-benefit analysis (SCBA). However, there are major methodological and empirical problems associated with SCBA.[2] Second, efficiency analysis could continue to be used, but the impact of a project on foreign exchange and government budget should be explicitly derived and stated. This information could be used for redesigning projects through exploring trade-offs.

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1 Kohli, K. N., "Financing Public Sector Development Expenditure: The Asian Experience", Asian Development Review, Vol. 5, No. 2, 1987.

2 Ali, I., Emerging Issues in Asia and Social Cost-Benefit Analysis, Economics Office Report Series No. 41. September 1988.

4. The purpose of this paper is to take the second approach and to describe a framework for estimating the foreign exchange and fiscal effects of an investment project whose ex-ante viability is being assessed using the efficiency criterion. The methodology and empirical content of efficiency analysis will be the starting point for determining additional information and methodology to determine the stated impacts. The paper begins by describing the meaning of economic viability and alternative ways of expressing it. This discussion is followed by the relationship between economic, financial and fiscal variables. While the economic variables associated with a project are directly linked to the foreign exchange impact of a project, the financial variables provide the starting point for determining the fiscal effects. The fiscal impact can be derived from the relationship between economic and financial variables. The methodological framework developed is illustrated through a simple numerical illustration.

II. ECONOMIC VIABILITY AND FOREIGN EXCHANGE IMPACT

5. The economic analysis of projects involves an assessment of costs and benefits. First, costs and benefits need to be identified. Second, they must be quantified and valued by a common yardstick or numeraire. Third, costs and benefits should be compared by the use of investment criteria. It is assumed that costs and benefits have been identified. In efficiency analysis, the valuation of inputs and outputs of a project is done in terms of the opportunity cost for the country. Accounting prices or shadow prices are used for this purpose. The starting point of all investment criteria is that if benefits exceed costs when measured by a common yardstick, the project is acceptable; if not, the project is rejected. This is known as the general economic profitability criterion. The excess of benefits over costs can be expressed in a number of ways, and this has led to alternative investment criteria.[3]

6. Consider an import-substitution project (i) which uses domestically produced inputs (j), imported inputs (m) and primary factors of production (f). Let a_{ji}, a_{mi} and a_{fi} indicate the direct amounts of domestically produced, imported and primary factor inputs used per unit of output i. Assume that p_i^s, p_m^s, p_j^s and p_f^s represent shadow prices for output, imported inputs, domestically produced inputs and primary factors of production respectively. Under the general economic profitability criterion:

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3 The equivalence of the general profitability and the rate of return to capital criteria was established in Chenery, H.B., Comparative Advantage and Development Policy, American Economic Review, March 1961. The equivalence of these criteria and the domestic resource cost criterion was shown in Bruno, M., The Optimal Selection of Export-Promoting and Import Substituting Projects in Planning the External Sector: Techniques, Problems, and Policies, New York, United Nations, 1965.

$$B_i = p_i^s - \sum_j a_{ji}\, p_j^s - \sum_m a_{mi}\, p_m^s - \sum_f a_{fi}\, p_f^s \gtreqless 0 \qquad (1)$$

shown in equation (1), the project will be accepted if the discounted value of net benefits (B_i) exceeds or is equal to zero, and is rejected if this value is negative.[4, 5] The valuation of inputs and output is made in terms of shadow prices.

7. The domestically produced inputs can be decomposed into traded goods and primary factors.[6] The decomposition is carried out by the use of a semi-input-output method that involves going down the input-output structure until a traded input or a primary factor is reached. This is done by utilizing the elements of the matrix of direct and indirect traded input and factor input coefficients for non-traded goods.[7] Denoting the total (direct and indirect) requirements of product j per unit of output of product i by r_{ji}, the full decomposition of the domestically produced input implies that the general profitability criterion can be expressed as

$$B_i = p_i^w e^s - \sum_j \sum_m a_{mj}\, p_m^w e^s\, r_{ji} - \sum_j \sum_f a_{fj}\, p_f^s\, r_{ji} \gtreqless 0 \qquad (2)$$

where $$p_i^s = p_i^w e^s \qquad (3)$$

$$p_m^s = p_m^w e^s \qquad (4)$$

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4 If the flow of benefits and costs are constant over time, their present values can be approximated by dividing annual flows by the discount rate. See Layard, R., Cost-Benefit Analysis, Penguin, Harmondsworth, Middlesex, 1974, pp 45,66.

5 The formulation of (1) has been stated for the case of a one-period production process to simplify the algebra. It can easily be adapted to the case when costs and benefits occur over time.

6 Little, I.M.D. and J.A. Mirrlees, Manual of Industrial Project Analysis in Developing Countries, OECD, Paris 1968.

7 See Powers, T.A., Estimating Accounting Prices for Project Appraisal, Inter-American Development Bank, Washington, D.C., 1981; and Balassa, B., The "Effects Method" of Project Evaluation, Oxford Bulletin of Economics and Statistics, Vol. 38, No. 4, 1976 for algebraic treatments.

and p^w represents world or border prices and e^s is the shadow exchange rate. The relationship between equations (1) and (2) can be seen by the treatment of domestically produced inputs which are divided into two parts: (i) traded inputs; and (ii) primary factors, used both directly and indirectly in the production of domestically produced goods. The former is then combined with the traded inputs, and the latter with the primary factors, used directly in the project.

8. From (2), it can be seen that

$$B_i \gtreqless 0$$

implies

$$\frac{\sum_j \sum_f a_{fj}\, p_f^s\, r_{ji}}{p_i^w - \sum_j \sum_m a_{mj}\, p_m^w\, r_{ji}} \lesseqgtr e^s \qquad (5)$$

The numerator gives the direct plus indirect domestic resource cost while the denominator represents the net gain in foreign exchange. The ratio (5) states that if the general profitability condition is fulfilled, the domestic resource cost of earning one unit of foreign exchange in the project will be equal or less than the shadow exchange rate. Alternatively, the project is economically viable if the domestic resource cost expressed in shadow prices of earning or saving a net unit of foreign exchange is less than or equal to the shadow exchange rate.[8]

9. The important result that follows from this analysis is that when the general profitability condition is fulfilled, the contribution of a project in terms of efficient net foreign exchange earning or saving will always be positive. Efficiency is defined in terms of domestic resource cost per unit of net foreign exchange earnings being less than or equal to the shadow exchange rate. The important issue that comes up from this discussion is that the relevant aspect to consider is not foreign exchange earnings but the resource cost at which the foreign exchange earning is made.

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8 While the derivation from the general profitability to the domestic resource criterion can be made when output of the activity or project leads to foreign exchange saving or earning, this derivation is not possible for a non-traded output. In this case, viability in terms of the general profitability criterion is perfectly compatible with net foreign exchange outflow.

III. FINANCIAL PRICES AND FISCAL IMPACT

10. The resource flows in equations (1) and (2) have been expressed in shadow prices. These resource flows could also be expressed in market prices. To derive the fiscal impact of a project, resource flows at market or domestic prices will need to be considered. Consider the import substitution project described in Section II. The domestic price of the product p_i^d will be given by

$$p_i^d = \sum_j a_{ji} p_j^d + \sum_m a_{mi} p_m^d + \sum_f a_{fi} p_f^d \qquad (6)$$

where the superscript d refers to domestic. As in the case of (2), the domestically produced inputs are broken down and the process of decomposition is continued by going back in the product chain until imports or primary factors are reached. Full decomposition will lead to

$$p_i^d = \sum_j \sum_m a_{mj} r_{ji} p_m^d + \sum_j \sum_f a_{fj} r_{ji} p_f^d \qquad (7)$$

[domestic price] = [domestic value of direct and indirect imported inputs] + [domestic value of renumeration of primary factors used directly and indirectly in production of output]

or

[domestic price] = [domestic value of direct and indirect imported inputs] + [domestic value of direct plus indirect value added per unit of output]

11. Using the small country assumption, the relationship between world and domestic prices for imported items will be given by

$$p_i^d = (1 + t_i)\ p_i^w\ e \qquad (8)$$

$$p_m^d = (1 + t_m)\ p_m^w\ e \qquad (9)$$

where t_i and t_m are the tariffs on imported output and inputs, p_i^w and p_m^w world prices for imported output and inputs and e is the official exchange rate. Substituting (8) and (9) in (7) leads to

$$(1 + t_i)\ p_i^w\ e = \sum_j \sum_m a_{mj}\ r_{ji}\ (1 + t_m)\ p_m^w\ e + \sum_j \sum_f a_{fj}\ r_{ji}\ p_f^d \qquad (10)$$

Rearranging the terms of (10) gives

$$\sum_j \sum_f a_{fj}\ r_{ji}\ p_f^d - (t_i\ p_i^w\ e - \sum_j \sum_m a_{mj}\ r_{ji}\ t_m\ p_m^w\ e)$$

$$= (p_i^w - \sum_j \sum_m a_{mj}\ r_{ji}\ p_m^w)\ e \qquad (11)$$

[Direct plus Indirect Value Added] - [Net loss of revenue] = [net gain in foreign exchange in terms of domestic currency]

[Net loss of revenue] = [Difference between tariff revenue foregone on the product and the tariff levied on imported inputs used directly and indirectly in its domestic manufacture]

[Net gain in foreign Exchange] = [Difference between world market price of product and world market cost of direct and indirect inputs] x official exchange rate.

Equation (11) indicates that the net loss in tariff revenue can be equated to the difference between domestic value added and the domestic currency equivalent of net foreign exchange savings.

12. Combining the information on direct and indirect inputs of traded and primary factors of production used in the economic analysis with market or domestic prices will enable an assessment of the foreign exchange and fiscal impact of a project producing a tradeable good. Export products will be valued at f o b prices and import substituting products together with imported inputs at c i f prices. The net loss in tariff revenue is calculated on the assumption that an import substituting project replaces foreign goods imported under tariff protection. Export subsidies will involve a tariff loss with $p_i^d = (1 + s_x)\ p_i^w\ e$ where s_x represents the export subsidy. Export taxes will represent a gain in revenue.

13. Consider a case where the project output is non-traded. Using the same assumptions underlying equations (6) and (7), the following will be applicable

$$MC_i^d = \sum_j \sum_m a_{mj}\ r_{ji}\ p_m^d + \sum_j \sum_m a_{fj}\ r_{ji}\ p_f^d \qquad (11)$$

where MC_i^d is the marginal cost for producing good i expressed in domestic or market prices. A pricing rule for public utility is used whereby

$$p_i^d = (1 - \alpha)\ MC_i^d \qquad (12)$$

implying that the domestic price is held below marginal cost. The public utility will need to be subsidized by $\alpha\ MC_i^d$ for every unit of output sold. The net fiscal impact of the project for every unit of output produced will be given by

$$-\alpha\ MC_i^d + \sum_j \sum_m a_{mj}\ r_{ji}\ t_m\ p_m^w\ e$$

and the foreign exchange impact for every unit of output produced will be

$$-\sum_j \sum_m a_{mj}\ r_{ji}\ p_m^w$$

14. The discussion in this section indicates that the resource flows expressed in domestic or financial prices will be the starting point for estimating the foreign exchange and fiscal impact of a project. The data that will be available from the economic analysis will include the direct and indirect traded inputs and the primary factors of production used in the production of good under consideration. The financial price data required will consist of the official exchange rate, import tariffs or export subsidies and taxes and pricing rules for the non-traded goods and services.

15. In principle, the semi input-ouput methodology which decomposes all domestically produced inputs into imported inputs and primary factors of production and is the basis for the discussions in Sections II and III has been widely accepted as a framework in the economic analysis of projects.[9] In practice, the decomposition is often not carried out and the analysis is undertaken with direct input components rather than total (direct and indirect) input components. In this situation, only the direct foreign exchange and fiscal impacts can be estimated.

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9 The World Bank, Operational Manual Statement: Economic Analysis of Projects, No. 2.21, May 1980; Asian Development Bank, Guidelines for Economic Analysis of Projects, May 1983, August 1987; Inter-American Development Bank, Powers, op.cit.

16. Consider the case of the import substitution project with the added complication that the domestically produced inputs are taxed (t^d) as well. In this case, equations (6), (8), (9) and the following are relevant.

$$P_j^d = (1 + t_j^d)\ MC_j^d \qquad (13)$$

Substituting equations (8), (9) and (13) in (6) we get

$$(1 + t_i)\ P_i^w\ e - \sum_j a_{ji}\ (1 + t_j^d)\ MC_j^d + \sum_m a_{mi}\ (1 + t_m)\ P_m^w\ e + \sum_f a_{fi}\ P_f^d \qquad (14)$$

Rearranging terms gives

$$\left[\sum_f a_{fi}\ P_f^d + \sum_j a_{ji}\ MC_j^d \right] + \left[\sum_j a_{ji}\ t_j^d\ MC_j^d + \sum_m a_{mi}\ t_m\ P_m^w\ e - t_i\ P_i^w\ e \right]$$

$$= \left[P_i^w - \sum_m a_{mi}\ P_m^w \right] e \qquad (15)$$

The second term on the left hand side gives the direct net loss in tax and revenue and the term on the right hand side gives the direct net gain in foreign exchange. If the output is non-traded with a domestic tax or subsidy, then equations (6), (9), (12) and (13) can be used to derive the direct net tariff and tax revenue and foreign exchange impacts of a project.

17. Clearly, full decomposition in the economic analysis into traded and primary factor inputs will lead to an accurate estimate of total (direct and indirect) fiscal and foreign exchange impact of a project. With no decomposition, only the direct or first round effects can be estimated. If the semi-input-output decomposition method which has been accepted widely in principle is actually used in the economic analysis of projects, the derivation of the foreign exchange and fiscal impacts of a project is straightforward.

IV. NUMERICAL ILLUSTRATION

18. The use of the framework described in this paper is illustrated through a numerical example.[10] Since the framework developed is for single period static analysis, the numerical illustration is also for single period static. To extend it to multi-period static analysis is

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[10] The data for the illustration is taken from Ali, I., Rice in Indonesia: Price Policy and Comparative Advantage, ADB Economic Staff Paper No. 29, 1986.

straightforward with the process described being repeated for each time period under consideration. Table 1 provides cost of production data for paddy in financial and economic values. Two points should be noted. First, only a two stage decomposition procedure in terms of the semi-input output approach was used. Second, the difference between total financial and economic cost is taken to reflect tax or subsidy. Table 2 indicates the derivation of the economic cost of marketing rice. A two-stage decomposition procedure was used. Table 3 indicates the derivation of the fiscal and foreign exchange impact of rice production.

19. On the foreign exchange aspect, rows 5, 6 and 7 of Table 3 are relevant. While net foreign exchange earnings ($/ha) are positive, the ratio of domestic resource cost to shadow exchange rate is the statistic that matters in assessing economic efficiency. In the present case, the ratio is less than unity indicating economic efficiency. However, it is conceivable that while net foreign exchange earnings are positive, the ratio of domestic resource cost to shadow exchange rate is greater than unity indicating economic inefficiency. Since a project or an activity which is economically viable will always have a positive net foreign exchange impact, it is advisable to focus attention more on economic viability than net foreign exchange earnings.

20. Rows 8 to 10 in Table 3 describe various aspects of the fiscal impact. Row 8 gives the direct fiscal impact defined in terms of actual budgetary outlays. Row 9 provides subsidies given by public sector institutions like irrigation authority and banks, but which are not directly reflected in the government budget. This case is discussed in para 13 of the paper. Row 10 is derived on the assumption that deficits of public sector institutions are met through grants from the government budget.

V. CONCLUSION

21. Balance of payments and government budget deficits have emerged as major macroeconomic constraints in many Asian developing countries. In the context of investment projects, there is concern that their implementation should not aggravate the macroeconomic constraints. In fact, to the extent possible, projects should alleviate them.

22. The methodology used in the economic analysis of projects can be divided into efficiency analysis emphasizing growth and social cost-benefit analysis (SCBA) focusing on ensuring growth with equity. In SCBA, the fiscal and foreign exchange impacts of a project are explicitly incorporated. However, there are major methodological and empirical impediments to its adoption.

23. The purpose of this paper was to explore to what extent the fiscal and foreign exchange impacts of a project which has been subjected

Table 1. Cost of Production
(Rp/ha)

		Production Cost	Production Cost Economic		
		Financial	Total	Foreign	Domestic
1.	Seed	8,116	8,116	-	8,116
2.	Fertilizer				
	Urea	18,473	42,474	36,938	5,536
	TSP	9,011	22,373	18,989	3,384
	KCL	1,857	2,681	2,226	455
3.	Dung/Compost	1,641	1,641	-	1,641
4.	Pesticide	6,259	15,247	9,148	6,099
5.	Insecticide	1,267	8,025	4,815	3,210
6.	Others	1,855	1,855	-	1,855
	Total Material Input	48,479	102,412	72,116	30,296
7.	Animal	8,870	8,870	-	8,870
8.	Tractor Service	4,513	4,705	3,131	1,574
9.	Irrigation Service	2,570	16,551	10,486	6,065
10.	Pre-harvest Hired Labor	111,673	111,673	-	111,673
	Total Pre-harvest Cost	176,105	244,211	85,733	158,478
11.	Interest on Pre-harvest Cost	10,566	14,653	5,144	9,509
12.	Harvest Labor	81,189	81,189	-	81,189
13.	Family Labor	63,551	63,551	-	63,551
14.	Land Rent	134,811	134,811	-	134,811
15.	Tax	27,604	-	-	-
	Total Production Cost	493,826	538,415	90,877	447,538

Table 2. Economic Cost of Marketing Rice, (Rp/kg milled rice)

ITEM		COST	FOREIGN	DOMESTIC	TAX
From Port to the Distributor		19.81	3.68	13.21	2.98
Transport Cost to Territory					
	A	14.6	5.74	7.39	1.47
	B	17	6.68	8.6	1.72
	C	22.5	8.84	11.39	2.27
	D	28.8	11.32	14.57	2.91
Economic Cost of Milling					
N. Sumatra	(B)	16.76	4.69	10.92	1.15
S. Sumatra	(C)	12.24	3.69	7.59	0.95
W. Java	(A)	17.53	4.72	11.71	1.1
C. Java	(A)	16.15	4.65	10.32	1.18
E. Java	(A)	10.69	3.4	6.38	0.91
S. Sulawesi	(D)	11.51	3.55	7.03	0.93
Transport Plus In/Out		2.76	1.08	1.4	0.28
Total Marketing Cost					
N. Sumatra	(B)	56.39	16.13	34.13	6.13
S. Sumatra	(C)	57.37	17.29	33.59	6.48
W. Java	(A)	54.76	15.22	33.71	5.83
C. Java	(A)	53.38	15.15	32.32	5.91
E. Java	(A)	47.92	13.9	28.38	5.64
S. Sulawesi	(D)	62.94	19.63	36.21	7.1
Average		55.46	16.22	33.06	6.18

Table 3. Derivation of Fiscal and Foreign Exchange Impact of Rice Production

	ITEM	
1.	Yield, milled rice	
	(ton/ha)	2.708
	Value ($/ha)	756
2.	Production Cost	
	a) Foreign Cost	
	($/ha)	91
	(Rp/ha)	90,877
	b) Domestic Cost	
	(Rp/ha)	447,538
	c) (i) Subsidy on material inputs (Rp/ha)	53,932
	(ii) Subsidy on tractor and irrigation (Rp/ha)	14,173
	(iii) Subsidy on interest rate (Rp/ha)	4,087
	d) Tax on Production (Rp/ha)	27,604
3.	Marketing Cost	
	a) Foreign Cost	
	($/ha)	44
	(Rp/ha)	43,924
	b) Domestic Cost	
	(Rp/ha)	89,526
	c) Marketing Tax	16,735
4.	Net Economic Profitability	
	(Rp/ha)	102,102
5.	Net Foreign Exchange Earnings	
	($/ha)	621
6.	Domestic Resource Cost	865
7.	Comparative Advantage	0.83
8.	Direct Fiscal Impact	-9,593
9.	Tax on Public Sector	18,260
10.	Total Impact on Government	-27,853

Formulae Used in Preparing Table 3

1. Value ($/ha) - yield x CIF price.

2. Marketing Cost - total marketing cost (from Table 2) x yield (Rp/ha)

3. Net Economic Profitability (Rp/ha)
   - Value (Rp/ha) - Foreign Production + Marketing) Cost in Rp/ha - Domestic (Production + Marketing) in Rp/ha x Standard Conversion Factor

4. Net Foreign Exchange Earnings ($/ha)
   - Value ($/ha) - Foreign Cost of Production - Foreign Cost of Marketing

5. Domestic Resource Cost (Rp/$)
   [Domestic Cost of Production + Domestic Cost of Marketing]
   : Net Foreign Exchange Earning

6. Comparative Advantage - DRC/SER where SER - 1037.5

7. Direct Fiscal Impact - -2ci + 2d + 3c

8. Tax on Public Sector - 2c'ii + 2c'iii

9. Total Impact on Government- 7-8

to efficiency analysis alone can be derived.[11] The foreign exchange impact of a project is explicitly incorporated in efficiency analysis. A major result of this paper is that if resource flows embedded in the efficiency analysis are converted to their domestic or market price counterparts, then the total foreign exchange and fiscal impacts can be derived. If the semi-input-output method of decomposition into traded and primary factor inputs had been adopted in the efficiency analysis, the result is straightforward. However, if no decomposition was followed, then the first round or direct foreign exchange and fiscal effects can be determined. In this paper, a numerical illustration with a partial two stage decomposition was provided to demonstrate the use of the framework described. Tariffs on traded goods and subsidies provided by public sector institutions were used to assess the fiscal impact.

24. While the methodology described in the paper would be useful to assess the fiscal and foreign exchange effects of an activity or project, a major potential would be to use it in considering alternative designs of a project. With each design there will be a different fiscal and foreign exchange impact. Thus, trade-offs, if any, could be determined and an informed judgment could be taken on the design to use among the various designs which are economically viable. In particular, an assessment of the fiscal impact of an activity or project is useful to indicate implications of government policy on inputs and outputs associated with the activity or project under consideration.

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11 An alternative procedure is provided in Chervel, M. and M.L. Gall, Manual of Economic Evaluation of Projects: The Effects Method, Ministers De la Cooperation, France, 1978.