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Report 1. Comparative Analysis of Approaches to Estimation of National Paramaters

Final Report to

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION and RESEARCH INSTITUTE FOR STANDARDS AND NORMS, GOVERNMENT OF PEOPLE'S REPUBLIC OF CHINA

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TERMS OF REFERENCE

This report is compiled by the DPPC for the Research Institute for Standards and Norms, and UNIDO under the following terms of reference.

Research report on UNIDO, World Bank and OECD approach to estimation of national parameters.

"2.1 UNIDO, World Bank and OECD approach to national parameters for project evaluation.

The Sub-contractor is supposed to carry out a comparative analysis of the UNIDO, World Bank and OECD approach to a determination of the national and regional parameters for project evaluation. The analysis will deal with the above mentioned approaches to the estimation of:

- the social (economic) discount rate
- the shadow foreign exchange rate,
- the shadow price of skilled urban and rural labour,
- the shadow price of unskilled urban and rural labour,
- the shadow price of land,
- the shadow price of capital,
- the conversion factors for traded and non-traded goods making part of the project's output and inputs,
- the cut-off financial and economic rates of return,
- other relevant items.

The analysis need to point out the advantages and shortcomings of each of the three approaches taking into account the general economic environment, the market imperfections, the international trade pattern, the data needed for computation of the national parameters, the need to establish regional parameters and others."

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1. Introduction

The modern methodology of cost benefit analysis for developing countries emerged in the late 1960's with the publication by the OECD Development Centre of Little and Mirrlees (1968). Since the OECD published this work the approach contained in it was initially described as the OECD approach, although it should not be seen as an official OECD publication. Similarly around the same time a group of economists - Sen, Marglin and Dasgupta wrote a book published by UNIDO, as UNIDO (1972). This work contained some differences of presentation and emphasis to that of Little and Mirrlees (1968) although it covered essentially similar ground. Again due to its publication by UNIDO this latter work is often still referred to as the UNIDO approach, although it has no formal standing with the organization.

These two works UNIDO (1972) and Little and Mirrlees (1968) can be seen as the seminal contributions to the cost benefit literature. Subsequent publications clarified and modified somewhat the original works, without altering their main focus. Little and Mirrlees restated and extended their arguments in Little and Mirrlees (1974), whilst two subsequent books were published by UNIDO-UNIDO (1978) by Hansen, and UNIDO (1980) by Weiss.

In addition two economists at the World Bank, Squire and van der Tak, produced a book published in 1975, (Squire and van der Tak 1975), which showed how the approach of Little and Mirrlees could be systematically extended to incorporate income distribution issues, which were highly topical in aid donor circles in the mid-1970s. Squire and van der Tak (1975) introduced a distinction between economic analysis and appraisal - concerned with issues of allocative efficiency - and what they termed social analysis and appraisal - concerned with issues relating to the distribution of income and the level of savings. Since their book was published on behalf of the World Bank it is sometimes referred to as the World Bank approach, although it is not an official approach, since World Bank appraisals have not generally followed the detailed recommendations of Squire and van der Tak in the area of social analysis.

Therefore although it is sometimes thought that there are three distinct approaches in the cost benefit literature - OECD, UNIDO and World Bank - this is misleading for two reasons. First, these organizations do not accept that the books referred to have any official standing, and second in general the differences between the main works in the literature - Little and Mirrlees (1968), and (1974), UNIDO (1972) and Squire and van der Tak (1975) - are due largely to presentation rather than to major issues of substance. Ray (1984), also by an economist at the World Bank, is a relatively recent survey of this literature, which also stresses the basic similarity between these works.

Because of their fundamental similarity it is really not appropriate to compare the strengths and weaknesses of these three approaches. They provide essentially the same type of information and therefore each has the same advantages and limitations. However it is necessary to draw attention to their presentational differences to clarify the discussion of how cost benefit parameters are defined.

1.1 Numeraire or Unit of Account

The key reason for presentational differences between the different works lies in the fact that all effects generated by projects must be expressed in a common unit, which has conventionally been termed a numeraire. In specifying a numeraire one must decide two key dimensions - what prices to use, and what type of income in which to express all effects. The prices used can be either domestic or world prices, and income can be distinguished by its use for either savings or consumption. Table 1 shows four possible dimensions of the numeraire. Box A corresponds to that used in UNIDO (1972) - average consumption at domestic prices - and box B to that in Little and Mirrlees (1968) - savings at world prices.

Choice of Numeraire

Prices	Savings	Consumption
Domestic		A
World	B	

Savings/Consumption

Income

Box A = UNIDO (1972) Numeraire
Box B = Little-Mirrlees (1968) Numeraire.

Use of alternative units - either consumption or savings - as the numeraire, should not be interpreted as implying a difference over government objectives. When UNIDO (1972) uses private consumption as the numeraire, this does not mean that it assumes consumption is the main development objective, but rather that if savings are more valuable than consumption they should be expressed in terms of units of consumption. Similarly use of savings as the numeraire by Little and Mirrlees (1968) implies that units of consumption should be expressed as equivalent to units of savings. Both works allow for the possibility of a savings constraint, which means that income that is saved is more valuable than that which is consumed. Choice of units therefore relates to the measurement of effects, not a judgement over the importance of different objectives.

Clearly use of such opposite numeraires means that in presentational terms analyses following the two works appear very different - just for example as distance appears different presentationally when it is given in kilometres or miles. However it can be shown that provided each approach makes identical assumptions they will given equivalent results. This is demonstrated formally in Appendix 1 of this report, where a case-study from UNIDO (1972) is reworked using the Little and Mirrlees numeraire.

Since the key issue is the choice of numeraires this report prefers to distinguish between different numeraires on the basis of whether they use world or domestic prices to value project effects. Therefore in the report the Little Mirrlees (or OECD approach) is referred to as a "world price system", and that of UNIDO as a "domestic price system". The other dimension of the numeraire - whether savings or consumption - is less critical, because in practice it is now fairly uncommon to see weights used to distinguish between income that is saved from that which is consumed. Both this and report 2 use the terminology of Squire and van der Tak to distinguish between economic and social analysis of projects. The majority of the discussion of this report is concerned with national parameters required for economic appraisal; that is assessing the impact of projects from the viewpoint of efficient allocation of existing resources, without regard for savings and income distribution effects. The focus on economic appraisal is because most practical applications of cost benefit techniques by governments and aid agencies have not gone as far as introducing the weights required for a social analysis. However the approach of social analysis, and its implications for the definition of national parameters, is discussed at the end of the report (section 9).

To avoid confusion between a domestic and a world price system, it should be stressed that similar government objectives can be incorporated in appraisals following the procedures set out in either literature. Table 1 compares the presentational differences between the alternative approaches. UNIDO (1972) divides the appraisal process into four separate stages each incorporating the effect of a project on a different set of government objectives. Squire and van der Tak (1975) distinguish between only three forms of appraisal, so that what they term social appraisal involves a combination of what UNIDO (1972) covers under stages 3 and 4. This is only a minor difference of presentation and involves no difference of substance.

Table 1 Government Objectives and Appraisals

Domestic price system[a)]		World price system[b)]	
Presentation	Government Objectives	Presentation	Government Objectives
Stage 1	Financial effects	Financial appraisal	Financial effects
Stage 2	Resource allocation effects	Economic appraisal	Resource allocation effects
Stage 3	Resource allocation plus Savings effects	Social appraisal	Resource allocation plus Savings plus Income Distribution effects.
Stage 4	Resource allocation plus Savings plus Income Distribution effects.		

Notes: a) follows UNIDO (1972)
b) follows Squire and van der Tak (1975).

The chief characteristics of the UNIDO, Little and Mirrlees (or OECD) and Squire and van der Tak (or World Bank) approaches can be summarized as in table 2.

Table 2 Characteristics of Alternative Approaches

	UNIDO		Little and Mirrlees/ Squire and van der Tak
Stage 1	All effects valued at market prices.	Financial appraisal	All effects valued at market prices.
Stage 2	- Traded goods valued at world prices at shadow exchange rate. - Non-traded goods valued either at marginal costs of production at domestic prices, or at willingness to pay at domestic prices. - Discount rate given by time preference for consumption. - Any external effects valued at domestic prices.	Economic appraisal.	- Traded goods valued at world prices at official exchange rate. - Non-traded goods valued at marginal costs of production at world prices, or at willingness to pay converted to world prices. - Discount rate given by opportunity cost of capital at world prices. - Any external effects valued at world prices.
Stage 3	- Additional savings revalued in terms of private consumption.	Social Appraisal	- Additional private consumption revalued in terms of government income (assumed to be saved)
Stage 4	- No formal consumption weighting system in UNIDO (1972), but suggested that weights for particular groups can be derived from observation of past government decisions.	Social appraisal	- Set of consumption weights relate one unit of private consumption to a group to either one unit going to average consumers, or to one unit of government income.

1.2 Shadow prices and conversion factors

A shadow price can be defined as a measure of value to the economy for a commodity or resource. Shadow prices will therefore be the measure of value for planners to use in assessing the full economic contribution of new investment projects.

For reasons discussed in report 2 it is conventional to give information on shadow prices as a set of ratios, termed conversion factors (CFs). A CF is a ratio of the shadow price value to the market price of an item. Once a set of CFs are known data on a project at market prices can be converted to shadow prices by multiplication by the appropriate CFs. Much of the discussion in this report considers ways of defining and estimating CFs, and the shadow prices on which they are based.

1.3 Use of world or domestic price system

As we have noted the numeraire or unit of account for an appraisal can be measured at either world or domestic prices. As appendix 1 demonstrates the choice of price unit will alter the NPV, but not the IRR of projects, and providing equivalent assumptions are made in both analyses, and a single approach is applied consistently the choice of world or domestic prices on its own is not an issue of significance. This can be illustrated with a simple numerical example.

Let us assume a project producing an output A and using two purchased inputs B and C. A and B can be traded on the world market at US$10 and US$5 respectively, whilst input C is only used locally and costs 50 Yuan. In this case the official exchange rate is 10 Yuan per US$. However due to various controls in the economy on average domestic prices are 50% above the price of comparable goods on the world market, after the US$ prices of these goods are converted at the official exchange rate (OER).

If we evaluate this project using domestic prices to measure the numeraire, the position is as follows:

	Value at Domestic Prices (Yuan)
Output A ($10 x 10) x 1.5	150
Input B ($5 x 10) x 1.5	75
C	50
Net Benefit	25

Both dollar values for A and B are converted at the official exchange rate of 10 Yuan/US$, but since on average domestic prices of comparable goods are 50% above their world prices, their values in local currency are raised by 50%. Input C initially valued at domestic prices is unchanged. This form of adjustment is equivalent to using what is termed a shadow exchange rate (SER) that increases the value of foreign exchange relative to local resources. In this example the SER is Yuan 15 per US$.

On the other hand, for the same example the units used can be at world prices. Now output A and input B will be converted at the OER, however input C will have its value reduced. This is because in the economy on average domestic prices are 50% greater than world prices for comparable goods at the OER. C is valued at domestic prices initially, so that when all project effects are expressed at world prices the value of C must fall. The new net benefit is as follows:

	Value at World Prices (Yuan)
Output A ($10 x 10)	100
Input B ($5 x 10)	50
C $50 \times \frac{1}{1.5}$	33.3
Net Benefit	16.7

Now C is reduced to 33.3. This is because on average if domestic prices are 50% above world prices, then world prices must be 67% of domestic prices ($\frac{1}{1.5}$ = 0.67). To allow for this average divergence C must be multiplied by 0.67 to lower its value to 33.3. Use of the ratio 0.67 is what is termed applying a standard or average CF, which gives the average ratio of world to domestic prices for the economy. It should be seen that this CF is derived directly from the ratio of the SER to the OER, so that $\frac{OER}{SER}$ = SCF, where SCF is the standard conversion factor.

In the two examples the values of net benefits are Yuan 25 and Yuan 16.7 respectively. Although these are different in absolute terms, they are directly comparable since the former is at domestic and the other at world prices. However domestic prices are on average 50% above world prices, so the net benefit figure at world prices of 25 is 50% above the figure at domestic prices of 16.7. The parallel given earlier of the difference between measuring distance in miles and kilometres should be recalled. Provided one is consistent either measure will give the right answer.

The above examples have been simplified in that they use one single average relationship between world and domestic prices for an economy. In practice in any accurate appraisal use of an average in this way will be misleading. It is necessary to calculate a set of CFs which measure the divergence between values at domestic and world prices for a range of commodities, sectors and resources. This is necessary in either a world or a domestic price system of appraisal, although most detailed studies of economic appraisal in recent years have tended to follow the world price system. In this report various important economic parameters are discussed in turn - starting with the standard or average conversion factor. In each case the discussion concentrates initially on the definition of parameters in a world price system; this is then followed by a briefer discussion of how the same parameter is treated in a domestic price system.

1.4 Terminology

Before commencing a detailed discussion of specific parameters it is necessary to draw attention to various uses of terminology. What are here termed shadow prices, are also described in the literature as accounting prices, to convey the sense that they may not be prices that actually prevail in markets. World prices have already been referred to, covering prices faced by a country on the world market. Another terminology for such prices is border prices, refering to the fact that these are prices for an item at the border of a country. Thus for a particular country what matters is not the price in a foreign port or frontier, but the price in its own ports or at its own frontier.

1.5 Advantages of Economic Analysis

The use of shadow pricing through the application of a system of CFs is to adjust existing market prices towards a measure of economic costs and benefits. Through the application of CFs the aim is that key characteristics of economies can be incorporated systematically in the appraisal of new projects. These characteristics may include:

- scarcity of foreign exchange;
- underemployment of unskilled labour;
- scarcity of investment funds;
- domestic relative prices that are considerably out of line with prices on the world market.

Either price system allows these features to be reflected in project calculations. A scarcity of foreign exchange, is manifested in a level of domestic prices in excess of those for comparable goods on the world market converted at the official exchange rate. This is covered in the domestic price system by placing a premium weight on foreign exchange relative to domestic resources (P^F = SER/OER), and in the world price system by giving a lower weight to domestic resources relative to foreign exchange (SCF = OER/SER).

Underemployment of labour is covered in both systems by valuing labour at its economic opportunity costs - that is its output foregone at either domestic or world prices. Where job opportunities are few, and there are various barriers to entry to labour markets, one would expect output foregone to be significantly below the wage paid on new projects. Use of a relatively low CF for labour of below 1.0 is the way this feature is incorporated in economic appraisals. There will also be indirect employment effects from an investment, since labour employed in non-traded activities will be affected by the demands for non-traded output generated by new projects. These effects will be incorporated in appraisals in either system whenever non-traded goods are valued at their supply cost, and shadow prices are used to estimate this cost. Underemployed labour used in non-traded production is likely to have a low CF and this will reduce the shadow price of the non-traded good.

A scarcity of funds for investment means that at existing interest rates too many projects are competing for limited funds. Both systems deal with this situation by specifying the economic discount rate as the return on a marginal project for which finance is not available. Hence for a new project to be justified it must earn an IRR above that in a marginal project. As the financial situation changes the discount rate can be modified by lowering the rate if the budget expands, and raising it if the budget contracts. The important point is that by specifying the discount rate as the economic return that can be obtained on alternative investment the scarcity of funds is incorporated directly in an appraisal.

In the past many developing countries allowed their internal set of prices to diverge very considerably from prices for similar goods on the world market. This made it difficult to plan how such countries should participate in foreign trade - particularly where they should rely on domestic production and where they should meet internal demand by imports. Both systems discussed here meet this problem by valuing all goods that are internationally traded by an economy at their world market rather than their domestic prices. This removes the effects of tariffs and direct import controls, which will raise the domestic prices of traded goods above their world market levels. In a domestic price system, world prices of traded goods are converted into local currency at the shadow not the official exchange rate, whenever there is premium placed on foreign exchange. The world price system converts these world prices at the official exchange rate. Again this is not a significant point of difference between the two approaches. Both base the relative prices of traded goods on prices prevailing in the world not the domestic market, and where it is appropriate both give a higher weight to traded goods in general as compared with non-traded goods.

Use of world prices to value traded goods allows both systems to incorporate what is termed the "trade efficiency" objective into planning. This involves assessing whether a particular investment is justified in terms of its domestic costs in comparison with the alternative of trading in the commodity concerned. In the case of an import-substitute project one must compare domestic costs with the value of output given by the world price of the importable good. Domestic costs must be at shadow prices and this will allow for factors like the use of otherwise underemployed workers either directly in the project itself, or indirectly in the production of non-traded inputs used by the project; similarly use of locally available non-traded inputs which may be cheap to produce by international standards will also be picked up by a low shadow price for these goods; also any external benefits and costs for others in economy generated by the project should be incorporated and deducted from domestic costs if they can be identified and quantified. The final calculation involves a comparison between discounted benefits (the cif value of output) and these adjusted discounted costs. If the NPV is not positive this implies, that allowing for the various features of the project and the economy, there is no economic case for local production of the good concerned, and that in resource efficiency terms it would be better to continue to import the good.

A similar exercise can be done for export-oriented projects to examine whether discounted costs are less than discounted benefits from selling on the world market. By defining benefits from production of traded goods in terms of values on the world market, and combining this with a detailed shadow pricing of project inputs, planners can incorporate the question of an economy's comparative advantage into the investment planning process. However insofar as it is possible to forecast costs over the life of a project allowing for learning and technical change, and to incorporate external gains to other producers in the calculations, cost benefit calculations should give an indication of dynamic or long-run comparative advantage, rather than simply a short-run measure. It is recognised that short-term comparative advantage is not necessarily the appropriate base for planning decisions, because it may lock a particular country into the production of goods with little long-run potential.

The ability of cost-benefit appraisals - what we have termed economic analysis of projects - to pick up these various effects is a strong argument for their regular use in investment planning. The disadvantages associated with economic analysis are not grounded in theory, but in the practical difficulty of quantifying precisely both key shadow prices, and all of the effects of individual projects. The following sections discuss the treatment of the main shadow prices used in appraisal.

2. Average Conversion Factor

2.1 Average Conversion Factor in a World Price System

The average conversion factor in a world price system of shadow pricing may also be called the standard conversion factor (SCF). This is simply an average conversion factor which is used limitedly either in the case of minor cost or benefit items, mainly nontraded, or in the case of those items where appropriate specific conversion factors cannot be estimated owing to lack of data. The SCF is estimated at a macro level and is considered to be an important national economic parameter reflecting the average divergence of domestic prices from world prices of goods in the economy.

There are several versions of the SCF. Some of these compare world and domestic prices for traded goods only, and others include both traded and non-traded goods in the comparison. Schydlowsky (1969) gives the SCF as the "ratio of the value of imports at border prices to their value at domestic prices". Little and Mirrlees (1974) define it as the "average ratio of world market (border) prices to domestic market prices for a representative selection of commodities"; this ratio should cover both traded and nontraded goods with weights given by their respective shares in total supply. Squire and van der Tak's version of the SCF is the "ratio of the value at border prices of all imports and exports to their value at domestic prices". Powers (1981) suggests that the SCF may be defined as the "weighted average of all the sectoral conversion factors in the economy".

Schydlowsky's short cut method for the esti-ation of the SCF is called the "force of tariff" (Schydlowsky 1969). The underlying assumptions of this method are:

(i) only imports are affected by the availability of additional foreign exchange as a result of a project, and

(ii) domestic prices diverge from border prices to the extent of the import tariff rate, where import tariffs are the only trade controlling policy measure.

The imports only SCF may be expressed as follows:

$$SCF = \frac{M}{M + Tm} \qquad (1)$$

where, M and Tm are the values of imports at cif prices converted at the official exchange rate, and total import tariffs, respectively.

The force of tariff method tends to yield a lower value of SCF than alternative methods discussed later, since the import tariff rate is generally higher than the net export subsidy rate. Where non-tariff import control measures are in effect, they can be incorporated in the above equation by simply adding Tm_1, the total value of import control premia, in the denominator. Nevertheless, inclusion of an export component is not possible without relaxing the fundamental assumption of the simple force of tariff method which covers the import sector only. Alternatively, this conversion factor may be called an average import conversion factor which may be used to shadow price minor import items or where specific conversion factors for imported goods are not readily available.

Another simple expression for the SCF allows for the fact that available foreign exchange may be used to both increase imports and to divert goods from the export market. Now incorporating both imports and exports into the formula equation (1) becomes

$$SCF = \frac{M + X}{(M + Tm) + (X - Tx)} \qquad (2)$$

where M and X are the total values of imports and exports at cif and fob prices, respectively converted at the official exchange rate,

and Tm and Tx are total import tariffs and export taxes, respectively.

This equation for the SCF is valid under the following conditions;

(i) elasticity of supply of exports and elasticity of demand for imports are infinite,

(ii) income elasticity of demand for all goods is equal to unity,

(iii) there are no domestic price restrictions and domestic prices reflect economic values of goods, and

(iv) there are no direct controls nor subsidies on trade.

Under the circumstances where one or more of the above mentioned conditions do not hold, adjustments should be made to the estimate of the SCF from equation (2).

For example, in developing countries domestic market prices may not reflect economic values of goods as a result of various government policy measures, of which price control is a major one. Likewise, various forms of trade control and promotion measures may influence domestic prices more effectively than the forces of the market; for example, quantitative restrictions on imports, which may be in the form of import licensing, or import quotas. Similarly a subsidy on exports, may prevail in the form of duty drawbacks, cash compensation, cash incentives, or foreign exchange entitlements. Likewise there may be subsidy on the import of important goods. In developing countries where such trade controls and promotion policy measures prevail and influence significantly the domestic prices of imports and exports, they should be taken into account in the calculation of the SCF. In other words, equation (2) should be modified, by incorporating the impact of quantitative restrictions on imports and subsidies on imports and exports, as shown below in equation (3),

$$SCF = \frac{(M + X)}{(M + Tm + Tm_1 - Sm) + (X - Tx + Sx)} \qquad (3)$$

where, Tm_1 is the total value of the import control premia,

Sm are total import subsidies,

Sx are total export subsidies, and all other items are as in equation (2).

This method of estimating the SCF is called a "weighted average tariff and subsidy method".

None of the above equations for the SCF take into account the price elasticities of imports and exports. Balassa (1974) suggests that if the level of the foreign exchange rate is likely to change as a result of the foreign exchange impact of a project, the relevant weights to use in comparing domestic and world market prices are the import demand and export supply elasticities of the major commodities traded by an economy.

When the price elasticities of import demand and export supply elasticities are incorporated in the computation of the SCF, for example, in equation (3), the SCF expression becomes

$$SCF = \frac{\Sigma m_i M_i + \Sigma e_j . X_j}{\sum_i m_i (M_i + T_i - S_i) + \sum_j e_j (X_j - T_j + S_j)} \quad (4)$$

where, i and j refer to imports and exports respectively,

M_i, T_i and S_i are the total value of import i, total taxes paid on i, and total subsidies received by users of i, respectively;

X_j, T_j and S_j are the total value of export j, total taxes paid on j, and total subsidies received by producers of j, respectively.

m_i is the price elasticity of demand for import i, and e_j is the price elasticity of supply for export j;

$\sum_i M_i$ equals total imports, and

$\sum_j X_j$ equals total exports.

This gives the elasticity - weighted average ratio of world to domestic prices of imports and exports by estimating the weighted average tariff and subsidy rate on imports and exports, where the weights are the respective price elasticities. This method of estimating SCF may be called an "elasticity-weighted average tariff and subsidy rate".

Nonetheless, there are two main reasons why this method using equation (4) may not be preferable to the simpler expressions;

(i) price elasticities for import demand and export supply are not readily available in developing countries. Estimation of price elasticities is usually beyond the scope of the estimation of national economic parameters studies and can be very demanding in terms of data, resources and time. Even though one can borrow from the estimates for other countries, there remains the problem of how reliable these are. Under such circumstances a simpler approach is to use equation (3).

(ii) Balassa's expression, as adopted in our equation (4,) implicitly assumes that a marginal increase in foreign exchange resulting from a project leads to an adjustment of the foreign exchange rate, and therefore, the use of price elasticities to weight imports and exports is necessary. Where either no adjustment to the exchange rate takes place, as a result of a marginal increase in foreign exchange, or alternatively assuming the values of all the price elasticities to be equal to 1.0 our equation (4) reduces to equation (3) (Bruce, 1976, 11).

Owing to these reasons, most estimates for developing countries have tended to use the version of the SCF in equations (3) or (2).

Equations (1) to (4) would normally be applied as part of a partial approach to national economic parameters (see report 2). In a semi-input-output analysis (SIOA), the SCF is expressed as the weighted average of all the conversion factors for productive sectors of the economy (Powers, 1981, 92). The sectoral conversion factors are derived from the SIOA and the weights are the respective shares of the sectors in value added in the economy. The SCF in a SIOA may, therefore, be expressed as

$$SCF = \sum_i a_i . CF_i \qquad (5)$$

where i refers to a productive sector,

a_i is the weight placed on the sector, and

CF_i is the CF for sector i.

Where SIOA can be applied it allows a more accurate estimate of the SCF that covers both traded and non-traded sectors. This allows the SCF to be estimated as a genuine average of commodities in the economy.

2.2 Shadow Price of Foreign Exchange in a Domestic Price System

The shadow price of foreign exchange (P^F) (UNIDO 1972, 215-229) in a domestic price system is the ratio of the shadow to the official exchange rate and is therefore equivalent to a CF for foreign exchange.

The shadow price of foreign exchange is normally defined as a ratio of domestic to world prices. This is on the assumption that foreign exchange is in fixed supply, and that domestic market prices reflect the value to the economy of goods that can be purchased with or made available by additional foreign exchange. Simple estimates use the inverse of equations (1) to (4) for the SCF as a measure of P^F (SER/OER). When one of these equations is used for both the SCF and P^F the world and domestic price systems are directly comparable.

More detailed approaches to P^F use direct comparisons of world and domestic prices for traded goods, provided the domestic prices used are free-market not controlled prices. This is the procedure suggested in UNIDO (1972), and illustrated in equations (6) and (7) below.

Assuming that foreign exchange is in fixed supply and that imports only will be affected as a result of additional foreign exchange availability,

$$P^F = \frac{SER}{OER} = \sum_i a_i . \frac{DP_i}{WP_i} \qquad (6)$$

where,

SER is the shadow exchange rate,

OER is the official exchange rate,

a_i is the share of good in the marginal import bill,

DP_i is the domestic price of good i and

WP_i is the cif import price of good i, converted at the official exchange rate.

The domestic price system also recognises that in some circumstances both imports and exports can be affected by the availability of additional foreign exchange. This means that (6) becomes

$$P^F = \sum_i a_i . \frac{DP_i}{WP_i} + \sum_j a_j . \frac{DP_j}{WP_j} \qquad (7)$$

where i and j refer to import and export goods respectively,

DP_i and DP_j are their domestic prices,

WP_i and WP_j are their world prices, cif and fob respectively, converted at the official exchange rate,

a_i and a_j are the shares of i and j in additional demand for foreign exchange, so that

$\sum_i a_i$ is total import demand, and

$\sum_j a_j$ is total demand for exportables diverted from the export market, and $\sum_i a_i + \sum_j a_j = 1.0$.

Use of equations (6) and (7) will give results which are not precisely comparable with equation (5) for the SCF. This is firstly because the SCF in principle covers all goods in the economy, not just traded goods, which is what the formula for P^F relates to in UNIDO (1972). Second the weighting system in (6) and (7) will differ slightly from that in (5).

In (5), $SCF = \sum_i a_i . CF_i$

where $CF_i = \frac{WP_i}{DP_i}$

Therefore its inverse, $1/SCF = \frac{1}{\sum_i a_i . \frac{WP_i}{DP_i}}$

or $1/SCF = \sum_i \frac{1}{a_i} . \frac{DP_i}{WP_i}$

In equation (6) and (7)

$SER = \sum_i a_i . \frac{DP_i}{WP_i}$

so that the weights are $\frac{1}{a_i}$ when the inverse of equation (5) is used, and a_i when P^F is estimated directly in equations (6) and (7).

Alternatively if foreign exchange is treated as being in variable supply its shadow price will be determined by the domestic resources required to generate additional foreign exchange through exports or import substitutes. Now P^F becomes

$$P^F = \Sigma a_i . DRC_i \qquad (8)$$

where a_i is the share of sector i in additional foreign exchange earned or saved,

DRC_i is the total of domestic resources required per unit of foreign exchange earned or saved in i,

DRC_i can be expressed simply as

$$DRC_i = \frac{(L_i + K_i + N_i)}{(F_i \times OER)}$$

where L_i, K_i and N_i are the total labour, capital and non-traded resources required per unit of i, valued in shadow prices,

F_i is the net foreign exchange generated per unit of i (output - traded inputs at world prices).

Whenever $\sum_i a_i.DRC_i > 1.0$ there will be positive premium on foreign exchange. This approach to P^F has no direct equivalent in the world price system.

As we have seen strictly the equivalence between the shadow price of foreign exchange (P^F) and the SCF, where

$$P^F = \frac{SER}{OER} = \frac{1}{SCF}$$

only holds were approximate formulae are used to estimate both the SCF and P^F. Where more detailed approaches to both parameters are followed the results are not precisely comparable.

2.3 Limitations of the Shadow Price of Foreign Exchange

Little and Mirrlees (1974) argue that use of an aggregate parameter like P^F can be misleading. This is because it is very difficult to estimate what it costs the economy to use or supply additional foreign exchange, without specifying in detail how the foreign exchange will be used or from where it will be supplied. If foreign exchange is in fixed supply its cost will depend on what users foregoe foreign exchange to allow a new project to use it. Alternatively if foreign exchange is in variable supply, so that exports and import substitutes can be increased to allow a project to use foreign exchange, its cost will depend on the economic costs per unit of foreign exchange in the various supplying sectors.

Little and Mirrlees argue that at a national level identifying these marginal costs is very difficult. Instead their approach focusses on the foreign exchange costs associated with individual projects, and expresses all project effects in terms of foreign exchange. If all costs and benefits are at world prices the choice of exchange rate will affect only their absolute size, not the comparison between costs and benefits. Therefore in a world price system any project with a positive NPV at the economic discount rate, in theory should have a positive impact on the foreign trade balance, by generating a net surplus of foreign exchange, and will be acceptable at whatever exchange rate is used; - whether a shadow or the official exchange rate.

Little and Mirrlees suggest that for simplicity one can use the official exchange rate to convert world prices to local currency. However, since individual foreign exchange effects of projects must be estimated, a set of specific CFs for project outputs and inputs will be required. These specific CFs, whose definition is discussed in sections 6 and 7 below, are used to estimate the full foreign exchange effects of projects.

For non-traded inputs used by projects, or their non-traded outputs, these CFs must express values at domestic prices in terms of foreign exchange equivalents. Where CFs for such goods are below 1.0, this has the effect of giving a higher weight to foreign exchange relative to domestic resources. This is the same relative adjustment implied by a shadow exchange rate above the official rate, so that $P^F > 1.0$, and explains why no SER is needed in a world price system, even when it is felt that foreign exchange is undervalued by the official exchange rate.

Since they reject the use of a single parameter for foreign exchange in general Little and Mirrlees also caution against the frequent use of their aggregate parameter, the SCF. They suggest that this should only be used to revalue minor items for which there is no detailed information that will allow a specific CF to be calculated.

In terms of the logic of the argument the Little and Mirrlees position is now generally accepted. Where their approach is applied fully it gives a more rigorous analysis than any alternative treatment. Furthermore if a domestic price analysis follows the same level of detail as the world price analysis - by expressing all effects in terms of foreign exchange - there is no need for a SER.

In practice approximations are always required, and in some versions of the systems relatively small differences of treatment can emerge. Where a detailed world price analysis is employed its results can be converted to domestic price units by multiplication by 1/SCF. The SCF gives the average ratio of world to domestic prices for an economy, so that where it is 0.8, on average domestic prices are 25% above world prices. In this case, all results in a world price system can be converted to domestic price units by applying this average ratio of 1.25.

Although 1/SCF will only be an approximate not a precise, indicator of P^F, the shadow price of foreign exchange, it is a useful summary measure of the degree of distortion in an economy. In a consistent SIO approach to the SCF using equation (5) the main features of an economy that create divergences between shadow and market prices will be captured. The SCF is influenced by labour underemployment, taxes and subsidies, surplus profits, supply constraints on non-traded sectors, and controls on prices and foreign trade. The net effect of these features of an economy is to create a general divergence between world and domestic prices. In practice this general divergence can be a reasonable guide to P^F, particularly since estimation of P^F using a partial approach, such as equations (6), (7) or (8), is often subject to considerable margins of error.

In report 3, where national economic parameter estimates for China are discussed, the approach used is to first estimate these parameters in a world price system. All estimates are then converted to domestic price units by multiplication by 1/SCF, which is taken as a proxy for P^F. In report 3 the SCF is termed the average conversion factor, ACF.

3. Economic Discount Rate

3.1 Economic Discount Rate in a World Price System

The discount rate used in the economic analysis of projects in a world price system "is the marginal productivity of capital in the public sector" (Squire and van der Tak, 1975, 110). It is, in other words, the rate of return earned by a marginal unit of public investment at world prices, usually termed q, the marginal productivity of capital. The parameter q serves two main functions in ex ante project analysis;

(i) it allocates the supply of public investment funds among competing projects from which the minimum rate of return on capital emerges;
(ii) it discounts the resource flows of projects to determine their present worth (Powers, 1981, 45-8).

The economic or efficiency discount rate (EDR) thus reflects the opportunity cost of capital and also the rate of fall in the value of numeraire over time; the numeraire in the world price system can be "uncommitted foreign exchange in the hands of the government" (Squire and van der Tak 1975, Little and Mirrlees 1974), or savings (Little and Mirrlees 1968).

There are several possible ways to estimate the value of q or EDR. In general, it is an estimate of what the economy loses or foregoes when a decision is made to use capital in a project. The calculation of this parameter is linked to the way projects are financed in the country's public capital budget. There are two possible cases: first, marginal budget outlays are financed with external or domestic borrowing; and second, the public capital budget is fixed, so public demand for investment funds faces a rigid supply, and additional expenditure can only be made by drawing funds away from other projects. In the first case, the marginal impact of a new project is the opportunity cost of the funds allocated to it, which depends in turn on the marginal cost of obtaining them in the external market or from domestic savers; the supply of such funds is elastic. In the second case, financing of a new project implies that another project must be foregone at the margin, since the supply of funds is fixed. This means that the opportunity cost will be equal to the loss of the net economic benefit produced by the displaced investment.

Empirical estimation of the EDR is crucially important because the allocation of investment resources depends largely on this parameter. When an artificially low discount rate is used a project may appear justifiable even with a lower rate of return than it should have in terms of the actual scarcity of resources. Likewise, if the discount rate is artificially high some projects may be rejected even though they would be economically profitable. However, there is not a universally accepted method which gives a precise estimate of the value of the EDR. The convention is to try a range of possibilities and select the most plausible value.

The following are the most commonly used methods for the approximation of the value of q and thereby the EDR.

3.2 Macro Approach

This approach assumes that the marginal productivity of capital in the economy indicates the value of the EDR. Marginal productivity of capital, q, by this approach is the incremental output-capital ratio net of labour's contribution (Squire and van der Tak, 1975, 110).

The incremental output-capital ratio may be calculated with the help of national accounts as the ratio of the net increase in national output to capital. Gross domestic product (GDP) net of wages and consumption of fixed capital assets provides a value for the net national output or net surplus in the economy; whereas, the value of fixed capital stock after adding capital formation and deducting consumption of fixed assets gives the value of capital employed. The ratio of the former to the latter, measured at constant shadow prices, provides an indication of the value of the q in the economy. It may be expressed symbolically as

$$q = \Delta 0/K \qquad (9)$$

where,

q is marginal productivity of capital in year t;

$\Delta 0$ is value of the net increase in national output at shadow prices; that is net national product after deduction of consumption of capital stock, and wages;

K is the value of total capital employed at shadow prices; K covers buildings and machinery, land and inventories.

In a world price system returns to capital must be expressed at world prices. This can be done by applying CFs to both sides of the ratio for q. Therefore $\Delta 0$ at world prices can be approximated by

$$\Delta 0 = (GDP_t \times SCF) - (W_t.CF_L + D_t.CF_{CAP}) \qquad (10)$$

and K by

$$K = (K_{t-1} + I_t - D_t) \cdot CF_{CAP} \qquad (11)$$

where subscripts refer to years

GDP_t is gross domestic product in year t,

W_t is wage bill in year t,

D_t is depreciation of capital assets in year t,

K_{t-1} is capital stock in year t minus one,

I_t is investment in year t,

SCF is the standard conversion factor,

CF_L is a labour conversion factor, and

CF_{CAP} is a conversion factor for capital.

With these specifications of $\Delta 0$ and K, equation (9) becomes a return at world prices.

This approach is rarely used in practice due to its approximate nature.

3.3 Sectoral Approach

This estimates the pre-tax rate of return on capital at constant shadow prices, that is the marginal productivity of capital at the sectoral level. The pre-tax rate of return on capital is the ratio of the gross profit to the capital employed, which may be expressed as

$$q_i = \Delta 0_i / K_i$$

where,

q_i is marginal productivity or rate of return on capital in i sector,

$\Delta 0_i$ is the value of net increase in sectoral output at shadow prices,

K_i is the value of total capital employed in the sector at shadow prices.

Care should be taken while interpreting this definition of q, since, if q_i represents average capital productivity in a sector comprising both public and private industries this may be misleading as a guide to returns to public investment. Where private industries yield a higher rate of return on capital it will probably be safer to estimate q_i for public sector industry only, assuming the alternative use of the public funds would be in this sector.

The above equations provide an estimation of q on an ex post basis. Ex ante q is also useful in estimating the value of the EDR. The assumption here is that the government chooses investment projects on the basis of their economic internal rates of return (EIRR). If the government selects projects with the highest EIRR and continues in decreasing order until the EIRR of the marginally accepted project is equal to the EDR, the highest EIRR of the rejected public investment projects may be taken to be the lower limit of the ex ante q. This method, however, requires a detailed study of a quite large number of investment projects and presupposes the use of the EIRR in project selection. Further, it can also be argued that under the circumstances where public investment projects are actually decided on the basis of social and policial rather than strictly economic criteria, this approach is inappropriate.

3.4 Cost of Foreign Investment or Borrowing

If, at the margin, a country is investing abroad the minimum marginal productivity of its capital should be equal to the real rate of return on additional foreign investment. Accordingly, the real rate of return on outward foreign investment, should be considered as the cut-off rate, that is, the EDR. However, excepting the capital surplus oil producing countries, very few developing countries invest significantly abroad.

If, at the margin, a country is borrowing from abroad to finance its investment projects, the marginal productivity of capital should be equal to the real cost of foreign borrowing (Squire and van der Tak, 1975, 113). The cost of Euro-dollar loans are normally based on the LIBOR (the London Inter Bank Offer Rate) plus spread, a variable component depending on the terms of the loan and the degree of borrower's risk, and extras, of commitment and administrative charges.

The cost of foreign borrowing should be expressed in real terms, which is done with an international price deflator. Since international inflation reduces the real value of the debt repayments, the appropriate price deflator should, therefore, be based on the price movements of the debtor country's principal exports and imports that constitute its total foreign trade. This assumes that to pay the debt arising out of the marginal foreign borrowing, a proportion of foreign exchange will come from a decrease in the value of imports of goods and a proportion from an increase in the value of exports of goods.

This approach of estimating the EDR tends to yield a lower bound value.

3.5 Cost of Domestic Savings

Where it is assumed that additional savings from domestic sources are forthcoming, normally domestic savers interest rates adjusted for inflation provide an approximate indicator of the cost to savers of postponing consumption.

3.6 Economic Discount Rate in Domestic Price System

The concept of the EDR in an economic analysis of projects is similar in both the world and domestic price systems. UNIDO (1972) works with a discount rate derived from the government's time preference for consumption, often termed the consumption rate of interest discount rate (CRI). However where there is no savings constraint, that is in economic analysis, and at stage 2 of UNIDO (1972), q will equal the CRI discount rate. As is discussed further in section 9, the CRI discount rate is subjective, however in a domestic price system q can be approached in the same way as in a world price system except that if we use equation (9), both $\Delta 0$ and K must be estimated at domestic prices not world prices. Estimation of these two items at domestic prices requires a separation into their local and foreign exchange components, and a revaluation of the latter by P^F the premium on foreign exchange (SER/OER). Therefore at domestic prices

$$\Delta 0 = d\Delta 0 + (1 - d)\Delta 0 . P^F \qquad (12)$$

and

$$K = d K + (1 - d) K . P^F \qquad (13)$$

where,

d is the domestic, and

(1 - d) the foreign exchange component and

P^F is SER/OER.

Equations (12) and (13) assume that for the domestic components ($d\Delta 0$ and dK), domestic prices already reflect economic value, so that no further shadow pricing adjustment is required for these items. This treatment, is equivalent to applying CFs of 1.0 to $d\Delta 0$ and dK. However, where appropriate there is no reason why these items could not be adjusted by CFs that differ from 1.0.

4.0 Shadow Price and Conversion Factor for Labour

4.1 Introduction

Labour is a major factor input to all the sectors of the economy. It enters into a project's accounts in two different ways - directly as an input to the project, and indirectly as an input to the nontraded goods used by the project. If the market is reasonably competitive the market wage rate is the appropriate shadow price for labour, just as any market price is the appropriate shadow price for a good or service. Neoclassical theory posits that the wage is equal to the productivity of the marginal labourer where there is no involuntary unemployment, implying that market wage rate reflects the economic opportunity cost of labour.

In most developing countries price distortions prevail in both factor and product markets as a consequence of structural disequilibria, wages legislation and union bargaining in the factor market, and as a result of various trade control and promotion policy measures in the product market. Market prices, therefore, do not reflect the real worth of factors and products. In order to adjust for such price distortions a set of shadow prices and conversion factors are required.

In the economic analysis of projects the shadow price of labour is defined as the economic value of the loss of output elsewhere in the economy caused by the project owing to the withdrawal of labour from previous occupations. The shadow price of labour depends on the skills, availability, origin, and foregone output associated with the workers concerned.

A conversion factor (CF) is the ratio of shadow to domestic market price values of goods and services, as defined earlier. Following this the CF for labour may be expressed as

$$CF_L = SP_L/DP_L \qquad (14)$$

where,

CF_L is the conversion factor for labour

SP_L is the shadow price of labour, and

DP_L is the domestic market price, or project wage, rate of labour.

For the purpose of the present study, we shall consider only three types of labour, namely unskilled, skilled, and foreign labour.

4.2 CF for Labour in World Price System

The shadow price of labour in world price system is the economic value of the net foregone output resulting from committing labour to the project. It is also called the economic or shadow wage rate. To maintain the logical consistency of the shadow pricing system, the net foregone output should be expressed at its world price equivalent value.

In theory the equation for the shadow price of labour should also incorporate a component reflecting the change in effort as a result of the change in employment, expressed at shadow prices.

If a labourer views a new job as more difficult or demanding than the present one, the economic cost of new employment should include an estimate of the labourer's disutility of effort. In practice reliable data on disutility of effort is hard to find; excepting in some special cases where a worker is very likely to be subjected to hazards and discomforts, it does not appear in the equation of the shadow price of labour (Squire and van der Tak, 1975, 80-1, Powers 1981, 36).

4.3 CF for Rural Unskilled Labour

Conventionally, unskilled labour absorbed in the modern non-agricultural sector in rural areas is believed to be overwhelmingly rural people whose alternative employment would be in the rural sector, mainly in agricultural activities. The opportunity cost or the foregone output of such labour is the loss of income in the agriculture sector which can be taken as approximately equal to their marginal product.

As long as the equality between (i) the foregone output and marginal product, and (ii) the marginal product and market wage rate prevails, the estimation of net foregone output is in principle straightforward, and with the help of a relevant CF to revalue output, the shadow wage rate can be estimated. However, considerable practical problems arise when the equality does not hold. In most developing countries, especially in the rural sector, underemployment is prevalent. This means that the sector experiences peak, and off-peak periods of employment, with rural wages varying over the year. Often in practice foregone output is estimated as a weighted average of rural wage rates over a full year, allowing for the possibility of low or zero employment at certain times of the year.

Following equation (14), the CF for rural unskilled labour may be expressed as

$$CF_{RUL} = SP_{RUL}/DP_{RUL}$$

where, the subscript RUL stands for rural unskilled labour, with DP being the market wage. SP_{RUL} is the economic value of the net foregone output elsewhere in the economy as a result of the withdrawal of rural unskilled labour arising from the demands of the modern non-agricultural sector in the rural areas. SP_{RUL} may be expressed as

$$SP_{RUL} = m.CF_m \qquad (15)$$

where, m represents marginal product or net foregone output at domestic prices, and CF_m the conversion factor to express m at its world price equivalent value.

4.4 CF for Urban Unskilled Labour

The demand for unskilled labour in urban areas is met by (i) the pool of underemployed or unemployed unskilled labour already living in the urban areas; (ii) the pool of employed unskilled labour already living in the urban areas; (iii) the pool of rural unskilled labour who may migrate to the city.

When a project in the urban areas draws unskilled labour from one or more of (i) to (iii) sources, the same principles discussed for rural unskilled labour are relevant. In other words, the shadow price of urban unskilled labour, is measured as the economic value of the foregone output for different sources of labour.

The estimation of the shadow price of urban unskilled labour becomes complicated only when there is multiple migration so that more than one worker leaves rural areas for every new urban job that is created. As urban employment expands it may attract rural workers in search of a higher paying job in the urban areas. A protected urban market for unskilled labour may pay higher wages than that prevalent in the unprotected rural and urban markets for unskilled labour. In practice it is difficult to be certain about the source and magnitude of labour movements as migration patterns may be more complex in urban than in rural areas. The decision to migrate to urban areas is usually based on two economic considerations. First, the expectation of finding a higher paying job in the urban areas; second, the difference in long term earning potential of rural and urban employment.

Where multiple migration takes place, the shadow price of urban unskilled labour should be adjusted for the number of migrant workers per job created by the project. Following this, the shadow price of urban unskilled labour, with a multiple migration effect, may be expressed as

$$CF_{UUL} = SP_{UUL}/DP_{UUL}$$

where the subscript UUL denotes urban unskilled labour, and $SP_{UUL} = a.m.CF_m$

where a is the number of workers assumed to migrate per urban job, m is output foregone per worker at domestic prices and CF_m is the CF for m.

4.5 CF for Skilled Labour

The shadow price of skilled labour is also determined in the same way as in the unskilled labour case. In other words, it is the economic value of foregone output in alternative employment.

It is usually assumed that the market wage rate is a reasonable reflection of the economic opportunity cost of skilled and professional labour. This implies that the market wage rates determined by the labour markets have already considered the probable output foregone caused by the movement of skilled labour from one sector to another. The only adjustment required in this case, therefore, is the conversion of the domestic market wage rate into its world price equivalent value. For this purpose, the origin of the skilled labour should first be known, and by applying the relevant sectoral CF, the shadow price of skilled labour is estimated. In the case where the origin of the skilled labour is unknown, or the relevant CF is not available, the SCF may be used.

CF for skilled labour may be expressed as

$$CF_{SL} = SP_{SL}/DP_{SL}$$

where, the subscript SL refers to skilled labour.

If output foregone at domestic prices equals the market wage, then

$$SP_{SL} = DP_{SL} \times CF_m$$

where DP_{SL} is the market wage for skilled workers, and CF_m is the conversion factor for the sector from which they are assumed to come. In this case

$$CF_{SL} = \frac{DP_{SL} \times CF_m}{DP_{SL}} = CF_m \qquad (16)$$

so that CF for skilled labour is the CF for the sector from which the workers are drawn. Alternatively where the SCF is used instead of a sectoral CF the CF for skilled labour equals the SCF.

6.2

4.6 CF for Foreign Labour

For foreign workers there are two possibilities

(i) that a project generates an additional demand for foreign labour who like any other import are drawn into the economy with a direct foreign exchange cost;

(ii) that the project uses foreign workers already resident in the country; here their economic cost is therefore output foregone and their treatment is identical in principle to that of any other type of worker.

It is conventional, however, to assume that (i) is the more relevant approach since in the majority of cases foreign workers are drawn from abroad. The shadow price of foreign workers as per this approach is the sum of the repatriated amount of their wages plus the foreign exchange equivalent of their consumption domestically.

Foreign labour usually repatriates some of its wages to its home country and spends the rest in the host country for daily consumption. The repatriated portion of the wages paid to foreign labour is a direct loss of foreign exchange to the economy and the rest spent locally on consumption, valued at shadow prices, is an indirect loss of foreign exchange to the economy. The relevant CF for the former, repatriated wages, is 1.0 since it is already in terms of foreign exchange, and for the latter, foreign labour's consumption, is the specific CF for foreign labour's consumption.

The CF for foreign labour may be expressed as follows:

$$CL_{FL} = SP_{FL}/DP_{FL}$$

where, the subscript FL refers to foreign labour and

$$SP_{FL} = R + (DP_{FL} - R)\ CCF_{FL}, \qquad (17)$$

and R is the repatriated amount of wages,

DP_{FL} is the wage of foreign labour at the project site,

so that, $(DP_{FL} - R)$ is the amount of wages spent locally on consumption,

and CCF_{FL} is the consumption conversion factor for foreign labour.

Further distinctions between skilled and unskilled foreign labour will not be necessary as the same considerations are valid in both cases.

4.7 CF for Labour in Domestic Price System

In the economic analysis of projects in the domestic price system, the shadow price of labour is equal to its economic opportunity cost measured in domestic prices. As the unit of account is in domestic prices, no further adjustment is necessary. The economic principles involved in shadow pricing labour are similar in both domestic and world price systems.

CF for labour in the domestic price system (CF_L*) is, therefore, the ratio of shadow price of labour to its domestic price, where the shadow price of labour is the domestic price value of its foregone output in alternative employment. The key difference with the world price approach is that any foreign exchange element in output foregone - in terms of traded goods production - is increased in value by P^F (SER/OER) to account for any additional value placed on foreign exchange. The domestic or non-traded element in output foregone is valued at domestic prices which in theory should be shadow prices expressed in domestic price units.

Therefore in a domestic price system labour's output foregone, which defines the shadow wage, can be expressed as

$$SP_{LAB} = dm + (1 - d)m. P^F \qquad (18)$$

where SP_{LAB} is the shadow price of labour

m is output foregone at domestic prices

d is the proportion of m which is not a foreign exchange cost (non-traded output)

(1 - d) is the proportion of m which is a foreign exchange cost (traded output)

P^F is the premium on foreign exchange

In turn in a domestic price system there will be a new set of CFs for domestic workers, so that for example, for labour in general

$$CF^*_L = \frac{SP_L}{DP_L}$$

where CF^*_L is the conversion factor for labour in a domestic price system

DP_L is the market wage

and SP_L is as in (18)

CF^*_L is therefore

$$CF^*_L = \frac{dm + (1 - d)m.P^F}{DP_L} \qquad (19)$$

Equation (19) holds for all categories of domestic workers, whether unskilled, urban, rural or skilled.

For foreign workers equation (17) must be modified, to become

$$SP^*_{FL} = R.P^F + (DP_{FL} - R) \qquad (20)$$

$$\text{so that } CF^*_{FL} = \frac{R.P^F + (DP_{FL} - R)}{DP_{FL}}$$

where SP^*_{FL} and CF_{FL} are the shadow price and conversion factor of foreign labour, respectively, in a domestic price system.

In (20) the direct foreign exchange element in the cost of employing foreign workers - the repatriated element in wages R - is adjusted by P^F, whilst the domestic element of local consumption (DP_{FL} - R) remains unadjusted, since it is already at domestic prices.

5.0 Shadow Price of Land

5.1 Introduction

Land is a unique primary factor of production. It is essentially non-reproducible, non-substitutable, immobile, and with adequate farming practices it can have an infinite life unlike other primary factors. It may be rented or owned by individuals, the community, and the government.

In a project's accounts land enters directly as an input to the project and indirectly as an input to the non-traded goods used by the project. The financial cost of purchased land appears as a capital investment and the financial expense of rented land appears as a current operating cost in the project cash flow.

5.2 Shadow Price of Land in a World Price System

The value of land varies as a function of expectations regarding its future use. Where there is a free market in land, the market price will reflect puchaser's assessment of the future net earnings from the land. Usually, urban land and land in the natural resource sense may be held as profitable speculative assets, with the current price determined on the basis of expected future returns. In most cases of urban land its market price is considered to be a reliable indicator of its real worth. Nevertheless, one should be careful in the case of government owned urban land where it may be subsidised for some special projects, and in some cases of urban land where the owners may declare a low value for their land to reduce their tax burden.

As development projects are not usually located on high value urban sites, a serious need for shadow pricing does not frequently arise for manufacturing projects. As we mentioned earlier, in many cases of urban land the market price may be considered to be equal to its shadow price, perhaps only adjusting for the average divergence in the economy between domestic and world prices by using the SCF.

A serious need for shadow pricing of land arises in the case of projects located in rural areas; particularly those projects requiring extensive use of land, for example, agricultural, forestry, mining, irrigation, and road projects. Manufacturing projects usually require only a small area of land for their buildings and plants, and the financial cost of such land in the project accounts will normally be a small item. In the case of such minor costs the SCF may be used.

For most agricultural projects using existing agricultural land the best approach is to measure the annual benefits of the project as the difference between what the land would have produced without the project, and what it is expected to produce with the project. The annual benefits, thus, obtained should be expressed at their world price equivalent values with the help of relevant CFs. Here, the CFs will be specific for individual agricultural products. The implicit assumption in this approach is that the land in such agricultural projects is an annual recurrent cost which represents its alternative marginal net product each year, and that the land use is reversible. Unlike agriculture-related projects, in some projects, particularly like open-cast mining, and road construction, land use is changed irreversibly because the costs of reversal are prohibitive. In such cases the annual costs will need to be capitalised at the economic discount rate.

For all projects incurring land costs, estimating the economic opportunity cost of land is usually an essential part of project design work; however forecasting the without project situation is very demanding in terms of data, resources and technical expertise.

For all projects incurring minor land costs, such as most industrial projects, the convention is to assume equality between the market and domestic shadow price value of land, using the SCF to revalue the land cost to world prices. Clearly for more land-intensive projects more detailed estimates will be required derived from the with and without project case.

5.3 Shadow Price of Land in a Domestic Price System

The coverage of shadow pricing of land in the domestic price system follows the same analysis. The economic cost of land is the value of net output foregone at domestic prices as a result of using the land for the project. As in the case of labour, the foreign exchange component of land's opportunity cost - covering traded output foregone - must be adjusted by multiplication by P^F to allow for any premium on foreign exchange.

6. Shadow Price and Conversion Factor for Traded Goods

6.1 Introduction

Traded goods are those goods which have direct international trading prices. Their consumption or production by a project has a direct effect on the balance of payments. The main economic opportunity costs of traded goods to the economy are their international trading prices, namely, cif import and fob export prices. A number of different types of traded goods may be associated with a project; the most likely types of traded goods are described below:

(i) goods which are imported by a project;
(ii) goods which are exported as a result of a project;
(iii) goods whose production by a project saves foreign exchange through import substitution;
(iv) goods which are diverted to domestic use by a project, and would otherwise would have been exported;

Whilst categories (i) to (iv) are assumed to be at constant prices there is a final category.

(v) goods imported or exported at variable international prices; here additional demand or supply by a project affects the world price of the good.

6.2 CF for Traded Goods in a World Price System

To estimate the CF for traded goods requires a comparison between their world prices plus various domestic transport and distribution costs, and their price in the domestic market. It is necessary to be consistent so that domestic price at a particular price level, for example wholesale or retail, and at a specific location is compared with the equivalent world price. This involves adding the appropriate transport and distribution costs to the world price to arrive at the appropriate shadow price for the price level chosen. To find the shadow price of a traded good in a world price system it is necessary to convert transport and distribution costs to world price terms by either using CFs for these sectors, or a single SCF.

This can be illustrated in terms of the different categories of traded goods identified above;

(i) imported goods at constant prices

Here the shadow price at a project of an imported good i is

$$SP_i = WP_i + T_i.CF_T + D_i.CF_D \qquad (21)$$

where SP_i is the shadow price of import i

WP_i is the cif price of i converted at the official exchange rate,

T_i is the transport cost at domestic prices involved in moving i from the port to the consumption point selected for the analysis

D_i is the distribution costs (including port costs) at domestic prices involved in moving i from the port to the domestic consumption point selected for the analysis.

and CF_T and CF_D are conversion factors for transport and distribution respectively, which will convert their domestic price values to world prices. The relevant CF for i is given by $\frac{SP_i}{DP_i}$

where DP_i is the domestic price at the selected point of consumption.

(ii) export goods at constant prices

Here the only difference of treatment is that domestic transport and distribution costs will have a negative sign, since by exporting the output these costs, associated with moving the goods from the project to the port or frontier, will reduce the benefit from the export sale. Therefore where x refers to an export good sold by a project

$$SP_x = WP_x - T_x. CF_T - D_x .CF_D \qquad (22)$$

Here WP_x is now an fob price converted at the official exchange rate.

The CF for x is therefore $\frac{SP_x}{DP_x}$, where DP_x is the domestic price of x at the project.

(iii) import substitutes at constant prices

For projects that produce import substitutes the geographical point of comparison should be the main market for the good. Without the project, domestic buyers would pay the cif cost of the import plus the transport and distribution cost between the port and this main market. With the project buyers will pay the project - gate price plus the transport and distribution cost between the main market and the project site. To determine the economic value of the good, that is, the substitute for imports produced by the project, the transport and distribution costs between the project and the port (T^1 and D^1) should be added to the cif price and the transport and distribution cost between the market and the project (T^2 and D^2), should be deducted from this total. This is because transport and distribution costs from the port to the market will now be saved as a result of the domestic production of the good. These savings must be added to the benefit in foreign exchange determined by the cif price of output. However costs incurred in moving the good from the project to the market lower the net benefit from the production of i.

Denoting an import substitute commodity by the subscript "is" the shadow price is

$$SP_{is} = WP_{is} + (T^1{}_{is} - T^2{}_{is})\ CF_T + (D^1{}_{is} - D^2{}_{is})\ CF_D \qquad (23)$$

where WP_{is} is the cif price at the official exchange rate

and T^1 and T^2, and D^1 and D^2 refer to the two set of transport and distribution costs respectively;

The relevant CF is therefore $CF_{is} = \frac{SP_{is}}{DP_{is}}$

where DP_{is} is the price in the domestic market, at the chosen price level, either retail or wholesale.

(iv) exportable goods at constant prices

These are goods diverted from export to the domestic market. There are two effects to be considered in the determination of their shadow price. These are the costs saved and revenue foregone by not exporting the goods and the transport and distribution costs incurred in using the goods in the domestic economy. The shadow price of the diverted exports will be the fob price plus the net economic value of the transport and distribution costs involved. These costs will comprise:

- the saved cost of transport and distribution from the producer to the port (T^1 and D^1); and
- the cost of transport and distribution from the producer to the main domestic market (T^2 and D^2).

Using the subscript dx for diverted exports, their shadow price is as follows;

$$SP_{dx} = WP_{dx} + (T^2{}_{dx} - T^1{}_{dx}).CF_T + (D^2{}_{dx} - D^1{}_{dx}).CF_D \qquad (24)$$

Now costs $T^1{}_{dx}$ and $D^1{}_{dx}$ are saved as a result of the good not being exported, and are therefore shown with a negative sign. Costs $T^2{}_{dx}$ and $D^2{}_{dx}$ are incurred in moving the good to the market so they are included with a positive sign.

WP_{dx} is the fob price converted at the official exchange rate.

The CF is given as $\frac{SP_{dx}}{DP_{dx}}$

where DP_{dx} is the domestic price at the chosen price level.

(v) traded goods with variable international prices

A common assumption in shadow pricing traded goods is that an increase in production or consumption as a result of a project in a developing country will not be sufficient to influence world prices for the goods. A project's incremental addition to or deduction from the level of world trade is assumed to be absorbed without any significant effect on world unit prices. If this assumption of infinite elasticity regarding the supply of imports and demand for exports appears unjustified, an estimation of marginal export revenue or import cost becomes necessary.

If the cif or fob price of a traded good is expected to vary significantly with the amount of purchase or sale, it should be adjusted before using it to reflect an economic cost or benefit. An adjustment must be made for the fact that a higher or lower unit price, at the margin, will increase or decrease the average price of the traded good associated with the project. If a project will require a very large quantity of an imported input, whose price rises in response to the project's demand, estimation of its marginal import cost to the economy becomes relevant. Likewise, if a project exports a very large quantity of a certain good and this causes the average price of the good to fall, the marginal export revenue becomes the appropriate measure of the unit value of the export good.

In these cases the average unit cif or fob price must be replaced as a measure of value for a traded good by the marginal import cost (MIC) and marginal export revenue (MER),

where $$MIC_i = WP_i \cdot (1 + \frac{1}{e_i}) \text{ and}$$

$$MER_x = WP_x \ (1 + \frac{1}{e_x})$$

where i and x refer to imported and export goods respectively;

WP_i and WP_x are cif and fob prices respectively converted at the official exchange rate,

and e_i and e_x are the elasticities of foreign supply of imports, and of demand for exports, respectively.

These specifications for marginal import costs and export revenues replace the average world prices (WP_i and WP_x) in equations (21) to (24). However situations where marginal estimates of this type will be required will be limited, and will refer chiefly to primary produ ' ~ where an individual developing country is a key supplier on the world market.

6.3 CF for Traded Goods in a Domestic Price System

The economic principles involved in shadow-pricing traded goods are similar in both systems. Both recognise that foreign exchange availability is affected by the consumption or production of traded goods by a project. However, the CFs used will vary because of the difference in unit of account used in the two systems.

In the economic analysis of projects following the domestic price system the shadow price of the traded goods, directly associated as outputs or inputs and indirectly used as inputs to nontraded goods, is the border price converted to domestic currency at the official exchange rate and adjusted by the shadow price of foreign exchange (P^F). Where relevant, the border price is adjusted for the economic cost of domestic transport and distribution associated with the traded good.

In the world price system, as described earlier, the foreign exchange component is kept unchanged as it is already in terms of foreign exchange; whilst, in the domestic price system, the foreign exchange component is adjusted by P^F to allow for any implicit exchange rate over-valuation, illustrated by the fact that on average domestic prices exceed world prices for comparable goods.

As is discussed in Appendix 1 in a domestic price system the values of traded goods at domestic market prices at the project site are decomposed into four main components: F (foreign exchange), L (unskilled labour), W (skilled labour) and D (domestic materials). D may be further decomposed into F, L, W, and D, until D becomes zero or very small. All the decomposed items are then shadow-priced using the relevant CFs.

Equations (21) to (24) can be re-expressed in a domestic price system. For example, for an imported good (i) in a domestic price analysis the relevant shadow price for i is as follows:

$$SP_i = WP_i . P^F + T_i + D_i \qquad (25)$$

where

P^F is the premium value placed on foreign exchange (SER/OER).

and other items are as in (21).

Equation (25) represents an approximate version of the domestic price system, since the domestic prices of transport and distribution costs are assumed to reflect their shadow price values. A more detailed procedure would be to breakdown T_i and D_i into their different components (F, L, W and D) and to give shadow price values to these different components. If this is done shadow prices for transport and distribution can also be estimated in a domestic price system, and CFs based on the ratios of these to their domestic market prices can be derived. Then equation (25) can be rewritten as:

$$SP_i = WP_i.P^F + T_i.CF_T{}^1 + D_i.CF_D{}^1 \qquad (26)$$

Now $CF_T{}^1$ and $CF_D{}^1$ are conversion factors in a domestic price system, and are used to convert transport and distribution costs associated with i to shadow prices in the domestic price system. Equation (26) rather than (25) is the version which is strictly comparable with equation (21) in the world price system.

In the same way comparable equations in a domestic price system can be given for equations (22) to (24).

7.0 Shadow Prices and Conversion Factors for Nontraded Goods

7.1 Introduction

The goods and services which do not enter international trade are called nontraded goods (NTGs). They are nontraded or nontradeable because their trade is prohibited either by their inherent physical nature, such as immobility, and high transport cost (transport, distribution, construction, communication, banking, insurance); or because government policy restricts their trade. Consumption or production of NTGs has an impact on the availability of foreign exchange indirectly since they use traded goods in addition to factor inputs in their production. As NTGs contain substantial amounts of traded goods, any change in the demand for and supply of NTGs as a result of a project indirectly affects the availability of traded goods, foreign exchange and thereby the balance cf payments. Therefore, to incorporate such an impact in economic analysis of projects, shadow pricing of NTGs is necessary. In order to facilitate the analysis a set of specific CFs for major NTGs is desirable (Bruce 1976, 9-13; Irvin 1978, 101-7; Little and Mirrlees 1974, 211-222).

NTGs may enter into project accounts both as an output and input. However, except in the case where marginal cost equals price, the shadow price of NTGs as an output differs from the shadow price of NTGs as an input.

7.2 CF for Nontraded Goods as Inputs in a World Price System

An increase in the demand for NTGs as a result of a project is met either by an increase in their production or a decrease in consumption elsewhere in the economy. Stated otherwise, where NTGs are in variable supply their additional demand is met by an increase in production; where NTGs are in fixed supply their additional demand is met by a decrease in their consumption elsewhere. In the case where the additional demand is met by increased production the shadow price of the NTGs will be the marginal cost of increased production expressed at equivalent world prices. Likewise, in the case where additional demand is fulfilled by reduced consumption the shadow price of the NTGs will be the value of foregone consumption expressed at equivalent world prices.

The first step in the estimation of the CFs for NTGs as inputs in variable supply is to identify their marginal supply cost at domestic prices; that is, the sum of inputs required to produce an additional unit at market prices. Second, the marginal supply cost thus identified is decomposed into its constituent inputs like traded goods, nontraded goods, labour capital and transfer payments (taxes, duties, excess profits). Further decomposition of nontraded goods and capital-related costs is carried out until they become a very small proportion in the total marginal supply cost. The final decomposed inputs are often termed primary inputs. Third, each primary input item is valued at equivalent world prices with the help of the relevant CFs. Finally, the ratio of the marginal supply cost at shadow prices to its value at domestic prices gives the CF for NTGs as inputs in variable supply.

Algebraically therefore marginal supply cost for non-traded activity n (MSC_n) can be expressed as

$$MSC_n = \sum^{f} a_{fn}.P_f \qquad (27)$$

where a_{fn} is the amount of primary input f per unit of additional output n,

and P_f is the shadow price of each primary input.

Therefore for activity n,

$$SP_n = MSC_n$$

and the relevant CF is

$$CF_n = \frac{SP_n}{DP_n}$$

where SP_n and DP_n are the shadow and domestic market prices of n, respectively.

When NTGs as inputs are in fixed supply their demand price rather than their supply cost is the basis for their shadow pricing. As mentioned earlier, the economic shadow price of such goods is the value of foregone consumption caused by the extra demand created by the project expressed at equivalent world prices. The market price which reflects consumers willingness to pay gives the value of foregone consumption. In the case where the market price is distorted, some adjustments for the distortion will be necessary.

The market price is always the first approximation to the value of foregone consumption, when demand increases for NTGs in fixed supply. The next task after the determination of the value of foregone consumption is to transform it into an equivalent world price value. This may be done with the help of average CFs, for example, a weighted average of the CFs for consumption goods, or by using simply the SCF. The idea here is that the shadow price of NTGs in fixed supply depends on how the consumers who can now no longer purchase them will spend the money which was previously used on their purchase.

Use of the market price as a measure of willingness to pay is correct as long as the additional demand from a project is small relative to the supply available, and therefore the market price remains virtually unchanged. In the case where the market price changes substantially, it is necessary to estimate an alternative price to use in valuing foregone consumption. When the additional demand for NTGs in fixed supply is great enough to change their market price, neither the price before, nor the price after the project is the correct value of foregone consumption; this will normally lie somewhere between the two. Therefore, in this case the average of the two prices provides a good approximation of the value of foregone consumption. Once the value of foregone consumptions is determined, its transformation into an equivalent world price can be done in exactly the same manner, as before, using the SCF or an aggregate CF for consumption in general.

7.3 CF for Nontraded Goods and Outputs in a World Price System

Generally, the shadow price of nontraded outputs is their value in consumption, that is, consumers' willingness to pay, expressed at equivalent world prices. Estimation of a CF for nontraded outputs can be done in the same way as in the case of nontraded inputs in fixed supply; the difference between the two cases is that nontraded outputs increase domestic supply, whereas use of nontraded inputs in fixed supply decreases it.

When nontraded outputs are directly quantifiable and saleable in the market the above mentioned approach of estimating consumer willingness to pay is appropriate for their shadow pricing. However, if nontraded outputs are not directly marketed a different approach should be adopted. In such cases, the benefit is enumerated indirectly on the basis of gains to consumers and producers. For example, in the case of rural roads, the value of the nontraded output is the producers surplus. Benefits as a result of a rural road might be a decrease in transport cost for local agricultureal output with farmers selling more at the same farm-gate price and also gaining from a decrease in the transport cost of farm inputs. Both effects will increase agriculture production and their summation will be the producers surplus arising from the rural road project. Similar arguments apply in relation to consumers, since a decrease in cost can create a consumers surplus. This is the difference between what consumers are prepared to pay and what they actually pay for a good or service. For example, in the case of an urban road project, the benefit will comprise savings in maintenance or recurring costs, savings in vehicle operating costs, savings in time for drivers, passengers and freight, reduction in accidents (which could result in death, injury and damages), and reduction in congestion and noise (see Appendix 2).

Once an estimate of the shadow price of a non-traded output at domestic prices is available this must then be converted to a world price equivalent figure using the SCF or an aggregate CF for consumption (Ray 1984, 55-63). When the shadow price of nontraded outputs is determined, their CF can be estimated exactly as in the case of other goods. However estimation of the appropriate shadow prices for non-traded activities can be complex, and is acknowledged to be one of the most difficult areas for the practical application of cost-benefit analysis.

7.4 CF for Nontraded Goods in a Domestic Price System

The economic principles which guide the derivation of CFs for nontraded goods are similar in both shadow pricing systems. The only difference is the unit of account.

If the additional demand for nontraded inputs as a result of a project is met by an increase in their production, marginal supply cost is relevant. The marginal supply cost should be decomposed into F, L, W and D, as in the cases of other goods, and shadow priced with the help of the relevant CFs. This will give the value of marginal supply cost of nontraded inputs at domestic prices, that is, the shadow price of nontraded inputs in variable supply in a domestic price system.

Some of the discussion in UNIDO (1972) implies that a full shadow pricing of non-traded inputs may not be necessary, so that for some items the domestic market price can be used as a proxy for their economic value, implying a CF of 1.0. However it is clear that theoretically a full decomposition of costs and a shadow pricing of the set of primary inputs into a non-traded activity is desirable.

As noted above UNIDO identifies four main primary input categories (F, L, W and D). However, D domestic materials, is a residual and in theory it can be sub-divided further until ultimately all inputs are either foreign exchange (F) or labour (L,and W). The more approximate the estimation procedures the larger will be the residual D in relation to the other primary inputs (see Appendix 1).

If the additional demand for nontraded inputs is met by a decrease in consumption elsewhere in the economy, or if the only impact of additional production of nontraded goods is to increase consumption in the economy, consumers willingness to pay at domestic prices is the shadow price. However unlike the world price system this analysis does not require that consumer willingness to pay be converted into an equivalent figure at world prices. Therefore the willingness to pay estimate at domestic prices is not adjusted further by another CF.

8. Other Aggregate CFs

8.1 Consumption

CFs for consumption are required to transform a marginal increase in consumer expenditure into its equivalent value at world prices. They are used in revaluing non-traded outputs, and in some more complex versions of the shadow wage rate. Stated otherwise, the basket of commodities making up the consumer's marginal consumption pattern must be valued at shadow prices. In a world price system the ratio of the world price value of the consumer's basket of commodities to its value at domestic prices provides the value for the CF for consumption (CCF). As consumption patterns vary in respect to geographical region and income levels, ideally CFs for consumption should be estimated for each region and income level.

In the way that the shadow exchange rate is derived in UNIDO (1972) the CCF is the inverse of the ratio of the shadow to the official rate, so that CCF = $\frac{1}{SER/OER}$. This equivalence follows because UNIDO (1972) defines the SER in relation to consumer goods only, not all goods in the economy (UNIDO 1972, 213-231; Scott 1974).

8.2 Capital

The national stock of capital is made up of various assets such as machinery and equipment, land, buildings, roads and bridges, and inventories. Therefore, in a world price system the CF for capital or aggregate investment is the ratio of the world to domestic price values of the respective shares of the different capital-related items. It may be a useful aggregate parameter to use for example, in estimates of the opportunity cost of capital, or in converting the capital costs of non-traded inputs to world price equivalents.

To illustrate the approach, if total capital in the economy is composed of 30% Land, 50% Buildings and 20% Equipment, then an aggregate capital CF can be calculated as a weighted average of the CFs relevant to these three types of assets. For example, if an Agricultural CF of 1.10 is used for Land, a Construction CF of 0.80 is used for Buildings, and the Equipment CF is 0.75, then the aggregate capital CF will be

$$(0.30 \times 1.10) + (0.50 \times 0.80) + (0.20 \times 0.75) = 0.88$$

A similar approach can be followed in a domestic price system except that shadow prices are now in domestic not world price values.

9. Social Analysis

9.1 Introduction

The discussion up to this point has concentrated on the shadow prices necessary to test the efficiency with which a project utilises the existing resources of the economy, and in particular for traded goods the degree to which they meet the objective of trade efficiency. This approach, termed one of economic analysis, can be extended to what has been termed a social analysis of projects (Squire and van der Tak 1975). Although this report does not recommend that social analysis be tried in appraisals in China, it is necessary to explain why this approach, which has been set out clearly in the theoretical literature, is largely inoperable in practice.

The basic aim of social analysis adjustments is to allow for the fact that by changing real incomes projects alter the levels of savings and consumption in the economy, and also affect their distribution between groups and individuals. From an economic efficiency perspective, such issues are not considered, since the concern is only with the creation of income in total. However if governments feel (a) that the level of savings in the economy in inadequate and (b) that the current distribution of income is unjust and (c) that decisions on projects should be used to change both of their situations - then it is argued that theoretically it is appropriate to adjust shadow prices to allow for these considerations.

When this type of social analysis is undertaken there will be a new set of shadow prices and thus CFs, which incorporate these savings and consumption effects. Squire and van der Tak (1975, 54, 62) express the net social benefit and therefore the shadow price of an item as

$$S = E - C(B - W)$$

where E is net economic benefit, defined as in the economic analysis; C is the net consumption change that arises from a project; B is the cost of this extra consumption (in terms of lower savings) and W is the social value placed on it by the government (in terms of meeting government poverty and income distribution objectives). The value of B is defined by the relevant CF for consumption for the recipients of the extra consumption, and that of W is determined by a set of social weights, discussed below. In principle all private sector recipients of consumption changes should be identified and shadow prices adjusted to take account of the effect of their additional consumption.

In the discussion in Squire and van der Tak (1975) where these adjustments were first set out in detail the main focus is on the treatment of unskilled labour, however it is clear that in a social analysis the shadow prices of non-traded goods, and the discount rate will also alter in comparison with an economic analysis. Therefore, a full new set of CFs will be required if social analysis is to be applied. The discussion below focusses on social analysis in a world price system since this is the approach used by Squire and van der Tak. Equivalent procedures can be used in a domestic price system.

9.2 Treatment of Unskilled Labour in Social Analysis

The attention given to unskilled labour is on the grounds that the most important income changes generated by a new project will be felt by unskilled workers employed on the project.

In economic analysis as we have seen the shadow wage or shadow price of labour (SP_L) is

$$SP_L = m.CF_m$$

where m is output foregone at domestic prices

CF_m is the relevant conversion factor to convert this output foregone to world price terms.

In a social analysis the new shadow price of labour becomes

$$SP^1{}_L = m.CF_m + (C^2 - C^1)\ CCF - d\ (C^2 - C^1) \qquad (28)$$

where,

C^2 is the new level of consumption of the worker after he has entered employment on the project,

C^1 is his old level of consumption prior to obtaining employment, so that $(C^2 - C^1)$ is his consumption gain,

C^2 and C^1 are measured at domestic prices and CCF is the CF required to express this consumption at world prices, and

d is the weight given to a unit of consumption at domestic prices going to the worker concerned, in relation to the numeraire. (d will vary with either the consumption or income level of the worker).

The new shadow wage (28) has three elements. The opportunity cost of labour ($m.CF_m$)) is a cost in terms of the efficiency objective since it represents a loss of income elsewhere in the economy; the extra consumption of the worker $(C^2 - C^1)$ CCF is a cost in terms of growth, since it diverts resources away from saving, and, by assumption, investment. However the extra consumption of the worker is also a benefit in terms of improving income distribution, so that the value of this benefit, $d.(C^2 - C^1)$ is subtracted from the other items, thus lowering the shadow wage.

Consideration of income distribution will lower SP^1_L, below what it would be if efficiency and growth were the only objectives, and the poorer are the workers employed on a project the higher will be the weight d and the benefit $d(C^2 - C^1)$, to be subtracted from the other terms in SP^1_L. In this analysis the inclusion of the equity objective affects project selection by lowering the cost of labour, and therefore biasing the choice of projects in favour of those which employ relatively large numbers of poor workers.

9.3 Treatment of Non-Traded Inputs in Social Analysis

In the case of non-traded commodities used as inputs by a project, their shadow price in an economic analysis will normally be determined by the resources used in their production valued at world prices, or equivalent world prices. For non-traded commodity n the shadow price can be defined as:

$$SP_n = \sum_i a_i SP_i + \sum_j a_j SP_j + a_\ell SP_L + W.r \qquad (29)$$

where,

$\sum_i$ are the traded inputs (i) used in the production of non-traded good n,

a_i is the number of units of i per unit of n,

SP_i is the world price (c.i.f. or f.o.b.) for traded good i,

$\sum_j$ are the non-traded inputs (j) used in the production of n,

a_j is the number units of j per unit of n,

SP_j is the shadow price of j (calculated for j in the same way as for n),

$a\ell$ is the number of workers required per unit of n,

SP_L is the shadow wage (calculated as in equation (14),

K is the value of capital stock at world prices required per unit of x, and

r is the percentage opportunity cost rate of return on capital.

Equation (29) assumes that the production of an additional unit of n requires extra capital facilities, so that the shadow price of n is based on estimated long-run, rather than short-run marginal costs. Capital costs are shown separately from the input items i and j.

In the social analysis the shadow price of non-traded goods must include an allowance for the income changes created as a result of the increased production of these commodities. These income changes can take various forms. Workers employed as a result of the extra production of a non-traded good will find their income increased if they move from lower income activities; owners of capital may find that they earn a higher rate of profit in the production of the non-traded good than they could in other sectors; consumers may also be affected if extra production of the non-traded good leads to price changes in other sectors; the government may also gain extra tax revenue paid by producers or consumers. In principle all these income changes should be revalued by the weights for private savings and consumption relevant for the groups concerned.

One simplifying assumption which can be adopted is that private savings is equal in value to government income. If this is so additional costs or benefits, as a result of income changes created by the production of a non-traded good, can arise only through changes in private consumption. This assumption is used here so that attention can be concentrated on consumption weights. Adopting this assumption, in a social analysis, the new shadow price of n (SP_n^1) will be

$$SP_n^1 = \sum_i a_i SP_i + \sum_j a_j SP_j^1 + a_\ell . SP^1_L + K \cdot r^1 + \sum_g (CCF_g - d_g)\, C_g \qquad (30)$$

where,

SP_j^1 is the shadow price of j in a social analysis,

SP^1_L is the new shadow wage (calculated from equation (28)),

r^1 is the opportunity cost of capital in a social analysis,

$\sum_g$ are the private groups, excluding labour, whose income is affected by production of n,

C_g is the value at domestic prices of the extra consumption of each group,

CCF_g is the CF required to express the cost of this extra consumption at world prices, and

d_g is the weight which expresses the value of a unit of consumption at domestic prices in units of the numeraire. (As in equation (28), d will vary between groups).

In equation (30) whether the extra consumption generated by a project will lower or raise the shadow price of n in relation to its value in an economic analysis will depend upon the value of extra consumption in relation to the numeraire. If the benefit of extra aggregate consumption exceeds its costs $\sum_g (d_g > CCF_g)$ it will be subtracted from the other items in equation (30), whilst if the cost exceeds the benefit $\sum_g (CCF_g > d_g)$, the income changes created by the production of n will have a negative social value and will raise the shadow price of n. Consumption gains for workers employed in the production of n do not need to be considered separately since they will have been revalued already in the shadow wage SP^1_L.

Poor groups will have a relatively high value of d, so that their extra consumption should produce a benefit to be deducted from the cost items in the shadow price of n. In this way the use of adjusted shadow prices for non-traded goods is intended to have the effect of lowering the shadow price of goods, whose additional production leads to income and consumption gains for poor groups. As in the treatment of labour this is a way of biasing the selection of projects in a particular direction; in this case in favour of those which use such non-traded goods.

9.4 The Discount Rate in Social Analysis

The discount rate for a social analysis will also vary from that for an economic. The discount rate can be specified as the opportunity cost of capital defined by the return on the marginal investment at shadow prices, so that

$$r = q$$

where

r is the economic discount rate

q is the marginal returns to investment at world prices.

However in a social analysis marginal returns must be adjusted to take account of the distributional changes generated by a marginal investment. These distribution changes will be the creation of additional consumption and savings for workers and capitalists associated with the marginal investments. The new discount rate can be specified generally as

$$r^1 = q + h \qquad (31)$$

where h denotes the value placed on these distributional changes.

As is discussed in report 2, h is normally negative, since where as in the normal specification of the world price system savings are the numeraire, consumption is given a lower value, lowering r^1 below r.

Where the discount rate r is defined by the marginal cost of borrowing, in a social analysis the discount rate will be redefined to equal the governments' time preference rate for consumption - often termed the consumption rate of interest discount rate (CRI). This reflects the degree to which the government judges consumption to fall in value over time. In other words, it will be economically rational to raise borrowing from either foreign or domestic savers - up to the point at which the cost of this borrowing equals the consumption rate of interest discount rate. A formula, discussed below, exists for estimating CRI. However the formula is based on two subjective parameters, regarding government preferences for income redistribution and risk-taking, so that the CRI remains an intrinsically subjective parameter.

9.5 Social Weights - Little and Mirrlees (1974) and Squire and van der Tak (1975)

Application of social analysis requires the identification of weights for the valuation of additional consumption and savings. The weakness of the approach is that such weights are intrinsically subjective with no real objective basis for their valuation. This subjectivity is probably the main reason why socially adjusted national economic parameter estimates have not been adopted systematically by either donor agencies or national governments.

Little and Mirrlees (1974) and Squire and van der Tak (1975) put forward two slightly different approaches to the derivation of these weights. Little and Mirrlees suggest they can be obtained by assuming first that there is certain level of annual per capita consumption, termed the base level of consumption, at which the government is indifferent between income consumed by people at the base level and the same income going to the government itself. Secondly they assume that the government's valuation of additional units of consumption falls at a constant percentage rate for a given percentage rise in the level of consumption of the recipient. In technical terms the latter assumption implies a government utility function with respect to increases in consumption of constant negative elasticity. The formula for consumption weights is

$$d_i = \left(\frac{b}{c_i}\right)^n \qquad (32)$$

where,

d_i is the consumption weight of group i

b is the base level of consumption,

c_i is the average level of consumption for group i, and

n is the assumed elasticity of the government utility function for consumption.

Groups on the base level have a weight of 1.0, since their consumption is equal in value to the numeraire, whilst those above the base level have a weight of <1.0, and those below it a weight >1.0.

Average consumption levels of different groups can, in principle, be calculated from observable data, so that the weights, d_i, will be determined by the choice of values for b and n. It is acknowledged that n is a subjective parameter which reflects the degree of government commitment to redistribute income. The higher the value of n the higher will be the weight given to the poorest groups, and the lower the weight given to the richest. A major obstacle to applying this approach is in identifying the value of b. It is suggested that it can be inferred from existing government policies on taxes and subsidies, and that it will lie between the income level at which income tax payments commence, where the government takes money from individuals, and the level at which individuals receive money from the government in the form of welfare subsidies. However in many countries such an income range cannot be defined clearly.

Squire and van der Tak do not derive consumption weights in the same way as Little and Mirrlees. Instead of identifying a base level of consumption, they relate private consumption to government income in two stages. First the value of a unit of the numeraire is calculated in terms of units of consumption at domestic prices going to an individual with the national average level of consumption per capita. Secondly they use the same government utility function as Little and Mirrlees, but compare the consumption of a particular group with the national average rather than an estimated base level.

The value of a unit of consumption at domestic prices going to group i, in relation to the numeraire, is given by d_i/v, where d_i is the value of a unit of consumption going to group i in relation to a unit going to the average consumer, and v is the value of a unit of government income in terms of units of consumption at domestic prices going to average consumers.

The weight d_i is determined by the relationship

$$d_i = \left(\frac{\bar{c}}{c_i}\right)^n \qquad (33)$$

where $\bar{c}$, the national average level of consumption, has replaced b, as the point of comparison with c_i.

The use of this formula is illustrated in table 2, for values of n of 0.5, 1.0 and 1.5; Squire and van der Tak suggest that this is a reasonable range in which n might lie. It can be seen that use of n = 1.0, and 1.5 can lead to weights that are very low and very high for rich and poor groups respectively. One of the key problems in applying the formula however is that there is no agreed basis for selecting a single value for n. In some analysis n = 1.0 has tended to be used on the grounds that it gives an intuitively understandable set of weights; n = 1.0 implying that the weight placed by the government on an additional unit of consumption falls in direct proportion with the rise in the consumption level of the recipient. In other words a unit received by a person with an average consumption of 600 units will be worth twice as much as a unit received by someone with an average consumption of 1200.

Table 3 Illustrative Consumption Weights for Different Groups

Average consumption of group (c_i)	National average consumption ($\bar{c}$)	($\bar{c}/c_i$)	Consumption weights (d_i) Elasticity paramater n = 0.5	n = 1.0	n = 1.5
10	100	10.0	3.16	10.00	31.62
50	100	2.0	1.41	2.00	2.83
75	100	1.33	1.15	1.33	1.53
100	100	1.0	1.00	1.00	1.00
150	100	0.66	0.81	0.66	0.54
300	100	0.33	0.57	0.33	0.19
600	100	0.17	0.41	0.17	0.17

Source: Squire and van der Tak (1975) table 1, p.64.

Use of equation (33) avoids the need to infer a base level of consumption from government policies. However problems in estimating b are replaced by problems in estimating the value of government income in relation to private consumption, v. Squire and van der Tak suggest that v can be calculated from a formula which relates the value of a unit of investment to the present value of the stream of consumption generated by the investment. This approach assumes that either all government income is invested or that, at the margin, the government allocates its resources optimally, so that all government expenditure whether investment, or current expenditure, is of equal value. A number of different formulae are given for v, but the main one is that for the shadow price of investment in UNIDO (1972);

$$v = \frac{q - s.q}{CRI - s.q.} / CCF \qquad (34)$$

where

q is the marginal product of capital in the public sector, at world prices,

s is the marginal propensity to reinvest in the public sector, CRI is the rate at which the government discounts future consumption, and

CCF is the conversion factor which translates consumption expenditure at domestic prices into world prices.

The value of investment (and by assumption government income) is determined by the annual returns on investment (q), the proportions of these which are saved (s), and consumed (1-s), and the extent to which the government places a lower value on consumption in the future (CRI). The expression

$$\frac{q - s.q}{CRI - s.q}$$

gives the present value of the stream of units of consumption generated by a unit of investment. However this consumption is measured at world prices, because (q) the annual surplus of a project is at world prices. Since what is required is a comparison between the value of a unit of government income at world prices and units of private consumption at domestic prices, the stream of consumption generated by a unit of investment must be converted into domestic prices by dividing by CCF.

Equation (34) is based on the simplifying assumptions,

(i) that the value of all parameters in the formula (q, s, CRI) remain constant; and

(ii) that all the consumption generated by an additional unit of investment accrues to those with a level of consumption equal to the national average.

Despite these simplifications there are major problems in practice in estimating v. In principle q and s can be calculated from observable data. q will be the internal rate of return calculated at world prices on the marginal public sector project; rough estimates of q can be obtained from industrial census data or from examinations of past project appraisals. Estimates of the future savings propensity, s, can be taken from targets in national plans, possibly adjusted downwards if these are judged to be unrealistically high. A conversion factor for consumption CCF, will be required in calculating other shadow prices. Despite difficulties in estimating q, s and CCF accurately, the major conceptual problem arises in the treatment of CRI, the government's discount rate for consumption. CRI is a subjective parameter which expresses the government's valuation of consumption at different points of time. However no government expresses its objectives in terms of a particular consumption discount rate. A formula given for CRI is

$$CRI = ng + p \qquad (35)$$

where

n is the elasticity of the government's utility function for consumption (as in equations (32) and (33),

g is the annual rate of growth of per capita consumption, and

p is the government discount rate for pure time preference.

The logic of this formula is that the rate at which a government discounts future consumption will depend upon firstly the extent to which average levels of consumption are growing over time (g); secondly the rate at which the government's valuation of extra consumption falls as the consumers who receive it get better off (n); and thirdly the extent to which the government feels that future consumption is less valuable simply because it occurs in the future rather than the present (p). A value of g can be obtained from plan projections or from extrapolations of past trends, and a value of n will be required in order to derive a set of consumption weights from equations (32) and (33). The problem with the formula for CRI is that p, the government rate of pure time preference, is also a subjective parameter, and there is little evidence on its likely numerical value.

Since governments do not specify their objectives in terms of particular rates of discount for future consumption, and the formula for CRI contains an unknown parameter, the value of CRI is highly uncertain.

The problem of estimating v can be illustrated in table 4. Alternative values of q of 10 per cent and 12 per cent are used. The values taken for s are 23 per cent and 15 per cent. CCF is taken to be 0.85.

Table 4 Alternative Values for Government Income in Relation to Average Consumption (v)

Discount Rate for Future Consumption CRI	Conversion Factor Translating Consumption Expenditure at Domestic Prices into World Prices (CCF) = 0.85			
	Marginal Propensity to Reinvest in Public Section (s)			
	s = 15%		s = 23%	
	Marginal Product of Capital in the Public Sector at World Prices (q)		Marginal Product of Capital in the Public Sector at World Prices (q)	
%	q = 10%	q = 12%	q = 10%	q = 12%
3.0	6.7	10.0	12.9	45.3
5.0	2.8	3.8	3.3	4.8
7.5	1.6	2.1	1.8	2.2

It can be seen that v can be highly sensitive to the choice of CRI, and when CRI is only slightly greater than s.q, v becomes very high. Using equation (34) and the assumed values in table 3 a unit of government income can be worth as much as 45.3 units of consumption going to average consumers or as little as 1.6 units. This is much too wide a range of possible values to use in any practical context.

The Squire and van der Tak weighting approach runs into difficulties therefore both because of the need to assume a single value for n, and because of the difficulty of making operational the formula for the weight on government income (v).

9.6 An Alternative Approach to Social Weights

The alternative approach to subjective weights of this type is that recommended in UNIDO (1972), which is to treat them as unknowns to be revealed by the preferences of decision-takers. For example, two projects A and B may be considered with A having a higher NPV in the economic appraisal. However B may create more consumption gains to unskilled workers. In these circumstances there will be a certain weight on these consumption changes which will be sufficiently high for B to have the higher NPV; this is termed the "switching value" weight, since at this weight the project decision switches from A to B. If B were to be chosen by decision-takers in preference to A one could conclude that implicitly the weight they placed on consumption changes to unskilled labour was at least this switching value. If a set of data on similar decisions were available it would allow planners to build up a picture of the implicit weights used by decision takers.

However in practice this approach to weights is virtually impossible to make operational. If requires data on a wide range of recent competing projects, so that the relevant switching values can be calculated, and in addition it assumes that decision-takers act consistently. If their preferences change over time so will the switching value weights, and the approach breaks down. This attempt, therefore, to avoid the weaknesses of the Little and Mirrlees and Squire and van der Tak weighting system offers no real alternative solution.

9.7 Problems in the use of Social Analysis

Several important difficulties arise in the use of social analysis. Apart from the practical difficulty of tracing through the full distributional effects of projects, there are two serious objections of a conceptual nature. First, key aspects of the weighting system are subjective. These relate to the consumption rate of interest discount rate (CRI) and via this the valuation of government income (or savings) in relation to average consumption (v); in addition the elasticity parameter n which determines the set of consumption weights (d_i) is also subjective. Whenever subjective parameters are involved there is a danger of inconsistency between decision-takers both in different Ministries and in the same group of decision-takers over time. Second, there is the problem that use of very high of low consumption weights could mean that projects are accepted which perform very poorly in efficiency terms: that is although they have a strong positive distributional effect they make little net contribution to national income. Alternatively with an extreme set of weights projects with a strong contribution to national income could be rejected if they have a regressive impact in terms of income distribution. The argument is that in these circumstances efficiency considerations are being sacrificed at the expense of distribution objectives, and that it would be more sensible to select projects on the basis of their basic economic efficiency, and then use tax or other direct measures to redistribute income and meet broader objectives such as poverty alleviation. If this latter route is chosen income losses arising from the choice of economically inefficient projects can be avoided.

Further it should be noted that social analysis should be less relevant in socialist than in capitalist economies since in the former the government will have more direct means to control the level of savings, and the distribution of income and consumption in the economy. In other words, socialist governments can use measures like land reform and property transfers to redistribute assets, price controls to redistribute consumption, and taxation and monetary policy to control the level of savings. The impact of projects on these variable is likely to be much less certain than will be that of such direct measures.

In summary, therefore, there are strong reasons why social analysis need not be considered as an appropriate planning tool in an economy such as China. Further as report 2 brings out no developing country government as yet has applied this analysis in its project appraisal procedures. It may be very useful to identify the main income distribution effects of projects. for example identifying the main gaining and losing groups. However this is not the same as applying a set of subjective weights to these income changes and recalculating the measure of the project's worth. This procedure of identifying but not valuing the income changes created by projects is probably the most that can be done to allow for distributional issues in project appraisal.

APPENDIX 1

THE SARANIA PULP AND PAPER MILL: A UNIDO Guidelines (UNIDO 1972) Case-study expressed in a Little-Mirrlees (1974) framework

Introduction

This paper expresses the Sarania Pulp and Paper Mill case-study of the UNIDO Guidelines in what may be termed a Little-Mirrlees (LM) framework of analysis. The aim of the paper is to show how, when a number of assumptions are adopted, the Net Present Values obtained using either method are directly comparable, and the Internal Rates of Return identical.

The Sarania project was for the production of 40,000 tons of rayon grade pulp and 20,000 tons of corrugated medium, when operating at 100% capacity utilisation. Data on the national economy of Sarania is given in Table 19.20 of UNIDO (1972); the national data used in this analysis are reproduced here in Table A.1.

The essential difference between a LM analysis and that of the UNIDO Guidelines lies in the choice of numeraire. LM uses income in the hands of the government and UNIDO uses present consumption. The choice of numeraire determines:

a) the discount rate;

b) the means by which diverse resource flows are converted into comparable units, that is the common numeraire.

Where the UNIDO shadow price of foreign exchange P^F is directly analogous to the Standard Conversion Factor (SCF) in LM, and the accounting price of investment P^{inv} is identical to the LM parameters S, the number of units of private consumption equal to one unit of government income, the NPV obtained under both systems will be identical once an allowance has been made for a difference in the numeraire.

The fact that in LM prices are expressed in terms of world market values, and in UNIDO in terms of domestic values, does not alter the equivalence of the two approaches. A single exchange rate, either the official (OER) or a shadow exchange rate (SER), can be used to make values in both systems identical.

I UNIDO System

UNIDO conducts its analyses of projects in stages.

Stage I. Benefits and costs are identified from the point of view of the economy as a whole. Market prices are used to value them. Net Benefit flows at market prices are identified and a NPV figure MC is calculated.

The UNIDO system divides the resource flows associated with a project into four categories.

i) Foreign Exchange F

ii) Skilled Labour W

iii) Unskilled Labour L

iv) Domestic Materials D

MC = F + W + L + D (at market prices).

Stage II. Various premia on the factors foreign exchange, skilled labour and unskilled labour are introduced. These premia reflect the divergence between the market and the economic value of these factors. MC is amended to give a new NPV figure of SC.

$$SC = MC + aF + bL + cW$$

where F, L and W are the NPV of net benefit flows of foreign exchange, unskilled labour and skilled labour in domestic market prices:

a, b, c are the premia placed on these respective costs

D are not given in a premium.

Stage III. The gainers and losers from a project are identified. The NPV figure SC is distributed between the different beneficiaries, and the total effect of the project upon the level of savings (and hence investment) in the economy is estimated. The savings benefits created by a project are revalued by the parameter P^{inv}.

At a further stage, stage IV, income distribution issues are introduced and differential weights can be given to the consumption benefits accruing to different groups. This aspect of the distributional impact of projects is not dealt with in the Sarania case study.

Table A.1. UNIDO National Parameters: Sarania

1.	Foreign Exchange Premium	a	=	0.5
2.	Unskilled Labour premium	b	=	-1.0
3.	Domestic skilled labour premium	c	=	+1.0
4.	Marginal rate of return on investment	q	=	0.2
5.	Marginal rate of savings in the economy as a whole	s	=	0.3
6.	Social rate of discount	i	=	0.08, 0.10, 0.12
7.	Shadow price of investment	P^{inv}	=	7, 3.5, 2.33
8.	Marginal propensities to save			
	(a) Government	s_G	=	1.0
	(b) Private Sector	s_P	=	0.6
	(c) Unskilled and semi-skilled labour	s_L	=	0.0

II UNIDO II in LM Analysis

Stage II of the UNIDO system introduces adjustments to the domestic market prices of goods and factors to value them in terms of economic opportunity costs. The national parameters used for Sarania are set out in Table A.1. Domestic Materials D are a residual category. They are the costs remaining after F, W and L have been identified. Their domestic market prices are assumed to reflect their opportunity costs.

The four resource categories used in the UNIDO case studies have a parallel in LM. Foreign Exchange F corresponds to LM traded goods, and Domestic Materials D to LM non-traded goods. UNIDO values all resource flows in terms of domestic prices. Foreign Exchange (F) values are converted into domestic terms by the Shadow Price of Foreign Exchange (P^F). The values of L, W and D are all expressed in domestic prices. In the LM system all values are expressed in terms of world market prices. Traded goods are valued at their border prices, cif or fob, whichever is relevant. Non-traded goods have no actual border-price; however a world price equivalent value is calculated. This is done by disaggregating the inputs into non-traded goods between traded goods and domestic factors; all inputs are valued at their actual or equivalent world market prices. Domestic factors, in this case, skilled and unskilled labour, are also valued at their equivalent world market costs.

The conversion of domestic values for non-traded goods and factors into world price terms is a complicated exercise which requires a large number of conversion factors for particular commodities and incomes. A short-cut is to use a single Standard Conversion Factor (SCF) representing the average relationship between border and domestic prices. The UNIDO Shadow Price of Foreign Exchange (P^F) gives an average relationship between domestic and border prices for the same commodity.

$$P^F = \sum_i a_i . \frac{DP_i}{WP_i} . OER$$

where

DP_i is the domestic selling price of good i,

WP_i is the cif price of i

OER is the official exchange rate

a_i is the share of i in marginal imports.

In this form P^F is the premium on foreign exchange or

$$P^F = \frac{SER}{OER}$$

SCF will be a weighted average ratio of border to domestic prices for identical goods; that is, where the same commodities are included in both comparisons

$$SCF = \frac{1}{P^F}$$

In Sarania $P^F = 1.5$, and it has been assumed that this reflects the average divergence of domestic from border prices, so that

$$SCF = \frac{1}{1.5} = 0.66.$$

This SCF can be applied to all domestic values for goods and factors in order to obtain a roughly equivalent world market value.

Table A.2 sets out stages I and II within the UNIDO analysis. The NPV figures given there differ from those in Table 19.22, p.288, UNIDO (1972), due to computational errors in the original. D, Domestic Materials, are not shown in Table 19.22; they are the residual after the net benefit flows (F + L + W) have been subtracted from MC.

Table A.3 sets out the equivalent stages within a LM framework. All values are expressed in world price terms. Foreign exchange net benefits F are valued at the official exchange rate, and the domestic values for L, W and D are reduced to world price equivalent terms by the SCF. The domestic goods and factors are first valued at their domestic economic opportunity costs, that is their market prices plus their premia; these domestic values are then translated into world price terms.

Table A.2. NPV of Net Benefit Flows, UNIDO
(Thousand creons)

Discount rates	8%	10%	12%
F	274,462	216,172	168,441
L	- 29,979	- 27,810	- 25,984
W	- 4,608	- 4,520	- 4,437
D	-332,117	-297,974	-269,105
MC	- 92,242	-114,132	-131,085
aF	137,231	108,086	84,220
bL	29,979	27,810	25,984
cW	- 4,608	- 4,520	- 4,437
SC	70,360	17,243	- 25,317

where MC = F + L + W + D
SC = MC + aF + bL +cW

In both systems the domestic economic opportunity cost of L, W and D is estimated to be

L + bL

W + cW

D + zero premium

Table A3 NPV of Net Benefit Flows, LM

(Thousand creons)

Discount rates	Conversion Factor	8%	10%	12%
F	1.0	274,462	216,172	168,441
L	1.0/1.5	- 29,979	- 27,810	- 25,984
bL	1.0/1.5	29,979	27,810	25,984
W	1.0/1.5	- 4,608	- 4,520	- 4,437
cW	1.0/1.5	- 4,608	- 4,520	- 4,437
D	1.0/1.5	-332,117	-297,974	-269,105
SC^1		46,907	11,496	- 16,878

$$SC^1 = F + \frac{1}{1.5} \cdot [(L + bL) + (W + cW) + D]$$

$$SC^1 = \frac{SC}{1.5}$$

Within the UNIDO framework the exchange rate over-valuation is covered by raising all foreign exchange net benefits F, by the premium on foreign exchange. In the LM system the over-valuation of domestic as opposed to foreign resources is treated by reducing all domestic values by the SCF.

Table A.4. Net Benefit Treatments in Both Systems

	UNIDO	LM
World Market Values	F + aF	F
Domestic values	L + bL	(L + bL) x SCF
	W + cW	(W + cW) x SCF
	D	D x SCF
Net Benefits	SC	SC^1

$$SC \times SCF = SC^1$$

where $SC \times SC^1 \times P^F$

$$P^F = \frac{1}{SCF}$$

The NPV figures in Tables A.2 and A.3 are directly comparable; SC is $SC^1 \times 1.5$. SC (the UNIDO figures) are in terms of domestic prices and SC^1 (the LM figures) are in terms of world prices. The ratio of domestic to world prices for identical goods was assumed to be 1.5 to 1.0 ($P^F = 1.5$), so that world prices must be translated into domestic equivalents by applying a premium of 0.5.

III UNIDO Stage III in LM Analysis

Stage III in the UNIDO analysis identifies the distributional effect of a project upon different groups in the economy. Three groups are identified in the Sarania case-study; the Government G, the Private Sector P, and unskilled labour L. Unskilled labour gains the housing benefits of the project and the additional income above what it would have been earning in the absence of the project. This additional income equals the premium on unskilled labour L. The private sector loses the premium on skilled labour W, which is the excess of its opportunity cost above its market wage. The government gains the remainder of SC resulting from the project. The net benefit of the project is therefore distributed so that:

$$SC = SC^G + SC^P + SC^L$$

where SC^G is the gains to the government, SC^P the gains to the private sector, and SC^L is the gains to unskilled labour.

A final figure for net consumption benefits C from the project is obtained by allowing for the additional investment from the income gains to the different groups. All additional savings are assumed to be invested. These savings are revalued by P^{inv}. which expresses the value of an extra unit of investment in terms of present consumption, the UNIDO numeraire.

The net consumption gains to the different groups are therefore

$$C^G \quad \left[(1 - s_G) + s_G P^{inv} \right] \quad SC^G$$

$$C^P \quad \left[(1 - s_P) + s_P P^{inv} \right] \quad SC^P$$

$$C^L \quad \left[(1 - s_L) + s_L P^{inv} \right] \quad SC^L$$

where s_G, s_P and s_L are the marginal propensities to save of the different groups respectively. If distributional considerations per se are to be taken into account this could be done by applying differential weights to the gains in present consumption $(1 - s_P)$ SC^P etc., accruing to the different groups. This has not been done in the Sarania case study.

Final net consumption benefits are

$$C = C^G + C^P + C^L$$

Table A.5 sets out the income and net consumption gains accruing to the three different groups; again the figures differ from those in Table 19.22 p 288, due to computational errors in the original.

An equivalent analysis in the LM system revalues all additional consumption benefits from a project in terms of the LM numeraire, which is income in the hands of the government.

In the Sarania case-study the UNIDO analysis does not distinguish between public and private investment; P^{inv} refers to an average unit of investment. In the Sarania case also the government is assumed to have a marginal propensity to save of one (s_G = 1.0). Units of public investment are therefore the same as income in the hands of the government. If a unit of private investment is assumed to be equal to a unit of public investment, any unit of investment, public or private, will equal a unit of income in the hands of the government. Where this hold the UNIDO P^{inv} will be equal to the LM parameter S which expresses the number of units of consumption equal to one unit of government income.

Table A.5 Net Income and Consumption Effect, UNIDO

(Thousand creons)

Discount rate	8%	10%	12%
(1) Net Social Benefits			
SC	70,360	17,243	-25,317
SC^G	43,315	-7,541	-48,209
SC^P	-4,608	-4,520	-4,437
SC^L	31,652	29,305	27,329
(2) Savings			
$s_G SC^G$	43,315	-7,541	-48,209
$s_P SC^P$	-2,764	-2,712	-2,662
$s_L SC^L$	0	0	0
(3) Consumption			
$(1 - s_G).SC^G$	0	0	0
$(1 - s_P).SC^P$	-1,843	-1,808	-1,774
$(1 - s_L).SC^L$	31,652	29,305	27,329
(4) Revalued Savings ((2) x P^{inv})			
$s_G SC^G.P^{inv}$	303,205	-26,393	-112,326
$s_P SC^P.P^{inv}$	-19,348	-9,492	-6,202
$s_L SC^L.P^{inv}$	0	0	0
(5) Final Net Consumption Benefits ((3) + (4))			
C^G	303,205	-26,393	-112,326
C^P	-21,191	-11,300	-8,864
C^L	31,652	29,305	27,329
C	313,666	-8,388	-93,861

s_G = 1.0, = 0.6, = 0.0

P^{inv} = 7.0 at 8% discount rate

3.5 at 10% discount rate

2.33 at 12% discount rate

IRR = 9.9%

Whilst the UNIDO analysis multiplies the value of all additional savings by P^{inv}, so they can be valued in terms of consumption units, LM reduces the value of all consumption benefits to express them in terms of government income. The net social benefit B of income accruing to different groups, in Little-Mirrlees terms is

$$B^G = SC^G$$

$$B^P = \left[\frac{(1 - s_P)}{S} + s_P \right] . SC^P$$

$$B^L = \left[\frac{(1 - s_L)}{S} \right] . SC^L$$

where B^G is the social value of income accruing to the government, B^P that of income to the private sector, B^L that of income to unskilled labour. S equals the number of units of consumption equal to one unit of government income, and one unit of private savings, and therefore investment, is treated as being equal to one unit of government income. As in the UNIDO analysis, the equity aspect of the question of income distribution could be dealt with at this stage by giving different weightings to the consumption gains of different groups. This would mean the use of a set of values for S, rather than a single value.

$$SC^1 = SC^{1G} + SC^{1P} + SC^{1L}$$

$$B = B^G + B^P + B^L$$

Table A.6 gives the LM analysis of the net income and consumption effects of the Sarania project. Total net social income SC^1 is divided between the different beneficiaries, and final net consumption benefits B are derived.

Table A.6 Net Income and Consumption Effect, LM

(Thousand creons)

Discount rate	8%	10%	12%
(1) <u>Net Social Benefits</u>			
SC^1	46,907	11,496	-16,878
SC^{1G}	28,977	-5,027	-32,139
SC^{1P}	-3,072	-3,013	-2,958
SC^{1L}	21,101	19,536	18,219
(2) <u>Savings</u>			
$s_G SC^{1G}$	28,877	-5,027	-32,139
$s_P SC^{1P}$	-1,843	-1,807	-1,774
$s_L SC^{1L}$	0	0	0
(3) <u>Consumption</u>			
$(1 - s_G).SC^{1G}$	0	0	0
$(1 - s_P).SC^{1P}$	-1,228	-1,205	-1,183
$(1 - s_P).SC^{1L}$	21,101	19,536	18,219
(4) <u>Consumption revalued in terms of government income</u> ((3) S)			
$\frac{(1 - s_P)}{S}.SC^{1P}$	-175	-344	-507
$\frac{(1 - s_L)}{S}.SC^{1L}$	3,014	5,581	7,819
(5) <u>Final Net Consumption Benefits</u> ((3) + (4))			
B^G	28,877	-5,027	-32,139
B^P	-2,018	-2,151	-2,281
B^L	3,014	-5,581	- 7,819
B	29,873	-1,597	-26,601

S = 7.0 at 8% discount rate

3.5 at 10% discount rate

2.33 at 12% discount rate

IRR = 9.9%

The NPV figures for B in Table A.6 are directly comparable with those for C in Table A.5, the UNIDO analysis. The differences are:

(i) the UNIDO values are in domestic price terms. They are greater than the LM values which are in terms of world prices by the premium 0.5. P^F the shadow price of foreign exchange (1.5) must be used to convert B into equivalent price terms to C;

(ii) the UNIDO values C are in units of present consumption, whilst the LM values B are in units of government income. The UNIDO figures are the LM figures multiplied by the relevant value of P^{inv} or S.

Therefore $C = B \times P^F \times P^{inv}$

The first conversion, multiplication by P^F, translates B into domestic price terms; the second conversion, multiplication by P^{inv} or S, translates B from units of government income into units of consumption.

IV Differences in the Application of the Two Methods

It should be noted that certain differences exist in the application of both methods which have been assumed away in this analysis. Firstly, there is the treatment of non-traded goods; D in the UNIDO case-studies. Normally in the case studies they are valued at domestic market prices with no premium introduced to cover their economic opportunity costs. The equivalent treatment in the LM analysis is to revalue these domestic market prices by the SCF. However, this is a major simplification of the full LM procedure, which suggests valuing non-traded goods at their costs of production in terms of world prices. The full LM treatment would therefore derive different CFs for different non-tradeables, which should be applied to convert their domestic market prices into their shadow prices in world price terms. The treatment of D in the UNIDO case-studies is a simplification, and any comprehensive treatment requires a set of CFs for different non-traded activities.

Secondly, there is the way in which P^F and SCF are calculated. Some confusion exists as to whether the price ratios upon which P^F and SCF are based should relate to goods at the border, or internally at domestic selling points. Also there is the problem of the weights to be used in the formulae. The UNIDO expression for P^F is based on the distribution of marginal import expenditure as between commodities, whilst the LM SCF is based on the share of different commodities in total domestic production.

the average ratio of domestic to world prices inherent in P^F, has been used to determine the value of the SCF $\left(\frac{1}{P^F}\right)$

However provided identical assumptions are made in the application of both approaches they will give equivalent results, since the only real difference between them is in the choice of numeraire and this is a matter of presentation and not of substance.

APPENDIX 2

An Introduction to the Valuation of Non-Traded Outputs (Benefits) in Project Analysis

When non-traded goods and services are used as inputs in a project, their valuation is usually on the basis that more will be produced to meet the additional needs created by the project, and their marginal cost of production is considered to reflect their value in monetary terms. As necessary, their monetary values are adjusted, using relevant conversion factors, for the divergence between their market and shadow prices.

When a non-traded good or service is the output of a project, there can be problems of valuation. Non-traded outputs, particularly in the case of social services, utilities, and subsistence agriculture projects, are very important in relation to economic development of a country. In fact, about half of the GDP of many developing countries is non-traded.

In principle non-traded outputs can be placed on the same footing as traded outputs, by valuing them first at market prices and then at shadow prices. But in many cases of non-traded outputs, the primary problem is to quantify their impact, for instance, the value of a road or a bridge or a hospital. The convention is that non-traded outputs are valued on the basis of their marginal benefit to consumers.

If non-traded outputs, which are quantifiable and saleable in the local market, are sold in a free market situation, then actual prices at which the transaction takes place may reflect consumers' willingness to pay. If the situation is otherwise, that is in a controlled market, the market prices will not reflect consumers willingness to pay. In such cases, the first step is to determine consumers willingness to pay and thereby the value of non-traded outputs at market prices. To convert the values of the non-traded outputs to their shadow prices, relevant CFs will have to be applied.

Consumers surplus, which is the difference between what consumers are prepared to pay and what they actually pay for a good or service, is particularly relevant in the case of some non-traded outputs where the incidence of subsidy or free provision is significant. Electricity, water and some public services are common examples where consumer's willingness to pay may be higher than what they actually pay.

Consumer surplus is treated as cost-saving in projects like roads, and bridges. The direct value of their output is always difficult to measure. The convention is that the benefits arising from having these projects are estimated with one major benefit in these projects being cost-saving. Cost-saving may be distributed between road users (transport sector) and producers (transport service users).

Producers surplus is a benefit item particularly in the case of a penetration or feeder road project. As a result of the project there will be a decrease in the transport cost of local output (say, agriculture) and the producers (farmers) will sell more at the same farm gate price; likewise, there will be a decrease in the transport cost of farm inputs and this will result in a decrease in production cost. Both will increase agricultural production. The summation of these two effects will be the producers surplus arising from the road project. However if the transport sector is not competitive, the transport cost saving may not all be passed on to the producers. In some cases, to increase local agriculture production some complementary investments may be necessary; also there may be some negative effects like substitution of local products by imported goods from other regions; and perhaps migration. Where significant, these aspects need to be considered for example by including additional complementary investment as part of the original road project.

Some Examples of Non-traded Outputs and their Valuation

1. Subsistence Agriculture

This type of non-traded output may include the following - low quality subsistence food, vegetables, unprocessed milk, livestock and draught animals - that are usually sold on unregulated markets. Their monetary values are measurable in most cases. In some cases, subsidy or free provision may be in practice. The valuation of these subsistence agriculture related non-traded products may be done using the consumer willingness-to-pay approach.

2. Cash Crops

Sugar cane is an example of a non-traded cash crop. It is usually not traded internationally because of transport cost and chances of loss of sucrose in transit. Sugar cane, in many cases, is grown with prior arrangement of sale to sugar mills. In some cases, governments not market forces control the price of sugar cane. Therefore, consumers (mills) willingness-to-pay may be at variance with the actual price paid by the consumers (mills). The consumers surplus approach may be applied. There may also be a possibility of a producers surplus if the consumers (mills) are operating at a less than the optimal capacity utilisation level owing to the shortage of sugar cane.

3. Water Supply

The price of water is often not only less than its cost but also less than willingness-to-pay by many users. One approach may be to estimate a price that would cover costs, and then to estimate the cost of water used at this price as a proportion of a typical wage (income) of the users. The basis of this approach is that clean water, which is seldom purchased in specific quantities, is demanded by users so long as the charge is no more than a certain proportion of wage income. The World Bank sets this proportion at less than 5 percent. This means that consumer surplus on all water used can be estimated as the difference between whatever is paid for water and 5 percent of income.

Water supply in rural areas is usually free, partly because many rural inhabitants are unable to pay. Hence the willingness to pay approach is of little use for rural water projects. The only valuation possible in such projects is to assign economic values to improved health and the benefits to the economy that may arise from it. One may estimate the benefit of improved rural health and other indirect benefits as a result of a project.

4. Electricity Generation and Supply

Electricity is usually a non-traded output. It can actually be traded across international borders under some bilateral arrangements. It is both a consumer good and an input into productive activities. The cost of alternative current sources of light or energy may be taken as a proxy for the minimum consumers would be willing to pay for electricity. Electricity service is often charged less than the amount many users are willing to pay. The consumer surplus approach is relevant in this case.

5. Postal, Telegraphic and Telephone Services

The consumer surplus approach may be applied. But in many cases it is substituted by cost-effectiveness analysis as the benefits arising from such communication-related projects are difficult to measure.

6. Health Services

Public health services in many cases are free or heavily subsidised. The benefits arising from health-related projects, although difficult to quantify, are enormous. The consumer willingness-to-pay approach may not be practical since many poor people will not be able to pay even small amounts. Monetary values are irrelevant here. A cost-effectiveness method is widely used in the analysis of such projects.

7. Irrigation Services

Irrigation projects are similar to rural development or agricultural development projects. Costs and benefits with and without project are measured. The output of an irrigation project is water, an input to agricultural production. The benefits arising from such a project are measured on the basis of incremental agricultural production and other associated benefits. A detailed base line study, particularly of farming practices, yield, and costs should be carried out; where relevant complimentary investments in agriculture should be included in investment cost. On this basis with and without project scenarios can be predicted; and the incremental net benefit of the irrigation project estimated.

8. Roads

It is always difficult to measure the benefits of road projects as their output value is not directly identifiable nor quantifiable. In such cases, the value of benefits is estimated on the basis of road users' saving, which include cost, time, accident costs and so on, with and without the proposed project.

The with and without project situation is different from that after and before the project. In the without case it is necessary to consider what costs would have been incurred by the road users and roads authorities.

Road traffic can be divided into three kinds:

Normal traffic - existing traffic without the project

Diverted traffic - existing traffic using alternative roads

Generated traffic - new traffic or induced traffic.

Benefit items in the case of Road Improvement Project can be identified as:

(i) Savings in maintenance or recurring costs.

(ii) Savings in vehicle operating costs.
This is a most important cost saving. It includes the cost saving of fuel consumption, lubricants, replacement (eg. tyres), vehicle maintenance and depreciation.

(iii) Value of time of travel, comfort and convenience;
Time savings of drivers, passengers and freight.

(iv) Savings in costs of accidents

(v) Savings in costs of noise

(vi) Net value of any incremental output generated as a result of the road improvement
This may be particularly significant for rural roads

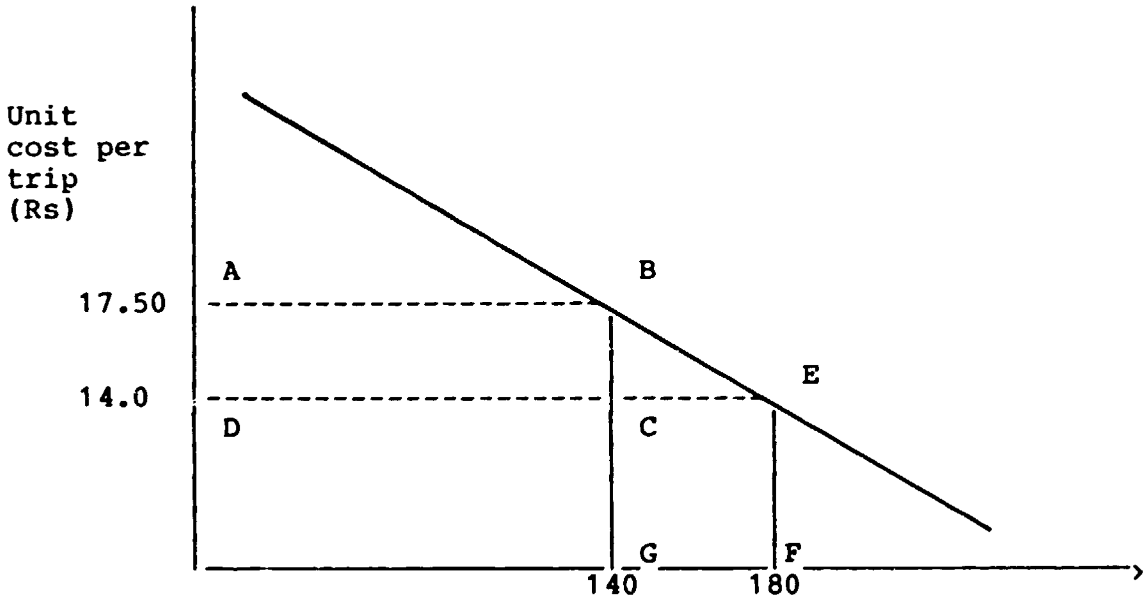
A Simple Example of Consumers' Surplus Estimation in Transport

Consumer willingness-to-pay means simply that people value something in proportion to what they are willing to pay or give up for it. This is illustrated through a demand curve which shows the quantity of a given product people are willing to buy at a given unit of price for that product.

In the case of roads, the product offered is trips of a given type, whilst the unit price for the trips is composed of such cost items as vehicles, fuel, lubricants, maintenance, insurance and taxes, and of course the time of the driver. Suppose, a road of 5 km length is built to connect towns A and B. It is also expected that, as the unit price gets higher, fewer trips will be made over the road.

If the unit price of travel is Rs. 14.00, 180 trips per day are made at this price. Some people would be willing to pay more than Rs. 14.00 for the trip, but would not be required to do so. Say for instance, 140 trips would be made even if the cost were higher at Rs. 17.50, per trip. As a consequence of the difference between willingness-to-pay and the money actually paid there is a surplus. This kind of surplus is called consumers surplus and can be considered as a benefit arising from the trips, which are the product of the road project. The summation of these benefits for all trips made gives the total benefit on daily trips made by users.

If a new road improvement project had the effect of lowering average costs per trip from Rs. 17.50 to Rs. 14.0 thus stimulating on extra 40 vehicles daily to use the road there would be two separate benefits.



Vehicle trips per day

Figure A.1.

a) a cost saving of Rs. 3.50 per trip for existing traffic; in total this is Rs. 3.50 x 140 = Rs. 490. This is shown as the area ABCD in figure A1.

b) a gain to new or diverted traffic given by the area under the demand curve - BEFG in figure A1. New users will actually pay Rs. 14.0 per trip for an extra 40 trips. However they are willing to pay more than this given by the triangle BCE, which is their consumer surplus.

Total consumer surplus is therefore Rs $(\frac{1}{2}(17.50 + 14.0) \times 40)$ plus R490; this gives Rs.560 at domestic prices.

In a world price system this value would have to be converted to world prices; strictly it would be necessary to convert benefit a) - the cost saving for existing users-by a CF for road transport, and benefit b) - willingness to pay of new users-by a CF for consumption.

Estimation of a demand curve

Use of consumer willingness to pay as a criteria of value for a non-traded good requires information on the shape of the demand curve for the good. For example, if supply is fixed in the short-run to OS in figure A.2 at price P there is an excess demand of D_1S. What is necessary is to estimate the price at which demand equals the amount available. This market-clearing price of P_2 is a measure of willingness to pay for ouput from projects that provide small additions to total supply in the economy; that is for projects whose output does not affect the level of the market-clearing price.

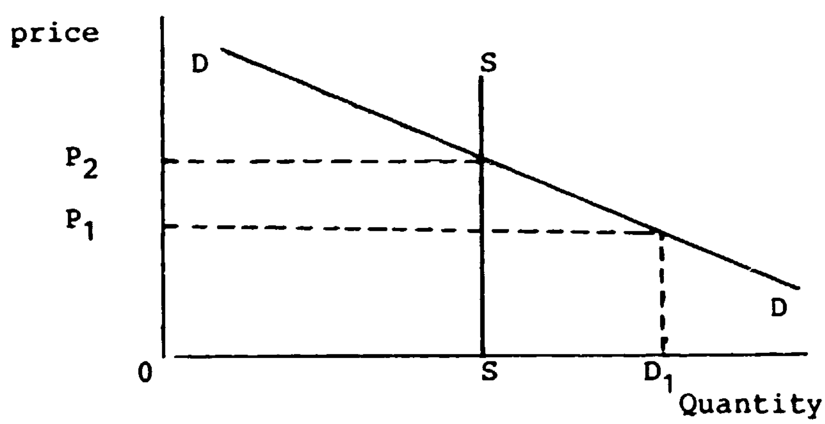


Figure A.2

Estimation of price P_2 requires the shape of the demand curve DD to be known. A simple appropach to estimation of demand curves uses an estimate of price elasticity of demand and the assumption that the curve is linear.

This follows since by definition price elasticity of demand (e) at a particular point on a demand curve equals $\frac{\Delta D}{D_1} \div \frac{\Delta P}{P_1}$

where D_1 and P_1 are the original points on the curve and

ΔD and ΔP are changes in demand and price respectively.

Therefore rearranging

$$e = \frac{\Delta D}{D_1} \cdot \frac{P_1}{\Delta P}$$

or

$$e = \frac{P_1}{D_1} \cdot \frac{\Delta D}{\Delta P}$$

If the original points P_1 and D_1 are known, and e is estimated from other data, then when the curve is a straightline its slope $\frac{\Delta P}{\Delta D}$ will be constant at all points on the curve. The slope for a linear curve is

$$\frac{\Delta P}{\Delta D} = \frac{P_1}{D_1} \cdot \frac{1}{e}$$

Therefore when P_1 and D_1 are known, and e is estimated or assumed, the slope $\Delta P/\Delta D$ can be found.

This procedure for identifying a demand curve can be illustrated where P_1 is 10 units, and demand at that price D_1 is 1,000. If price elasticity of demand (e) is 2.0, then the slope of the curve $\frac{\Delta P}{\Delta D}$ is $\frac{5}{1000}$,

since $$\frac{\Delta P}{\Delta D} = \frac{10}{1000} \cdot \frac{1}{2} = \frac{5}{1000}$$

With a slope of 5/1000, the position of this demand curve can be found by extrapolating to the vertical and horizontal axes. Figure A.3 shows the curve meets the vertical axis at a price of 15, and the horizontal axis at a quantity of 3,000.

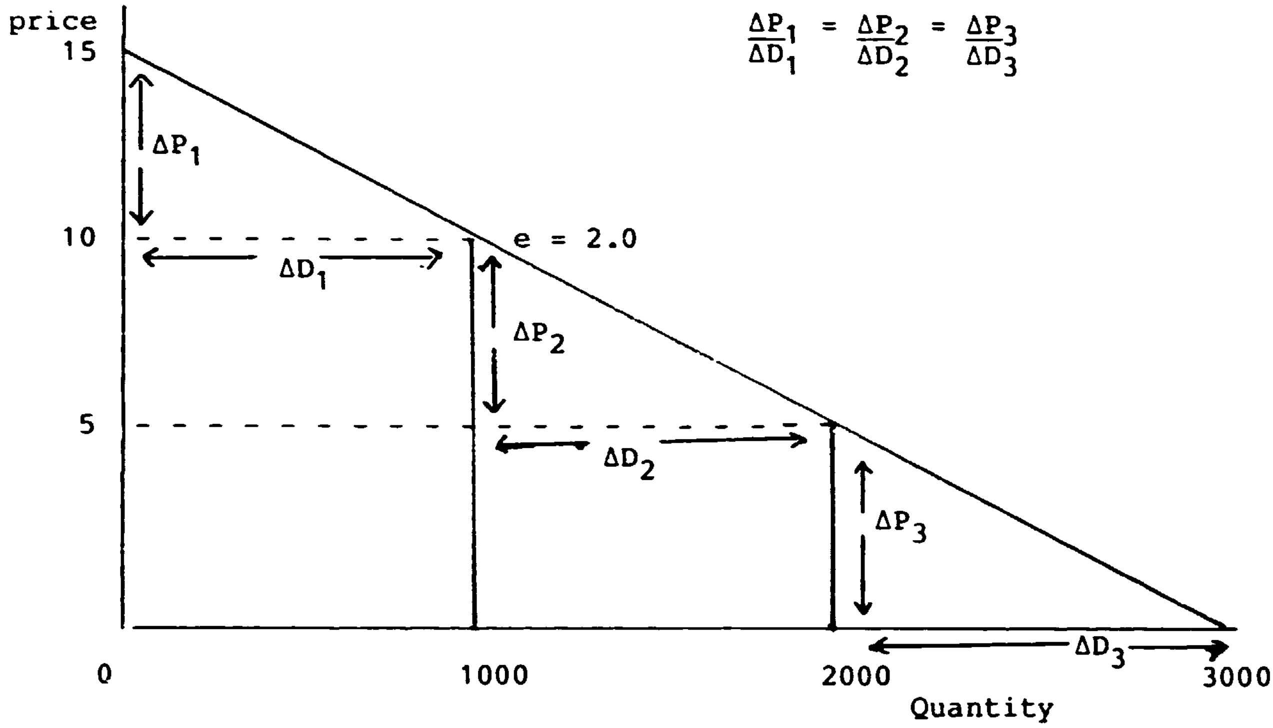


Figure A.3

This procedure is a simplification, since not all demand curves will be linear. Further it requires that, if as in figure A.2, the original price is not a market clearing price that the size of the excess demand be known, so that the original price and demand points can be identified. Price elasticities for different products will rarely be known with accuracy, but approximations or estimates for the same goods in other countries may be used.

Demand price, such as P_2 in figure A.2 gives a measure of willingness to pay for project output that is marginal, since the additional project output does not lead to a change in price. However where the addition to supply is non-marginal, so that the new project's output is sufficient to cause a fall in price, willingness to pay is given by the area under the demand curve for the relevant output. In figure A.4 a new project raises total supply from S_1 to S_2 causing a fall in price from P_1 to P_2. Total willingness to pay for additional output S_1 S_2 is now the area OLS_2S_1. In addition there is a gain to existing users of P_1 QMP_2 due to the fall in price from P_1 to P_2. In a world price system consumer willingness to pay must be converted to world price equivalents using a consumption CF for the group of consumers concerned.

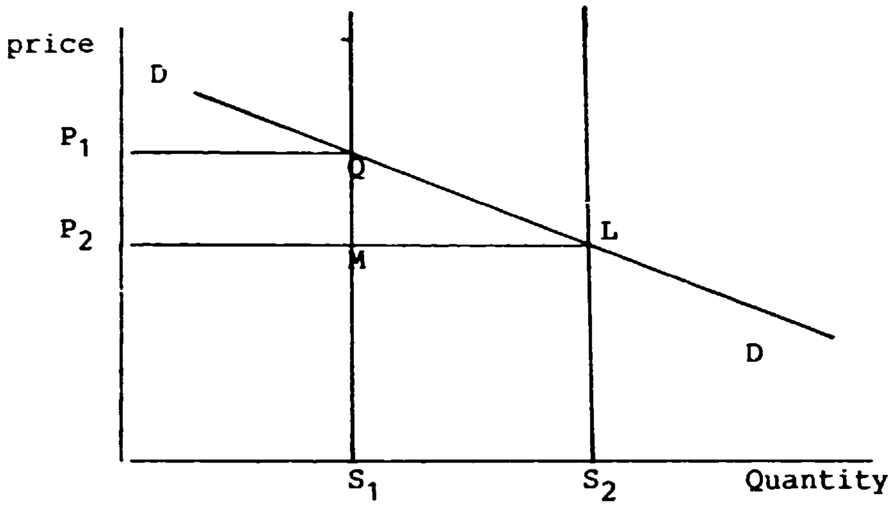


Figure A.4

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Report 2   Application of National Parameters

Final Report to

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION and RESEARCH INSTITUTE FOR STANDARDS AND NORMS, GOVERNMENT OF PEOPLE'S REPUBLIC OF CHINA

Prepared by

DEVELOPMENT AND PROJECT PLANNING CENTRE, UNIVERSITY OF BRADFORD, UK
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TERMS OF REFERENCE

This report is compiled by the DPPC for the Research Institute for Standards and Norms, and UNIDO, under the following terms of reference.

Research report on the application of UNIDO, World Bank and OECD approach to national parameters in developing and developed countries.

"2.2 Application of UNIDO. World Bank and OECD approach to national parameters.

To carry out a research related to the situation and effectiveness of application of UNIDO, World Bank and OECD approach to national and regional parameters specified under item 2.1 in both developing and developed countries.

In particular, the research will focus on:

- the relationship between the pattern of a country's development and the choice of the approach,
- the availability of data needed to estimate the national and regional parameters,
- the attitude of decision makers toward the application of national and regional parameters,
- the monitoring of national and regional parameters,
- others.

The choice of countries constituting the sample for this research is to be decided upon by the Sub-contractor."

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1. INTRODUCTION

1.1 National Economic Parameters (NEPs)

NEPs can be defined as those shadow prices relevant to appraisal of projects drawn from a range of different sectors. They are termed national in that they are not specific to a particular project. The economic discount rate, for example, is a parameter applicable to all projects that compete for limited funds. However the value of a commodity like fertilizer is a project-specific parameter relevant in the appraisal of projects that either produce fertilizer as an output, or use it as input. The justification for focussing research efforts of a national planning agency on the estimation of NEPs is first that it is highly undesirable for such parameters to be estimated by analysts working independently on individual projects. This would lead to the danger of inaccuracy since such analysts given the constraints involved with project work, would be highly unlikely to have access to the data and resources needed to estimate a set of NEPs accurately. Secondly there is a danger of inconsistency in the treatment of different projects if separate estimates of NEPs are applied in their appraisal. For example in the case of the discount rate, it is clearly undesirable for this NEP to be estimated separately every time a new project is appraised.

Most studies of NEPs identify at least parameters relating to the following:-

- unskilled labour, perhaps differentiated by region;
- skilled labour;
- the main non-traded sectors, such as electricity construction, road and rail transport, and trade and distribution;
- a single parameter reflecting the relative value of foreign exchange and domestic resources; (the shadow exchange rate in the domestic price system and the standard conversion factor in the world price system)
- the discount rate.

Other parameters are also included in more detailed studies.

1.2 Conversion Factors

It has become common to present the results of NEP studies as a series of conversion factors (CFs). Those are simply ratios of the value of an item at shadow prices to its market price value, so that

$$CF_i = \frac{SP_i}{MP_i}$$

where CF_i is the conversion factor to item i,

SP_i is the shadow price of i,
and MP_i is its market price.

CFs can be given at different levels;

- for a particular commodity (for example, rice)
- for a particular sector (for example, construction)
- for a particular factor (for example, unskilled labour)
- for a particular category of expenditure (for example, investment)
- for the economy as a whole (the shadow exchange rate or the standard conversion factor).

Further they can be applied in either a world or a domestic price system of shadow pricing. The only difference will be that SP_i will be in terms of domestic prices in the latter and in world prices in the former. However it is important to note that CFs should be consistent in the price level to which they relate. Market prices, can be prices paid by consumers (retail prices), or prices received by producers (ex-factory prices plus indirect taxes on inputs used, and on outputs sold). Therefore it must be made clear which type of market price is included in the CF, and the shadow price of the item should be estimated at the same price level. For consistency it is desirable that all CFs be estimated at the same price level - normally either at consumer or producer prices.

It should be noted that one use of terminology is to apply the term CF to only aggregate relationships, referring to categories of expenditure - like consumption and investment - and to the average ratio of domestic to world prices for the economy - the standard conversion factor. Following this convention ratios of shadow to market prices for either individual commodities or sectors are referred to as accounting price ratios (APRs), since the term accounting price is used instead of shadow price, to refer to an economic value. This terminology is used in the major study Powers (1981), for example. Here, for simplicity, we prefer to use one single term - a conversion factor - to refer to any ratio of a shadow to a market price. It should be remembered, however, that when we refer to a CF, for example for rice or construction, in other discussions in the literature these might be referred to as APRs.

The rationale for providing information on NEPs as a set of CFs is twofold. First, ratios can be applied easily to project data at market prices to convert these directly to economic values. For example, in appraising a project with a market wage cost of 1,000, if the appropriate CF for the labour concerned is estimated to be 0.60 the project analyst appraising the project will only be required to multiply the wage cost of 1,000 from the financial appraisal by the CF of 0.60 to give an economic value of 600. Thus the analyst will not need to estimate the relevant shadow wage per day to apply to the categories of workers concerned, since this shadow wage is already implicit in the labour CF.

Secondly, there is the problem of changes in both market and shadow prices over time due both to inflation and more fundamental policy and structural changes in the economy. As is discussed in a later section CF estimates require to be up-dated periodically (probably at least every two or three years), but normally unless there are major changes in the economy they should be valid for the short-run (up to two years). This is because due to inflation whilst shadow prices will change in absolute terms, if market prices rise by the same percentage over the same period, the CF which is the ratio of the two will not change. For example, if over two years due to inflation the shadow wage rises from 100 Yuan to 120 Yuan, if the market wage, initially 167 Yuan also rises by 20% to 200, the CF for labour will remain unchanged at 0.60. Obviously, due to circumstances to be discussed, below, there will be cases where shadow and market prices do not rise at the same rate. However in the short-run one can often assume some stability in CFs even whilst absolute values of shadow prices change.

1.3 Different Approaches to Estimation of NEPs

In considering different approaches to the estimation of NEPs two distinct approaches can be identified. The simpler is what we will term a "partial" approach, and the more complex, but more rigorous we shall call a "consistent" approach. The former partial approach is characterised by valuing each individual parameter independently of all others. For example, in partial calculations the shadow wage rate (and the CF for labour) would be estimated independently of the value of CFs for major non-traded activities. This is despite the fact that some of labour's output foregone might be from non-traded activities, and thus its value determined by the CFs for non-traded goods. Similarly, however, labour will be an input into non-traded activities, so that its value will in turn be one of the influences on the CFs for non-traded sectors. Another example of such interdependence will be in relation to the standard conversion factor (SCF). In a partial exercise the SCF would be estimated independently of any other CF. However strictly the SCF should be an average of all the CFs for the main productive sectors, so that the SCF cannot be calculated accurately independently of the value of other sectors.

This type of interdependence is resolved in what we have termed the consistent approach. One version of this approach is to solve the valuation problem by setting out NEPs as a set of linear simultaneous equations. Here the value of any particular CF is determined by other CFs in the system.

The logic of the system can be set out algebraically in general terms as follows:

$$
\begin{aligned}
CF_1 &= a_1 + b_{11}\,CF_1 + \ldots\, b_{n1}CF_n \\
&\vdots \\
CF_n &= a_n + b_{1n}\,CF_1 + \ldots\, b_{nn}CF_n
\end{aligned}
$$

where

there are n conversion factors (CF) that there are unknowns in the system

$CF_1 \ldots CF_n$ are the conversion factors for equation 1 to n,

$a_1 \ldots a_n$ are the constants which can vary between equations, and which may be zero.

$b_{11} \ldots b_{nn}$ are the weights placed on conversion factors in the equations, so that b_{1n} is the weight of CF_1 in equation n to solve for CF_n. The weights $b_{1n} \ldots b_{nn}$ can also be zero.

The value of each conversion factor therefore is given by a constant plus the values of all conversion factors in the system with a non-zero weight.

To give a specific example; if CF_1 refers to unskilled labour this conversion factor will be determined by the conversion factors of the sectors which produce the workers' output foregone. If only two such sectors are involved, and these are termed sectors 2 and 3, CF_1 will be determined by a constant a_1, and by the conversion factors CF_2 and CF_3, and the weights placed on these. On the other hand, since labour is an input into all domestic productive activity CF_2 and CF_3 will be determined in part by the value placed on unskilled labour, CF_1, so that CF_1, CF_2 and CF_3 cannot be estimated accurately in isolation from one another.

This simultaneous equation approach was used, for example, in a study on Jamaica, which is discussed as one of the country cases in Appendix 2. Although it allows for consistency in calculating CFs its major drawback as applied in the Jamaican study is that it treats the main non-traded sectors in the economy only crudely. Theoretically the economic value of a non-traded activity approached from the supply-side is given by the sum of the economic value of all inputs into its production.

The Jamaican study, because of data non-availability discussed further in the Appendix, could identify only a few aggregate categories of inputs into the main non-traded sectors. The final results are therefore consistent, but nevertheless approximate, because of the level of aggregation involved in the valuation of non-traded sectors.

It is recognised that a superior form of the consistent approach is to identify as many direct inputs into a non-traded sector as possible, and then decompose these direct inputs into a set of 'primary inputs'. This is the technique of 'semi input-output analysis' (SIOA), so called because it involves the construction of a form of input-output table, tracing the production relation between different sectors of the economy.

For each individual sector the shadow price will be given by the sum of the value of total, direct plus indirect, primary inputs into the sector. Algebraically therefore for sector i

$$SP_i = \sum^{f} a_{fi}.MP_i \times CF_f$$

where

SP_i is the shadow price of i

MP_i is the market price of i

a_{fi} is the input of primary input f per unit of i

CF_f is the conversion factor for primary input f.

In terms of conversion factors, CF_i for sector i becomes a weighted average of the conversion factors for the primary inputs into i,

$$\text{so that } CF_i = \sum^{f} a_{fi} \times CF_f$$

Set up in this way the problem becomes one of tracing through the full set of primary inputs into each sector, and valuing these primary inputs at their appropriate shadow prices. However, since the shadow price and therefore conversion factor of some primary inputs will depend on the conversion factors for several productive sectors, the interdependence problem remains.

The solution again involves use of a simultaneous equation system, but now, unlike the simpler consistent approach, the conversion factor for productive sectors is determined by the value of their total primary input components. The system of simultaneous equations is significantly more complex computationally in the semi-input-output approach since two stages are involved.

First the input categories into each productive sector are decomposed into a set of primary inputs. Since total primary inputs are required this necessitates the process of matrix inversion of the direct coefficients of the input-output table. Secondly once total primary inputs are known a system of simultaneous equations can be used to solve for the interdependence between the values of primary inputs and conversion factors.

SIOA has become the main technique for detailed NEP studies. One of its first applications was in Kenya in Scott and others (1976), and it has been applied in a number of other countries, particularly in Latin America (for example Powers 1981). A fuller explanation of the technique of SIOA is given in Appendix 1, and some of the results of NEP studies using this approach are given in table 1 below.

In terms of the relevance of different approaches to NEP estimation for different developing countries it must be stressed that the key choice is between partial and consistent studies. The issue of whether such studies use a world or a domestic price numeraire is not of major concern. As report 1 has stressed use of either numeraire will give equivalent results provided equivalent assumptions are made, and a similar level of detail is used in the calculations. However it must be pointed out that in recent years the detailed studies using SIOA to estimate NEPs have generally used a world price system of analysis.

Although, theoretically, because of the interdependence of different parameters it is clear that the consistent approach is preferable, there will be some developing countries where the errors generated by estimation using a simpler partial approach may not be very great. These will be economies where the level of interdependence between parameters is not high, because most productive sectors of the economy can be treated as internationally traded. This means that additional demands from, or outputs generated by new projects will have their main impact on the foreign trade balance - in terms of imports and exports - rather than on the level of activity in the domestic economy. The key form of interdependence in a system of NEPs is between the valuation of non-traded sectors and other parameters - for example labour or the SCF - and between different non-traded activities themselves - for example the valuation of electricity influencing that of construction and vice-versa. Therefore a consistent SIOA will be most important in developing economies, where a high proportion of domestic production is most appropriately classed as non-traded.

It should be remembered that activities can be non-traded for a number of different reasons; high transport costs in relation to output value may be one factor (power supply is an obvious example of this category); the characteristics of the product which mean it has to be produced and sold domestically (for example, domestic retailing) will be another; however goods can also be non-traded because of significant quality differences between locally and foreign made goods (for example, simple textile products which are sufficiently cheap not to compete directly with imports, but for which there is no export potential because of their low quality); finally government restrictions on foreign trade that limit competition from imports can make some activities non-traded.

One can generalize that the level of non-traded to traded production is likely to be higher in developing economies with two particular characteristics:

(1) a fairly restrictive policy towards foreign trade that keeps down the share of imports in total economic activity;

(2) a large domestic market, in terms of geographical size.

The link between foreign trade policy and non-traded activity has already been noted. The influence of the domestic market arises since the larger the geographical size of an economy the greater will be transport costs in moving imports to consumers at inland locations. High transport costs of this type provide local producers with a "natural" form of protection, which may restrain the extent to which they face competition from imports of similar goods.

Given China's large size, and the past orientation of its trade policy, one would expect that a significant proportion of its economic activity will be non-traded. Future trade policy changes may alter the balance between traded and non-traded activity, but nonetheless one would not expect the balance between these activities to alter significantly in the short-run. With a relatively high proportion of activity classed as non-traded, China is precisely the type of economy where inter-dependence between NEPs is likely to be important. It is thus the type of economy where a consistent approach based on a SIOA is likely to be most effective, and where simpler partial approaches could be misleading.

2. SOME ILLUSTRATIONS OF NEP STUDIES

Table 1 summarizes the results of a range of published studies on NEPs conducted in the last 15 years or so. Although these studies were carried out at different times for economies that are often quite different, some general points linking the results can be noted.

(i) The average parameter - the SCF in a world price and the SER in a domestic price system - tends to fall within a fairly narrow range, if one excludes extreme cases. In all the studies covered in table 1, for example, the SCF is in the range of 0.59 (Turkey) to 0.96 (Egypt). However both of these countries had peculiar features at the time of the studies. Turkey was heavily protected through an import licensing system, which raised the domestic prices of import competing goods, by an estimated 60% above the tariff-inclusive world prices. Incorporation of this large premium is the main reason for the low SCF. Egypt in the 1970's, on the other hand, used a policy of subsidizing key traded goods which kept their prices below world levels. The impact of these subsidies is to raise the SCF.

Excluding these two cases, the range of SCF estimates is somewhat narrower from 0.73 (Paraguay) to 0.92 (Colombia), with a tendency for the average value from these studies to be around 0.80. The range of values found in the studies has an intuitive logic in that the more protected economies at the time of the studies (such as Turkey, Paraguay and Mexico) tend to have lower SCFs than the more open economies where trade restrictions are less significant (such as Barbados and Botswana). However even fairly open economies with no or low trade taxes can still have an SCF of below 1.0, because of the presence of non-traded goods in the calculation of the SCF, and the fact that wherever labour is underemployed or there is surplus production capacity, this brings the CF for a non-traded activity below 1.0.

(ii) Most SIO studies estimate CFs for consumption in addition to the average SCF. In addition different types of consumption expenditure may be distinguished; - for example urban and rural, and high and low-income. In general, whilst there may be differences between consumption CFs defined in various ways - there is a tendency in many countries for the average CF for consumption in general to be fairly close to the SCF. This is not surprising given that the SCF is normally a weighted average of CFs with total production in different activities as the weights used in the calculation. The average consumption CF is another weighted average but now with consumption expenditure as the weights. However one would not expect these weighting systems to be markedly different, so that the SCF and the average CF for consumption can be close. In some countries distinguishing between consumption CFs for different categories of consumer does not produce very different results - for example the detailed analysis for El Salvador (Londero 1981) gives six CFs in the fairly narrow range of 0.82 to 0.86. Here distinctions by rural-urban location and by income levels do not appear significant. In the geographically larger economy of Kenya however there are more significant differences, with an average urban consumption CF of 0.82, and a rural one of 0.94. One would expect that other things being equal, the geographical size of an economy would tend to create differences in price between consumer goods in different parts of the country.

(iii) In most economies, for most types of non-traded activity studied, CFs are below 1.0, so that their economic value is below their market price. There is a tendency for construction - normally a labour-intensive activity - to have a low CF, generally below the SCF. Electricity, on the other hand, which is intensive in the use of traded energy inputs, tends to have a CF above the SCF. There are some exceptions to this generalization; for example in

Paraguay under-utilization of existing capacity creates a very low CF for electricity where only variable costs are included in the estimate of its shadow price. Also in Botswana due to power imports from South Africa electricity is treated as a partially traded good, and this may contribute to keeping down its CF. Where its CF is estimated local trade and distribution, like construction a fairly labour-intensive activity, also tends to have a relatively low CF. Egypt is a major exception in its CFs for non-traded sectors since due to the heavy subsidies noted above, on average non-traded activities have market prices below their economic costs, implying CFs of more than 1.0.

(iv) One would expect significant variations in CFs for unskilled labour both between countries, and between regions of the same country. Of the countries studied, for urban unskilled labour the economic CF is in the range from 0.29 (Botswana) to 0.66 (Pakistan). There is a tendency for estimates of the urban labour CF for unskilled workers to fall around the mid-point of this range at about 0.50. In some countries CFs for rural unskilled labour are estimated to be above those for urban workers - for example for Jamaica there is a rural labour CF of 1.15. Higher CFs for rural unskilled labour tend to be the result of three factors: first rural labour markets are often treated as reasonably competitive so that on a daily basis market wage rates are a good proxy for productivity; secondly agricultural output may be worth more at world prices than at the prices received by farmers, which results in a CF for output foregone in rural areas that is greater than 1.0; and thirdly the fact that it may be more appropriate to calculate CFs for rural labour on a daily not an annual basis, thus removing the effect of seasonal underemployment from the estimates. For skilled labour many of the studies use the SCF as the CF for skilled workers. However a distinction is drawn between skilled local and foreign workers, with the latter having a different CF.

(v) The discount rate is perhaps the parameter which shows the greatest similarity between the studies. This reflects partly the crude treatment of this parameter, which is estimated in a similar way in many of the studies. If one excludes socially weighted discount rates, the range is from 5% (Botswana) to 12% (many countries). However Botswana is in a peculiar position, being a net external investor, and the returns lost from withdrawing from investment overseas form the basis for this low estimate. If the country is excluded because of its unusual position, the range of estimates for the discount rate narrows considerably from 9% to 12%, with a tendency for most estimates to be between 10% and 12%.

(vi) Many of the studies estimates social values - to give the NEPs required for a social analysis. Socially weighted estimates for unskilled labour and the discount rate - are shown in table 1. As is discussed in report 1 despite considerable theoretical interest in the 1970's the methodology of social analysis has largely remained unused both by national governments and by international agencies. It is worth noting in relation to the estimates that in all cases the social discount rate is below the economic, generally in the range of 5% to 8%. In most cases the CFs for unskilled labour are lower in the economic than in the social analysis since the adjustment to the economic cost of labour to allow for consumption and saving effects generally raises rather than lower its value. The exceptions are the studies on Egypt and Colombia, where the social shadow wage is below the economic. The explanation in these cases is that the social weight placed on the consumption gains of workers is sufficiently high (because of their low income) to offset the consumption costs of their employment. Other studies have not employed such high weights.

(vii) Finally, regarding approach, a majority of the studies covered in table 1 are 'consistent' in that they employ SIOA. The number of columns in the semi input-output tables determines the size of the matrix that has to be inverted, and therefore the computational complexity involved. The size runs from 31 columns (Colombia) to 130 (Egypt) and 138 (Kenya). Naturally the larger and more economically complex is an economy the more detailed should be the analysis, and the more columns it is desirable to include in the calculations. The majority of studies use a world price system.

This brief survey of the results of a range of published studies has identified some common features of their NEP estimates. For economic appraisal the main findings can be summarized as follows:

- there is a tendency for the SCF to be around 0.80 with the average consumption conversion factor close to this;
- for non-traded activities the CF for construction is generally below the SCF, and that for electricity is often above the SCF;
- the CF for urban unskilled labour tends to be around 0.50, although regional variations for labour can be important, and for rural labour some studies find a CF above that for urban workers;
- the discount rate tends to fall in a narrow range of 10% to 12%.

Table 1 Examples of NEP Studies

Author	Year of estimates	Country	Main parameters	CFs	Comments
1. Weiss (1980)	1977/78	Pakistan	SER	1.20	Partial approach.
			unskilled labour	0.33-0.66	Domestic price system.
			non-skilled sectors		Some social analysis in individual case-studies.
			Contruction	0.68-0.74	Some NEPs given as
			Electricity	0.99-1.08	a range.
			Local Trade	0.31-0.45	
			Road Transport	0.57-0.62	
			Rail Transport	0.83-0.84	
			discount rate	10%-12%	
2. Adhikari (1988)	1980-82	Nepal	SCF	0.83	Partial approach.
			SER	1.20	World price system.
			Average Consumption CF	1.00	
			unskilled labour	0.45	
			Non-traded sectors		
			Electricity	0.90	
			Transport public	0.80	
			private	0.73	
			discount rate	9%	
3. Linn (1977)	1975	Ivory Coast	SCF	0.83	Partial approach.
			Average Consumption CF	0.84	World price system.
			unskilled labour		Social analysis
			urban economic	0.31	used to estimate
			social	0.60	both economic and
			non-traded sectors		social NEPs.
			Construction	0.77	
			discount rate		
			economic	10%	
			social	7%-8%	
4. Mashayekhi (1980)	1979	Turkey	SCF	0.59	Partial approach
			Average Consumption CF	0.79	World price system
			Unskilled labour		Social analysis used
			urban economic	0.43	to estimate both
			social	0.57-0.60	economic and social
			rural economic	0.39	NEPs.
			social	0.56-0.60	Some NEPs given
			discount rate		within a range.
			economic	12%	
			social	5%	

Table 1 contd....

Author	Year of estimates	Country	Main parameters	CFs	Comments
5. Scott and others (1976)	1970-73	Kenya	SCF	0.80	Consistent SIO approach using SIOA. Social analysis used. SIO table 138 columns. World price system.
			Average Consumption CF		
			urban	0.82	
			rural	0.94	
			Unskilled labour		
			urban social	0.70	
			rural social	1.00	
			Skilled labour	0.80	
			Non-traded sectors		
			agriculture (urban retail level)	0.85	
			discount rate		
			social	10%	
6. Lal (1980)	1973-74	India	Average Consumption CF	0.82-0.86	Consistent approach. World price system. SIO table for non-traded activities with 57 columns. Labour CFs for 15 states. Social analysis used.
			Unskilled labour		
			urban	0.56-0.73	
			Non-traded sectors		
			Construction	0.53	
			Electricity	0.69	
			Rail transport	0.64	
			Road transport	0.82	
			Discount rate		
			social	11%	
7. Schohl (1979)	1978-79	Colombia	SCF	0.92	Consistent approach using SIOA world price system. Social analysis applied as well as economic. SIO table with 31 columns. Some NEPs given within a range.
			Average Consumption CF	0.94	
			Unskilled labour		
			rural economic	0.58	
			social	0.46	
			urban economic	0.59	
			social	0.55	
			Non-traded sectors		
			Construction	0.84-0.87	
			Electricity	0.96-1.10	
			Transport	0.96-1.09	
			Discount rate		
			economic	11%	
			social	6%	

Table 1 contd....

Author	Year of estimates	Country	Main parameters	CFs	Comments
8. Page (1982)	1979-80	Egypt	SCF	0.96	Consistent approach using SIOA. World price system. Social analysis used as well as economic analysis. SIO table with 130 columns.
			Unskilled labour		
			urban economic	0.47	
			social	0.40	
			rural economic	0.56	
			social	0.22	
			Skilled labour		
			economic	1.08	
			social	1.12	
			Non-traded sectors		
			median	1.21	
			discount rate		
			economic	10%	
			social	6%	
9. Weiss (1985)	1983-84	Jamaica	SCF	0.79	Consistent approach using simultaneous equations. World price system. No social weighting.
			Unskilled labour		
			rural	1.15	
			urban	0.57	
			Skilled labour	0.79	
			Non-traded sectors		
			Construction	0.73	
			Transport	0.73	
			Electricity	0.74	
			Distribution	0.63	
			Discount rate	10%	
10. Saerbeck (1989)	1987	Botswana	SCF	0.86	Consistent approach using SIOA. World price system SIO table with 49 columns. No social weighting.
			Average Consumption CF	0.86	
			Rural Consumption CF	0.92	
			Unskilled labour		
			Urban	0.29	
			Rural	0.83	
			Skilled labour		
			Local	0.86	
			Foreign	0.92	
			Non traded sectors		
			Construction	0.72	
			Electricity	0.80	
			Transport Road	0.81	
			Rail	0.88	
			Discount rate	5%	

Table 1 contd...

Author	Year of estimates	Country	Main parameters	CFs	Comments
11. Castagnino (1981)	1979	Paraguay	SCF	0.73	Consistent approach using SIOA. World price system. SIO table 71 columns. Discount rate given within a range. No social weighting.
			Consumption CF		
			Urban low income	0.76	
			middle income	0.73	
			Unskilled labour		
			urban	0.50	
			rural	0.43	
			Skilled labour	0.73	
			Non-traded sectors		
			Electricity	0.29	
			Construction	0.65	
			Transport road	0.70	
			Discount rate	6%-12%	
12. Londero (1981)	1979	El Salvador	SCF	0.86-0.88	Consistent approach using SIOA. World price system. SIO table 109 columns. Some NEPs given within range. No social weighting.
			Consumption CF		
			urban low income	0.86-0.89	
			rural low income	0.84-0.87	
			Unskilled labour		
			urban formal	0.29-0.45	
			rural informal	0.50-0.78	
			Non-traded sectors		
			Electricity	0.83-0.84	
			Construction	0.79-0.83	
			Discount rate	12%	
13. Donoso (1981)	1979	Ecuador	SCF	0.82	Consistent approach using SIOA. World price system. SIO table 41 columns. No social weighting.
			Average Consumption CF	0.84	
			Unskilled labour	0.26	
			Non-traded sectors		
			Electricity, Gas, Water	1.02	
			Construction	0.72	
			Transport	0.89	
			Discount rate	12%	
14. Morales (1981)	1979	Barbados	SCF	0.91	Consistent approach using SIOA. World price system. SIO table 49 columns. No social weighting.
			Unskilled labour	0.59	
			Skilled labour	0.87	
			Non-traded sectors		
			Electricity, Gas, Water	0.89	
			Construction		
			public	0.81	
			private	0.85	
			Transport road	0.80	
			Discount rate	12%	

Table 1 contd...

Author	Year of estimates	Country	Main parameters	CFs	Comments
15. Bid Nafinsa (1987)	1986	Mexico	SCF	0.75	Consistent approach using SIOA. World price system. SIO table 85 columns. No social weighting.
			Average Private Consumption CF	0.74	
			Unskilled labour	0.52	
			Skilled labour	0.72	
			Non-traded sectors		
			Electricity	0.97	
			Construction	0.77	
			Transport	0.80	

This is not to imply that there is a "typical" set of NEPs which can be applied as approximations in all countries. It is clear that circumstances of a particular country will alter its NEPs in relation to the values just discussed. For example, other things being equal, the more protected an economy is from foreign trade competition, the lower will be its SCF. The greater the degree of surplus labour and the gap between urban and rural wages, the lower will be the CF for urban unskilled labour. Similarly the greater is the scarcity of funds for domestic investment the higher will be the economic discount rate. NEPs for an individual country must be estimated allowing for its national situation. However the summary results just discussed may be useful as a starting-point in the process, since one can assess whether national circumstances are sufficiently different to generate NEPs that differ markedly from those found for other countries.

3. DATA SOURCES FOR NEP ESTIMATION

3.1 SCF/SER

As report 1 has made clear the SCF and the SER can be made compatible, with one being the reciprocal of the other, so that

$$SCF = OER/SER$$

where OER is the official exchange rate, so that SER/OER -1 is the premium on foreign exchange.

Partial approaches to the estimation of the SCF and the SER generally work with simple formulae that compare domestic and world prices for goods produced and consumed in the economy. The simplest approach to the SCF uses a weighted tariff-subsidy formula (equation 1)

$$SCF = \frac{X + M}{(X - T_x + S_x) + (M + T_m - S_m)} \qquad (1)$$

where X and M are total values of exports and imports at fob and cif prices respectively, converted to world prices at the OER.

T_x and T_m are total taxes paid on exports and imports respectively, and S_x and S_m are total subsidies on exports and imports respectively.

Equation (1) gives only a crude approximation of the divergence between world and domestic prices in the economy, since it assumes that all price differences are determined solely by taxes and subsidies on foreign trade. Inclusion of additional premia due to the impact of import licensing and other quantitative controls on trade will be required wherever non-tariff barriers are important. Equation (1) must then be modified to

$$SCF = \frac{X + M}{(X - T_x + S_x) + (M + T_m + P_m - S_m)} \qquad (2)$$

where P_m is the value of the premia on imports caused by quantitative controls.

Equation (1) has been used to estimate the SCF (or the SER) in several of the studies discussed earlier. It has the advantage in that data requirements are not great. Total import and export values will be known from the trade statistics. Also total taxes on both exports and imports will generally be published by the Ministry of Finance in a statement of sources of government revenue. The most difficult area in relation to data requirements of equation (1) lies in subsidy statistics. Often, whilst total government financial subsidies can be found from the financial accounts of the government the information will be in aggregate terms. It will be necessary therefore to make estimates of how the subsidy total can be split into different components, and how much of the total should go to imports and how much to exports.

Equation (2) is clearly preferable to (1) where quantitative trade controls are important in influencing domestic prices. However estimating the size of P_m in (2) will require a survey of prices for a sample of traded goods. Clearly the sample should be reasonably representative of the goods a country trades in. However mounting a large accurate survey will be time-consuming, and will require care in matching domestic and foreign goods of similar quality and specifications.

The SER premium can be estimated as the inverse of equations (1) or (2) minus 1.0, however some studies have used a more sophisticated weighting system than is implicit in these equations. In (1) and (2) the weights on different commodities are implicitly their current average share in trade. If one assumes that a new project will have a small impact on the exchange rate it is appropriate to use a weighting scheme based on the price elasticity of demand for imports, and price elasticity of supply for exports. Here the SER is given by an elasticity-weighted formula so that

$$SER/OER = \frac{\sum_i m_i.(M_i + T_i - S_i) + \sum_j e_j.(X_j - T_j + S_j)}{\sum_i m_i.M_i + \sum_j e_j.X_j} \qquad (3)$$

where i and j refer to imports and exports respectively,

M_i, T_i and S_i are the total value of import i, total taxes paid on i, and total subsidies received by users of i, respectively;

X_j, T_j and S_j are the total value of export j, total taxes paid on j, and total subsidies received by producers of j, respectively.

m_i is the price elasticity of demand for import i, and e_j is the price elasticity of supply for export j;

$\sum_i M_i$ equals total imports, and

$\sum_j X_j$ equals total exports.

The only difference between (3) and (1) is in the weighting system used; in (1) all goods are weighted on the basis of their current share in trade whilst in (3), because it is assumed that there will be a small change in the exchange rate, trade shares are allowed to alter depending upon the relevant demand and supply elasticities. For example, by definition with a fall in the exchange rate, and a rise in the local currency price of an import, those goods with a high price elasticity of demand will have a lower share in total imports. Similarly those exports where domestic supply is more responsive to the price change created by the fall in the exchange rate will experience an increase in their share in exports.

Equation (3) is considerably more demanding than (1) in its data requirements, since estimates of trade elasticities are needed. These will rarely be known for a particular developing country with any great accuracy. One short-cut in applying (3) is to use elasticity estimates taken from studies on other, perhaps developed economies. Another is to split exports and imports into broad categories such as:

- traditional exports (primary products)
- non-traditional exports (manufactures)
- consumer goods imports

- raw material imports
- capital and intermediate goods imports.

One can then make approximate estimates of the export and import elasticities for these broad categories varying with the characteristics of the categories; for example non-traditional exports would normally have a higher price elasticity of supply than traditional exports and consumer goods imports often a higher price elasticity of demand than capital and intermediate goods. However due to the crude nature of the aggregation this procedure is subject to potentially significant margins of error, and normally would be unlikely to give very much more accurate estimates than the application of equation (1).

Equations (1) to (3) would normally be applied as part of a partial approach to NEPs. In a consistent SIOA the SCF is defined as the average - normally a weighted average - of the CFs for the main productive sectors of an economy given from a SIO table. Here the SCF is

$$SCF = \sum_i a_i . CF_i \qquad (4)$$

where CF_i is the CF for sector i

a_i is the weight placed on sector i

(current share of value-added in i in GNP would be a common weight).

This specification of the SCF is more rigorous than that of the earlier equations. It takes account of the interdependence between CFs, and it also incorporates the effect of non-tariff controls on trade, since import premia will be allowed for in the calculation of individual sector CFs. However, the weights involved will be average not marginal weights as in (3), and thus changes in production and expenditure shares may reduce the accuracy of (4). Data to calculate (4) will be that required initially to set up a semi-input-output system, so that (4) requires no additional information.

3.2 Other Common Aggregate CFs - Consumption Conversion Factor, (CCF) and Investment Conversion Factor (ICF)

It is often useful to have aggregate CFs to adjust broad categories of expenditure - such as consumption or investment - from market to shadow price values. The CCF, for example, is required in the treatment of foreign labour and the ICF in some of the approaches to the estimation of the discount rate. The CCF can be defined as a ratio of world to domestic prices for a particular basket of consumer goods.

$$CCF = \sum_i a_i . \frac{WP_i + TD_i}{DP_i} \qquad (5)$$

where DP_i the domestic retail price (inclusive of indirect taxes) of good i

WP_i is the world price of i (fob or cif)

TD_i is the transport and distribution (including port) costs involved in moving i from the border to consumers, and strictly in a world price system TD_i should also be at world prices. (Where i is an exportable TD_i will be negative, since diversion to domestic sales will save these costs).

a_i is the share of good i in consumption expenditure.

Estimation of (5) requires information on world and domestic prices for commodities, estimates of the transport and distribution margins involved, from the border to consumers, and data on the distribution of additional consumer expenditure between goods. This latter distribution will normally be available from Household Expenditure Survey data, and would be expected to differ significantly for different income levels. Several studies therefore allow for this by estimating different CCFs for different groups, for example urban high income CCF, or rural low income CCF.

As part of a SIOA one can use the CF results for consumer goods sectors to derive a value for the CCF. Here

$$CCF = \sum_j b_j . CF_j \qquad (6)$$

where j refers to a consumer goods sector,

and b_j is the share of consumer expenditure on output from sector j in marginal consumption expenditure.

In (6) the CCF is therefore a weighted average of the CFs for consumer goods sectors in the SIO table. This approach again has the advantage of consistency. The weights b_j can be determined from Household Expenditure Survey data and often average expenditure shares are used as an approximation for marginal shares. However in the absence of this information source, a rougher approach is to take the share of each consumer goods sector in total production of consumer goods as an approximate weight.

In principle, the treatment of ICF is similar. It is a weighted average of world to domestic prices for investment goods, so that (5) and (6) apply, with the weights now changed to relate to the share of different goods in investment expenditure. Normally these weights will be estimated rather more crudely than for consumer expenditure. A common procedure is to breakdown estimates of the current capital investment of the economy into broad categories such as - land, plant and equipment and buildings. It is then assumed that current shares in investment expenditure for these categories can represent marginal shares. In deriving the ICF from (6) it will be necessary to value the different categories of investment by CFs for appropriate productive sectors of the SIO table. For example, land could be valued by an average of the agricultural CFs, plant and equipment by a CF for machinery producing sectors, and buildings by a CF for construction. Data on the distribution of current investment between different categories of fixed asset will normally be available from the national statistical office since it will be required for the compilation of the national accounts. Sectoral CFs will be derived from the SIO table.

3.3 Traded commodities and Traded Sectors

Traded commodities are the output of traded sectors and as such the main part of their shadow price value will be their world price. However traded commodities also have various domestic and non-traded components such as transport and distribution costs, and taxes, which enter into their final selling price on the domestic market. For example, the domestic retail price of good i, an import, may be expressed as

domestic retail price of i	=	import price	plus	import tariff	plus

import premia due to licensing controls	plus	transport costs border to consumer	plus	distribution costs border to consumer.

The shadow price value of i is not simply its cif world price, but this plus the economic value of the non-traded inputs of local transport and distribution that go into supplying i to consumers. As report 1 brings out the situation is more complicated for tradeable goods that are actually supplied locally (import-substitutes) or consumed locally (exportables), since here it is the incremental transport and distribution costs in comparison with the trading alternatives, that are relevant.

Use of the above expression for i will be relevant, for example, in calculating the CCF as defined in equation (5). However it is also relevant in the treatment of traded sectors in SIOA. As is discussed in more detail in Appendix 1 it is necessary to disaggregate the output value of a traded sector. If the domestic price of output i is set at 100, and its cif price at 60, the different components of i price can be illustrated as follows:

Entry in SIO table	Absolute Value	Unit value
Transport	5	0.05
Distribution	15	0.15
Foreign Exchange	60	0.60
Taxes	10	0.10
Surplus Profits	10	0.10
Output price	100	1.00

Local transport and distribution have a value of 20, with taxes and import premia (surplus profits) 10 each. In a SIO table the costs of transport and distribution will be entered in the sector rows corresponding to those non-traded activities. The cif import price will be entered under the foreign exchange row, with taxes and import premia shown either separately or as one aggregate transfer category. Normally import premia due to licensing would be treated as surplus profits, on the grounds that traders' normal profits would be included already under distribution costs.

This treatment of traded sector activity requires data on the different components of the divergence between domestic and world prices. Information on tariffs will normally be available from Customs Tariff schedules, although even this source may still not give unambiguous information, since some goods may enter free of tariffs due to various exemptions, or from illegal trade. Furthermore in many countries tariff rates are not always clearly specified with commodities of slightly different characteristics eligible for different rates. One way around this is instead of using published tariffs applicable, to calculate tariffs actually collected as a percentage of import value of different import categories. These average actual tariff rates would then be used in the calculation of the tariff element in output at domestic prices for traded sectors. This latter approach is probably preferable, wherever tariffs collected are published in sufficient detail.

Disaggregating the divergence between domestic and world prices for traded goods into the other components will normally be even more difficult. In a SIO table one will be working at a national level, so that precise location points for consumption and production cannot be identified. Inevitably one will have to specify the national average share of distribution and transport costs in the domestic selling price of traded goods. This can only be done very approximately, allowing for the location of the main consumption centres viz-a-viz the main ports of entry and exit for traded goods, with perhaps some allowance for the characteristics of the goods produced by different sectors. Data on project studies, showing the transport and distribution costs of different traded goods, are one source that may be useful here. In some instances it may not be possible to do more than use a rough standard percentage, such as 10%, for the share of these costs in output value across all traded sectors. Finally unless one has specific evidence to lead to more precise estimates, the import premia arising from import controls can be taken as the residual element in the difference between domestic and world prices, after transport and distribution costs and tariffs have been identified.

3.4 Non-Traded Commodities and Non-Traded Sectors

The economic value of a non-traded commodity can be viewed from either the demand or the supply side. In NEP studies it is generally assumed that for most non-traded sectors supply can be increased, either in the short or the medium term, so that economic value can be defined in terms of the unit cost of incremental supply. Following this approach requires that each commodity to be valued must be disaggregated into its various cost components with each given its own shadow price value. Therefore for non-traded good n its shadow price is

$$SP_n = \sum_i a_{in}.SP_i. \qquad (7)$$

where SP refers to shadow price,

i is an input into the production of n

and a_{in} is the number of inputs of i required per unit of n.

Data on the cost of supplying a non-traded activity will normally distinguish between raw materials, labour, components, capital costs and taxes. As Appendix I discusses in more detail, SIOA disaggregates these various categories still further by breaking them down into a series of primary inputs into a non-traded sector. Here one can think of i in equation (7) as referring to primary inputs. The CF for n is derived as a weighted average of the CFs for the primary inputs into n; so that

$$CF_n = \sum m_{fn}.CF_f \qquad (8)$$

where f now refers to primary inputs into n and the weight m_{fn} is the share of f in output value of n at domestic market prices.

The procedure can be illustrated using a simplified example. Assume that the costs of a non-traded activity construction can be broken down into the following categories.

Raw Materials	Cost
- Cement	70
- Bricks	30

Electricity	20
Imports	
- Cif Value	30
- Tariffs	5
- Transport and Distribution	8
Labour	
- Skilled	20
- Unskilled	40
Operating Surplus	60
Taxes	40
Total	303

Entries in a SIO table would be as set out in table 2. The procedure is to distinguish between inputs from productive sectors and direct primary inputs. In this case there are inputs from three productive sectors. These themselves must be broken down into primary inputs, so that to value construction using equation (8), the three productive sectors must be decomposed into the five primary inputs. The total value of construction is then given by the sum of all primary inputs into construction - both the direct primary inputs shown in column (2) of table 1, plus the indirect primary inputs that go into the three productive sectors which are included in column (3) of the table.

The conversion factor for construction is given as a weighted average of the CFs for the primary inputs, using their share in output (from column 3)as weights. Therefore

$$CF_C = (0.22 \times CF_{FE}) + (0.24 \times CF_{UL}) + (0.12 \times CF_{SKL}) + (0.15 \times CF_{TAX}) + (0.27 \times CF_{OP})$$

where CF_C is the CF for construction

and CF_{FE}, CF_{UL}, CF_{SKL}, CF_{TAX} and CF_{OP}, are the CFs for the primary inputs.

This treatment of non-traded activities requires detailed information on their cost structure. Several possible sources of these data may be available.

(a) National Input-Output (NIO) tables are an obvious starting point where they exist. These will identify a number of non-traded activities although the classification of a NIO table may be too aggregate for the purposes of an SIO study. For example, in a NIO table Electricity, Water and Gas is sometimes shown as a single sector, whilst for project

Table 2 Illustrative Treatment of Construction in a SIO Table

Rows		Direct Inputs: Absolute Values (1)	Direct Inputs: Unit Values (2)	Total inputs[f]: Unit Values (3)
Productive sectors	Non-Metallic Minerals[a]	100	0.33	
	Electricity	20	0.06	
	Transport and Distribution[b]	8	0.03	
Primary Inputs	Foreign Exchange[c]	30	0.10	0.22
	Unskilled Labour	40	0.13	0.24
	Skilled Labour	20	0.07	0.12
	Taxes and Transfers[d]	25	0.08	0.15
	Operating Surplus[e]	60	0.20	0.27
		303	1.00	1.00

a) Covers Cement and Bricks.
b) For simplicity only Transport and Distribution costs relating to direct imports are included.
c) Covers direct imports at cif prices.
d) Covers taxes on domestic inputs, plus tariffs on imports.
e) Profits are assumed to equal capital costs of the sector.
f) Including the primary inputs into three productive sectors.

appraisal purposes it will often be desirable to have separate CFs for these three activities. Similarly in some NIO tables Transport is shown as a single sector, and not disaggregated into road and rail components. Again separate CFs for these will generally be essential for project work. Therefore NIO data will often have to be broken down further when building a SIO table.

(b) Surveys of particular sectors - such as Censuses of Production - provide another useful data source. Such surveys are typically carried out for Manufacturing, and in some countries it may be appropriate to classify a significant proportion of Manufacturing as non-traded. Often sector surveys are carried out regularly as part of the process of estimating production and incomes in different sectors for the national accounts. Although the sample sizes involved are often much less than those for full Censuses of Production their regular nature means they will be a useful source.

(c) For some activities it may be that cost data can only be obtained from project feasibility studies. Whilst project documents normally refer to only a particular part of a sector, so that there is a danger that they may be unrepresentative, they can have the advantage of containing reasonably up-to-date information on costs, particularly capital costs. Further, where a single project is large relative to a sector in the table, use of that projects' feasibility study may provide a reasonable guide to the whole sector's cost structure.

It should be noted that in the treatment of non-traded activities a distinction should be drawn between those with surplus capacity in the short to medium term, and those without it. For the former, only variable costs of production, excluding any capital charge, will be relevant in calculating the sector's shadow price. Where there is no such surplus capacity, however, full costs must be included. In this latter case additional supply from the sector will require new investment, which itself has an opportunity cost, so a capital charge must be allowed for.

In our construction example in table 2, if there is surplus capacity in the sector, the capital charge - represented by the primary factor Operating Surplus - must be set at zero. This will have a major effect in lowering the shadow price and the CF.

However data on capital costs for non-traded sectors is particularly difficult to obtain. Theoretically what is required is the replacement cost of fixed assets, converted to shadow prices. This must then be expressed as an annual capital charge using a capital recovery factor, determined by the economic discount rate and the assumed life of the assets. However data on assets at replacement costs is generally difficult to obtain - so that often only approximations will be possible. One short-cut, used in the example in table 2, is to assume that actual profits earned approximate this annual capital charge.

3.5 Unskilled and Skilled Labour

Labour's economic value will vary between projects depending upon the region of a projects' location, and the job opportunities open to workers in that area. Most NEP studies include some national average estimate for labour - often distinguishing between unskilled labour employed in rural and urban areas. This national value is necessary for certain national level calculations; for example, it is normally the case that national average values for labour will be used in a SIO table. Similarly calculations to estimate the return to marginal investments required for the discount rate (see the following section) will also normally use a national average value for labour.

However for appraisal of individual projects it is important to bear in mind the possibility of major regional differences in the valuation of labour. To meet this point it is generally desirable - particularly in large economies - to calculate regional average shadow prices and CFs for unskilled labour, both rural and urban, and if necessary supplement these with estimates by individual project analysts that take account of peculiarities in the labour market situation affecting individual projects.

The simple expression for the shadow price of labour for an economic appraisal is defined as

$$SP_{UL} = m.CF_m \tag{9}$$

where m is output foregone at domestic market prices

and CF_m is the CF to revalue m at shadow prices.

The principle behind (9) holds for both unskilled and skilled workers, although the value of output will differ between these categories.

Output foregone can be a bundle of commodities rather than a single good, and in principle more than one worker may migrate looking for work in response to one new job created, so that m can refer to lost output of more than one person. This will not be the case however if, when more than one worker migrates, those not obtaining work return to their original jobs. Migration in China appears to follow this latter pattern so that there is no case for including output foregone of more than one worker in equation (9).

Estimation of output foregone can draw on a range of possible data sources.

(i) At the crudest level one approach is to use aggregate average income estimates as a proxy for output foregone. For example, in terms of workers leaving rural areas for urban work a rough estimate of output foregone can be obtained by dividing net agricultural income by the number of total agricultural workers. These income and labour figures could be either national or regional, where such estimates exist.

(ii) Another possibility is to use wage rate data, particularly in rural labour markets, as a proxy for daily labour productivity. Then to find output foregone annually one needs an estimate of days worked per year, which when multiplied by the average daily wage gives an estimate of m. Daily wage rates are likely to vary between seasons. In some countries data on prevailing wages are published regularly whilst in others it may be necessary to conduct a field survey to ascertain current rates.

(iii) Agricultural household surveys can provide further information on earnings by type of activity, and on days worked per year. Data from such surveys can be used to estimate m either in conjunction with, or as an alternative to daily wage rates.

(iv) Probably the most satisfactory approach to estimating output foregone is to conduct field surveys in both rural and urban areas to collect direct information on production activities, migration patterns, and days worked. Such surveys can be time-consuming, but may well be essential if existing information does not answer the precise questions required to estimate output foregone. Such direct surveys will also shed light on regional and local divergences in labour market conditions.

In terms of skilled labour equation (9) also holds. However is some countries it can be assumed that labour market conditions for such labour are sufficiently competitive for wages actually paid to broadly reflect output foregone in alternative activities (at domestic prices). Under such circumstances the only adjustment required is to use a CF to express this market wage at shadow prices. Many studies use the SCF for this purpose rather than applying equation (9).

However there may be circumstances where wages for skilled workers are controlled by the government and are clearly held below workers' marginal productivity. Here one needs to estimate the degree to which marginal productivity (which will determine output foregone) exceeds market wages. One approach is to examine wage and productivity trends over time, taking as a starting point a year in which wage controls were not in force. If productivity can be shown to rise by an annual percentage rate in excess of the rise in market wages one can calculate by how much this divergence has grown by a particular year. In some countries time series data on wages and productivity movements are either published, or can be estimated from published data.

3.6 Discount Rate

As report 1 has discussed the economic discount rate can be approached from two perspectives; the first assuming that the investment budget is fixed, and the second that savings can be increased, so the budget becomes flexible.

In the first approach, the discount rate is specified as the opportunity cost of investment funds, which is the return on marginal investment.

$$r = q.CF_q \qquad (10)$$

where r is the discount rate,
and q is the marginal return on investment at market prices.

CF_1 is the conversion factor required to convert marginal returns to shadow prices.

Estimation of this marginal return can draw on a number of sources, of which three are likely to be the most important;

(1) a survey of past project feasibility studies and the rates of return estimated in these gives an indication of returns expected of new investments. However this source has the drawback that returns are projected, not actual, and that not all appraisals are necessarily carried out to the same level of sophistication. Theoretically what is required is estimated marginal returns at shadow, not market prices.

(2) a more satisfactory source would be ex-post appraisals of projects currently in operation, since this would allow an assessment of returns actually achieved .ather than simply projected in ex-ante studies. However few governments have gone as far as conducting regular and comprehensive ex-post appraisals, although some of the international donors do so. Therefore there is a limit to the extent one can expect information of this type.

(3) alternatively one can try to adjust the published operating results of enterprises to identify their economic returns. For example for manufacturing, Census of Production data can be revalued to approximate economic returns to capital. This involves adjusting the values of output and inputs, including labour, to bring them to shadow price terms. CFs will be required for this exercise. However a particular problem is that even if a detailed set of CFs are available, for example from a SIO table, the categories used in census data may be very aggregate - for example grouping most inputs into production as 'Raw Materials' without specifying a more detailed breakdown. Hence it may be necessary to apply only aggregate CFs - for example the SCF - to revalue Raw Materials. In addition the valuation of capital assets is always a problem in this type of exercise, since census data will normally be at historical book values, not at the replacement cost of the assets. Hence if assets are not brought up to replacement values there is a danger that they are given an artificially low valuation, which will mean that the return to capital will be overestimated. However identifying accurately an adjustment to asset values will be difficult. Ideally what one needs is information on their age, so that an inflation adjustment can be made which escalates their value to allow for price changes from the year of their purchase to the year to which the production data relates. Similar problems arise if one tries to use published financial accounts of enterprises as a basis for calculating returns to capital.

Strictly what is required is that marginal returns to capital be specified as

$$q = \frac{P_i - \sum_j a_{ji}.P_j - \sum_\ell a_{\ell i}.W_\ell}{K_i} \qquad (11)$$

where P_i is the domestic value of output i

a_{ji} is the number of units of purchased input j required per unit of i

P_j is the domestic price of j

$a_{\ell i}$ is the number of units of labour input ℓ required per unit of i

W_ℓ is the market wage per worker of category ℓ

and K_i is the value of capital required per unit of i measured in domestic prices at replacement costs.

Theoretically different CFs will be required for each separate component of (11) to express q at world prices. In practice only very rough adjustments, for example using the SCF for the numerator of (11) and the ICF for the denominator may be all that is possible, so that

$$r = q \times \frac{SCF}{ICF} \qquad (12)$$

where r is the discount rate

q is the marginal return on investment at domestic prices,

SCF is the standard conversion factor, and

ICF is the investment conversion factor.

If the supply of savings is treated as flexible some of these data problems in estimating the discount rate are overcome, but others still remain. For countries that have access to international capital markets, several studies have used the commercial international interest rate - the London Inter-Bank Offer Rate (LIBOR) - as a measure of the cost of capital. This rate must be adjusted for the country's own credit rating, which will add perhaps an extra 1% to 2% to the basic rate. However what is required is a real, not a nominal rate, so that this nominal interest rate must be deflated by a price index.

The most appropriate index theoretically is one for the goods which the borrowing country trades internationally, both as exports and imports. Although the index can be specified in different ways the simplest approach is to define it as a weighted average of projected price movements for all goods which the country trades, with the weights determined by the shares of the different goods in total exports plus imports. Accurate estimation of such an index is very demanding, since it requires accurate projections of price trends on the world market for all the country's exports and imports. In practice only crude approximate projections for broad categories of goods will be all that is possible. Hence although the approach of using LIBOR as the basis for the discount rate may appear to offer a simple solution for those economies which are credit-worthy, it is also not free from data difficulties.

Finally it is possible that additional savings may be forthcoming from domestic sources. Here the approach is normally to use domestic interest rates to savers as an approximate measure of the compensation required by savers to forego immediate consumption, and thus as a measure of the cost of their saving. This domestic interest rate must also be in real terms, and the domestic consumer price index is the obvious deflator to use.

Where it is judged that additional savings will come from a combination of foreign and domestic sources, the discount rate will be a weighted average of the cost of foreign and domestic savings, so that

$$r = a_1 \cdot i_{DOM} + a_2 \cdot i_{INT} \qquad (13)$$

where r is the discount rate

i_{DOM} is the real interest rate on domestic savings

i_{INT} is the real international interest rate on foreign borrowing

a_1 and a_2 are the shares of domestic and foreign savings, respectively, in additional savings.

Estimates of the share of domestic and foreign sources in new savings will be best made by the national planning agency as part of the exercise to construct the national plan.

3.7 Land

Like labour it is difficult to treat land as a national parameter, since its productivity will vary with alternative uses and by region. Estimates of the opportunity cost of land, that reflect the returns that are obtainable from alternative land uses, will be most relevant for agricultural projects. A simple approach is to estimate net returns per hectare of land, at shadow prices, for different crops in different regions of the country. This involves estimating output per hectare, and subtracting all inputs including farmers' time. The residual net income can be interpreted as returns to land. Data for this exercise have to be obtained from surveys of agricultural practices, that identify farm budget data under different crops. Where such surveys are available for different regions they should allow this calculation at the regional level.

Table 3 Summary of Data Sources for Main NEPs

	Equations	Concept	Sources
SCF/SER	(1),(2),(3),(4)	Relative prices domestic and world	Trade Statistics. Customs Tariffs. Direct price surveys.
CCF	(5),(6)	as above	As above, plus Household Expenditure Surveys.
ICF	(6)	as above	As above, plus capital stock estimate from national accounts.
Non-traded goods	(7),(8)	Input costs	Sector surveys National accounts National input-output tables.
Labour	(9)	Output foregone	Daily market wage rates Family income estimates from Household Expenditure or Income Surveys. Income and employment estimates from national accounts.
Discount rate	(10),(11) (12),(13)	Opportunity cost of investment funds, or cost of borrowing.	Project Documents. Ex-post project appraisals. Published financial performance. Domestic and foreign interest rates Price indices.

4. CHANGES IN NEPs OVER TIME

NEP estimates require periodic adjustment to allow for changes in government policy and underlying economic conditions. There is no general agreement as to how frequently NEPs need revision, since much will depend on how rapidly policy and economic conditions change in a country. The experience of the international organization that has conducted the most work in this area - the Inter-American Development Bank - leads its chief researcher to comment that "Average 'shelf' life of a study is about two years, after which sufficient changes accumulate to justify producing a revised set of accounting prices" (Powers 1989, p.68).

To illustrate the type of changes that can take place in NEPs, one can note that two studies for Mexico in 1984 and 1986 found significantly different results. For example the average CF fell from 1.01 in 1984 to 0.82 in 1986. These changes were due partly to a different specification of the SIO model, but also to changes in the economy. The treatment of the petroleum sector, through reductions in petroleum subsidies for users had a big impact in lowering the CF for petroleum from 5.0 to 2.2, which was important in lowering the CFs for sectors for which petroleum is a major input (BID-NAFINSA 1987).

Not all NEP studies show major shifts in values over time, the Jamaican study (Weiss 1985) described in Appendix 2 revealed some stability between estimates for the late 1970' and those for the early 1980's. However it is important to remember that NEP estimates based on SIO tables can be revised relatively easily, once the basic SIO model is available. All that is required is to alter periodically some of the basic data of the model to account for policy or other changes, and a new set of CFs will result.

In considering changes likely to alter NEP estimates, four main types of change can be identified. These can be classed as

- changes in trade taxes and controls
- changes in domestic price controls and subsidies
- changes in the level of domestic demand in the economy
- changes in the exchange rate.

4.1 Trade Taxes and Controls

A key change will be in taxes and subsidies on international trade. We have seen that valuation of traded goods is based on a comparison between world and domestic prices, with taxes and subsidies on trade being one of the key factors creating a divergence between these prices. Therefore other things being equal, the higher an import tariff the greater will be the divergence between domestic and world prices. This will be reflected in aggregate formulae such as equations (1) and (2), as well as more detailed sectoral CFs for traded activities in an SIO table. Therefore any shift in trade policy that has a significant effect on the level of import tariffs will alter CFs for traded activities. Introduction of tariff reform programmes is likely to be one of the most important influences changing NEP results.

Similarly policy on import controls will also create divergences between world and domestic prices for traded activities. Import quotas, by restricting imports push up their domestic prices creating a further divergence in addition to the tariff imposed on the commodity. This additional price rise is often termed the 'implicit tariff' created by the import controls. Therefore any change in trade policy towards controls over imports will also affect relative domestic and world prices. Other things being equal, therefore, an increase in controls, by lowering quotas or making more goods subject to an import licence, will push up domestic in comparison with world prices; similarly a relaxation of controls will have the reverse effect.

In addition as has been pointed out above some sectors of the economy may be non-traded because trade policy restricts competition from imports. This means that additional production or use of such goods affects the domestic economy - through price or output changes - rather than the balance of trade. However major shifts in policy towards import controls - for example a programme of trade liberalization that makes it easier to obtain access to foreign exchange and to import goods witnout restrictions - may have significant consequences for how some sectors of the economy are classified. If competition from imports becomes possible, goods previously treated as non-traded may become traded, which means that their economic value will be defined differently, and a new CF will result.

4.2 Price Controls and Subsidies

Controls on the domestic prices paid by consumers or received by producers clearly affect CFs, since they determine the domestic price that must be compared with the shadow price. For example, domestic prices paid to farmers for foodstuffs may be below world levels to keep food prices low for urban consumers. Similarly where use of petroleum-based products is subsidized domestic retail prices will be below the price of imports. Any change in policy that alters a controlled price will affect the CFs for the goods or sectors concerned. For example, a decision to lower the level of subsidy that results in controlled prices rising towards comparable world levels, will raise the CF for the goods involved.

4.3 Level of Domestic Demand

Government influences internal demand through fiscal and monetary policy, as well as through its own expenditure programmes. A change in the level of demand will influence CFs for labour and non-traded goods. For labour, for example, a fall in demand will influence job prospects and the level of unemployment. Where the change in demand is large this may reduce the estimated output foregone per worker - since if it is more difficult to find alternative employment a worker's opportunity cost will be lower. However given the approximate assumptions that often have to be adopted in shadow wage estimates it may be that it will be difficult to identify the influence of short-run demand shifts on the economic valuation of labour.

For non-traded activities the impact of demand can be important in terms of the distinction between activities with and without excess production capacity. For those with excess or surplus capacity shadow price valuation is based on variable costs of production only, with no allowance for a capital charge. A downturn in demand may mean that an activity moves to a situation of excess capacity. This will lower its shadow price - now based on short-run costs of production - and in turn lower its CF. Similarly with an increase in demand that leads to the removal of any excess capacity, the shadow price will rise, since capital costs must be included in additional to variable cost, and the CF will now be higher. Identifying which non-traded activities will move between excess and full capacity working as a result of demand shifts can be difficult, and often judgement will be involved in deciding how to treat particular activities. There is also an important question as to how long an activity will remain in either surplus or full capacity working. This involves forecasting the length of time short-run demand shifts last for.

4.4 The Exchange Rate

Changes in exchange rates have become common in recent years. A nominal devaluation where the rise in prices of traded goods domestically, is matched by a rise in prices of non-traded goods, will have no impact on CFs and can be ignored. However a real devaluation where as a result of the devaluation domestic prices of traded goods rise by more than do those of non-traded goods, will have an impact on the way resources are allocated, and will alter CFs. A real devaluation lowers the value of non-traded relative to traded activities, and over time these relative price effects will have some impact on the way in which production takes place - so that input coefficients for non-traded sectors change, with less traded inputs used in comparison with non-traded inputs and labour. It will also lead to a shift in use of labour and investment funds between sectors, which might be sufficiently large to influence the shadow wage and discount rate estimates. Predicting exactly how resources will move and how this will affect NEPs will be extremely difficult. The appropriate procedure is therefore to revise NEP estimates perhaps a year after a major real devaluation to see how the picture has changed.

The need to adjust NEPs in this type of situation is strengthened by the fact that many of the policy shifts, discussed above, may occur simultaneously, with changes in policy towards foreign trade, often accompanied by devaluation and contraction in internal demand. It is clear that in economies going through this type of reform package the need for frequent revisions of NEPs will be particularly important.

It is sometimes suggested that the type of Structural Adjustment reform packages introduced in many countries in recent years remove the need for shadow pricing and NEP estimates. This is not a valid argument however. Even though trade liberalization programmes by lowering tariffs and import controls, may remove much of the divergence between domestic and world prices, other gaps between market prices and economic values will remain. Any domestic tax and subsidy measures will have this effect. Further unless labour markets become self-equalibrating, so that full employment is achieved, there will be a gap between permanent wage rates and opportunity costs. As long as shadow and market wages differ, and some domestic taxes and subsidies are imposed, shadow and market prices for non-traded activities will diverge. Therefore even in economies with foreign trade policies of free trade - with zero tariffs and controls - some form of shadow pricing adjustment and NEP estimation will be required.

5. GOVERNMENT ATTITUDES TOWARDS USE OF NEPs

The idea that the financial profitability of an investment may differ from its full impact on the economy has a history in economics going back well over 50 years. Most governments, therefore, through the technical advice of their economic advisers, accept that in some circumstances financial criteria are insufficient for assessing the desirability of an investment. However the degree to which detailed economic calculations, involving sets of NEPs, are accepted varies considerably between countries.

5.1 Developed Economies

Most developed economy governments do not use NEPs in appraising returns to public sector productive investments. One of the reasons is that it is often argued that in developed economies prevailing market prices are not sufficiently "distorted" to require their replacement by an alternative set of detailed shadow prices. This is on the grounds that generally in comparison with developing economies, exchange rates will be less over-valued, taxes and controls over foreign trade will be less significant, and unemployment will be a less serious problem. Where some shadow pricing calculations are carried out for public sector investments is in relation to projects for which output is not marketed, or is only marketed at a price which does not reflect its economic value. Studies of transport projects that attempt to value benefits of time savings or vehicle operating costs are one example; studies on water resource schemes that put an economic value on water that is not sold directly to users would be another. The discussion of the UK case in Appendix 2 considers in more detail UK practice. It is of interest to note that the Northern Ireland Office of the UK government has recently started to consider whether it would be appropriate to use a shadow wage instead of the market wage in assessing new investments in Northern Ireland. This is because of the persistently high level of unemployment in that region.

5.2 Aid

In their role as Aid Donors, however, most developed economy governments have stressed the desirability of applying economic criteria in the assessment of aid-financed projects. The world price methodology discussed in report 1 is the approach that is most generally applied by donors in their appraisals. In particular, the British ODA, the Netherlands and German Aid agencies, and most of the major international lending agencies such as the World Bank, the Inter-American Development Bank, and the Asian Development Bank, apply at least a simplified version of the world price approach. Generally the practice of individual donor agencies is not as rigorous as that of the international agencies. Often only larger projects are appraised using economic calculations, and the NEPs used for individual recipient countries may be only approximate. Although the significance of the economic impact of projects is generally accepted, social analysis involving weights for consumption and savings changes has not been adopted by either individual donor agencies or by the international lending institutions. Most agencies insist on some assessment of the income effects and broader social and environmental consequences of projects, but this has not gone as far as applying a set of social weights to revalue income changes, in the manner discussed in report 1. Some of the national donor agencies have their own manuals or handbooks giving guidelines for appraisals. Two of these have been published in recent years and give an indication of donor thinking; these are ODA (1988) for the British Aid agency and Kuyvenhoven and Mennes (1985) for the Netherlands Aid agency. Both of these manuals are restatements of the world price approach.

International agencies, particularly the Inter-American Development Bank and the World Bank have gone furthest in deriving NEP estimates for recipient countries. The Inter-American Development Bank pioneered the use of SIOA by international aid agencies in the mid-1970's, and since then has estimated sets of NEPs for many of the countries for which it provides funds. At present NEP estimates are available for the countries listed in table 4. Most of these estimates are based on input-output models. The World Bank despite extending the theoretical approach to NEPs in the 1970's, has gone less far than the Inter-American Development Bank in deriving detailed and comprehensive NEP estimates. Individual SIO studies by staff members have been published - for example Schohl (1979) for Colombia, and Page (1982) for Egypt - but generally at present it appears that Bank estimates of NEPs tend to be based on a partial approach, and it does not seem that there is a clear policy of developing comprehensive NEPs for member countries in the same way as the Inter-American Development Bank.

Table 4 Countries Covered by Inter-American Development Bank with NEP Estimates 1987

Country	Year of Study	Type of Study[a)]
Barbados	1981	SIO
Bolivia	1980	Partial
Chile	1977	NIO
Columbia	1984	SIO
Costa Rica	1980	SIO
Dominican Republic	1979	Partial
Equador	1981	NIO
El Salvador	1981	SIO
Jamaica	1985	Partial
Mexico	1987	SIO
Nicaragua	1978	NIO
Paraguay	1980	SIO
Uruguay	1987	SIO

Notes: a) Partial involves use of trade and production data, but no input-output relations.
For NIO, national input output table used instead of constructing a new SIO table.

Source: Powers (1989) table 3.3.

5.3 Developing Economies

Governments of developing countries also vary markedly in their acceptance of the use of NEPs in project selection. Few governments use NEPs estimates in a systematic and regular way. This is no doubt partly because accurate estimates are not available, but also because the decision-taking process is inevitably complex with various interests influencing the final decision. At one extreme one can identify countries like India, Chile and Ethiopia, where economic calculations are a normal feature of project selection for all public sector projects. On the other hand, there are a significant number of countries where economic calculations are carried out only for aid-financed projects, largely with a view to meeting the criteria for receipt of aid. For example, in the case of Mexico the NEP estimates made under the supervision of the Inter-American Development Bank are not applied to projects financed domestically by NAFINSA the country's major development bank, but only to projects with external aid financing.

Appendix 2 has a discussion of country studies for Jamaica and Tanzania plus the UK. In the former two cases their use is selective, despite the fact that NEPs are available from a fairly recent study for Jamaica. In Tanzania there is relatively little information on NEPs and their use has been in a form of sensitivity testing. No developing country government, to our knowledge has employed a social weighting system, on a formal and regular basis in appraisals.

The question of the impact of the application of NEP estimates in developing countries is difficult to answer. One would expect that, where applied systematically, they would ensure that major errors in project decision-taking are not made, so that high cost inefficient projects are rejected. So far, however, no detailed research has been done on the actual effect of the use of these estimates on the type of projects selected. Furthermore where projects are selected on the basis of a mixture of political and economic criteria even the existence of a set of NEP estimates does not guarantee that only projects that are acceptable using these estimates will be chosen.

CONCLUSIONS

NEPs require a considerable amount of data to estimate accurately, and often existing data will allow only approximate results. However there exists a well developed methodology - SIOA - that allows for a consistent and comprehensive approach to their estimation. The technique of SIOA is clearly the preferable approach to NEP estimation, particularly in large complex economies, such as China.

The most desirable approach to NEPs is that they be estimated by a central planning body, then made available to ministries or banks responsible for appraisals. Revisions to the NEPs should be made regularly, and are far easier computationally where the estimates are carried out in a SIO system. Major revisions are likely to be required every two to three years, but perhaps sooner where major policy changes occur. The success of the Inter-American Development Bank in this field shows what can be achieved in terms of estimation. The fact that at present few developing countries governments apply NEPs, unless external funding is involved, should be seen as a weakness in their planning procedures, not an argument against applying NEPs. In socialist economies where public sector decision-taking is critical, NEPs become an important planning tool in guiding resource allocation. However there are both theoretical and practical arguments for limiting estimates to basic economic efficiency NEPs, rather than moving into the area of social weighting.

APPENDIX 1 AN INTRODUCTION TO SHADOW PRICING IN A SEMI-INPUT-OUTPUT APPROACH

Introduction

In recent years it has become increasingly common for estimates of national parameters to be derived from an input-output framework. This approach, conventionally described as semi-input-output (SIO) analysis, has a number of advantages over partial procedures that estimate key parameters independently of each other. This appendix sets out the logic of the SIO approach in what are intended to be relatively simple introductory terms. It also draws attention to both the advantages and some of the problems encountered in the application of SIO analysis. Although the approach is now part of the toolkit of techniques available to economists for the appraisal of projects in developing countries, much of the literature on its application is highly technical, and thus relatively inaccessible to the non-specialist.

Traded and Non-Traded Sectors

Although several authors have contributed to the development of this approach the original theoretical insight owes much to Tinbergen. Tinbergen's key step in integrating an input-output system and shadow pricing was to distinguish between what he termed international and national sectors; see for example Tinbergen (1967) chapter 7. For the former when additional domestic expenditure occurs this has its predominant impact on the balance of payments. In other words, commodities produced by an international sector can be bought and sold on the world market, and if additional expenditure is allocated to them this will either create more imports or divert these commodities from the export market. National sectors on the other hand, are those where additional expenditure has its main direct impact on the domestic economy, leading either to additional production or price rises for the commodities concerned. More recent terminology now refers to these two categories as traded and non-traded sectors, since their categorization is based on international trading possibilities. The important point about this distinction is that sectors will be valued differently in economic terms depending upon whether they are classified as producing traded or non-traded commodities. Traded commodities have an economic value determined by prices on the world market, whilst those that are non-traded must be valued either by the resources that go into their production, where their supply is variable, or by some indication of consumer willingness to pay, where their supply is fixed and additional demand causes some users to forego consumption.

A SIO table can be constructed without formal partitioning that places all traded sectors in one portion of the table and all non-traded sectors in another. However at the outset it is necessary to distinguish clearly between the two categories of sector because of the different approaches to economic valuation noted above. In terms of its coverage a SIO table can be comprehensive, in the sense of covering all production sectors in an economy. Alternatively it can be more limited focusing on sectors which are linked closely with new investment projects. The aim is to establish the main economic effects of new investment, so that there is less need to incorporate sectors that are affected in only a minor way. Outputs from sectors covered in the table that are used as inputs into other economic activities can be termed "produced inputs", in the sense that they come from sectors covered by the SIO system. This is in contrast with inputs supplied exogeneously, either from abroad, or from domestic activities not shown as productive sectors in the table.

Primary Factors

The logic of the SIO approach is that the economic value of sectors can be found by decomposing their output, valued at domestic market prices, into a number of input categories, termed primary factors. These are exogeneous inputs supplied from outside the SIO system. The specific primary factors used can vary with the level of detail and assumptions adopted in an analysis. As a minimum requirement, however, there need to be primary factors for foreign exchange, transfer payments - including taxes, subsidies and any surplus profits, labour - perhaps distinguishing between skilled and unskilled workers, and capital inputs. The treatment of the latter poses a particular problem that is commented on below.

The analysis consists of a series of steps for breaking down sector output into primary factors, so that for sector i producing commodity i

$$P_i = \Sigma c_{fi}.P_f \qquad (1)$$

where P_i is the market price value of a unit of output i;

c_{fi} is the number of units of primary factor f per unit of i, at market prices;

P_f is the value of a unit of f, at market prices.

Once total - including both direct plus indirect - primary factor inputs have been found the economic value of a sector is given as the sum of the primary factors that go into the sector, with each primary factor itself valued in economic terms. For sector i, economic value (V_i) is given as

$$V_i = \Sigma c_{fi} V_f \qquad (2)$$

where V_f is the economic value of primary factor f, and

c_{fi} is as in (1)

Conversion Factor

It is conventional to give information on economic values in the form of ratios, termed either conversion factors (CFs) or accounting price ratios (APRs), These are simply the ratio of economic value to market price for a particular item, so that

$$CF_i = \frac{V_i}{P_i} \qquad (3)$$

These ratios can be calculated at different levels;

- for an individual primary factor, such as unskilled labour;
- for an individual commodity, such as rice;
- for an individual sector, such as construction;
- for an aggregate category of expenditure, for example investment;
- for the economy as a whole, as an average of the CFs for all sectors.

One use of the terminology is to describe the first three levels, relating to factors, commodities and sectors, as APRs, using the term accounting price to refer to economic value. CF is then reserved for the latter two more aggregate levels. Here however for simplicity the term CF is used generally for all five levels noted above.

To derive a CF for a particular sector requires an economic valuation of the primary inputs into that sector. It can be shown easily from equations (1), (2) and (3) that CF_i can be derived as a weighted average of the conversion factors of each of the primary inputs that go into i, so that

$$CF_i = \Sigma\, m_{fi}\, CF_f \qquad (4)$$

where CF_f is the conversion factor for primary factor input f.

m_{fi} is the share of input f in output value of i at market prices so that

$$m_{fi} = \frac{c_{fi} \cdot P_f}{P_i}$$

The results of a SIO analysis are given typically as a set of conversion factors;

- for all sectors in the table;
- for all primary factor inputs into these sectors;
- for all aggregate categories for which an aggregate CF is specified.

The rationale for setting out the information as CFs rather than absolute values is that ratios can be applied directly to project data at market prices to adjust these to economic terms, and that ratios will become dated less rapidly than absolute values, which must always be adjusted for price changes. An exception is where external project effects are not estimated initially at market prices, so that there is no market price flow to be revalued by a CF. In this case it will be necessary to estimate the external effect directly at shadow prices, and a CF will not be required.

Structure of the SIO Table

The table can be described as a "columns only" input-output table in that only the input side of sectors is identified. The row totals of a full input-output table, which show the destination of output to intermediate or final demand, are not given. The table can be seen as composed of two distinct matrices. What is conventionally termed the A matrix shows the produced inputs into sectors; what is termed the F matrix gives inputs of primary factors, that are exogeneous to the system, into the different sectors. To solve the system direct coefficient matrices are required which show inputs per unit of sector output. The structure of the direct coefficient matrix of a SIO table can be illustrated in figure 1.

In figure 1 the table has n columns, covering sectors and aggregate CFs, so that the A matrix is n x n in size. There are g primary factor inputs so that the F matrix is g x n. Since all entries are direct coefficients, each column in the table must total 1.0; a_{1n}, for example, is the value of inputs from sector 1 into one unit of sector n; a_{gn} is the value of primary factor input g per unit of sector n.

Total primary factor requirements are both the direct primary inputs shown in F, plus the primary factors that go into the produced inputs in A. Their calculation requires first total produced inputs per unit of sectoral output; total produced inputs are direct inputs from the A matrix plus inputs from further back in the productive structure, for example inputs that go into direct inputs and so on. Once total produced input requirements per sector are known, the primary factors that go into these can be calculated.

Formally in matrix terms the calculation requires the Leontief inverse of the A matrix - to give total produced inputs per unit of sector output. One must then post-multiply the direct primary factor matrix F by the Leontief inverse to give total primary factor inputs per unit of output, so that

$$M = F\,[1-A]^{-1} \qquad (5)$$

where M is the matrix of total primary factor requirements

F is the direct coefficient matrix of primary factors

A is the direct coefficient matrix of produced inputs

$[1-A]^{-1}$ is the Leontief inverse.

$$
[A] = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} \quad (\text{rows } 1 \to n,\ \text{columns } 1 \to n)
$$

$$
[F] = \begin{bmatrix} f_{11} & \cdots & f_{1n} \\ \vdots & & \vdots \\ f_{g1} & \cdots & f_{gn} \end{bmatrix} \quad (\text{rows } 1 \to g)
$$

$1.0 \longrightarrow 1.0$

Figure 1. SIO table - direct coefficients

The model is solved finally for the set of CFs by applying the values of CFs for different primary factors to the total primary requirements for each sector. Formally in matrix terms M must be multiplied by the vector of CFs for primary factors, so that

$$P_n = P_f \cdot M \qquad (6)$$

where P_n is the vector of final CF results

and P_f is the vector of CFs for primary factors.

In the solution iteration is required since P_n and P_f will not be independent of each other. Initial seed values of P_f have to be used until a unique converged solution for P_n and P_f is obtained. A computer programme is required for the solution.

Simple Illustration of a SIO Table

To illustrate the logic of the approach it may be helpful to work at a simple level with a small table of only four productive sectors, one aggregate CF, and four primary factors. Although all actual calculations will involve a far larger table this is sufficient for illustrative purposes. In this example the A matrix is composed of four sectors

- Industry
- Agriculture
- Services
- Transport

plus an aggregate average conversion factor (ACF), that is a weighted average of the CFs for the four productive sectors.

The F matrix is composed of four primary factors

- Transfers
- Foreign Exchange
- Labour
- Operating Surplus

All Labour is assumed to be unskilled, and all Operating Surplus to represent real economic costs associated with the use of capital, so that no surplus profits are involved. Transfers cover taxes and subsidies. Of the four sectors it is assumed that Industry and Agriculture are traded, with significant imports of the former and exports of the latter. Services and Transport are taken to be non-traded.

As we have seen a direct coefficient matrix is constructed by expressing all entries in the rows as a proportion of the market value of output in each sector. An important practical issue is what level of market prices are used to value output. The chief alternatives are producer's or purchaser's prices. In practice most SIO analyses work with the latter and this example also uses purchasers prices as the reference price level. This means that, for each sector, market prices include distributors margins, transport costs in moving goods from producers to purchasers, and retail and producer-level indirect taxes.

In a SIO analysis the aim is to assess the consequences of additional expenditure on each of the sectors in the table. For traded sectors the main effect will be in terms of foreign exchange - with more imports if the goods consumed are imported at the margin, and less exports it they are exported. The foreign exchange effects as a proportion of the market price will be shown in the foreign exchange row of the F matrix. In addition for all traded commodities there will be some costs incurred in non-traded sectors, since tradeables have to be transported and distributed to users. The costs are shown in the relevant rows for non-traded sectors - such as Transport and Distribution.

For non-traded activities in a SIO table a distinction must be drawn between those whose supply can be expanded in the medium term, and those where supply is taken to be fixed. For the former, where supply is variable, additional expenditure will induce additional production, whose economic value is given by the resources that go into this production. The row entries in the table for such sectors will show, as a proportion of the value of output at market prices, produced inputs from other sectors, as well as primary factors that enter directly into the sector. Non-traded goods in fixed supply are found less commonly and are not shown in the example. They are normally treated as an additional row in the F matrix, since like primary factors their supply is not determined within the SIO system. In the solution the value of this type of non-traded input will be revalued by one of the aggregate conversion factors - normally one for consumption.

Table A.1 gives the direct coefficients for this example. All row entries are proportions of the domestic market price value of output. As expected for the traded sectors - Industry and Agriculture - output value is predominantly foreign exchange. For Industry - an importable - the cif value of output is 60% of the market price, with an import tariff of 50% of the cif price; the Foreign Exchange entry is therefore 0.60 and Transfers 0.30. There are small domestic costs of distribution and transport both of which are 5% of output value involved in moving the imported industrial goods to users and consumers. These are shown in the Services and Transport rows respectively. For Agriculture - an exportable - the fob export price is 90% of the domestic market price, whilst there is an export subsidy of 10% of the fob price. Entries in the Foreign Exchange and Transfer rows are 0.90 and 0.09 respectively. The only relevant transport and distribution costs will be any additional costs associated with the domestic consumption of agricultural output as compared with export. There is a small additional domestic transport cost of 1% of the domestic market price, so that the Transport entry is 0.01.

The non-traded sectors Services and Transport use both produced inputs from other sectors, and primary factors. For Services produced inputs from Industry, Services itself and Transport are 10%, 20% and 10%, of output at market prices respectively. Primary factors Foreign Exchange, Labour, and Operating Surplus are 20%, 30% and 20% of output at market prices, respectively. Similarly for Transport produced inputs from Industry and Services are 15% and 5% output respectively, whilst primary factors Transfers, Foreign Exchange, Labour and Operating Surplus are 10%, 30%, 30% and 10% of output, respectively.

	INDUSTRY	AGRICULTURE	SERVICES	TRANSPORT	ACF
INDUSTRY			0.10	0.15	0.20
AGRICULTURE					0.45
SERVICES	0.05		0.20	0.05	0.25
TRANSPORT	0.05	0.01	0.10		0.10
ACF					
TRANSFERS	0.30	0.09		0.10	
FOREIGN EXCHANGE	0.60	0.90	0.20	0.30	
LABOUR			0.30	0.30	
OPERATING SURPLUS			0.10	0.10	
	1.0	1.0	1.0	1.0	1.0

Table A.1 SIO table - direct coefficients illustration

Any aggregate CF will be an average of CFs for particular sectors. In this example the ACF is a weighted average of the CFs for the four productive sectors. The weights used are 0.20, 0.45, 0.25 and 0.10, for Industry, Agriculture, Services and Transport, respectively, and can be taken to reflect the relative value of output in the different sectors.

Solution of the SIO system proceeds by finding total primary factor input requirements per unit of output in each sector through inversion of the A matrix and the multiplication of this by the direct coefficients matrix of primary inputs. These are shown in table A.2. In all cases total primary inputs are greater than the direct inputs shown in table A.1, because of the primary factors that go into the produced inputs used in all sectors. This is most obviously the case for the Labour and Foreign Exchange inputs into Services and Transport. For Services, for example, whilst the direct labour input per unit of output is 0.30, the total labour input rises to 0.42. Even the traded sectors with no direct labour input, have a small indirect input through their use of non-traded Transport and Services.

	INDUSTRY	AGRICULTURE	SERVICES	TRANSPORT
TRANSFERS	0.310	0.091	0.057	0.149
FOREIGN EXCHANGE	0.639	0.904	0.381	0.415
LABOUR	0.037	0.003	0.420	0.326
OPERATING SURPLUS	0.012	0.001	0.140	0.108

Table A.2 Total primary factors per unit of output in productive sectors

Once total primary factor requirements are known they must be revalued with appropriate CFs for each primary factor. It will be recalled from equation (4) that

$$CF_i = \Sigma m_{fi} . CF_f$$

The weight m_{fi} placed on the conversion factor for primary factor f is the share of total requirements of that factor in output value in i at market prices. In this example, therefore, table A.2 gives the weights for the different primary factors.

As far as CFs for primary factors are concerned the example uses the following:

	CF
Transfers	0
Foreign Exchange	1.0
Labour	0.5 x Agriculture conversion factor (CF_{AG})
Operating Surplus	1.0 x ACF

Transfers have no economic value, so that their CF is zero. Foreign Exchange has a CF of 1.0, since in this type of analysis it has become conventional to use world prices as the numeraire or unit of account in which economic effects are expressed. Since all Foreign Exchange effects will be measured at world prices already there is no need for any further adjustment, hence the CF of 1.0. For Labour in this example is it assumed that a worker's output foregone at domestic prices is 50% of the actual market wage. However a further step is required since the shadow wage must be converted to world prices by a CF that is appropriate to the output a worker would have produced. The shadow wage rate (SWR) can be expressed as

$$SWR = m \times CF_m \qquad (7)$$

where m is output foregone from a worker's alternative employment at domestic prices;

and CF_m is the conversion factor required to convert this output to world prices.

The conversion factor for labour (CF_{LAB}) is the ratio of the shadow to the market wage

$$CF_{LAB} = \frac{SWR}{MWR} \qquad (8)$$

where MWR is the market wage

or substituting (7) into (8)

$$CF_{LAB} = \frac{m}{MWR} \times CF_m$$

In this example $\frac{m}{MWR}$ is taken to be 0.50, whilst workers for new projects are assumed to be drawn from Agriculture, so that the Agriculture conversion factor (CF_{AG}) is used for CF_m

CF_{LAB} is thus $\frac{m}{MWR} \times CF_{AG}$, or $0.50 \times CF_{AG}$.

The use of CF_{AG} in the valuation of a primary factor is a clear illustration of the interdependence of values in a SIO system, since CF_{AG} depends among other things on the value of Labour, whilst in turn it is one of the influences on Labour's value.

Finally Operating Surplus is taken to reflect real economic costs reflecting the opportunity cost return on the capital committed to each sector, at domestic prices. Therefore no surplus profits in excess of these resource costs are involved. However Operating Surplus, despite reflecting the opportunity costs of capital, must still be converted to world prices. It is assumed that capital is mobile within the economy and can thus be employed in any sector. It is therefore appropriate to use the average conversion factor (ACF) to revalue Operating Surplus, since the ACF is an average ratio of world to domestic prices for the whole economy. Interdependence also arises in the treatment of Operating Surplus since it is revalued by the ACF, whilst Operating Surplus itself is one of the influences on the CF for each sector, and the ACF is a weighted average of sectoral CFs.

Using this set of CFs for primary factors and the weights from table A.2 gives the results reported in table A.3.

		CF
Sectors	Industry	0.67
	Agriculture	0.91
	Services	0.68
	Transport	0.65
	ACF	0.78
Primary factors	Transfers	0
	Foreign Exchange	1.0
	Labour	0.46
	Operating Surplus	0.78

Table A.3 CF Results

The ACF is an average of the four sectoral CFs with the weights given in the fifth column of table A.1. Therefore

Sector	CF	Weight	Average
Industry	0.67	0.20	0.13
Agriculture	0.91	0.45	0.41
Services	0.68	0.25	0.17
Transport	0.65	0.10	0.07
ACF		1.00	0.78

ACF = 0.78

The treatment of the sector CFs can be illustrated with the industry CF, which is an average of the CFs for the primary inputs into industry with the weights given in table A.2 column 1.

Primary factor	CF	Weight	Average
Transfers	0	0.310	0
Foreign Exchange	1.0	0.639	0.639
Labour	0.46	0.037	0.017
Operating Surplus	0.78	0.012	0.009
Industry			0.665

Industry CF = 0.67

Advantage of the SIO Approach

Two major advantages can be claimed for this approach over simpler partial estimates. First, there is the advantage of consistency, since SIO analysis is equivalent to the solution of the economic valuation problem through a series of simultaneous equations. There is interdependence in this analysis with values for certain primary factors being some of the determinants of values for productive sectors, but in turn being influenced by the value of those sectors. In this illustration we have seen this for the primary factors Labour and Operating Surplus. In addition there will be interdependence between the values of productive sectors, since most will be inputs into each other. Using this example Services are an input into Industry and will thus help determine the value of the latter, but in turn Industry is an input into Services. Only a simultaneous solution can resolve this interdependence and achieve consistent results.

The second advantage of the SIO approach is that it allows the linkage effects of additional expenditure to be captured in a manner that is not possible outside an input-output framework. Expenditure on traded sectors by definition falls largely on the trade balance, however for non-traded sectors in variable supply domestic resources will be mobilized to meet additional demand. The two most important linkage effects are likely to be the generation of jobs, where labour was previously underutilized, and the direction of demand to sectors where there is surplus capital capacity. The total employment effect of expenditure on non-traded sectors will be captured, since as we have seen direct and indirect employment in non-traded activities is estimated. Where labour is under-employed, so that output foregone from a previous activity is below the market wage, this is likely to result in a CF for Labour of below 1.0. Non-traded sectors, which generate employment effects, thus have the economic value of their output reduced relative to its market price value. The consequence is therefore that use of such non-traded inputs is encouraged in comparison with activities where such employment effects are not forthcoming. A similar analysis applies where demand is directed to non-traded activities with surplus capacity. Here their economic valuation will be based only on variable costs of production, so that no charge for capital is relevant. Operating Surplus, the primary factor reflecting capital charges will thus have a CF of zero in these situations. This adjustment will again have the effect of lowering the economic valuation of the output from such sectors, thus encouraging its use.

The overall significance of adjustments for such linkage effects depends on the importance of non-traded sectors in an economy. Where the economy is relatively closed in terms of trade policy any realistic cost-benefit appraisal of new investments will require use of an input-output framework to capture the inter-relations between a project and its suppliers and users.

Some Difficulties in the use of SIO Analysis

Despite its rigour and consistency SIO analysis is not free from problems of both a practical and conceptual nature. Probably the most significant are as follows.

(i) Classification of sectors.

The issue of how a productive sector is classified is critical, but not always straightforward. One has to establish if additional demand has its main impact on the foreign trade balance, or on domestic production or consumption. For specific commodities where trade currently takes places, the answer may be quite clear. However the existence of current imports and exports does not mean that the sectors from which they come should be classed automatically as traded, since it is the future position of sectors that is relevant. Import policy, for example, may change either in the form of looser or tighter import controls. On the export side the emergence of market constraints may mean that current levels of exports cannot be expanded significantly in the short to medium term, or alternatively changed incentives offered to exporters may stimulate export sales where previously no sigrificant exports took place. Such circumstances, particularly changes in trade policy, mean that judgement must be applied in classifying productive sectors.

There may also be situations where output of a sector is insufficiently homogeneous to be wholly traded or non-traded, so that it is necessary to distinguish between the traded and non-traded components. Here there are two possible approaches that yield identical results. One can either split the sector and show its traded and non-traded elements as separate columns in the SIO table; alternatively one can class the sector as "partially traded" and keep one single column, whose direct coefficients are weighted averages of the traded and non-traded components of the sector.

(ii) Reference price level and distribution and transport costs.

As stated above it is essential to use a single reference price level for domestic market prices. This is necessary for consistency so that for all activities domestic prices at one price level can be compared with economic values at the same price level. Whatever price level is adopted requires data on distribution and transport costs, and indirect taxes, as a proportion of the market price. This is obviously the case where purchasers' prices are the reference level, but even where producers' prices are used much of the original data from which the table is constructed will be at purchasers' prices, so that these cost and tax elements must be deducted to arrive at prices at the producer level.

The major point here is that in a SIO table used to estimate national parameters one will be working with very aggregate data, so that there will normally be only a very vague indication of where the production and consumption activities covered in the table will be located geographically. In these circumstances it will be difficult to estimate the importance of transport and distribution costs for particular sectors. Most tables will normally use an approximate average proportion of the market price for these costs. How far this is misleading will vary between economies, and within economies between sectors. If the economy concerned is geographically small internal transport costs are likely to be low as a proportion of most domestic prices with relatively little regional variations. However in larger economies the transport cost element could be more significant, with regional variations. Distribution costs can be related to type of commodity, length of storage, and market conditions. Scarcities, whether or not they arise from policy-imposed constraints, will work to raise distribution margins, so that the proportion of the market price accounted for by distribution costs including surplus profits, will vary between commodities. Again in larger countries there can be regional variations.

Where SIO analysis is used to derive national parameters some national average approximations for these costs are inevitable. The chief difficulty lies when national CFs derived from the analysis are applied inappropriately at the project level when more detailed regional or project-specific values are required. For example, the CF for a commodity like wheat derived from a national table, could be very different from the CF relevant to a local agricultural project because of the differences between local and national transport and distribution costs and margins. However particularly in large economies, there is also the possibility of misleading CF estimates for particular sectors, where it is difficult to estimate transport and distribution costs. This is an argument for omitting transport and distribution costs in the Chinese case, and conducting SIO analysis at producers' prices.

(iii) National shadow wage

A similar problem arises in the treatment of labour. It is generally acknowledged that in relation to unskilled labour in all but geographically small economies labour is best treated as a regional not national parameter, in the sense that there is insufficient mobility for the opportunity cost of employing an unskilled worker to be the same in all regions. In some analyses this is also extended to skilled labour, although it is more common to find the assumption that workers in this broad category have sufficient mobility for them to be treated at a national level.

The implication of this view of unskilled labour is the need for regional, and in some circumstances project-specific, estimates of the shadow wage. However in a SIO table used to derive national parameters it is common to find a single entry for unskilled labour in each column, and thus a single CF used to revalue this labour input. In other words, unskilled labour is treated as a nationally homogeneous input and revalued by a national level CF, despite the recognition of regional variations. In principle one can be more rigorous and factor, with its own CF. In this approach one would estimate the proportion of workers coming from each region into each productive sector. This level of sophistication requires considerable information however, not only on local labour market conditions by region to estimate regional output foregone and the extent of regional migration, but also on the geographical location of additional production from each sector. If one is to value labour input into each sector on a regional basis one needs to know where production in that sector is going to take place. Given the complexity of this information it is not surprising that the national-level treatment of unskilled labour is used commonly.

However this qualification does mean that whilst the SIO approach is consistent in its treatment of labour, matching the value of labour with that of the productive sectors, into which it is an input, it is nonetheless crude in its neglect of the regional dimension. This means that there is a need to caution against an uncritical use of a CF for unskilled labour derived at a national level in the analysis of a particular project. Inevitably there will be a need to check how far national and regional conditions are similar, to discover whether a specific CF for labour is required. Furthermore for labour-intensive non-traded activities, where local labour market conditions differ significantly from the national average, sectoral CFs derived from SIO analysis can also be misleading; here more detailed non-traded CFs allowing for regional labour estimates will be required.

(iv) Average and marginal cost

In principle it is clear that SIO tables should provide information on the opportunity costs of additional output from productive sectors; the relevant concept here is marginal not average costs. However often the data on which tables are constructed come from full input-output tables or sector surveys, which relate to average conditions. Insofar as possible efforts should be made to revise these to incorporate marginal or incremental estimates. This is particularly the case where non-traded sectors are working at below full capacity, so that additional output requires only variable inputs not new capital investment. Where additional investment is required data on costs should come from recent project documents since new projects will provide the additional output.

(v) Primary factor capital

Confusion over the treatment of capital reflects profound debates in the theoretical economics literature on the meaning of capital and profit. For example is profit the return to the productive factor capital, or a residual transfer to the owners of capital after labour costs are deducted from value-added? The answer in the cost-benefit literature is that the economic cost of committing resources in the form of capital assets is the opportunity cost rate of return that could have been earned if the resources had been invested elsewhere. This can be expressed as an annuity charge by applying a capital recovery factor - based on the assumed economic discount rate and length of life of the assets - to the value of the assets. This gives the economic charge for the use of the resources involved and any profit in excess of this charge will be surplus profit, not an economic opportunity cost.

Some discussions treat all of profit income as an economic cost on the grounds that surplus profits, as defined above, are not a transfer but returns to the factor enterpreneurial skill, which is taken to be an additional factor of production distinct from and in addition to capital itself. The theoretical basis for this introduction of an extra factor of production seems weak however, and the distinction between a part of profits that are an economic cost, reflecting the opportunity cost of resources, and another part that as surplus profit are a form of transfer payment, seems more appropriate.

Following this latter approach necessitates a division of profit income in each non-traded sector into each of these two categories. In principle this division requires data on value of capital assets, at replacement not historical cost, length of working life of the different assets, and the economic discount rate. Each of these pieces of information will be subject to varying degrees of uncertainty, particularly the value of capital assets, since historical book values will rarely be a useful guide to current values. Division of profit income into these two categories often tends to be approximate, weakening the accuracy of the estimates, most particularly for non-traded sectors that are highly capital-intensive.

Conclusion

SIO analysis provides a relatively sophisticated means of deriving a consistent set of national shadow prices for use in investment appraisals. However the rigour of the technique should not divert attention from the weak data that often goes into SIO tables and the problems that remain with the application of the technique. Shadow pricing studies have come a long way, but this is an area in which one will always be dealing with approximations rather than precise estimates.

APPENDIX 2 COUNTRY STUDIES

A.2.1. Jamaica: NEP Estimates

Jamaica was one of the countries selected by the Inter-American Development Bank for a pilot study on shadow prices for social analysis. This work was published in 1977 (Lal 1977). Although based on a fairly short fieldwork visit it contained fairly detailed estimates of parameters required to carry out both an economic and a social appraisal. At this time the Jamaican government had developed a fairly well organized system of project appraisal with a government team scrutinizing new projects and calculation their financial returns. The importance of moving into economic appraisal in a systematic way was recognised, however it is significant that the NEP estimates in Lal (1977) were not adopted by the government. From discussion with one of the team of government project planners it seems that the difficulty of comprehending the approach used in Lal (1977) was a major deterrent to the application of the results, even though it would not have been necessary to apply all of the NEPs contained in Lal (1977). Furthermore since the results were given separately for the economic efficiency and social analysis, use of these NEPs would not have involved a move into the more complex and controversial area of social weighting.

No systematic form of economic calculation was applied despite the existence of this NEP study. In 1983 in recognition of the potential importance of economic calculations the Project Planning Centre, University of Bradford, UK, was approached by the Administrative Staff College, Ministry of the Public Service, Government of Jamaica, to carry out a new NEP study. It was stressed that the earlier work had not been helpful because of what was perceived as its inaccessibility to the non-specialist.

The new study was conducted in 1983-84, and published separately in both Jamaica and the UK in 1985 (Weiss 1985). The approach adopted has been described in the main text of this report as a simplified consistent approach. As with Lal (1977) a world price system was used. To gain precision in the estimates all the main CFs were set out as a series of simultaneous equations, and their values estimated simultaneously through the solution of this set of equations. The full system of equations is given in table A.4, with the results given in table A.5.

The data base in Jamaica was not strong in relation to the information needed for NEPs. The main problem related to non-traded activities like construction, power and transport. There was no NIO table, nor regular published surveys of the cost structure of those sectors. Furthermore there were not sufficient up-to-date project documents to allow a picture of the cost structure of these activities to be developed from project sources. In the absence of further data, information on these sectors from the national accounts had to be used. The Statistical Institute of Jamaica regularly surveys producers in various sectors as part of its work in estimating national income. Information from this source allowed a very crude breakdown of costs in non-traded activities into labour, raw materials, depreciation, taxes and operating surplus. Although the very aggregate nature of the category 'raw materials' did not allow a detailed cost breakdown showing the precise intermediate and material inputs into sectors, this approximate information had to be used in the NEP study in the absence of other data. It was due to the poor data base for non-traded sectors that the more detailed SIO approach was not used in Jamaica.

Data on labour's opportunity cost in both rural and urban areas was based on estimates of daily wage rates and earning opportunities. For unskilled labour in urban areas it was assumed that new jobs would be filled partly by migrants from rural areas and partly from workers already in urban areas. The proportions for these two sources of labour were taken to be given by the existing distribution of employment between rural and urban areas. Output foregone for each new urban job created was therefore estimated as a weighted average of rural and urban marginal products. Data on wage rates in different activities, both rural and urban were collected, partly through interviewing employers. These wage figures were then combined with estimates of days worked per year to give annual earnings. Annual earnings estimates per worker were converted to shadow price values using CFs appropriate to the type of work involved, to give a proxy measure of output foregone per worker at shadow prices. This output foregone estimate divided by the annual wage for urban labour gave the CF for urban unskilled workers.

For rural workers a high CF of 1.15 is shown in table A.5. This needs some interpretation. It refers to rural workers employed on a daily basis, and drawn from export agriculture - principally bananas and sugar cultivation. The argument used is that rural labour markets are seasonal with periods of high and low demand. However on a daily basis the market wage can be used as an approximate measure of output foregone per day at market prices. This output foregone must be converted to shadow prices. For Jamaica for agricultural export products world prices net of appropriate transport, distribution and processing margins, were found to be well above prices paid to farmers. An agricultural export CF of 1.15 was estimated (see Appendix 2 of Weiss 1985). If the daily wage rate is used to represent output foregone at domestic market prices, and this output has a CF of 1.15, the CF of 1.15 will be that relevant for rural unskilled labour.

It should be noted that skilled labour is valued using the SCF (termed the average CF in Weiss 1985). Finally a discount rate of 10%, based on the real cost of foreign borrowing to Jamaica, is used.

Table A.4 Equations for CFs from Jamaica Study

$$CF_D = 0.18 + 0.16\ CF_{INV.} + 0.30\ CF_{UL} + 0.20\ CF_{SL}$$

$$CF_T = 0.60 + 0.11\ CF_{INV} + 0.04\ CF_{UL} + 0.03\ CF_{SL}$$

$$CF_C = 0.52 + 0.06\ CF_{INV} + 0.19\ CF_{UL} + 0.07\ CF_{SL}$$

$$CF_E = 0.57 + 0.15\ CF_{INV} + 0.04\ CF_{UL} + 0.04\ CF_{SL}$$

$$CF_{INV} = 0.38 + 0.50\ CF_C$$

$$CF_{UL} = 0.41 + 0.12\ CF_D + 0.12\ CF_C$$

$$CF_{SL} = 1.0\ ACF$$

$$ACF = 0.46 + 0.26\ CF_D + 0.11\ CF_T + 0.10\ CF_C + 0.02\ CF_E$$

where CF_D = CF for Distribution
CF_T = CF for Transport
CF_C = CF for Construction
CF_E = CF for Electricity
CF_{INV} = CF for Investment
CF_{UL} = CF for Unskilled Labour
CF_{SL} = CF for Skilled labour
ACF = Average CF

Source: Weiss (1985). See Appendix 1 of source for explanation of the derivation of these equations.

Table A.5 Results of Jamaican Study

CF_D	=	0.63
CF_T	=	0.73
CF_C	=	0.73
CF_E	=	0.74
CF_{INV}	=	0.74
CF_{UL} urban	=	0.57
rural	=	0.15
CF_{SL}	=	0.79
ACF	=	0.79
Discount Rate	=	10%

It is worth noting that in comparison with the results of the earlier study (Lal 1977), those of Weiss (1985), show both differences and similarities. Weiss (1985) focusses on economic not social parameters, so that only the economic NEP estimates of the earlier study are comparable. The CF for urban unskilled labour for example, shows little change between the two estimates; it is 0.53 in the earlier study and 0.57 in the more recent. This stability should not be surprising given the approximate nature of the estimates, and the fact that labour market conditions that determine this NEP are generally long-run and structural rather than subject to short-run changes. The SCF shows a rise from 0.72 in the earlier study to 0.79 in the later. Although such estimates cannot be interpreted as precise some relaxation of trade controls occurred in the early 1980's, which would be expected to lower the gap between domestic and world prices, and thus raise the SCF. Finally there is a major difference in the economic discount rate which appears implausibly high at 22% in Lal (1977). There the discount rate is defined as the opportunity cost of capital at shadow prices. Using a different definition - based on the cost of foreign borrowing-the later study suggests a much lower rate of 10%.

Despite the existence of the newer NEP study shadow pricing on a regular basis has still not been adopted by the Government of Jamaica. The results of Weiss (1985) were disseminated in Jamaica through distribution of the study, through training programmes for government officials and by a public lecture given by the author that was reported in the local press. However the Government has remained reluctant to apply the NEPs. The exact reasons for this reluctance are not known, but it was argued that the policy reforms that took place post-1985 rendered the estimates out of date, and therefore no longer appropriate for current appraisals. An attempt was made to organize a follow-up study to revise the estimates, but as yet this has not been arranged.

It appears that at present within the government sector when new public sector projects are appraised they are examined largely in financial terms. Some of their economic effects - such as foreign exchange earning or saving, and employment - are highlighted, but no attempt is made to quantify these effects in an economic NPV or IRR calculation using NEPs. However it is understood that use of the NEP estimates has been made in Jamaica by some of the Development banks, particularly where the projects concerned require external funding by international agencies. Further the NEP study was sent to the Inter-American Development Bank and the World Bank, and it is understood may have been used in the appraisal of projects that require their funding.

A.2.2. Tanzania: Agricultural Project Appraisal

The basis of Tanzanian economic and social policy is defined in the Arusha Declaration of 1967. The policy is broadly socialist in outlook although there have been significant changes in the last six years during the period of negotiation and eventual agreement with the IMF. The Tanzanian economy experienced a severe decline in the late 1970's and the first half of the 1980's for which various explanations have been given relating both to external and internal factors. Undoubtedly a major cause of the acceleration of the decline after 1979 was the cost of the war with Uganda. This was followed by a period of generally unfavourable commodity prices for major export crops accompanied by declining or stagnant production and resulting in a chronic foreign exchange shortage. From 1979 onwards annual domestic inflation ranged from 20-40% partly due to government attempts to maintain the level of services with a rapidly diminishing real tax base. Although minor devaluations occurred in 1982, 1983 and 1984 they were not enough to compensate for the substantial divergence between domestic and international inflation.

More than 80% of Tanzania's export earnings are derived from the agricultural sector, particularly from coffee, cotton, tea, sisal, tobacco and cashewnuts. Nearly all the cotton and cashewnuts and over 80% of the coffee and tobacco are grown by small farmers whose crops were marketed through parastatal crop authorities in the period 1976-83 and afterwards by cooperative unions. All the sisal and about 75% of the tea are produced on public and private sector estates. For part of the period from the mid-1970's to the late 1980's Tanzania faced a severe shortage of officially marketed basic foods, most of which were grown by small farmers. As a result the government was forced to rely on imported food to feed the urban areas. It was clear that the agricultural sector had a major role to play in economic recovery. It was also clear that the official prices for major crops, which were set according to prevailing financial and institutional constraints, were not good indicators of their economic value.

Government proposals to resolve the economic problems were set out in the National Economic Survival Programme (NESP) and the Structural Adjustment Programme (SAP). In each case the critical role of the agricultural sector was emphasised in relation to the dual objectives of food self sufficiency and increased export earnings. It was therefore important to obtain a clear idea of the economic value of agricultural projects in a situation where market prices were not very good indicators of opportunity cost.

Unfortunately, the most up to date estimate of shadow prices for Tanzania was contained in a mimeographed paper (Hughes 1977) relating to 1976, and this paper was not readily available. No guidance could be obtained from the Ministry of Economic Affairs and Planning on NEPs to be used in appraising projects.

Approach to Shadow Pricing

Under the circumstances described above, economists working in the Ministry of Agriculture were faced with a dilemma. The problems facing the agricultural sector were partly a consequence of the overvalued exchange rate and analysis of export crop projects at market prices would seriously understate their economic value. An approach was therefore devised in which the critical parameters of the shadow exchange rate (SER) and the discount rate were treated as unknowns and results were given within what was thought to be the likely range of values. Break-even values were also calculated.

The methodology used was a variant of the domestic price system of the UNIDO Guidelines, but in this case all costs and benefits were broken down into basic resource categories before discounting to allow the effect of the project on the availability of resources from year to year to be shown. All costs and benefits were broken down into three basic categories. These were Foreign Exchange (F), Domestic Resources (D) and Transfers (T). No attempt was made to separate out unskilled labour as a seperate category because there was no evidence of surplus labour in the rural areas. In fact many of the large scale farms faced labour shortages and in some project appraisals labour costs were inflated to cover the incentive payments thought necessary to attract labour to the project. In the case of smallholder projects the normal approach was to use the casual wage rate in the area concerned as a measure of the opportunity cost of labour. Sometimes this involved imputing a value to payments made in kind. From 1983 onwards there was no case when the casual wage rate was found to be less than the rural minimum wage.

For all projects for which an economic analysis was undertaken the results were set out in a matrix (see Table A.6) in which the project NPV was given for three different discount rates (5%, 10% and 15%) and two different shadow exchange rates (50% and 100% above the official rate). At each discount rate the domestic resource cost of foreign exchange (DRC of FE) was calculated to show the break even shadow exchange rate, and the internal rate of return (IRR) was calculated for each shadow exchange rate value. Shadow pricing was therefore used as a form of sensitivity analysis, in the absence of accurate NEPs.

Sources of Data

In almost all cases the composition of the value of the major output was estimated on a project-specific basis using World Bank commodity price projections as the basis for the estimation of border prices of traded goods. These prices were then adjusted for freight costs and quality differences and internal transport and handling costs.

In 1983 an attempt was made to estimate cost breakdowns for major cost items used in agricultural projects. The most prominent items were transport, fuels, construction, fertilizers and farm vehicles and equipment. Attempts were also made to gather information on agricultural chemicals, hand tools, various packing materials and polythene sheeting. Estimation of the cost composition of transport costs also involved gathering information on tyres and batteries. No attempt was made to undertake a systematic analysis of cost composition for all sectors or to use semi input output methods. It is extremely unlikely that such information would have been available in an up to date form and the scope of the work lay outside the responsibility of the Ministry of Agriculture. All information was collected by questionnaire and follow up visits to the relevant institutions. The National Price Commission was also used as a source, and the Finance Act of 1980 with its various amendments gave rates of import duty and sales tax.

Table A.6 Summary of Incremental Costs and Benefits and Results of Economic Analysis for a Specimen Project

Discount Rate	5%	10%	15%	IRR
NPV (OER)	329974	-52531	-160726	8.8%
NPV (SER/OER = 1.5)	1139450	239993	-58369	13.5%
NPV (SER/OER = 2.0)	1948927	535518	43988	15.8
DRC of FE	0.80	1.09	1.79	

The 1983 estimates were never completed in the comprehensive way originally intended and updating of the estimates was done on an ad hoc basis whenever changes in the Finance Act were noted. It was very difficult to obtain information of this nature in a consolidated form. Satisfactory estimates for two important sectors were never really obtained. These were railway transport and electricity. This was because of the special problems of relating rail freight and electricity tariffs to long run marginal cost estimates.

It is likely that the 1983 estimates were reasonably accurate for major items and were usable for the next two years with ad hoc updating. From 1986 onwards major devaluations occurred and it is likely that some of the estimates became progressively inaccurate. When work of this nature is undertaken by an organisation which does not normally have such responsibilities, it is extremely difficult to allocate time for regular updating.

Attitudes of Users of the Analysis

The reports prepared using this approach were all pre-feasibility studies intended for submission for funding through the government development budget or through donor agencies. Many were prepared at a time when it was believed that significant donor support would be forthcoming for SAP. This was not the case, and the funds available under the government development budget were insufficient to get many projects off the ground. There is no evidence to suggest that the approach used was not acceptable to decision makers, but there was no feedback mechanism to those preparing the projects and so any judgement on the attitudes of decision makers is difficult to make.

The approach was discussed at two workshops held at the Institute of Development Management and a set of draft guidelines was produced in 1983 following these workshops. The draft guidelines were discussed at a workshop held by the Ministry of Agriculture in 1985 and recommendations for revision were made without altering the basic approach. Representatives from the Ministry of Economic Affairs and Planning were invited to each workshop.

A major problem for a government taking decisions on the basis of economic analysis in conditions of gross exchange rate overvaluation is the issue of the difference between economic and financial profitability. Many of the projects prepared for export crops showed very high economic rates of return but marginal to low financial rates of return. This presents major problems for financing when the institution supposed to implement the project is heavily in debt and subject to stringent government financial controls intended to reduce the deficit. Under such circumstances the government is forced to give subsidies.

Changes in Cost Composition

The resource composition of crop outputs varied quite considerably from project to project because of differences in transport costs and from year to year because of changes in producer prices. This did not present problems because the estimates were project specific. Other items such as vehicles tended to be fairly stable because they were largely imported with standard rates of duty and sales tax and a small local assembly component in the case of semi-knocked-down (SKD) kits and locally fabricated truck bodies. The only significant changes that occurred were when tax rates changed and these were infrequent and easy to cater for.

The most difficult items to deal with from the point of view of cost composition were fertilizers and fuels. Variations in the cost composition of fuels also fed through to transport costs which are always important for agricultural projects with outputs that are bulky, physically scattered and with relatively low value to weight/bulk.

In the case of fertilizers there were two problems. Firstly policy on fertilizer subsidies changed significantly in the mid 1980's when they were removed. Later on, when exchange rate changes became very rapid, attempts were made to delay the impact on increasing fertilizer prices and it was not clear which exchange rate the fertilizer price related to. Secondly there was a policy of charging the same price for fertilizer throughout the country despite substantial differences in transport costs. The degree of subsidy therefore varied from region to region. In order to have reliable estimates it would have been necessary to have updated values for each region in each year.

In the case of fuels the major problem was that taxes were based on a volume basis rather on a value basis. Furthermore, as the process of exchange rate adjustment developed, the government tried to delay increases in fuel prices in order to keep transport costs down. As with fertilizer it was not clear what exchange rate any particular fuel price related to because the refined products would have used crude oil purchased some months previously at a different exchange rate.

Undoubtedly the most important source of uncertainty was the exchange rate. Table A.7 shows that the conversion factor for the shadow exchange rate implied by changes in relative prices and exchange rates increased steadily from 1979 to reach a maximum of 2.76 in 1985. Following the IMF agreement in 1986 this ratio fell rapidly, and by 1988 the simple method of calculation by comparing changes in internal consumer prices with changes in world prices for manufactured goods indicates a shadow exchange rate below the official rate. This is both a reflection of the inadequacies of such a crude measurement during periods of rapid exchange rate changes and the existence of a substantial lag in the adjustment of domestic prices to increased local prices for imports. The series is not intended to give an accurate estimate of the movement of the Tanzanian shadow exchange rate, but it does give an idea of the size and direction of movements.

The problem of rapid exchange rate changes for the project analyst is that the analysis has to be undertaken at a particular exchange rate. Some prices adjust immediately to the exchange rate, but other prices (eg. producer prices, fertilizers etc.) are set for a period of one year. Which exchange rate do these prices relate to ? It is very difficult to be consistent in appraising projects in these circumstances and equally difficult to make comparisons between projects. The world price numeraire approach with conversion factors for different cost categories assumes that a very high proportion of costs can be reduced to border prices and that the ratio of the world price to the domestic price is stable. Neither of these conditions held very well for Tanzanian agricultural projects in the 1980's.

Table A.7 Estimation of Tanzanian Shadow Exchange Rate by Relative Price Changes

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exchange Rate (TSh. per US$) (Annual Average) (1)	8.38	8.27	7.69	8.25	8.20	8.29	9.28	11.14	15.29	17.72	31.87	63.60	99.95
National Consumer Price Index (1985 = 100)	14.8	16.5	18.4	20.9	27.2	34.2	45.5	54.2	78.0	100.0	133.3	171.8	220.3
World Bank MUV Index (2) (1985 = 100)	66.4	73.0	83.9	95.1	104.3	104.8	103.3	100.7	99.0	100.0	118.3	130.8	140.7
Implied Shadow Exchange Rate (1976 = 1.30 x OER)	10.89	11.05	10.71	10.75	12.77	15.97	21.50	26.32	38.51	48.86	55.07	64.19	76.51
Shadow Exchange Rate Conversion Factor (SER/OER)	1.30	1.34	1.39	1.30	1.56	1.93	2.32	2.36	2.52	2.75	1.73	1.01	0.77

(1) Selling rate based on fortnightly average.
(2) MUV is Manufacturing Unit Value.

A.2.3. UK: Economic Appraisal of Investments in the United Kingdom Public Sector

The Basic Framework for Economic Analysis

Specific advice on investment appraisal in the public sector is given by H M Treasury in a series of guides and papers, some of which are published. These are revised and updated from time to time. The most recent versions of these documents reflect the thinking of the present administration. These point to economic analysis through the discounting of a statement of all identified costs and benefits that can be quantified and valued. Both internal and external effects should be incorporated, includng not only those that impinge on the private sector but also those affecting government departments of any kind and public sector bodies. All values are to be expressed in pounds of constant value. Relative price changes over the investment period will be allowed for where they are important and can be predicted with realistic confidence.

No numeraire is defined explicitly. In effect, the basis of value is consumption at domestic market prices in a base period. However, with no general barriers to trade and market-determined exchange rates for all convertible currencies, domestic prices and world prices should correspond closely for tradeable goods.

Shadow Pricing

Shadow pricing in market economies covers three main areas:

- adjustments that allow for 'normal' market imperfections and other market phenomena whereby project price is not equal to economic value;
- assessing the value of non-market effects; and
- adjustments to allow for price interventions by government that cause deviations between market price and economic value.

(i) The first of the three main pricing areas - value distortions stemming from normal market operations - is not the subject of much specific Treasury advice. Professional economists working on the appraisal of government projects are expected to recognise and allow for these effects independently.

Two other types of effect may be considered to fall in this category. The first is monopoly effects, either when project inputs are supplied by producers at higher than production cost because of the the control of supply by one or a few firms, or when only one or a few buyers take a project output, often at a price less than the parity value of consumers' or exporters' valuations. In both cases excess profits may arise that should be adjusted for if they are significant.

The second type of situation arises where the markets are so arranged that all suppliers obtain goods at the same price or on the same tariff. Investment appraisal looks at each project as a marginal activity to the economy as a whole, but this marginal situation may not be reflected in the project price. Thus, where a project input (say power) is met from existing surplus capacity, the average price tariff charged may overstate the actual resource cost of meeting this additional demand. Both spare capacity and economies of scale arguments may be relevant. Conversely, average price charging may understate the resource costs of supplying a particular additional user, especially where the fixed costs (power connections for example) associated with a particular project may be higher than the average on which standard tariffs and charges are based.

Both the 'monopoly' and the 'non-marginal' reasons for price revaluation are likely to be more important for medium and small projects than for big ones. Large entities may either negotiate, or be charged, special prices that reflect either the specific situation of the project, or its own degree of monopoly strength.

(ii) Amongst the non-market effects that are most consistently and thoroughly valued are those associated with roads. Very detailed standardised and computerised programmes for trunk road appraisal are used by the Department of Transport (the COBA system). Other types of investment (for example land reclamation) are also to be valued as fully as possible in this approach. However, it is recognised that not everything can be valued for incorporation in an appraisal. Well established procedures are used for the cost-effectiveness analysis of aspects of some services (for example hospital construction) but not everything is covered in detail. Imputed values for time, noise and pollution for example may be brought into an appraisal. However, it is recognised that many things cannot be handled in value terms. It is conventional to argue that non-valued effects should always be mentioned and listed in appraisals, and quantified wherever possible. Some specialist guides and manuals for particular types of non-market appraisal are published by the technical department responsible, chiefly the Department of Health and Social Security, and the Department of Transport.

(iii) Price interventions by governments may occur on both the output and the cost sides of a project. Where product prices are controlled effectively, a project parity value can be calculated on the basis either of border prices or of domestic market-clearing prices. These reference point values are adjusted for the relevant costs either from the project to the port or to the market. Sometimes this adjustment is simply allowing for actual or disguised taxes and subsidies, but often more is involved.

The main interventions normally allowed for in shadow pricing for developing countries on the cost and resource side are;

- foreign exchange;

- labour; and

- taxes/subsidies.

In the UK, no adjustment to foreign exchange values is recommended or made. All convertible currencies are freely traded. (The problem is of forecasting the relative exchange rate movements with particular partners, not of allowing for any suppressed demand at a given rate). Nor is there any case for a general adjustment between external and internal prices caused by specific taxes and subsidies on trade. These are relatively small, being used mainly as a means of protection for individual commodities, rather than a general instrument used to raise revenue, or to suppress the demand for imports.

Labour is not shadow-priced under Treasury procedures. The full market wage is used, even in areas of high unemployment. Although transfer payments are made to unemployed workers through the various social security schemes which could influence the supply price of labour, keeping it above its opportunity cost in terms of other work or leisure foregone, no revaluation away from actual employment costs is made.

Taxes of two kinds are distinguished. Firstly, indirect taxes on inputs, especially Value Added Tax but also special taxes and excises (for example on petrol), are recognised to be transfer payments, not resource costs, so they are excluded from an appraisal. However, secondly, it is recognised that some taxes (and subsidies) are designed to correct for external effects; normally external costs associated with use of the inputs concerned. Taxes and subsidies of these kinds, where they are recognised, should not be adjusted for. Of course, in this case the associated external effects should not also be counted separately in the cost-benefit calculation. Situations of the second kind may not be common. The normal presumption will be that all taxes are of the first kind, and are therefore excluded as transfer payments.

The Discount Rate

A central feature of the Treasury guidance on economic appraisal is its stipulation of a Required Rate of Return (RRR) that should be earned by nationalised industries on total assets. This rate, which was first set in 1967, is changed from time to time. In 1978, it was set at 5 percent, and this rate was confirmed in 1984 (H.M. Treasury 1984). Recently in 1989 it was increased to 8 percent for public sector trading organisations. Individual nationalised industrial and trading bodies are left to decide what Test Discount Rate (TDR) they should use for new investments and no single TDR is set for them by the government. Clearly, as the Treasury guide (H.M. Treasury 1984) on the discount rate implies, the basic TDR should be set with the need to meet the RRR on total assets borne in mind. In particular sectors with low returns on existing assets, a higher TDR may be needed for new investments.

The underlying approach is that of opportunity cost. To prevent excessive investment in the public sector, returns there should be as high as pre-tax rates of return on private investment by firms carrying normal risk. These returns are monitored continually by the Treasury from reported accounts, and projections for a few years are made. (HMSO 1978). These are real rates of return, estimated on a constant value basis, which may at times exceed the real cost of borrowing to either the private or the public sectors.

In April 1989, the government announced (Hansard, 1989) new RRRs. They estimated that the rate of return in the private sector had risen to around 11 percent. Accordingly, the RRR for nationalised industries and trading public bodies was raised from 5 to 8 percent. This target rate is for investment programmes as a whole. Discount rates for individual projects could be different. Proper attention would need to be paid to risk, and full allowance for it may (the Financial Secretary said) "be equivalent to requiring a higher rate of return on riskier projects." At the same time, the discount rate for the non-trading sector was set at not less than 6 percent, "based on the cost of capital for low risk purposes in the private sector". Risk will be analysed separately, with more risky projects required to demonstrate correspondingly higher benefits.

Illustrations of Economic Appraisal in Britain

The Treasury guides contain a number of numerical examples, which demonstrate procedures on the basis of hypothetical situations. Unlike the ODA guide for project appraisal (ODA 1988) no government publication contains illustrations of or is based on actual investment appraisals undertaken internally by departments, nationalised industries and other public bodies. For an outline of underlying principles, H.M. Treasury (1984) refers to amongst others, the text books by Mishan (1982) and Sugden and Williams (1978). Implicitly, these sources are taken to reflect underlying ideas and good practice that is consistent with the Treasury's approach to investment appraisal in the UK public sector.

A volume edited by Pearce (1978) is concerned with the idea and the practical problems of placing a money value on non-marketed effects, drawing largely on studies undertaken in Britain. Specific illustrations refer to the valuation of noise nuisance, air pollution, recreational land use, water pollution, human life and suffering.

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Report 3. Estimates of National Economic Parameters for China

Final Report to

Research Institute for Standards and Norms, Government of People's Republic of China, and UNIDO

Prepared by

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Introduction

This study should be seen as a set of preliminary national economic parameter (NEP) estimates for China. It is based on data supplied by the staff of the Research Institute for Standards and Norms (henceforth RI) to a team from the DPPC. The study utilises the semi-input-output (SIO) methodology for NEP estimates. It develops a SIO model for China and indicates how this model can be modified and improved when more data become available. The results should be seen as preliminary and illustrative of the SIO approach rather than as definitive. This is because of difficulty in assembling the data required for this work. The national input-output data utilized in the SIO model has several limitations noted in the text. Also given the complexity of the price structure in China, and wide ranging controls over prices it is difficult to obtain a set of prices that reflect scarcity values in the economy. Given the limited time available the study could do little on the important parameters of labour and the discount rate, although these are discussed briefly.

CHAPTER 1 METHODOLOGY EMPLOYED

This study estimates a set of National Economic Parameters (NEPs) for China. Given the gradual opening of the economy to foreign trade and investment in recent years, the question of planning the future participation of China in foreign trade is of relevance. The methodology of cost-benefit analysis surveyed in general terms in reports 1 and 2 allows projects to be assessed in terms of the efficiency with which they generate foreign exchange. Even projects producing non-traded marketed outputs can be valued indirectly in terms of foreign exchange benefits and costs.

However as a geographically large, and still partially protected economy a significant portion of economic activity in China remains non-traded. Therefore any approach to NEPs must allow for the interdependence between different non-traded sectors of the economy. This interdependence can only be captured adequately utilizing input-output data. Therefore the approach to NEP estimation employed here is one of semi-input-output analysis, following the procedures outlined in general terms in report 2. The basis for the SIO table is the national input-output data compiled regularly for China. This data has some limitations that are commented on below, but in general provides a useful starting point both for this exercise and for future work.

1.1 Numeraire, price level and year of study

The analysis of NEPs employing a SIO approach takes 1987 as a reference year, and uses domestic prices as the price units or the numeraire. The reference price level for the SIO table is producer prices. All CFs therefore give the ratios $CF_i = \frac{SP_i}{DP_i}$ where SP is the shadow price of i at domestic prices, and DP_i is the domestic producer price of i.

The choice of reference year, price units and price level was carried out in consultation with RI staff. The main data base for the analysis is the national input-output table for 1987. Since the table is at producer's prices for 1987 this determines the year and price level. The use of a domestic price numeraire is at the request of the RI staff who argued that this was more widely understandable in China, as it involves a shadow exchange rate, and also would be consistent with the earlier estimates by the RI.

1.2 National Input-Output table

The 1987 table covers 72 productive sectors. The table had to be modified however to match the requirements of SIO analysis. A critical adjustment is division of the productive sectors into traded and non-traded. This classification was done by RI staff. As a working criteria a sector was treated as traded if total trade imports plus exports is more than 5% of total output value.

It should be noted that an examination of the trade data from the national input-output table reveals that this working criterion was not in fact followed consistently, so that some sectors that would be traded on this criterion have not been classed as traded. In SIO methodology there is no agreed formal definition of what constitutes a traded sector, but any recalculation of the SIO model could include more sectors in the traded category. RI staff are revising their classification of sectors to examine how this will affect the results.

In some cases it was felt necessary to split the original sectors of the national input-output table, since they covered too wide a range of goods, some of which were judged sufficiently important to be shown as a separate sector.

- Maize is separated from 3 - other grain crops to become 3A
- Tea is separated from 6 - Other cash crops to become 6A
- 16 is split into separate parts distinguishing between crude oil, which become 16A, and natural gas which become 16 B.
- Sugar is separated from sugar, cigarettes and wine, to become 55 A, whilst the latter two remain grouped together as 55 B.

In addition two sectors are treated as partially traded in that some domestic production is of a sufficiently different quality and specification to that of imports to be non-competing with imports. This problem is handled by splitting the sectors into non-traded and traded elements, with the traded part covering only import - competing goods. This approach is followed for

31 **Steel shapes**
31A import - competing
31B non-traded

39 **Transportation Equipment**
39A import - competing
39B non-traded

40 **Power Equipment**
40A import - competing
40B non-traded

In addition to splitting some of the original sectors from the national input-output table, other sectors are aggregated. This is primarily for purposes of computation to bring the total A matrix to no more than 65 x 65. As far as possible relatively homogeneous sectors are grouped together. The groups and their new titles and coding are given in table 1.

Table 2 gives the original and new classification of all productive sectors, distinguishing between traded and non-traded. There are 62 productive sectors in the table, and three columns covering aggregate conversion factors. These are the average of all conversion factors (ACF), a conversion factor for Agriculture (AGCF), and for average consumption (CCF). It should be noted that two sectors from the original table are not shown. These are Electricity (original code 18) and Rail Transport (original code 59). These two are included as primary inputs in the F matrix, since they are treated as non-traded activities in fixed supply (see below).

Table 1 Aggregation of Sectors

Original Code	Sectors	New Code	New Title
8	Meat)		Other Non-
9	Vegetables)	10	Traded
10	Fish)		Agriculture
11	Fruit)		
20	Non-Metallic Metals)		Non-Metallic
21	Cement)	19	Minerals and
22	Glass)		others
23	Other Building Materials)		
24	Chemical Minerals)	20	Chemicals
25	Chemical Materials)		
38	Industrial Equipment)		
39B	Transport Equipment)	34	Equipment
40B	Power Equipment)		
41	Other Machine Products)		
43	Electronic Components)	38	Electronics
44	Electronic Products)		
68	Various Distribution)		
69	activities)		
70	)	62	Distribution
71	)		
72	)		

Table 2 Classification for Productive Sectors

Original Code	Sector	Category	New Code
1	Rice	T	1
2	Wheat	T	2
3A	Maize	T	3
3B	Other Grains	NT	4
4	Food Oil	NT	5
5	Cotton	T	6
6A	Tea	T	7
6B	Other Cash Crops	NT	8
7	Hides and Skins	T	9
8	Meat	NT)	
9	Vegetables	NT)	10
10	Fish	NT)	
11	Fruit	NT)	
12	Rubber	T	11
13	Forest Products	T	12
14	Medicinal Materials	NT	13
15	Coal	NT	14
16A	Crude Oil	T	15
16B	Natural Gas	NT	16
17	Oil Products	NT	17
19	Processed Wood	NT	18
20	Non-Metallic Minerals	NT)	
21	Cement	NT)	19
22	Glass	NT)	
23	Other Building Materials	NT)	
24	Chemical Minerals	NT)	20
25	Chemicals Materials	NT)	
26	Fertilizer	T	21
27	Organic Chemicals	NT	22
28	Toiletries	NT	23
29	Iron Ore	T	24
30	Pig Iron	NT	25
31A	Steel Shapes	T	26
31B	Steel Shapes	NT	27
32	Refractory Materials	NT	28
33	Coking and Gas	NT	29
34	Iron Alloy	NT	30
35	Non-Ferrous Minerals	T	31
36	Non-Ferrous Metals	T	32
37	Agricultural Machinery	NT	33
38	Industrial Equipment	NT)	
39B	Transport Equipment	NT)	34
40B	Power Equipment	NT)	
41	Other Machine Products	NT)	
39A	Transport Equipment	T	35
40A	Power Equipment	T	36
42	Telecommunications	NT	37
43	Electrical Components	NT)	38
44	Electrical Products	NT)	

Table 2 contd....

Original Code	Sector	Category	New Code
45	Railway Equipment	NT	39
46	Shipbuilding	NT	40
47	Textile Fabrics	T	41
48	Cotton Textiles	T	42
49	Woollen Textiles	NT	43
50	Jute Textiles	T	44
51	Knitwear	T	45
52	Silk Products	T	46
53	Household Electricals	NT	47
54	Light Industrial Products	NT	48
55A	Sugar	T	49
55B	Cigarettes and Alcohol	NT	50
56	Other Food Products	NT	51
57	Paper Making	T	52
58	Medical Products	NT	53
60	Water transport	NT	54
61	Road Transport	NT	55
62	Air Transport	NT	56
63	Public Service	NT	57
64	Housing	NT	58
65	Public Transport	NT	59
66	Construction	NT	60
67	Restaurants	NT	61
68	(	NT)	
69	(	NT)	
70	(Various	NT)	62
71	(Distribution	NT)	
72	(	NT)	
ACF			63
AGCF			64
CCF			65

T = Traded
NT = Traded

A major limitation of the national input-output table for this analysis is that it does not have a direct import row, so that all direct coefficients show total purchases by one sector from another regardless of whether supplies are produced domestically or are imported. This is a major limitation for SIO analysis, since it means that if the coefficients are used without adjustment the direct foreign exchange content of non-traded sectors will not be estimated. The approximate approach that was suggested by DPPC staff to overcome this difficulty was to assume that for each transaction in the table the share of imports in demand was equal to the share of total imports in total output for the good concerned. For example for raw cotton if total raw cotton imports are 10% of total domestic output of raw cotton, this approach assumes that for each purchase of raw cotton, shown in the national table, 10% of this will go on imports and 90% on domestic supplies. This approach is only approximate since it implies a constant import share in all purchases. Further it fails to distinguish between expenditure on imports at cif prices, and expenditure imports due to tariffs.

Unfortunately this adjustment was not made, so that the unadjusted coefficients from the national table are used in the SIO model. This is equivalent to the assumption that there are not direct imports, and that the foreign exchange content of production arises only through the purchase of domestically produced import-competing or exportable goods. Without seeing the adjusted coefficients it is difficult to assess how great is the inaccuracy caused by this assumption.

1.3 Non-Traded Goods Sectors

The majority of production is treated as coming from non-traded sectors, with the assumption that in the medium term for most sectors domestic supply can increase to meet additional demand from new projects. For non-traded sectors in variable supply the shadow price is defined as the full cost (variable plus fixed) per unit of production. In principle this should be a marginal cost, but in practice in this type of analysis constant costs are normally assumed so that marginal and average costs are treated as being equal. The cost structure for these non-traded activities comes from the coefficents of the national input-output table. Some non-traded sectors are treated differently however.

After discussion with RI staff it was decided that currently five sectors have sufficient surplus capacity to expand without additional investment. This decision was taken on the basis of the judgement of the RI staff since no capacity utilisation data were available. The sectors concerned and their codes are

Original Code		New Code
38	Industrial Equipment	34
41	Other Machine Products	34
44	Electronic Products	38
53	Household Electricals	47
55B	Cigarettes and Alcohol	50

The analysis is complicated by the fact that the equipment sectors (38 and 41 in original code) and electronic products (44 in original code) are now part of the aggregated sectors 34 and 38 respectively. Furthermore since precise data on capacity utilization are not available it is difficult to check the accuracy of the assumption of excess capacity. However as part of the sensitivity analysis of NEP estimates in one of the cases examined, these sectors are valued only on their variable costs. This means, in this case, that the primary input capital charge is zero for these sectors, and any actual profits become surplus profits and are shown as transfers.

Also at the suggestion of the RI staff it was agreed to treat two non-traded sectors as being in fixed supply. This implies that in the medium term capacity will not be expanded sufficiently to meet demand, and any additional expenditure on those sectors will divert their services from other users rather than lead to an expansion of capacity. The two sectors treated in this way are 18 Electricity and 59 Rail Transport. As sectors in fixed supply they are taken out of the part of the table relating to productive sectors, the A matrix, and placed in the F matrix as one of the primary inputs.

1.4 Traded Good Sectors

In entering values for traded sectors in the SIO table the standard procedure for this analysis at producer's prices is employed.

For direct imports the CF is

$$\frac{CIF}{DP}$$

where CIF is the import price, and DP is the landed cost domestic price inclusive of tariffs and indirect taxes on imports.

For import-competing domestic goods the CF is

$$CIF = \frac{CIF + (T_1 + D_1) - (T_2 + D_2)}{DPP}$$

where DPP is the domestic producer price.

T_1 and D_1 are the costs at shadow prices of transport and distribution in moving imports of a good from the port of entry to the main consumption centre.

T_2 and D_2 are the costs at shadow prices of moving local supplies of the same good from its domestic production point to the main consumption centre.

If for simplicity it is assumed that $(T_1 + D_1) = (T_2 + D_2)$ the CF for an import-competing domestic good reduces to

$$CF = \frac{CIF}{DPP}$$

This is the approach used here since in an SIO model it is generally very difficult to distinguish transport and distribution costs for imports and import-substitutes.

For exports and exportables the CF is

$$\frac{FOB - (T_3 + D_3)}{DPP}$$

where FOB is the export price, and T_3 and D_3 are domestic transport and distribution costs involved in moving the export good from the production site to the port. T_3 and D_3 should be valued at shadow prices.

To arrive at these price ratios for China direct price comparisons had to be made, since differences between domestic and world prices for China cannot be inferred from tax rates. This is because of the existence of both import controls and producer and consumer subsidies, all of which affect domestic prices for tradeable goods.

To derive the relevant CFs for traded sectors it is necessary to estimate the price ratios noted above. This was done by identifying what were judged to be representative commodities for each of the traded goods sectors and by taking the price ratio for the sector as a whole as a weighted average of the ratios for these representative commodities. Selection of the commodities and the calculation of the price ratios was done by RI staff.

The treatment can be illustrated as follows:

TRADED SECTOR - IMPORT COMPETING

$$\text{PRICE RATIO} = a_1 \frac{CIF_1}{DPP_1} + a_2 \frac{CIF_2}{DPP_2} \qquad (1)$$

where 1 and 2 are representative commodities

and a_1 and a_2 are the weights placed on these

DPP_1 and DPP_2 are average domestic producer prices for 1 and 2, and CIF_1 and CIF_2 are import prices.

TRADED SECTOR - EXPORTS

$$\text{PRICE RATIO} = a_1 \frac{FOB_1}{DPP_1} + a_2 \frac{FOB_2}{DPP_2} \qquad (2)$$

where FOB_1 and FOB_2 are export prices.

TRADED SECTOR - MIXED

$$\text{PRICE RATIO} = a_1 \frac{FOB_1}{DPP_1} + a_2 \frac{CIF_2}{DPP_2} \qquad (3)$$

where 1 is an export and 2 is an import competing product.

Where possible the weights used in the formulae refer to quantity of imports and exports, but where non-homogeneous goods are involved import and export values for the items are used as weights.

Some sectors are mixed in that they contain both import-competing and export goods. In this case equation (3), which gives an average price ratio for both types of traded good is used. Where the representative commodities are both exported and imported, they are treated as either one or the other on the basis of which total value is greater.

Strictly to estimate price ratio (2) above the transport and distribution costs of export sectors, as a percentage of the export price, should be known. This information was requested but as it was not supplied by RI staff all calculations for export sectors omit transport and distribution components. For most sectors the errors involved in this omission are not likely to be great but it could be corrected in a later calculation when these estimates become available.

A complication arises in the case of domestic producer prices given the complex price system in China and the coexistence of both state-controlled and market determined prices. The 1987 national input-output table is based on average prices - which are averages of these two types of prices. For consistency therefore as far as possible average DPP prices - average of both free market and controlled prices - are identified and used in the price ratios. Price data were collected and analysed by RI staff and the results of their calculations are given in table 3. The column headed ratio gives the price ratios, and the final column gives the number of representative commodities used for each sector. Unfortunately for only 5 traded sectors was it possible to identify free market prices, so that for most of the sectors DPP is a controlled not an average price.

1.5 Aggregate Conversion Factors

The last three columns of the SIO table are aggregate CFs that are defined as weighted averages of the CFs for groups of productive sectors in the table. The average conversion factor (ACF) is a weighted average of all CFs, with weights given by total output value for each sector at 1987 domestic prices taken from the national input-output table.

Table 3 Price Ratios for Traded Sectors

Table No.	Sectors	Unit	T.IM.V m$	T.IM.Q	T.EX.V m$	T.EX.Q	Ratio	No. Rep
1	Rice*	mkg	81.859	553.902	187.121	1021.6	1.6927	2
2	Wheat*	mkg	1448.26	13873.41			0.8369	3
3A	Maize*	mkg	150.532	1541.851	323.189	3916.185	1.009	1
5	Cotton	mkg	12.788	5.976	777.033	818.154	1.0901	3
6A	Tea	mkg	13.987	12.052	362.493	174.279	1.6843	1
7	Hides, Skins Leather*	mn	48.976	2.371	73.232	11.875	1.5015	3
12	Natural Rubber	mkg	391.645	413.659			0.5793	2
13	Forest Products*	mcm	559.934	8.237	33.518	7.058	0.9721	4
16A	Crude Oil	mkg	29.1	128.7	3141	27225.4	3.8152	1
26	Chemical Fertilizer	mkg	1399.22	10895.26			1.1652	4
29	Ferrous Metal Mine	mkg	332.184	11393.29	12.246	100.072	1.4573	4
31A	Steel Shapes	mkg	4567.737	12838.91			1.8907	17
35	Nonferrous Metal Mine	mkg	544.79	859.23	180.789	134.691	1.0458	5
36	Nonferrous Metal	mkg	113.551	98.633	148.211	66.039	0.8132	6
39A	Transportation Equipment	n	1219.054	99371			0.5205	8
40A	Power Equipment	mn	211.488	29.9458			0.7752	5
47	Textile Fabrics	mkg	946.992	488.745	565.988	187.878	1.4224	10
48	Cotton Textile	mm	261.429	188.45	2071.484	2341.484	1.3866	3
50	Jute Textile	mm	33.234	13.916	134.256	99.7	0.9971	2
51	Knitwear Textile	mm	273.478	163.921	924.054	1591.475	1.0151	6
52	Silk Products	mkg			426.76	28.184	1.2642	3
55A	Sugar	mkg	297.435	1826.693	90.565	452.466	0.4523	2
57	Paper Making	mkg	1105.658	2515.037	186.576	321	0.7083	14

Notes: T.IM.V; T.EX.V - Total value of imports and exports.
T.IM.Q; T.EX.Q - Total quantity of imports and exports.
Ratio - Weighted average ratio of traded price and domestic producer price as explained in text equations (1), (2) and (3).
No.Rep. - The number of each sector's weighted representative commodities.
mkg - million kilograms
mn - million number of items.
n - number of item.
mcm - million cubic meters.
mm - million meters.
Official exchange rate: 1US$ = 3.72 RMB.
* - sectors for which free market prices available.

The agriculture conversion factor (AGCF) is a weighted average of the CFs for agricultural sectors, with the share of each sector in total agricultural output used as weight. For this calculation the following sectors were classed as Agriculture.

Original Code	Sectors	New Code	Weight
1	Rice	1	0.1337
2	Wheat	2	0.0785
3A	Maize	3	0.0543
3B	Other grains	4	0.0604
4	Food oil	5	0.0344
5	Cotton	6	0.0285
6A	Tea	7	0.0028
6B	Other cash crops	8	0.3157
7	Hides and skins	9	0.0151
8	Meat)		
9	Vegetables)		
10	Fish)	10	0.2586
11	Fruit)		
12	Rubber	11	0.0073
13	Forest products	12	0.0107
			1.0000

For consumption the procedure is first to find the total of final demand going to each sector. This is done by applying the final demand coefficient for each sector to the total output value for the sector. Where sectors have negative coefficients they are excluded from the analysis. The national input-output data does not distinguish between consumption and investment as sources of final demand. Therefore 23 consumption sectors are identified on the basis of judgement. The consumption weights for the CCF are given as the final demand going to each of the consumption sectors as a proportion of final demand for the total of the 23 consumption sectors. The sectors selected and their weights are given below.

Original Code	Consumption Sector	New Code	Weight
1	Rice	1	0.0935
2	Wheat	2	0.0382
3A	Maize	3	0.0174
3B	Other grains	4	0.0203
4	Food oil	5	0.02803
6A	Tea	7	0.00309
6B	Other cash crops	8	0.0074
8-11	Other non-traded agriculture	10	0.1865
28	Toiletries	23	0.0115
48	Cotton textiles	42	0.0648
49	Woollen textiles	43	0.0222
50	Jute textiles	44	0.0019
51	Knitwear	45	0.0457
52	Silk products	46	0.0313
43	Household electricals	47	0.0397
54	Light industrial products	48	0.1472
55A	Sugar	49	0.0116
55B	Cigarettes and Alcohol	50	0.0770
56	Other food products	51	0.1018
58	Medical products	53	0.0252
64	Housing	58	0.0076
67	Restaurants	61	0.0175
			1.0000

1.6 Structure of the Model

The model is based around three matrices. the A matrix (65 x 65) covers the transactions between the 62 productive sectors and three aggregate conversion factors. The F matrix (7 x 65) gives the inputs of primary factors into each productive sector. The T matrix (7 x 65) gives the values of the primary inputs, and covers the interdependence between CFs for primary inputs and productive sectors.

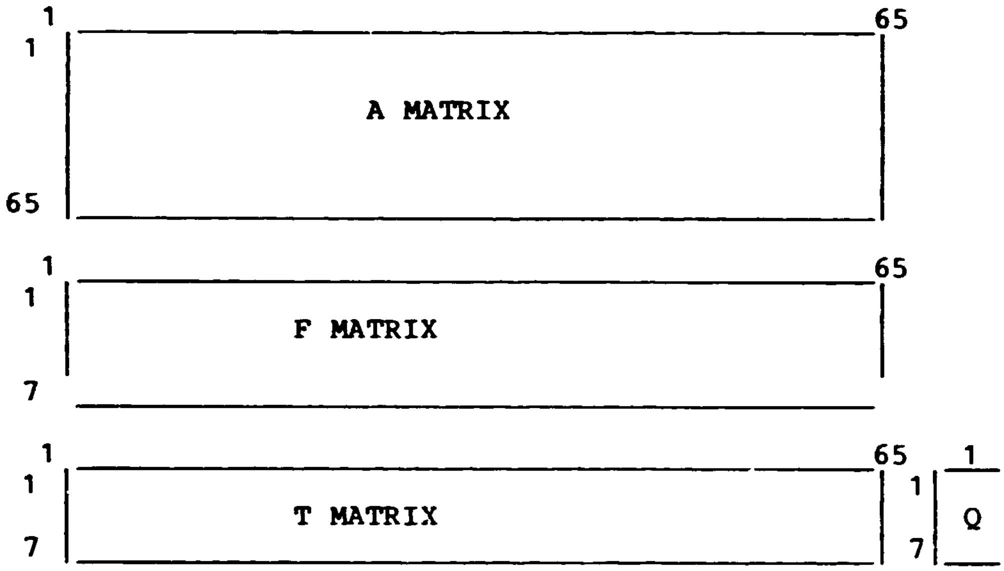
In principle any primary input CF may be determined by any productive sector or aggregate CF. This is allowed for in the T matrix. Where a primary input CF is determined by the CF for one of the 65 columns this is shown as a non-zero entry in the T matrix.

For example if the Labour CF is given as

$$a + b_{25}\ CF_{25} + b_{42}\ CF_{42}$$

it is a function of a constant "a" and the CFs for columns 25 and 42. The coefficients b_{25} and b_{42} are entered in the Labour row in columns 25 and 42 of the T matrix. All other entries in the Labour row of the T matrix will be zero.

Primary inputs can have constant terms, like "a" in the expression for Labour given above. All constants are given in the vector Q (7 x 1),. Therefore for the Labour row in the Q vector, in this example the entry will be a.



A full print out of the model for cases 1b and 1c is given in the Appendix.

1.7 SIO entries for traded sectors

Estimation of the direct price ratios provided the data for each traded sector in the A matrix of the SIO table. The DPP is set at 1.0, as the reference point for the table. The price ratio for the representative commodity sample gives the world price of the output of the sector. This is the foreign exchange value for the sector. In the cases of import competing production the difference between DPP and CIF is treated as a subsidy to producers where it is positive and a tax where it is negative.

For example, where the price ratio is 1.25 the CIF price is 25% above the DPP, and this 25% margin is a tax on domestic producers, who receive negative protection from the trade control system. In this case the SIO entries will as follows

Foreign Exchange	1.25
Transfers	-0.25
DPP	1.0

Where the price ratio is 0.8, the CIF price is below the DPP, and domestic producers receive a subsidy. The SIO entry will be

Foreign Exchange	0.8
Transfer	0.2
DPP	1.0

For import-competing goods no transport and distribution costs need be considered, since the comparison is at the producer price level, and the economic value of output is simply the cif price, without including any local costs associated with moving the good to local consumption points. For exports and exportables however these local costs are relevant since the economic value of output is the fob price net of local transport and distribution costs involved in moving the good to the border for export. For example, if these latter costs are 5% of the DPP, and the price ratio is 1.20, the SIO entries will be

Transport and Distribution	-0.05
Foreign Exchange	1.20
Transfers	-0.15
DPP	1.00

Date on estimated coefficients for transport and distribution costs for major exports were requested from RI staff but were not available for the study.

1.8 SIO Entries for Non-Traded Sectors

The coefficients for these sectors in the SIO table are taken directly from the national input-output table. Inputs from non-traded sectors are shown in the A matrix, and inputs from traded sectors in the F matrix.

Indirect taxes on output of each sector are shown under Transfers, and wage costs are shown under the primary input Labour. Interest, Profits and Depreciation are grouped together under Capital charge in one case, and partly treated as surplus profits and entered under Transfer in another. Inputs from Electricity and Rail Transport sectors are shown as primary outputs in the F matrix as these are treated as non-traded items in fixed supply. Finally the residual Others is shown as a separate primary input. (see 1.9 below).

1.9 Primary Inputs in SIO table

Following the standard SIO procedure all productive sectors are decomposed into a set of primary inputs. The inputs used in the table are determined by data availability and particular features of the economy. In this analysis seven primary inputs are used.

Foreign Exchange (F1)

This is the direct input content of non-traded sectors, and the foreign exchange value of all traded sectors. In a world price system it is valued at 1.0. In a domestic price system it is valued at 1.0 plus the premium placed on foreign exchange, and given by the ratio of the shadow to the official exchange rate.

To make analyses in the two systems directly equivalent the premium on foreign exchange can be set as 1/ACF, where ACF (the average conversion factor) is the average ratio of world to domestic prices for the economy.

Transfers (F2)

These transfer payments cover all taxes, subsidies, and excess profits, where the latter can be identified.

Labour (F3)

Chinese input-output statistics do not distinguish between skilled and unskilled workers, so only an aggregate labour category could be used. Given the uncertainty surrounding the value of labour three alternatives are used in the calculations, termed cases a, b and c.

Capital Charge (F4)

This item covers the charge for the use of capital assets in non-traded activities. Given the uncertainty surrounding the real capital charge two alternative approaches are used. The first (case 1) will give an estimate that is likely to have a downward bias, and the other (case 2) is likely to have an upward bias. They can be seen as alternatively 'low' and 'high' estimates of the capital charge.

The national input-output table gives capital related entries of Profits before tax, Interest, Depreciation and Major Repairs. The total of these will be termed Operating Surplus.

The first approach to the capital charge (case 1) estimates it by applying a capital recovery factor (at 10% discount rate for 20 years) to the capital stock data for fixed plus working capital from the national input-output table. For all but the agricultural sectors any Operating Surplus above this estimate of the capital charge is treated as surplus profits and entered under Transfers. For the agriculture sectors capital stock figures are low relative to output, and the excess of Operating Surplus over the estimated capital charge is treated as returns to family labour, and included under the primary factor Labour. Also in case 1 zero capital charge is shown for the four sectors where surplus capacity is assumed. This approach whilst theoretically more rigorous than the second has the limitation that capital stock figures from the national input-output table are at historical not replacement cost. This will almost certainly give a downward bias to this capital charge estimate.

The other approach used (case 2) assumes that all of Operating Surplus reflects the charge for the use of capital. In one of the cases examined this is the assumption for all sectors except 58 Housing. There Operating Surplus is negative. On the grounds that it is difficult to interpret returns to capital in this sector it is valued on the basis of variable costs only. Since all of Operating Surplus is unlikely to be a real capital cost there is an overestimation in this approach.

Electricity (F5)

This sector is treated as subject to excess demand in the medium term, so that any additional project expenditure will divert supply from other users rather than creating an expansion of supply. For this reason it is not treated as a productive sector in the A matrix.

Rail Transport (F6)

This is treated in the same way as Electricity.

Others (F7)

This is a minor residual category in the national input-output table, which is used to maintain the balance of the table. It can be interpreted as minor costs that cannot be attributed to particular sectors.

1.10 Valuation of Primary Inputs

In an SI system the CF for each sector is a weighted average of the CFs for the total - direct plus indirect - primary inputs that go into the sector. Solution of the system requires a vector of CFs for the set of primary inputs. Some of these CFs for primary inputs are specified exogenously, whilst others are determined within the SIO model.

The logic of the approach used is to express all sectors in terms of the value of primary inputs into those sectors. So for sector i

$$CF_i = \sum_f a_{fi} CF_f$$

where CF_f is the CF for primary input f and a_{fi} is the share of input f in output value in sector i.

The SIO model used here was developed originally for calculation in a world price system. Here all estimates are initially derived in a world price system, they are then converted to domestic price units by multiplication by the inverse of the ACF (1/ACF). All results are directly comparable in both price units. The treatment of the seven primary inputs in both price systems is summarized in table 4.

Table 4 CFs for Primary Inputs

	Domestic Price System	World Price System
Foreign Exchange	1/ACF	1.0
Transfers	0	0
Labour	a) 0.75 $AGCF^1$+0.25 CCF^1 b) 0.50 $AGCF^1$ c) 0.25 $AGCF^1$	a) 0.75 AGCF+0.25 CCF b) 0.50 AGCF c) 0.25 AGCF
Capital charge	1.0	ACF
Electricity	e x CCF^1	e x CCF
Rail Transport	t x CCF^1	t x CCF
Others	1.0	ACF

where ACF is the average conversion factor in a world price system,
AGCF is the agriculture conversion factor in a world price system,
CCF is the consumption conversion factor in a world price system,
$AGCF^1$ and CCF^1 are the agriculture and consumption conversion factors, respectively, in a domestic price system,
where $AGCF^1 = AGCF \times \frac{1}{ACF}$, and $CCF^1 = CCF \times \frac{1}{ACF}$
e is the ratio of willingness to pay for electricity at domestic prices to the market tariff, and
t is the ratio of willingness to pay for rail transport at domestic prices to the market tariff.

Three alternative treatments of the labour input a), b) and c) are used. The willingness to pay estimates at domestic prices e and t are taken from estimates by RI staff. All the aggregate conversion factors ACF, AGCF and CCF are calculated within the model.

The valuation of each of the primary inputs in a domestic price analysis is discussed in turn.

Foreign Exchange

The premium is estimated as the inverse of the average conversion factor, $\left(\frac{1}{ACF}\right)$.

This approach assumes that the economy wide-divergence between domestic producer prices and world prices for both traded and non-traded sectors determines the premium. This is a precisely equivalent treatment to that in a world price system, where foreign exchange as the numeraire has a value of 1.0.

Transfers

These all have an economic value of zero.

Labour

As an important parameter subject to considerable uncertainty, labour is valued in three different ways. In a) a "high" value is used. Here labour is valued by a weighted average of CFs for Agriculture and Consumption. This is on the grounds that the earlier estimate by the RI had identified two components of the shadow wage - output foregone in agriculture and the additional consumption cost associated with employing new workers. This latter component arising from medical and infrastructure expenditures was put at 25% of the market wage.

Estimates of output foregone in agriculture are difficult to obtain. As a first approximation to an upper-estimate the assumption was more that the average annual wage in agriculture can be used as a proxy for output foregone. In 1987 this average wage was ¥1171. This is approximately 75% of the average market wage in state owned enterprises in 1987. Output foregone comprises output from both traded and non-traded sectors and must be revalued by a CF for Agriculture. The model calculates a weighted average for agricultural goods which is applied in the Labour calculations. Similarly the consumption cost component must be revalued, and the average CF for consumption is used for this purpose.

On these assumptions the expression for the shadow wage is

$$SWR = m.\ AGCF + c.\ CCF$$

where m is output foregone in agriculture

and c is additional consumption cost of employment.

By assumption m = 0.75 MWR

and c = 0.25 MWR

where MWR is the market wage rate on new projects.

Therefore SWR = 0.75 MWR. AGCF + 0.25 MWR. CCF

The CF for Labour is thus

$$\frac{SWR}{MWR} = 0.75\ AGCF + 0.25\ CCF$$

This estimate of labour's cost is likely to have an upward bias chiefly because it equates average wages in agriculture with output foregone which relates to marginal products. Treatment b), which can be seen as an "intermediate" estimate of labour's cost assumes that output foregone in agriculture is 50% of the market wage (m = 0.50 MWR), and that for marginal workers the extra consumption cost of employment is zero, since they will use existing housing, medical or other facilities. Here

SWR = 0.50. MWR · AGCF

and the CF for labour is 0.50. AGCF.

As an alternative treatment c) assumes a "low" estimate for labour's cost, where output foregone in agriculture is 25% of the wage paid on new projects, so that

SWR = 0.25. MWR AGCF

and the CF for labour is 0.25 AGCF.

Capital Charge

This represents the capital charge for use of assets in a sector. It represents foregone surplus elsewhere in the economy. Assuming the resources are mobile this foregone surplus could come from any sector, so that one can use the economy-wide ACF to express this capital charge at world prices. In a domestic price analysis where the foreign exchange premium is applied to world prices these two adjustments cancel out ($ACF \times \frac{1}{ACF} = 1.0$), so that the final conversion factor for capital assets is 1.0.

Electricity and Rail Transport

As sectors in fixed supply some estimate is required of their scarcity value to users. At existing tariffs there is a large excess demand for these sectors. The RI staff estimated approximately the market-clearing price at domestic prices, and this gives an approximation for the premium above current tariffs. This estimated premium-inclusive price can be interpreted as an app imate estimate of willingness to pay for these services at dom tic prices. For electricity the ratio of the premium-inclusive to the current price is 3.0, whilst for rail transport it is 2.50. In a world price system consumer willingness to pay must be converted to world price equivalents by a consumption conversion factor. In a domestic price system this world price value must be converted back to domestic price units by the premium on foreign exchange. Where ACF = CCF the conversion factor for these non-traded items will be 1.0, but here whilst in some cases the ACF and the CCF are close, the CCF is always below ACF so that the conversion factor applied to e and t is always below 1.0.

Others

This residual item has a CF of 1.0 in a domestic price system. It is already at domestic prices and is not adjusted in the calculations. In a world price system it is valued at the ACF, but as with the capital charge use of the foreign exchange premium of 1/ACF reduces its CF to 1.0.

Values for primary input CFs are entered in the T matrix (7 x 65) and in the vector Q (7 x 1). For example for labour the relevant entry is row 3 in the T matrix. In a) where Labour's CF is 0.75 AGCF + 0.25 CCF all columns will be zero except column 64 for Agriculture where the entry is 0.75, and column 65 for Consumption, where it is 0.25. In b) where Labour's CF is 0.50 AGCF the entry in the T matrix for labour row 3 is zero except for column 64 Agriculture where it is 0.50. In c) the entry in column 64 is 0.25.

The Q vector is used only for constant terms. Electricity and Railways have entries of 3.0 and 2.50 respectively in column 65 Consumption; their primary inputs are 3.0 x CCF for Electricity and 2.50 x CCF for Railways. For Foreign Exchange, Capital charge and Others, there is an entry of 1.0 in vector Q.

1.11 Sensitivity Analysis

To cover uncertainty in the basic data six runs of the model were carried out changing values relating to the capital charge coefficients in the F matrix and the value of the primary input labour in the T matrix.

Case 1 refers to the low capital charge estimate derived by applying a capital recovery factor to the historical capital stock data. Case 2 refers to the high capital charge estimate using total Operating Surplus as the capital charge. These two alternative treatments of capital are combined with the three treatments of labour - the high shadow wage (a), the intermediate shadow wage (b), and the low shadow wage (c).

The sensitivity analysis is summarized in table

Table 5 Sensitivity Analysis

Capital			
Case 1	1a	1b	1c
Case 2	2a	2b	2c
		Labour	

a) SWR = 0.75.AGCF + 0.25.CCF b) SWR = 0.50.AGCF c) SWR = 0.25.AGCF

CHAPTER 2 THE RESULTS

2.1 Sensitivity Analysis

The results for the aggregate CFs and labour for the six alternative cases are summarized in table 6.

Table 6 Results of Sensitivity Analysis - Aggregate Parameters

	Case		
Parameters	1a	1b	1c
Foreign Exchange CF	0.86	1.14	1.26
Labour CF	1.00	0.44	0.20
AGCF	1.02	0.88	0.82
CCF	0.93	0.93	0.93
	Case		
Parameters	2a	2b	2c
Foreign Exchange CF	0.69	0.83	0.89
Labour CF	0.92	0.46	0.23
AGCF	0.93	0.91	0.90
CCF	0.91	0.98	1.02

The foreign exchange CF is the average ratio of domestic to world prices for the economy (1/ACF). The premium on foreign exchange is the foreign exchange CF - 1.0, so that a value of below 1.0, implies a negative premium and an overvaluation of foreign exchange. The fall in the labour CF between the different cases reflects the assumption used in the treatment of labour, as (a) refers to a high valuation, (b) to a intermediate and (c) to a low.

A negative premium on foreign exchange appears a counter-intuitive results given the apparent scarcity of foreign exchange, and the existence of a black market. Therefore all cases except 1b and 1c are not given further consideration because they imply a negative premium on foreign exchange; that is a shadow exchange rate below the official rate.

2.2 Detailed Results for Cases 1b and 1c

The full results for these cases are given in the accompanying computer print-out as a set of CFs. The code S refers to column numbers. S1 to S62 covers the 62 productive sectors. S63 is the ACF, S64 is the AGCF and S65 the CCF. The primary inputs have codes F1 to F7, and their conversion factors are also given.

Case 1b

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
1.932100	0.955263	1.151703	0.599014	0.607416	1.244273	1.922512	0.558972	1.713858	0.644092	0.661230	1.109585	0.725870	0.894123

S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
4.354787	0.685812	1.653437	1.268254	0.814039	0.891435	1.329995	0.847528	0.685359	1.663407	1.271227	2.158103	0.874637	0.676727

S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40	S41	S42
0.866816	1.250678	1.193708	0.928211	0.846967	0.612877	0.594114	0.884837	0.672625	0.522882	0.846360	0.941249	1.623571	1.582708

S43	S44	S45	S46	S47	S48	S49	S50	S51	S52	S53	S54	S55	S56
1.055176	1.138120	1.158666	1.442997	0.464404	0.814636	0.516269	0.488621	0.797066	0.808475	0.674399	0.886208	0.860066	1.013169

S57	S58	S59	S60	S61	S62	S63	S64	S65
1.091941	1.199813	0.988733	0.838367	0.652146	0.823321	1.000000	0.879376	0.931803

F1	F2	F3	F4	F5	F6	F7
1.141431	0	0.439688	1	2.795409	2.329507	1

Case 1c

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
2.130787	1.053498	1.270139	0.444645	0.425882	1.372228	2.120213	0.375318	1.890103	0.500472	0.729228	1.723689	0.618527	0.801513

S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
4.802611	0.674699	1.788926	1.247455	0.783129	0.869383	1.466765	0.857774	0.631357	1.834463	1.263976	2.380032	0.864108	0.644902

S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40	S41	S42
0.822024	1.277357	1.316463	1.023664	0.823797	0.588361	0.655210	0.975829	0.669049	0.515556	0.915708	0.901167	1.790531	1.745465

S43	S44	S45	S46	S47	S48	S49	S50	S51	S52	S53	S54	S55	S56
1.122960	1.255159	1.277818	1.591387	0.452497	0.822326	0.569359	0.447319	0.778022	0.891615	0.650296	0.855444	0.836248	1.019213

S57	S58	S59	S60	S61	S62	S63	S64	S65
1.043949	1.080606	0.937348	0.780431	0.514266	0.759031	1.000000	0.817974	0.934392

F1	F2	F3	F4	F5	F6	F7
1.25881	0	0.204493	1	2.803177	2.335981	1

TOTAL PRIMARY INPUTS

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13
F1	1.6927	0.8369	1.009	0.166142	0.057177	1.0901	1.6843	0.083277	1.5015	0.185407	0.5793	0.9721	0.023361
F2	-0.6927	0.1631	-0.009	0.027454	0.028060	-0.0901	-0.6843	0.012728	-0.5015	0.012845	0.4207	0.0279	0.025554
F3	0	0	0	0.739589	0.801795	0	0	0.822809	0	0.703640	0	0	0.468256
F4	0	0	0	0.048054	0.047015	0	0	0.039043	0	0.068470	0	0	0.436049
F5	0	0	0	0.007916	0.041719	0	0	0.010635	0	0.011814	0	0	0.004800
F6	0	0	0	0.002376	0.001310	0	0	0.001396	0	0.002828	0	0	0.001407
F7	0	0	0	0.008465	0.022920	0	0	0.030109	0	0.014993	0	0	0.040570

S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27
0.092441	3.8152	0.129271	1.242133	0.563778	0.174889	0.217601	1.1652	0.358848	0.199683	1.4573	0.321143	1.8907	0.213158
0.013319	-2.8152	0.418389	-0.43540	-0.30122	0.261179	0.228102	-0.1652	0.263060	0.250423	-0.4573	-0.06001	-0.8907	0.252784
0.442593	0	0.114586	0.045146	0.371642	0.222054	0.206190	0	[illegible]	0.331016	0	0.196644	0	0.154639
0.344300	0	0.230411	0.089284	0.247994	0.209224	0.214400	0	0.133917	0.146377	0	0.316902	0	0.241451
0.060435	0	0.069424	0.023231	0.033119	0.066213	0.096346	0	0.065470	0.031692	0	0.041245	0	0.076399
0.025463	0	0.019164	0.019515	0.027129	0.042138	0.023550	0	0.014793	0.027171	0	0.151874	0	0.035165
0.021447	0	0.018751	0.016087	0.057561	0.024299	0.013807	0	0.025812	0.013715	0	0.032209	0	0.026400

S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40	S41
0.112328	0.102090	0.417238	1.0458	0.8132	0.191105	0.210449	0.5205	0.7752	0.248048	0.220136	0.190611	0.166406	1.4224
0.363450	0.218419	0.094504	-0.0458	0.1868	0.230896	0.409427	0.4795	0.2248	0.368417	0.517583	0.200324	0.064089	-0.4224
0.193919	0.245515	0.101227	0	0	0.196993	0.211406	0	0	0.140626	0.142687	0.228302	0.255885	0
0.193117	0.249966	0.148248	0	0	0.252066	0.073993	0	0	0.143538	0.047090	0.268087	0.401987	0
0.049578	0.046498	0.162136	0	0	0.056775	0.038189	0	0	0.031092	0.042667	0.051271	0.041915	0
0.033044	0.093928	0.038954	0	0	0.044586	0.031913	0	0	0.021762	0.009534	0.041815	0.037550	0
0.054560	0.043581	0.037688	0	0	0.027575	0.024620	0	0	0.046514	0.020300	0.019586	0.032164	0

S42	S43	S44	S45	S46	S47	S48	S49	S50	S51	S52	S53	S54	S55
1.3866	0.755833	0.9971	1.0151	1.2642	0.167407	0.408242	0.4523	0.210571	0.433997	0.7083	0.212753	0.152106	0.335855
-0.3866	0.031132	0.0029	-0.0151	-0.2642	0.562995	0.208135	0.5477	0.422588	0.133091	0.2917	0.311476	0.057941	0.089782
0	0.089577	0	0	0	0.135697	0.172220	0	0.281464	0.298253	0	0.210075	0.207471	0.269910
0	0.097627	0	0	0	0.063929	0.154777	0	0.046880	0.098348	0	0.200012	0.540469	0.252058
0	0.010923	0	0	0	0.031132	0.024003	0	0.011243	0.013082	0	0.026037	0.012032	0.020027
0	0.007513	0	0	0	0.017947	0.013865	0	0.014253	0.009329	0	0.020117	0.012998	0.013256
0	0.007391	0	0	0	0.020899	0.018755	0	0.012997	0.013896	0	0.019526	0.016979	0.019107

S56	S57	S58	S59	S60	S61	S62	S63	S64	S65
0.385144	0.162135	0.293363	0.323580	0.180520	0.094883	0.147276	0.476870	0.506125	0.591792
-0.01455	0.018280	-0.33714	-0.05471	0.133735	0.030997	0.062460	0.058143	-0.07902	0.023936
0.167233	0.289595	0.656860	0.381876	0.339064	0.634053	0.348052	0.240401	0.513975	0.284940
0.410366	0.370420	0.225983	0.263961	0.223236	0.211934	0.366978	0.127851	0.034552	0.068675
0.015823	0.130356	0.075312	0.050241	0.045299	0.013079	0.009352	0.045653	0.008326	0.012658
0.007094	0.011666	0.040620	0.009042	0.041535	0.001135	0.032477	0.032667	0.001361	0.006747
0.028896	0.017544	0.045005	0.026012	0.036608	0.013917	0.033401	0.018410	0.014682	0.011248

A print-out is also given for the matrix of total (direct plus indirect) primary inputs into each sector. This set of coefficients shows how each sector is decomposed into different inputs, and these coefficients are the weights a_{fi} in the equation for CF_i, where

$$CF_i = \Sigma a_{fi}.CF_f$$

For traded sectors only primary inputs of Foreign Exchange and Transfers are shown. This is because no non-traded costs are involved for these sectors due to the omission of local transport and distribution costs. For non-traded sectors all seven primary inputs are involved. These sectors have no direct Foreign Exchange input because the table does not include direct imports, but they use Foreign Exchange through their use of domestically produced traded goods.

The derivation of the results can be explained using two illustrations from case 1b - the non-traded sector Railway Equipment (S39) and the traded sector Transport Equipment (S35).

The primary input coefficients are as follows

	S39	S35
F1	0.190611	0.5205
F2	0.200324	0.4795
F3	0.228302	-
F4	0.268087	-
F5	0.051271	-
F6	0.041815	-
F7	0.019586	-

In the case 1b the primary input CFs are

F1	1.141431
F2	0
F3	0.439688
F4	1.0
F5	2.795409
F6	2.329507
F7	1.0

The CF for the two sectors is given by the expression

$$CF_i = \sum_f a_{fi}.CF_f$$

where a_{fi} is the primary input coefficient and

CF_f is the primary input CF.

Therefore for S39

F1	0.190611	x	1.141431	=	0.2176
F2	0.200324	x	0	=	0
F3	0.228302	x	0.439688	=	0.1004
F4	0.268087	x	1.0	=	0.2681
F5	0.051271	x	2.795409	=	0.1433
F6	0.041815	x	2.329507	=	0.0974
F7	0.019586	x	1.0	=	0.0196
			S39		0.8464

For S35

F1	0.5205	x	1.141431	=	0.5941
F2	0.4795	x	0	=	0
			S35		0.5941

Tables 7 and 8 set out the CFs for sectors separated into non-traded and traded, Table 9 gives the CFs for the primary inputs in both cases.

In case 1b (with a low capital charge and an intermediate shadow wage) in general CFs for non-traded sectors tend to be below those for traded sectors and have less variability around the mean. A similar pattern holds for case 1c (with a low capital charge and a low shadow wage). In comparing the two cases 1c has more extreme values with on average lower CFs for non traded sectors (as a result of the use of a lower shadow wage) and higher CFs for traded sectors (because of the higher foreign exchange premium in this case).

In the results for the primary factors the main differences between the two cases are in labour and foreign exchange. Case 1c has both a higher foreign exchange premium (26% as compared with 14%) and a lower shadow wage (20% of the market wage as compared with 44%). The differences in the other aggregate parameters between the two cases are small.

Table 7 CF results Productive Sectors (Case 1b)

Code	Non Traded	CF
4	Other Grains	0.60
5	Food oil	0.61
8	Other Cash Crops	0.56
10	Other Non-Traded Agriculture	0.64
13	Medicinal materials	0.73
14	Coal	0.89
16	Natural Gas	0.69
17	Oil Products	1.65
18	Processed wood	1.27
19	Non-metallic Minerals and others	0.81
20	Chemicals	0.89
22	Organic Chemicals	0.85
23	Toiletries	0.69
25	Pig Iron	1.27
27	Steel Shapes	0.87
28	Refractory Materials	0.68
29	Coking and Gas	0.87
30	Iron Alloy	1.25
33	Agricultural Machinery	0.85
34	Equipment	0.61
37	Telecommunications	0.67
38	Electronics	0.52
39	Railway Equipment	0.85
40	Shipbuildings	0.94
43	Woollen Textiles	1.06
47	Household Electricals	0.46
48	Light Industrial Products	0.81
50	Cigarettes and Alcohol	0.49
51	Other Food Products	0.80
53	Medical Products	0.67
54	Water Transport	0.89
55	Road Transport	0.86
56	Air Transport	1.01
57	Public Service	1.09
58	Housing	1.20
59	Public Transport	0.99
60	Construction	0.84
61	Restaurants	0.65
62	Distribution	0.82

Standard Deviation = 0.25
Mean = 0.84
Standard Deviation/Mean = 0.29

Code	Traded	CF
1	Rice	1.93
2	Wheat	0.96
3	Maize	1.15
6	Cotton	1.24
7	Tea	1.92
9	Hides and Skins	1.71
11	Rubber	0.66
12	Forest Products	1.11
15	Crude oil	4.35
21	Fertilizer	1.33
24	Iron Ore	1.66
26	Steel Shapes	2.16
31	Non Ferrous Minerals	1.19
32	Non-Ferrous Metals	0.93
35	Transport Equipment	0.59
36	Power Equipment	0.88
41	Textile Fabrics	1.62
42	Cotton Textiles	1.58
44	Jute Textiles	1.14
45	Knitwear	1.16
46	Silk Products	1.44
49	Sugar	0.52
52	Paper-Making	0.81

Standard Deviation = 0.78
Mean = 1.39
Standard Deviation/Mean = 0.56

Table 8 CF Results Productive Sectors (Case 1c)

Code	Non Traded	CF
4	Other Grains	0.44
5	Food oil	0.43
8	Other Cash Crops	0.38
10	Other Non-Traded Agriculture	0.50
13	Medicinal materials	0.62
14	Coal	0.80
16	Natural Gas	0.67
17	Oil Products	1.79
18	Processed wood	1.25
19	Non-metallic Minerals and others	0.78
20	Chemicals	0.87
22	Organic Chemicals	0.86
23	Toiletries	0.63
25	Pig Iron	1.26
27	Steel Shapes	0.86
28	Refractory Materials	0.64
29	Coking and Gas	0.82
30	Iron Alloy	1.28
33	Agricultural Machinery	0.82
34	Equipment	0.59
37	Telecommunications	0.67
38	Electronics	0.52
39	Railway Equipment	0.82
40	Shipbuildings	0.90
43	Woollen Textiles	1.12
47	Household Electricals	0.45
48	Light Industrial Products	0.82
50	Cigarettes and Alcohol	0.45
51	Other Food Products	0.78
53	Medical Products	0.65
54	Water Transport	0.86
55	Road Transport	0.84
56	Air Transport	1.02
57	Public Service	1.04
58	Housing	1.08
59	Public Transport	0.94
60	Construction	0.78
61	Restaurants	0.51
62	Distribution	0.76

Standard Deviation = 0.28
Mean = 0.80
Standard Deviation/Mean = 0.36

Code	Traded	CF
1	Rice	2.13
2	Wheat	1.05
3	Maize	1.27
6	Cotton	1.37
7	Tea	2.12
9	Hides and Skins	1.89
11	Rubber	0.73
12	Forest Products	1.22
15	Crude oil	4.80
21	Fertilizer	1.47
24	Iron Ore	1.83
26	Steel Shapes	2.38
31	Non Ferrous Minerals	1.32
32	Non-Ferrous Metals	1.02
35	Transport Equipment	0.66
36	Power Equipment	0.98
41	Textile Fabrics	1.79
42	Cotton Textiles	1.75
44	Jute Textiles	1.26
45	Knitwear	1.28
46	Silk Products	1.59
49	Sugar	0.57
52	Paper-Making	0.89

Standard Deviation = 0.86
Mean = 1.54
Standard Deviation/Mean = 0.56

Table 9 CFs Primary Factors and Aggregate CFs

Primary Factor	Case 1b	Case 1c
Foreign Exchange	1.14	1.26
Labour	0.44	0.20
Capital charge	1.00	1.00
Electricity	2.79	2.80
Rail	2.33	2.34
Others	1.00	1.00
AGCF	0.88	0.82
CCF	0.93	0.93

2.3 Interpretation of the Results

The results in tables 7 to 9 give a series of CFs for the ratio of the shadow price of an item in domestic price units to its domestic producer price. Any CF not equal to 1.0 implies a divergence between the shadow price and the domestic producer price. In general for traded goods CFs tend to be above 1.0, implying that domestic producer prices are controlled below world levels. This is particularly the case for Crude Oil which has the highest of any of the CFs. For non-traded activities, where shadow prices are based on costs of production in domestic price units, in general CFs tend to be below 1.0, implying that costs in economic terms are below the price received by producers. This is due to taxes, surplus profits and underemployment. The exceptions are electricity and rail transport where capacity constraints are assumed, and shadow prices are significantly above the actual prices received by producers.

The results suggest a shadow exchange for foreign exchange of somewhere between 14% to 26% above the official exchange rate in 1987. Given the data available at this point it is difficult to do more than indicate this as the likely magnitude of the premium on foreign exchange.

The general recommendation for results of this type of study is that they are general background information for analysts examining particular projects. Rather than having to estimate their own discount rate, premium on foreign exchange or CFs for major non-traded activities analysts can use those from a national study. However important outputs and inputs, and labour, should normally be valued on a project-by-project basis.

If more detailed project information is not available the CFs from this study can be used for traded sectors to revalue both outputs and inputs, since traded activities are valued solely at their world prices. For non-traded sectors, however, CFs can be used only for inputs, since these activities are valued at their costs of production. Non-traded outputs produced by projects must be valued by the project analyst based on the demand price-willingness to pay approach. The CFs estimated here will not be relevant. The exceptions to this are Electricity and Rail Transport, since their CFs are based on willingness to pay, and can therefore be applied to value output from projects in these sectors.

2.4 Discount Rate

As an approximate indicator of the returns to capital data on the financial operating performance of state owned enterprises were examined. These data give

- output value
- wages
- material inputs
- working capital
- capital assets

for enterprises in Agriculture, Industry, Construction, and Transport. In addition more disaggregated figures by industrial branch are available for more recent years. The data are at current prices, and capital assets are at historical book values rather than at replacement costs. Since no information is available on the age of capital assets it was not possible to convert assets from historical to replacement values. However all data were adjusted to constant price using 1987 as the base year. The all-Chinese retail price index was the only general series available, so that it was not possible to allow for differential rates of inflation for different costs, or outputs. Table 10 gives the constant 1987 price figures for the financial data on state-owned enterprises in industry.

From an examination of the data it appears that capital assets in Agriculture and Construction are seriously underestimated relative to output value, giving extremely high financial returns on assets (often well over 100%). Also since Transport enterprises are subject to severe price controls that should cause a further serious distortion of their financial profitability only the position of industrial enterprises is examined in detail.

Table 10 gives net surplus to total assets at market prices. The results show a clear trend towards falling returns on assets at market prices, reaching around 14% by the mid-1980's. Figures are also given for incremental returns, defined as the change in net surplus over the change in capital assets for the same year. No systematic trend emerges from these incremental figures on an annual basis.

Table 10 Financial Position of Industrial State-Owned Enterprises. 1978-87 (1987 prices, ¥100 million)

	Fixed Capital	Working Capital	Net Surplus	Net Surplus/ Total Capital[a)]	Incremental Net Surplus/Incremental Total Capital
1978	5169.4	1525.8	1151.9	0.172	
1979	5502.8	1584.3	1234.9	0.174	0.212
1980	5586.5	1530.8	1222.7	0.172	-0.404
1981	5913.9	1536.1	1218.7	0.163	-0.012
1982	6278.6	1591.1	1255.4	0.159	0.087
1983	6741.2	1643.4	1314.2	0.157	0.114
1984	7145.8	1682.5	1426.6	0.162	0.253
1985	7525.9	1846.0	1517.1	0.162	0.166
1986	8040.6	2094.7	1439.3	0.142	-0.102
1987	8531.0	2215.0	1514.1	0.141	0.122
Average				0.160	

a) Net surplus = Profit before tax
Total Capital = Fixed and Working

Source: Data supplied by RI

Table 11 Economic Returns on Capital Industrial State-owned Enterprises (1987 Shadow Prices ¥ 100 million)

	Fixed Capital	Working Capital	Net Surplus	Net Surplus/ Total Capital	Incremental Net Surplus/Incremental Total Capital
1978	3877.1	1480.0	1117.3	0.208	
1979	4127.1	1536.8	1197.9	0.211	0.263
1980	4189.9	1484.9	1186.0	0.208	-1.092
1981	4435.4	1490.0	1182.1	0.199	-0.016
1982	4708.9	1543.4	1217.7	0.195	0.109
1983	5055.9	1594.1	1274.8	0.192	0.144
1984	5359.4	1632.0	1383.8	0.198	0.319
1985	5644.4	1790.6	1471.6	0.198	0.198
1986	6030.5	2030.5	1396.1	0.173	-0.120
1987	6398.3	2148.6	1468.7	0.172	0.149
Average				0.195	

The results in table 10 are averages. However, evidence on marginal returns in industry are given in the China Statistical Yearbook, which shows return on capital for different industrial branches. Whilst the average is around 20% in 1986 the least profitable branches are coal with negative profits, non-ferrous metal mining at 9% and coking gas at 8%. If we exclude unprofitable activities returns in the latter two branches give an indication of marginal returns at market prices of 8% to 10%.

The data from table 10 are adjusted by CFs from the main analysis to give returns at shadow prices.

Case 1b is used as the most likely case, and the following CFs are taken from the analysis of case 1b.

- Manufacturing CF
- Construction CF
- Equipment CF.

The Manufacturing CF is calculated from the data generated by the SIO model. It is defined as the weighted average of the CFs for Manufacturing sectors in the table (sectors 13 to 53), with their output value used as a weight. The resulting CF for Manufacturing is 0.97.

In adjusting the data from table 10 the following procedures are applied.

- Net Surplus is adjusted by the Manufacturing CF
- Working Capital is adjusted by the Manufacturing CF.
- Fixed Assets is adjusted by a Capital CF.

The Capital CF is estimated as a weighted average of the CFs for Construction and Equipment. Detailed information on fixed assets are not available, however data on total government fixed investment for 1987 by the RI suggest that Construction is approximately 60%. If one assumes that for Manufacturing equipment makes up the remaining 40%, this gives weights of 0.60 and 0.40 for Construction and Equipment respectively. The Capital CF is therefore 0.75.

Applying these CFs to the data from table 10 gives new estimates of net surplus/capital, in table 11.

The figures in table 11 show higher returns at shadow than at market prices, because capital assets are reduced by more than net surplus. However the adjustments to shadow prices are crude, particularly the use of the average CF for Manufacturing, since strictly where Non-traded sectors are part of Manufacturing this CF should be applied only to inputs not to outputs. Furthermore the initial valuation of fixed capital assets at historical prices will create an upward bias in the estimates of returns to capital.

As a partial means of overcoming this latter problem one can look at total changes in net surplus and capital over the period. Changes in capital - that is net investment - will be valued at current replacement costs, so that historical valuation will not be a problem. Table 12 shows changes in, or incremental values for, net surplus and total capital at both market and shadow prices. On an annual basis there is no clear relationship, but a simple approach is to compare total incremental net surplus over the period with total incremental capital. At market prices this gives an average return on new capital of 9% and at shadow prices of 11%. These results suggest that the earlier estimate by the RI of a 10% economic discount rate still remains valid.

As an alternative approach one can also look at the cost of borrowing on the assumption that the investment budget can be expanded by drawing on additional savings. For the purpose of this calculation foreign borrowing is taken as the source of additional savings. Normally commercial borrowing is taken as the marginal source of foreign funds, since lower cost forms of borrowing will be used first before use is made of loans on commercial terms. Data supplied by the RI staff suggest that commercial loans to China are currently at interest rates of around 13% - 14%. For a discount rate estimate using this approach it is future commercial interest rates for foreign borrowing that will be relevant, but the calculation here assumes that the current rates will prevail in the future.

Table 12 Incremental Net Surplus and Incremental Total Capital (¥ 100 million)

	Market Prices			Shadow Prices		
	Incremental Capital		Incremental Net Surplus	Incremental Capital		Incremental Net Surplus
	Fixed	Working		Fixed	Working	
1979	333.4	58.5	83.0	250.0	56.8	80.6
1980	83.7	-53.5	-12.2	62.8	-51.9	-11.9
1981	327.4	5.3	-4.0	245.5	5.1	-3.9
1982	364.7	5.3	36.7	273.5	53.4	35.6
1983	462.6	52.3	58.8	347.0	50.7	57.1
1984	404.6	39.1	112.4	303.5	37.9	109.0
1985	380.1	163.5	90.5	285.0	158.6	87.8
1986	514.7	248.7	-77.8	386.1	241.3	-75.5
1987	490.4	120.3	74.8	367.8	116.7	72.6
Total	3361.6	639.5	362.2	2521.2	668.6	351.4

$$\frac{362.2}{(3361.4 + 639.5)} = 0.09 \qquad \frac{351.4}{(2521.2 + 668.6)} = 0.11$$

Also nominal interest rates must be deflated for inflation. For foreign loans to be repaid in foreign exchange the relevant price deflators will be for international prices - strictly the prices of the borrowing country's imports and exports. This is because higher export and import prices mean that a given foreign exchange loan repayment is worth less in terms of goods that must be sacrificed to make the repayment. For this calculation it is assumed that for any additional foreign borrowing China repays the loans by importing less than it would otherwise; therefore the cost of repaying the foreign loans is imports that are foregone. If this is the case the relevant price deflator will be a price index for Chinese imports.

This is estimated by identifying the main trading partners and taking the import price index as a weighted average of the price increases for exports of these countries with their share in Chinese trade as weights. China's four main trading partners are Hong Kong, Japan, U.S.A. and West Germany. The rise in their import prices and their relative share in trade is shown in table 13. On average the rise in import prices over 1980-87 is around 2% per year. If this is assumed to hold for the future it can be used as the price deflator.

A nominal interest rate on commercial borrowing of 13% - 14% is deflated by a price deflator of 2% following the formula

$$\left(\frac{1 + i}{1 + P} - 1\right)\%, \ .$$

where i is the nominal interest rate

and P is the deflator.

This gives a real interest charge of 10.7% to 11.8%, or approximately 11% to 12%.

This alternative approach to the discount rate is again crude since it projects current interest charges and past inflation rates into the future. However it also gives an estimate of the discount rate which is close to 10%.

Table 13 Export Price Indices Trading Partners

	Price Index 1987[a] (1980 = 100)	Weight[b]
Hong Kong	107.2	0.44
Japan	124.9	0.32
U.S.A.	115.3	0.15
West Germany	115.1	0.09
Weighted Average	1.147	1.00

a) For Japan, USA and West Germany indices are Export Unit Value indices from IMF International Financial Statistics. For Hong Kong export price index is calculated using the consumer price index adjusted for devaluation of the Hong Kong dollar in relation to the U.S. dollar.

b) Weights are the share of each country in the total trade of China with these four countries.

2.5 Further Modifications

The present exercise should be seen as a first attempt to derive NEP estimates using a SIO model. The data clearly need further refinement to develop more accurate results. Several areas for improvement can be noted.

(1) The accuracy of the classification of sectors into traded and non-traded needs to be checked.

(2) The direct import content of sectors, which is not available from the national input-output table, needs to be estimated.

(3) The accuracy of the capital charge figures needs to be checked by obtaining realistic current price capital stock figures for productive sectors.

(4) The labour situation needs to be examined in detail to distinguish both between different categories of labour and to derive more accurate shadow wages figures.

(5) The domestic producer price figures for different sectors are averages of controlled and free-market prices. If these figures are not accurate, or if the relative size of sales at controlled and free market prices shifts, this can have important implications for CFs, particularly for traded sectors. The questions of the aggregate weighted average producer price for each sector should be looked into.

It is important to note that SIO methodology whilst rigorous and consistent will produce results that are no better than the data on which they are based. Poor or inaccurate data will clearly give inaccurate CF estimates.

2.6 Use of Domestic Resource Cost Ratio to Estimate Shadow Price of Foreign Exchange

As explained in report 1 one approach to the Shadow Price of Foreign Exchange is to define this as a weighted average of the Domestic Resource Cost (DRC) ratio for sectors that supply foreign exchange through exports or save foreign exchange through import substitutes.

Therefore

$$P^F \text{ (SER/OER)} = \sum_i a_i . DRC_i$$

where P^F is the shadow price of foreign exchange

SER and OER are the shadow and official exchange rates, respectively,

DRC_i is the Domestic Resource Cost ratio of activity i

a_i is the share of i in the expansion of foreign exchange.

Further, DRC_i can be defined as

$$DRC_i = \frac{(L_i + K_i + N_i)}{(F_i \times OER)}$$

where L_i, K_i and N_i are the labour, capital and non-traded inputs required per unit of i, valued at shadow prices,

F_i is the net foreign exchange value per unit of i (foreign exchange value of output minus foreign exchange value of traded inputs per unit of i).

This estimate is partial whenever the shadow prices for the L, K and N inputs into i are estimated independently of the shadow price of foreign exchange.

For this exercise as an alternative treatment for the premium on foreign exchange an attempt was made to estimate DRC ratios for all traded sectors in the economy. This involves specifying the data on traded sectors in a different way from that used in the SIO analysis. Now instead of treating traded sectors as being composed of only transfers and foreign exchange, these sectors are decomposed in the same way as non-traded sectors in the SIO model.

Since the DRC estimate is based on domestic costs of production the total inputs into traded activities must be estimated. For the DRC calculations new A and F matrices are required with all inputs from other productive sectors into traded sectors shown in the A matrix and primary inputs shown in the F matrix. For example, for sector 1 Rice, instead of showing only Foreign Exchange and Transfers, inputs into Rice from all 62 productive sectors are shown, as well as direct primary inputs. These productive inputs come from the national input output data with amendments as discussed in this report. A print out of the new A and F matrices for the DRC estimates is given in the Appendix.

To estimate DRC ratios requires estimation of the total - direct plus indirect - primary inputs into each traded sector. This is found by inversion of the Leontief inverse of the extended A matrix that has this new treatment of traded sectors, and its multiplication by the new F matrix, so that

$$M = F^1.(1 - A^1)^{-1}$$

where M is the total primary input matrix (7 - 65)

F^1 is the new F matrix (7 - 65)

A^1 is the new A matrix (65 x 65) for the DRC exercise.

A printout of total primary inputs for traded sectors using the assumption of Case 2 of the main model relating to the capital charge is shown for illustration.

Each sector's domestic producer price (DPP) is decomposed into primary inputs. Foreign exchange is always shown as zero, since no direct imports are identified in the model. To calculate the DRC ratio as defined above requires that the net foreign exchange generated by each sector (F_i x OER) be estimated. Since there are no direct foreign exchange costs by assumption, F_i can be found simply by applying the appropriate price ratio for the traded sector given in table 3 above. This will convert the producer price to an equivalent value in foreign exchange.

Items L_i, K_i and N_i in the formula are represented here by Labour costs, Capital charge and the three non-traded inputs Electricity, Railways and Others. To find the DRC each of these inputs must be converted to shadow prices by the appropriate CF.

Table 14 Illustration of DRC Calculation (Rice Sector 1)

	Market Prices	CF	Shadow Prices
Foreign Exchange	0.0000	-	-
Transfers	0.0684	0	-
Labour	0.3086	0.50	0.1543
Capital Charge	0.5785	1.00	0.5785
Electricity	0.0244	3.00	0.0732
Railways	0.0052	2.50	0.0130
Others	0.0149	1.00	0.0149
DPP	1.0000	1.69	1.6900

$$L_i = 0.1543$$
$$K_i = 0.5785$$
$$N_i = (0.0732 + 0.0130 + 0.0149)$$
$$F_i \times OER = 1.6900$$

$$DRC_i = \frac{(0.1543 + 0.5785 + 0.1011)}{1.6900} = 0.49$$

The procedure is illustrated for sector 1 Rice, in table 14. The price ratio for Rice from table 3 is 1.69, implying that its foreign exchange value is 69% above the domestic producer price. For illustration a CF of 0.50 is used for Labour, 1.00 for Capital charge and Others, and 3.00 and 2.50 for Electricity and Railways, respectively. As noted earlier, theoretically all parameters should be estimated simultaneously, however these CFs for primary inputs are applied without adjusting for any premium

Case 2

Domestic Resource Cost - Total Primary Inputs

CHINA APRs

SEMI INPUT OUTPUT TABLE: CHINA

DRC RATIOS	CASE 3	1	2	3	6	7	9	11	12	15	21	24	26
FORE EXCHG	F	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TRANSFERS	T	0.060418	0.080940	0.070963	0.084521	0.038499	0.024394	-0.245480	-1.914630	0.252006	0.247399	0.140016	0.254154
LABOUR	L	0.300630	0.344871	0.348752	0.383463	0.335945	0.203174	0.398346	1.510660	0.136049	0.189637	0.255617	0.194870
CAP CHARG	C	0.570542	0.504745	0.543627	0.476171	0.574099	0.755462	0.832575	1.352208	0.495069	0.387098	0.427621	0.389681
ELECTRICITY	E	0.024397	0.033160	0.018892	0.020075	0.016276	0.002012	0.007445	0.004345	0.075154	0.110396	0.076432	0.089288
RAILWAYS	R	0.005106	0.007469	0.005749	0.004669	0.003126	0.001589	0.003387	0.001763	0.021189	0.033133	0.088639	0.042530
OTHERS	O	0.014904	0.020813	0.012015	0.031099	0.032051	0.013367	0.003731	0.045658	0.020530	0.032334	0.011673	0.029474
SPPs		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

	31	32	35	36	41	42	44	45	46	49	52
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	0.165841	0.238620	0.288160	0.250720	0.221827	0.206342	0.152580	0.241463	0.192745	0.225501	-0.026560
	0.238159	0.209518	0.198421	0.228057	0.254816	0.304778	0.472534	0.273873	0.405692	0.337002	0.369720
	0.386821	0.384840	0.403322	0.392361	0.406199	0.401379	0.287811	0.411431	0.319812	0.386344	0.523638
	0.152700	0.121647	0.054512	0.060504	0.066035	0.045202	0.025951	0.036739	0.041275	0.017836	0.056764
	0.027477	0.024735	0.029257	0.048577	0.016680	0.011462	0.037639	0.011772	0.006554	0.016835	0.051010
	0.028999	0.020629	0.025432	0.019778	0.034441	0.030834	0.023082	0.024718	0.031919	0.016835	0.025428
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

on foreign exchange. In this approach therefore the final result for P^F, based on a weighted average of DRC ratios, will be an approximation. In this case the result for Rice of 0.49 implies that the Rice sector is an efficient generator of foreign exchange. The final weighted average DRC ratio for all sectors gives the shadow price of foreign exchange.

Although this approach was tested in this study it was not found to give meaningful results, since the premium on foreign exchange was found to be negative, that is a weighted average DRC ratio of below 1.0; there are two major problems with the data used in this calculation which may explain this result. First, no direct imports are identified in the national input output table. This means that F_i x OER is simply DPP multiplied by the relevant price ratio from table 3. Direct imports will reduce the foreign exchange value of any sector, and thus lower the denominator of the DRC ratio. Second, are the problems with the price ratios in table 3. For most sectors they are based on controlled prices for DPP. However the national input-output data is based on average prices, so that the total output of a sector is valued at an average of free market and controlled prices. Unit costs in the input-output table must total to the average price per sector. If the controlled price is significantly below the average a sector which appears efficient in relation to world prices, on the basis of price ratios in table 3, may not be efficient if world prices are compared with average prices.

For example, if the controlled price is 100, the free market prices is 150, and the weighted average price is 120, total inputs per unit of output in the national table will equal 120. However if the world price at the OER is 110, the price ratio comparing this with the controlled price will be 1.10, when what is actually required is a price ratio of 0.92 (110/120). Conversion of DPP by 1.10 to estimate the foreign exchange value of output will be misleading since a conversion factor of 0.92 should be used. Foreign exchange value will be overestimated, and the DRC ratio therefore will be underestimated, by this use of a higher conversion factor.

Further work using revised price data could check the DRC ratios for traded sectors, and thus derive an alternative estimate of the shadow price of foreign exchange.

A P P E N D I X

Case 1b

CHSDR2 DP

SEMI INPUT OUTPUT TABLE CHINA

A MATRIX		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
1	S1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008405	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	S2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3a	S3	0.000000	0.000000	0.000000	0.0[illegible]8924	0.003232	0.000000	0.000000	0.012403	0.000000	0.094541	0.000000	0.000000	0.001034	0.000000	0.000000	0.000000
3b	S4	0.000000	0.000000	0.000000	0.05436[illegible]	0.009146	0.000000	0.000000	0.013781	0.000000	0.105045	0.000000	0.000000	0.001149	0.000000	0.000000	0.000000
4	S5	0.000000	0.000000	0.000000	0.000000	0.119159	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000003	0.000000	0.000002
5	S6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000
6a	S7	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005584	0.000000	0.000043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6b	S8	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.061433	0.000000	0.000474	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7	S9	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000026	0.000000	0.000000
8-10	S10	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.189076	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
12	S11	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
13	S12	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
14	S13	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001179	0.000000	0.000000	0.199936	0.000000	0.000000	0.000000
15	S14	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.060853	0.000000	0.002011
16a	S15	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.009042
16b	S16	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002260
17	S17	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002226	0.000000	0.000000	0.000000	0.006282	0.000000	0.015313
19	S18	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000013	0.000000	0.000000	0.000000	0.025045	0.000000	0.003645
20-23	S19	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005500	0.000000	0.000229	0.000000	0.000000	0.000000	0.016675	0.000000	0.010756
24-25	S20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002087	0.000000	0.002327
26	S21	0.000000	0.000000	0.000000	0.079351	0.032080	0.000000	0.000000	0.041135	0.000000	0.004159	0.000000	0.000000	0.010443	0.000000	0.000000	0.000000
27	S22	0.000000	0.000000	0.000000	0.000000	[illegible]	0.000000	0.000000	0.000000	0.000000	0.003567	0.000000	0.000000	0.000000	0.030017	0.000000	0.016931
28	S23	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
29	S24	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000130	0.000000	0.000006
30	S25	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000366	0.000000	0.000695
31a	S26	0.000000	0.000000	0.000000	0.000090	0.000035	0.000000	0.000000	0.000047	0.000000	0.000018	0.000000	0.000000	0.000030	0.000511	0.000000	0.000660
31b	S27	0.000000	0.000000	0.000000	0.008941	0.003546	0.000000	0.000000	0.004655	0.000000	0.001852	0.000000	0.000000	0.003059	0.050641	0.000000	0.065369
32	S28	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000321	0.000000	0.000236
33	S29	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000154	0.000000	0.000152
34	S30	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000716	0.000000	0.000226
35	S31	0.000000	0.000000	0.000000	0.000060	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000597	0.000000	0.001315
36	S32	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000723	0.000000	0.002301
37	S33	0.000000	0.000000	0.000000	0.006476	0.003404	0.000000	0.000000	0.002252	0.000000	0.000369	0.000000	0.000000	0.002398	0.000000	0.000000	0.000000
3839&40&41	S34	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.065760	0.000000	0.145440
39a	S35	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000106	0.000000	0.000507
40a	S36	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000215	0.000000	0.001046
42	S37	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000563	0.000000	0.004486
43-44	S38	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
45	S39	0.000000	0.000000	0.000000	0.000000	[illegible]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
46	S40	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014317	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
47	S41	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000740	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
48	S42	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005638	0.000000	0.000733
49	S43	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001166	0.000000	0.000051
50	S44	0.000000	0.000000	0.000000	[illegible]	0.000000	0.000000	0.000000	0.000000	0.000000	0.001228	0.000000	0.000000	0.000000	0.000164	0.000000	0.000011
51	S45	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006160	0.000000	0.007035
52	S46	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
53	S47	0.000000	0.000000	0.000000	0.000000	0.0000[illegible]	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
54	S48	0.000000	0.000000	0.000000	0.013083	0.008249	0.000000	0.000000	0.000000	0.000000	0.005753	0.000000	0.000000	0.000000	0.004412	0.000000	0.003937
55a	S49	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000005	0.000000	0.000000
55b	S50	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000033	0.000000	0.000000
56	S51	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CKSEK2 DP

S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34
0.000000	0.000000	0.000000	0.000000	0.000000	0.022742	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000082	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000091	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000040	0.000008	0.000038	0.000041	0.000000	0.027514	0.088887	0.000000	0.000000	0.000000	0.000010	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000240	0.000000	0.000000	0.000443	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.128272	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.070063	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005396
0.000000	0.362710	0.010734	0.000354	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000028	0.021331	0.057907	0.027554	0.000000	0.008753	0.005580	0.000000	0.009853	0.000000	0.007387	0.018490	0.351331	0.010234	0.000000	0.000000	0.005448	0.006790
0.307821	0.000528	0.000777	0.003185	0.000000	0.003189	0.000665	0.000000	0.000035	0.000000	0.000730	0.002841	0.000000	0.003129	0.000000	0.000000	0.000221	0.000846
0.076955	0.000132	0.000194	0.000796	0.000000	0.000797	0.000166	0.000000	0.000008	0.000000	0.000182	0.000710	0.000006	0.000782	0.000000	0.000000	0.000055	0.000210
0.003936	0.032377	0.027259	0.023049	0.000000	0.023822	0.029616	0.000000	0.006455	0.000000	0.018938	0.026286	0.017021	0.008314	0.000000	0.000000	0.008325	0.012947
0.000441	0.158062	0.003666	0.014100	0.000000	0.027509	0.006108	0.000000	0.001746	0.000000	0.001726	0.002498	0.000391	0.00176[illegible]	0.000000	0.000000	0.001210	0.003699
0.001881	0.005672	0.070621	0.013532	0.000000	0.002221	0.000377	0.000000	0.004327	0.000000	0.009203	0.051230	0.000671	0.015072	0.000000	0.000000	0.001770	0.003977
0.003459	0.003848	0.012835	0.102524	0.000000	0.029781	0.094876	0.000000	0.013081	0.000000	0.005576	0.001025	0.017908	0.018711	0.000000	0.000000	0.001478	0.002195
0.000000	0.001809	0.000011	0.001433	0.000000	0.001829	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001449	0.000000	0.000000	0.000000	0.000000
0.013220	0.052336	0.026674	0.028054	0.000000	0.179117	0.031253	0.000000	0.010093	0.000000	0.007403	0.007186	0.002222	0.002573	0.000000	0.000000	0.058695	0.048997
0.000000	0.000172	0.003857	0.003055	0.000000	0.007355	0.184911	0.000000	0.000000	0.000000	0.000045	0.000099	0.000000	0.000000	0.000000	0.000000	0.000137	0.000397
0.000000	0.000000	0.000721	0.002457	0.000000	0.000129	0.000001	0.000000	0.139076	0.000000	0.033698	0.003479	0.000000	0.122060	0.000000	0.000000	0.000036	0.000238
0.000037	0.000431	0.003085	0.000134	0.000000	0.000017	0.000005	0.000000	0.003233	0.000000	0.096180	0.000332	0.000712	0.033707	0.000000	0.000000	0.013994	0.013604
0.000148	0.000146	0.000369	0.000110	0.000000	0.000075	0.000022	0.000000	0.000129	0.000000	0.001559	0.000295	0.000157	0.002540	0.000000	0.000000	0.001623	0.001335
0.014746	0.014548	0.036640	0.010910	0.000000	0.007488	0.002190	0.000000	0.012848	0.000000	0.154432	0.029238	0.015632	0.025216	0.000000	0.000000	0.160752	0.132192
0.000179	0.000062	0.004649	0.000356	0.000000	0.000077	0.000020	0.000000	0.002731	0.000000	0.011802	0.114460	0.000194	0.005375	0.000000	0.000000	0.001064	0.001992
0.000198	0.000280	0.000713	0.012794	0.000000	0.007563	0.001826	0.000000	0.064887	0.000000	[illegible]	0.018922	0.002905	0.033171	0.000000	0.000000	0.002487	0.000954
0.000000	0.000000	0.000376	0.000016	0.000000	0.000038	0.000004	0.000000	0.000000	0.000000	0.013338	0.000000	0.000038	0.018848	0.000000	0.000000	0.002801	0.003667
0.000311	0.001435	0.002355	0.007410	0.000000	0.007287	0.004457	0.000000	0.004232	0.000000	0.017654	0.007990	0.001421	0.150176	0.000000	0.000000	0.013111	0.024000
0.000376	0.000312	0.002117	0.000741	0.000000	0.001935	0.004891	0.000000	0.000380	0.000000	0.003800	0.000254	0.001156	0.009724	0.000000	0.000000	0.012466	0.027780
0.000000	0.005228	0.002072	0.000019	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.225426	0.004287
0.049334	0.061298	0.030169	0.002268	0.000000	0.004614	0.000010	0.000000	0.008147	0.000000	0.095022	0.061492	0.127506	0.002115	0.000000	0.000000	0.152451	0.211423
0.000000	0.000555	0.000179	0.000012	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000049	0.000940
0.000182	0.000083	0.000982	0.000084	0.000000	0.000018	0.000000	0.000000	0.000040	0.000000	0.002531	0.000000	0.000000	0.000000	0.000000	0.000000	0.006923	0.006189
0.000000	0.001297	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010728	0.000000	0.001658	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000661
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010548
0.000000	0.000322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000264	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000049	0.000008	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000014
0.014482	0.000290	0.001094	0.001892	0.000000	0.075766	0.000075	0.000000	0.025596	0.000000	0.003516	0.000326	0.004952	0.000790	0.000000	0.000000	0.000108	0.000736
0.000662	0.000154	0.003118	0.004558	0.000000	0.000247	0.007562	0.000000	0.000000	0.000000	0.000005	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000330
0.002466	0.000007	0.000635	0.000000	0.000000	0.000060	0.000001	0.000000	0.000000	0.000000	0.000024	0.000000	0.000006	0.000000	0.000000	0.000000	0.000533	0.000601
0.001927	0.000312	0.000932	0.000000	0.000000	0.000843	0.000000	0.000000	0.012629	0.000000	0.001972	0.000000	0.000019	0.000000	0.000000	0.000000	0.000000	0.007838
0.000000	0.000073	0.000006	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000003	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000111
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006965	0.013292	0.009535	0.023261	0.000000	0.029774	0.008330	0.000000	0.001220	0.000000	0.000000	0.007247	0.004946	0.000000	0.000000	0.000000	0.017977	0.003382
0.000001	0.000079	0.001631	0.000015	0.000000	0.000001	0.000130	0.000000	0.000000	0.000000	0.000005	0.000000	0.000005	0.000000	0.000000	0.000000	0.000003	0.000007
0.000011	0.000476	0.009790	0.000093	0.000000	0.000011	0.000781	0.000000	0.000000	0.000000	0.000031	0.000000	0.000033	0.00006[illegible]	0.000000	0.000000	0.000022	0.000046
0.000000	0.000000	0.000000	0.212082	0.000000	0.018717	0.063021	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CHSDR2 DP

S35	S36	S37	S38	S39	S40	S41	S42	S43	S44	S45	S46	S47	S48	S49	S50	S51	S52
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007586	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.028566	0.104998	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005524	0.091712	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.01051[illegible]	0.016365	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011682	0.018183	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000012	0.000000	0.000000	0.000000	0.000034	0.000387	0.000000	0.000909	0.001365	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008711	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.095826	0.000008	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.298980	0.000000	0.000000	0.000000	0.000000	0.015671	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005873	0.194260	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005318	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.005044	0.002124	0.009084	0.000609	0.000000	0.000000	0.005330	0.000000	0.000000	0.000000	0.001473	0.004154	0.000000	0.006052	0.007900	0.000000
0.000000	0.000000	0.000409	0.000385	0.000246	0.000000	0.000000	0.000000	0.000533	0.000000	0.000000	0.000000	0.000000	0.000609	0.000000	0.000549	0.000250	0.000000
0.000000	0.000000	0.000102	0.000096	0.000061	0.000000	0.000000	0.000000	0.000133	0.000000	0.000000	0.000000	0.000000	0.000152	0.000000	0.000137	0.000062	0.000000
0.000000	0.000000	0.001462	0.006236	0.013703	0.006347	0.000000	0.000000	0.002237	0.000000	0.000000	0.000000	0.001539	0.007188	0.000000	0.002517	0.001977	0.000000
0.000000	0.000000	0.000901	0.002734	0.037189	0.003738	0.000000	0.000000	0.000322	0.000000	0.000000	0.000000	0.005947	0.012081	0.000000	0.00030[illegible]	0.000102	0.000000
0.000000	0.000000	0.000365	0.005168	0.018264	0.000916	0.000000	0.000000	0.000429	0.000000	0.000000	0.000000	0.000382	0.005013	0.000000	0.001140	0.001260	0.000000
0.000000	0.000000	0.000341	0.014816	0.006401	0.003248	0.000000	0.000000	0.001511	0.000000	0.000000	0.000000	0.004239	0.013569	0.000000	0.001942	0.009244	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000904	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.040676	0.036272	0.030978	0.013896	0.000000	0.000000	0.023954	0.000000	0.000000	0.000000	0.064034	0.007690	0.000000	0.001105	0.001591	0.000000
0.000000	0.000000	0.000000	0.000000	0.000038	0.000008	0.000000	0.000000	0.000278	0.000000	0.000000	0.000000	0.000000	0.004194	0.000000	0.000447	0.001669	0.000000
0.000000	0.000000	0.000000	0.000000	0.000130	0.000027	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000901	0.000008	0.002743	0.000600	0.000000	0.000000	0.000031	0.000000	0.000000	0.000000	0.007820	0.001594	0.000000	0.000026	0.000000	0.000000
0.000000	0.000000	0.000276	0.000118	0.001945	0.001051	0.000000	0.000000	0.000016	0.000000	0.000000	0.000000	0.000424	0.000422	0.000000	0.000029	0.000024	0.000000
0.000000	0.000000	0.027385	0.011715	0.192589	0.104092	0.000000	0.000000	0.001591	0.000000	0.000000	0.000000	0.042045	0.041806	0.000000	0.002882	0.002453	0.000000
0.000000	0.000000	0.000000	0.000393	0.001722	0.000280	0.000000	0.000000	0.000015	0.000000	0.000000	0.000000	0.000043	0.000702	0.000000	0.000069	0.000000	0.000000
0.000000	0.000000	0.000024	0.001218	0.004932	0.000111	0.000000	0.000000	0.000038	0.000000	0.000000	0.000000	0.000646	0.000502	0.000000	0.000306	0.001100	0.000000
0.000000	0.000000	0.000000	0.000332	0.002972	0.000350	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000663	0.000009	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.065828	0.028577	0.005979	0.004642	0.000000	0.000000	0.000029	0.000000	0.000000	0.000000	0.015788	0.000120	0.000000	0.003223	0.000588	0.000000
0.000000	0.000000	0.034413	0.056154	0.017414	0.008491	0.000000	0.000000	0.000060	0.000000	0.000000	0.000000	0.008990	0.022359	0.000000	0.000257	0.000127	0.000000
0.000000	0.000000	0.000000	0.000000	0.000758	0.025480	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.156272	0.048194	0.102404	0.303260	0.000000	0.000000	0.025858	0.000000	0.000000	0.000000	0.067549	0.029649	0.000000	0.017009	0.002633	0.000000
0.000000	0.000000	0.000000	0.000016	0.000015	0.000513	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.012403	0.000000	0.006437	0.001485	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004036	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.004386	0.000000	0.041163	0.007092	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.332017	0.339256	0.007263	0.008032	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007517	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.070996	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.201184	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000002	0.000000	0.000000	0.000000	0.000000	0.127718	0.000000	0.000000	0.000000	0.000000	0.000033	0.000000	0.000000	0.000002	0.000000
0.000000	0.000000	0.000194	0.000256	0.000517	0.000258	0.000000	0.000000	0.041844	0.000000	0.000000	0.000000	0.000007	0.107194	0.000000	0.003412	0.000034	0.000000
0.000000	0.000000	0.000000	0.000002	0.000355	0.000022	0.000000	0.000000	0.012921	0.000000	0.000000	0.000000	0.000000	0.024070	0.000000	0.001578	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000061	0.000000	0.000000	0.016955	0.000000	0.000000	0.000000	0.000000	0.006206	0.000000	0.002188	0.002323	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008125	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000021	0.000006	0.000013	0.000000	0.000000	0.000186	0.000000	0.000000	0.000000	0.000007	0.008544	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.001746	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.219145	0.007484	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.003777	0.053305	0.030365	0.001296	0.000000	0.000000	0.002431	0.000000	0.000000	0.000000	0.106662	0.117848	0.000000	0.022386	0.045740	0.000000
0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000000	0.011396	0.006451	0.000000
0.000000	0.000000	0.000000	0.000025	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000006	0.000010	0.000000	0.068377	0.038710	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.120220	0.166577	0.000000

CHSEN2 DP

S53	S54	S55	S56	S57	S58	S59	S60	S61	S62	S63 ACF	S64 AGCF	S65 CCF
0.006387	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.024166	0.011584	0.036248	0.133700	0.093483
0.012459	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.023940	0.012328	0.021276	0.078500	0.038160
0.011196	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007711	0.002163	0.014733	0.054300	0.017399
0.012440	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008567	0.002403	0.016370	0.060400	0.020359
0.000190	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007852	0.001814	0.009330	0.034400	0.028032
0.000812	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000720	0.000776	0.028500	0.000000
0.001188	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000366	0.000775	0.002800	0.003086
0.013074	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004033	0.008527	0.315700	0.007377
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000927	0.004099	0.015100	0.000000
0.012145	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.043231	0.031864	0.070121	0.256600	0.186535
0.000000	0.010767	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001993	0.007300	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014624	0.000000	0.000000	0.002913	0.010700	0.000000
0.036666	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004714	0.000000	0.000000
0.005272	0.000787	0.003591	0.002059	0.013431	0.010608	0.001999	0.000822	0.008074	0.001649	0.013167	0.000000	0.000000
0.000727	0.000000	0.000000	0.000000	0.016138	0.000000	0.000000	0.000000	0.000000	0.000000	0.011946	0.000000	0.000000
0.000181	0.000000	0.000000	0.000000	0.004034	0.000000	0.000000	0.000000	0.000000	0.003356	0.002987	0.000000	0.000000
0.003998	0.088061	0.212259	0.242976	0.027872	0.046792	0.231307	0.003570	0.000000	0.001180	0.017541	0.000000	0.000000
0.000394	0.000000	0.000000	0.001614	0.005167	0.096997	0.000000	0.027951	0.000000	0.000799	0.008176	0.000000	0.000000
0.000983	0.002441	0.058272	0.003306	0.007037	0.760721	0.005680	0.174043	0.000000	0.003049	0.035226	0.000000	0.000000
0.026647	0.000000	0.000000	0.000000	0.024887	0.000000	0.000000	0.002515	0.000000	0.001119	0.007698	0.000000	0.000000
0.001344	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012546	0.008977	0.000000	0.000000
0.039420	0.000000	0.051604	0.001466	0.007829	0.058809	0.027190	0.008376	0.000000	0.002643	0.022517	0.000000	0.000000
0.003702	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002081	0.000000	0.003955	0.005126	0.000000	0.011505
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001183	0.000000	0.000000
0.000008	0.003837	0.000000	0.000000	0.002188	0.000000	0.000000	0.001769	0.000000	0.000117	0.009728	0.000000	0.000000
0.000042	0.000000	0.000042	0.000126	0.000067	0.001087	0.000042	0.001485	0.000000	0.000030	0.000361	0.000000	0.000000
0.004256	0.000000	0.004183	0.012506	0.006730	0.107648	0.004256	0.147100	0.000000	0.002934	0.035743	0.000000	0.000000
0.000063	0.000000	0.000000	0.000000	0.000064	0.000000	0.000000	0.000000	0.000000	0.000000	0.001025	0.000000	0.000000
0.000051	0.000000	0.000000	0.000000	0.000280	0.000000	0.000000	0.000000	0.000000	0.000000	0.002025	0.000000	0.000000
0.000143	0.000000	0.000000	0.000000	0.000010	0.000000	0.000000	0.000000	0.000000	0.000000	0.002128	0.000000	0.000000
0.000382	0.000000	0.000000	0.000000	0.008237	0.000000	0.000000	0.000000	0.000000	0.002471	0.002970	0.000000	0.000000
0.000698	0.000000	0.000394	0.000000	0.007581	0.000000	0.000000	0.000000	0.000000	0.000419	0.014259	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000009	0.000000	0.000000	0.000000	0.000000	0.000000	0.009819	0.000000	0.000000
0.000014	0.000000	0.144203	0.000000	0.001289	0.000000	0.103579	0.095766	0.000000	0.000061	0.085897	0.000000	0.000000
0.000000	0.000000	0.002126	0.000000	0.000000	0.000000	0.001577	0.000278	0.000000	0.000064	0.000254	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000978	0.000000	0.000026	0.001523	0.000000	0.000000
0.000000	0.000000	0.000000	0.002847	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000675	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003275	0.017683	0.000000	0.000000
0.000000	0.015748	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002117	0.000000	0.000000
0.000000	0.178715	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001924	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006652	0.000000	0.000000
0.012624	0.000000	0.000000	0.000000	0.006749	0.000000	0.000000	0.009578	0.000000	0.006162	0.038661	0.000000	0.064808
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001309	0.008452	0.000000	0.022202
0.000020	0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.002140	0.000000	0.000000	0.001761	0.000000	0.001941
0.007312	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005411	0.000000	0.005428	0.014739	0.000000	0.045706
0.000061	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001973	0.008668	0.000000	0.031351
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.019027	0.014713	0.000000	0.039753
0.114893	0.000000	0.017269	0.000000	0.022755	0.000000	0.000000	0.023632	0.000000	0.086173	0.056517	0.000000	0.147251
0.005995	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002139	0.004374	0.000000	0.011655
0.035973	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012837	0.026242	0.000000	0.077046
0.000000	0.000000	0.000000	0.150201	0.000000	0.000000	0.000000	0.023324	0.019118	0.010424	0.045003	0.000000	0.101875

CHSEN2 DP

57	S52	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001388	0.000000	0.000457
58	S53	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008942	0.000000	0.000000	0.000000	0.000000	0.000000	[illegible]
60	S54	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000201
61	S55	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001729	0.000000	0.014515
62	S56	0.000000	0.000900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
63	S57	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002751	0.000000	0.005804
64	S58	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
65	S59	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
66	S60	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011726	0.000000	0.000000
67	S61	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
68-72	S62	0.000000	0.000000	0.000000	0.045034	0.022843	0.000000	0.000000	0.024090	0.000000	0.032540	0.000000	0.000000	0.027983	0.012407	0.000000	0.022215
ACF	S63	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
AGCF	S64	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CCF	S65	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

F MATRIX

FORE EXCHG	F1	1.692700	0.836900	1.009000	0.000000	0.000000	1.090100	1.684300	0.000000	1.501500	0.000000	0.579300	0.972100	0.000000	0.000000	3.815200	0.000000
TRANSFERS	F2	-0.692700	0.163100	-0.009000	0.030300	0.025000	-0.090100	-0.684300	0.017700	-0.501500	0.007700	0.420700	0.027900	0.019100	-0.031400	-2.815200	0.361300
LABOUR	F3	0.000000	0.000000	0.000000	0.678800	0.688900	0.000000	0.000000	0.751300	0.000000	0.473100	0.000000	0.000000	0.363100	0.365300	0.000000	0.050400
CAP CHARG	F4	0.000000	0.000000	0.000000	0.023100	0.029600	0.000000	0.000000	0.024300	0.000000	0.028300	0.000000	0.000000	0.337200	0.281700	0.000000	0.179700
ELECTRICITY	F5	0.000000	0.000000	0.000000	0.005700	0.035800	0.000000	0.000000	0.008800	0.000000	0.007000	0.000000	0.000000	0.003200	0.044800	0.000000	0.054500
RAILWAYS	F6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.016900	0.000000	0.009700
OTHERS	F7	0.000000	0.000000	0.000000	0.005841	0.019007	0.000000	0.000000	0.027020	0.000000	0.009184	0.000000	0.000000	0.031368	0.013329	0.000000	0.010715
TOTAL		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

T MATRIX

FORE EXCHG	T1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TRANSFERS	T2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
LABOUR	T3	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CAP CHARG	T4	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
ELECTRICITY	T5	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
RAILWAYS	T6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
OTHERS	T7	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CNSEN2 DP

0.000438	0.015913	0.066299	0.002204	0.000000	0.005002	0.010408	0.000000	0.000337	0.000000	0.000000	0.000000	0.000061	0.000000	0.000000	0.000000	0.000041	0.002491
0.000000	0.000000	0.000000	0.000236	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001992	0.002066	0.004219	0.004771	0.000000	0.001628	0.000619	0.000000	0.003576	0.000000	0.000514	0.000000	0.003112	0.000280	0.000000	0.000000	0.000579	0.000512
0.001198	0.027037	0.017158	0.005651	0.000000	0.002878	0.003479	0.000000	0.002439	0.000000	0.002504	0.006488	0.000003	0.018861	0.000000	0.000000	0.003082	0.009021
0.001648	0.000000	0.000000	0.000000	0.000000	0.000111	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000582
0.000000	0.000956	0.001743	0.003071	0.000000	0.004971	0.002222	0.000000	0.025534	0.000000	0.003158	0.000000	0.003388	0.000000	0.000000	0.000000	0.000000	0.001554
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018996	0.053264	0.037148	0.000102	0.000000	0.017352	0.023532	0.000000	0.065964	0.000000	0.023782	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008112
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	1.165200	0.000000	0.000000	1.457300	0.000000	1.890700	0.000000	0.000000	0.000000	0.000000	1.045800	0.813200	0.000000	0.000000
0.374700	-0.308501	0.192000	0.176500	-0.165200	0.230500	0.169200	-0.457300	-0.053200	-0.890700	0.192900	0.289500	0.160200	0.143900	-0.045800	0.186800	0.057800	0.270500
0.011300	0.247000	0.132700	0.081900	0.000000	0.045400	0.046400	0.000000	0.115100	0.000000	0.066100	0.123500	0.052200	0.060800	0.000000	0.000000	0.075500	0.120400
0.050700	0.149700	0.127400	0.133800	0.000000	0.069400	0.055700	0.000000	0.242100	0.000000	0.139700	0.130400	0.105200	0.101900	0.000000	0.000000	0.124100	0.000000
0.013000	0.016300	0.048300	0.075400	0.000000	0.044500	0.006200	0.000000	0.026200	0.000000	0.050400	0.032300	[illegible]	0.149600	0.000000	0.000000	0.019500	0.012900
0.014700	0.015400	0.031400	0.014300	0.000000	0.007400	0.016200	0.000000	0.138100	0.000000	0.008000	0.020900	0.079000	0.027000	0.000000	0.000000	0.019900	0.015900
0.011622	0.041200	0.015603	0.004904	0.000000	0.015890	0.002003	0.000000	0.022376	0.000000	0.013204	0.042512	0.031510	0.031910	0.000000	0.000000	0.010331	0.012305

1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CHSDX2 DP

0.000000	0.000000	0.000097	0.006052	0.000161	0.000005	0.000000	0.000000	0.000524	0.000000	0.000000	0.000000	0.000460	0.039302	0.000000	0.013073	0.008521	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015960	0.000000
0.000000	0.000000	0.000000	0.000032	0.000000	0.005159	0.000000	0.000000	0.000033	0.000000	0.000000	0.000000	0.000570	0.001018	0.000000	0.003358	0.000307	0.000000
0.000000	0.000000	0.003338	0.000189	0.002296	0.001145	0.000000	0.000000	0.000605	0.000000	0.000000	0.000000	0.002821	0.003196	0.000000	0.004386	0.002237	0.000000
0.000000	0.000000	0.015037	0.000687	0.001731	0.001785	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000186	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005057	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000552	0.003625	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.012496	0.000000	0.026490	0.000000	0.000000	0.031387	0.000000	0.000000	0.000000	0.006673	0.035821	0.000000	0.041055	-0.001694	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.520500	0.775200	0.000000	0.000000	0.000000	0.000000	1.422400	1.386600	0.000000	0.997100	1.015100	1.264200	0.000000	0.000000	0.452300	0.000000	0.000000	0.708300
0.479500	0.224800	0.108400	0.286500	0.068900	-0.117000	-0.422400	-0.386600	0.237900	0.002900	-0.015100	-0.264200	0.357700	0.165700	0.547700	0.378200	0.125100	0.291700
0.000000	0.000000	0.042700	0.056700	0.117000	0.100700	0.000000	0.000000	0.063300	0.000000	0.000000	0.000000	0.048000	0.096100	0.000000	0.106400	0.068100	0.000000
0.000000	0.000000	0.093500	0.000000	0.156700	0.247100	0.000000	0.000000	0.074300	0.000000	0.000000	0.000000	0.000000	0.083300	0.000000	0.000000	0.048900	0.000000
0.000000	0.000000	0.005200	0.019400	0.019700	0.009800	0.000000	0.000000	0.006500	0.000000	0.000000	0.000000	0.010100	0.006800	0.000000	0.004900	0.004200	0.000000
0.000000	0.000000	0.011400	0.001700	0.023400	0.013600	0.000000	0.000000	0.004800	0.000000	0.000000	0.000000	0.006000	0.005300	0.000000	0.009200	0.004900	0.000000
0.000000	0.000000	0.033152	0.008817	0.003443	0.012368	0.000000	0.000000	0.004594	0.000000	0.000000	0.000000	0.008679	0.009185	0.000000	0.004620	0.006236	0.000000

1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CHSDN2 DP

0.000958	0.000000	0.000000	0.000000	0.005366	0.000000	0.000000	0.000000	0.000000	0.002511	0.011990	0.000000	0.000000
0.202152	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911	0.017399	0.010836	0.000000	0.025278
0.000293	0.003508	0.000000	0.000000	0.000341	0.000000	0.000000	0.006629	0.000000	0.016610	0.003938	0.000000	0.000000
0.001603	0.000485	0.002109	0.000000	0.013106	0.000000	0.000000	0.000000	0.009456	0.028133	0.007136	0.000000	0.000000
0.001120	0.000000	0.000000	0.008457	0.000140	0.000000	0.000000	0.000000	0.000000	0.000000	0.002187	0.000000	0.000000
0.005429	0.001546	0.004084	0.000000	0.009224	0.000000	0.000000	0.001256	0.016464	0.000000	0.004191	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002050	0.000000	0.007697
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001867	0.000000	0.000000	0.003689	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.063083	0.000000	0.000000	0.124511	0.000000	0.000000
0.000000	0.000000	0.000000	0.094475	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004868	0.000000	0.017501
0.069667	0.007236	0.013545	0.000769	0.040762	0.002916	0.011715	0.013309	0.008090	0.000061	0.051838	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.193100	0.076000	0.087500	0.063500	0.055200	-0.528278	-0.007600	0.005400	0.038300	0.021600	0.000000	0.000000	0.000000
0.048600	0.148700	0.198100	0.045100	0.246000	0.419300	0.338900	0.204300	0.571400	0.275100	0.000000	0.000000	0.000000
0.077500	0.449300	0.191400	0.344700	0.325300	0.000000	0.224800	0.104700	0.191900	0.324200	0.000000	0.000000	0.000000
0.009500	0.001000	0.000700	0.005300	0.122000	0.007900	0.038200	0.012700	0.009000	0.003300	0.019004	0.000000	0.000000
0.009700	0.002900	0.000300	0.000000	0.007000	0.000000	0.000000	0.020900	0.000000	0.029000	0.013430	0.000000	0.000000
0.006418	0.008969	0.008319	0.020598	0.013212	0.015500	0.018355	0.020413	0.011820	0.028719	0.000000	0.000000	0.000000

1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.141431
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.500000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	3.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	2.500000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000

Case 1c

CNSEB3 DP

SEMI INPUT OUTPUT TABLE: CHINA

A MATRIX		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
1	S1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008405	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	S2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3a	S3	0.000000	0.000000	0.000000	0.048924	0.003232	0.000000	0.000000	0.012403	0.000000	0.094541	0.000000	0.000000	0.001034	0.000000	0.000000	0.000000
3b	S4	0.000000	0.000000	0.000000	0.054360	0.009146	0.000000	0.000000	0.013781	0.000000	0.105045	0.000000	0.000000	0.031149	0.000000	0.000000	0.000000
4	S5	0.000000	0.000000	0.000000	0.000000	0.119159	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000003	0.000000	0.000002
5	S6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000
6a	S7	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005584	0.000000	0.000043	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6b	S8	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.061433	0.000000	0.000474	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7	S9	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000026	0.000000	0.000000
8-10	S10	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.189076	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
12	S11	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
13	S12	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
14	S13	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001179	0.000000	0.000000	0.199936	0.000000	0.000000	0.000000
15	S14	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000020	0.000000	0.060853	0.000000	0.002011
16a	S15	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.009042
16b	S16	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002260
17	S17	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002226	0.000000	0.000000	0.000000	[illegible]	0.000000	0.015313
19	S18	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000013	0.000000	0.000000	0.000000	0.025045	0.000000	0.003645
20-23	S19	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005500	0.000000	0.000229	0.000000	0.000000	0.000000	0.016675	0.000000	0.010756
24-25	S20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002007	0.000000	0.002327
26	S21	0.000000	0.000000	0.000000	0.079351	0.032080	0.000000	0.000000	0.041135	0.000000	0.004159	0.000000	0.000000	0.010443	0.000000	0.000000	0.000000
27	S22	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003567	0.000000	0.000000	0.000000	0.030017	0.000000	0.016931
28	S23	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
29	S24	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000130	0.000000	0.000006
30	S25	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000366	0.000000	0.000695
31a	S26	0.000000	0.000000	0.000000	0.000090	0.000035	0.000000	0.000000	0.000047	0.000000	0.000018	0.000000	0.000000	0.000030	0.000511	0.000000	0.000660
31b	S27	0.000000	0.000000	0.000000	0.008941	0.003546	0.000000	0.000000	0.004655	0.000000	0.001052	0.000000	0.000000	0.003059	0.050641	0.000000	0.065369
32	S28	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000321	0.000000	0.000236
33	S29	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000154	0.000000	0.000152
34	S30	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000716	0.000000	0.000226
35	S31	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000597	0.000000	0.001315
36	S32	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000723	0.000000	0.002301
37	S33	0.000000	0.000000	0.000000	0.006476	0.003404	0.000000	0.000000	0.002252	0.000000	0.000369	0.000000	0.000000	0.002398	0.000000	0.000000	0.009000
38,39b,40b,41	S34	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.065760	0.000000	0.145440
39a	S35	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000106	0.000000	0.000507
40a	S36	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.070215	0.000000	0.001046
42	S37	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000543	0.000000	0.004486
43-44	S38	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
45	S39	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
46	S40	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014317	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
47	S41	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000740	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
48	S42	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005638	0.000000	0.000733
49	S43	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001166	0.000000	0.000051
50	S44	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001228	0.000000	0.000000	0.000000	0.000164	0.000000	0.000011
51	S45	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006160	0.000000	0.001035
52	S46	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
53	S47	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
54	S48	0.000000	0.000000	0.000000	0.013083	0.008248	0.000000	0.000000	0.000000	0.000000	0.005753	0.000000	0.000000	0.000000	0.004412	0.000000	0.003937
55a	S49	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000005	0.000000	0.000000
55b	S50	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000033	0.000000	0.000000
56	S51	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
57	S52	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001388	0.000000	0.000457
58	S53	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008942	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

JHSD13 0P

S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34
0.000000	0.000000	0.000000	0.000000	0.000000	0.022742	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000082	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000091	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000040	0.000000	0.000038	0.000041	0.000000	0.027514	0.000007	0.000000	0.000000	0.000000	0.000010	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000240	0.000000	0.000000	0.000443	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.128272	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.070063	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005396
0.000000	0.362710	0.010734	0.000354	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000028	0.021331	0.057907	0.027554	0.000000	0.008753	0.005580	0.000000	0.009853	0.000000	0.007387	0.018490	0.351331	0.010214	0.000000	0.000000	0.005448	0.006790
0.307821	0.000528	0.000777	0.003185	0.000000	0.003189	0.000665	0.000000	0.000035	0.000000	0.000730	0.002841	0.000000	0.003129	0.000000	0.000000	0.000221	0.000840
0.076955	0.000132	0.000194	0.000796	0.000000	0.000797	0.000166	0.000000	0.000008	0.000000	0.000182	0.000710	0.000000	0.000782	0.000000	0.000000	0.000055	0.000210
0.003936	0.032377	0.027259	0.023049	0.000000	0.023822	0.029616	0.000000	0.006455	0.000000	0.018938	0.026286	0.017931	0.000314	0.000000	0.000000	0.000325	0.012947
0.000441	0.150062	0.003666	0.014100	0.000000	0.022509	0.006108	0.000000	0.001746	0.000000	0.001726	0.002490	0.000391	0.001763	0.000000	0.000000	0.001210	0.003699
0.001001	0.005672	0.070621	0.013532	0.000000	0.002221	0.000377	0.000000	0.004327	0.000000	0.009203	0.051230	0.000671	0.015073	0.000000	0.000000	0.001770	0.003977
0.003459	0.003040	0.012035	0.102524	0.000000	0.029781	0.094076	0.000000	0.013001	0.000000	0.005576	0.001025	0.017900	0.010711	0.000000	0.000000	0.001470	0.002195
0.000000	0.001009	0.000011	0.001433	0.000000	0.001029	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001449	0.000000	0.000000	0.000000	0.000000
0.013220	0.052336	0.026674	0.028054	0.000000	0.179117	0.031253	0.000000	0.010093	0.000000	0.007403	0.007186	0.002222	0.002573	0.000000	0.000000	0.050695	0.040997
0.000000	0.000172	0.003057	0.003055	0.000000	0.007355	0.184911	0.000000	0.000000	0.000000	0.000045	0.000099	0.000000	0.000000	0.000000	0.000000	0.000137	0.000397
0.000000	0.000000	0.000721	0.002457	0.000000	0.000129	0.000001	0.000000	0.139076	0.000000	0.033690	0.003479	0.000000	0.122060	0.000000	0.000000	0.000036	0.000238
0.000037	0.000431	0.003005	0.000134	0.000000	0.000017	0.000005	0.000000	0.003233	0.000000	0.096180	0.000332	0.000712	0.033707	0.000000	0.000000	0.013994	0.013604
0.000148	0.000146	0.000369	0.000110	0.000000	0.000075	0.000022	0.000000	0.000129	0.000000	0.001559	0.000295	0.000157	0.002540	0.000000	0.000000	0.001623	0.001335
0.014746	0.014548	0.036640	0.010910	0.000000	0.007480	0.002190	0.000000	0.012848	0.000000	0.154432	0.029230	0.015632	0.025216	0.000000	0.000000	0.160752	0.132192
0.000179	0.000062	0.004649	0.000356	0.000000	0.000077	0.000020	0.000000	0.002731	0.000000	0.011002	0.114460	0.000194	0.005375	0.000000	0.000000	0.001064	0.001992
0.200198	0.000200	0.000713	0.012794	0.000000	0.007563	0.001826	0.000000	0.064007	0.000000	0.011300	0.010922	0.002905	0.033171	0.000000	0.000000	0.002487	0.000954
0.000000	0.000000	0.000376	0.000016	0.000000	0.000038	0.000004	0.000000	0.000000	0.000000	0.013338	0.000000	0.000038	0.010848	0.000000	0.000000	0.002801	0.003667
0.000311	0.001435	0.002355	0.007410	0.000000	0.007207	0.004457	0.000000	0.004232	0.000000	0.017654	0.007990	0.001421	0.150176	0.000000	0.000000	0.013111	0.024000
0.000376	0.000312	0.002117	0.000741	0.000000	0.001935	0.004091	0.000000	0.000380	0.000000	0.003800	0.000254	0.001156	0.009724	0.000000	0.000000	0.012466	0.027780
0.000000	0.005220	0.002072	0.000019	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.225426	0.004207
0.049334	0.061290	0.030169	0.002260	0.000000	0.004614	0.000010	0.000000	0.000147	0.000000	0.095022	0.061492	0.127506	0.002115	0.000000	0.000000	0.152451	0.211423
0.000000	0.000555	0.000179	0.000012	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000049	0.000940
0.000182	0.000083	0.000982	0.000084	0.000000	0.000018	0.000000	0.000000	0.000040	0.000000	0.002531	0.000000	0.000000	0.000000	0.000000	0.000000	0.006923	0.006109
0.000000	0.001297	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010720	0.000000	0.001650	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000661
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010540
0.000000	0.000322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000264	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000049	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000014
0.014482	0.000290	0.001094	0.001092	0.000000	0.075766	0.000075	0.000000	0.025596	0.000000	0.003516	0.000326	0.004952	0.000790	0.000000	0.000000	0.000108	0.000736
0.000662	0.000154	0.003110	0.004558	0.000000	0.000247	0.007562	0.000000	0.000000	0.000000	0.000005	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000330
0.002466	0.000007	0.000635	0.000000	0.000000	0.000060	0.000001	0.000000	0.000000	0.000000	0.000024	0.000000	0.000006	0.000000	0.000000	0.000000	0.000533	0.000901
0.001827	0.000312	0.000932	0.000000	0.000000	0.000043	0.000000	0.000000	0.012629	0.000000	0.001972	0.000000	0.000019	0.000000	0.000000	0.000000	0.000000	0.007830
0.000000	0.000073	0.000006	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000003	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000111
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006965	0.013292	0.009535	0.023261	0.000000	0.029774	0.008330	0.000000	0.001220	0.000000	0.000000	0.007247	0.004946	0.000000	0.000000	0.000000	0.017977	0.003302
0.000001	0.000079	0.001631	0.000015	0.000000	0.000001	0.000130	0.000000	0.000000	0.000000	0.000005	0.000000	0.000005	0.000000	0.000000	0.000000	0.000003	0.000007
0.000011	0.000476	0.009790	0.000093	0.000000	0.000011	0.000781	0.000000	0.000000	0.000000	0.000031	0.000000	0.000033	0.000000	0.000000	0.000000	0.000022	0.000046
0.000000	0.000000	0.000000	0.212082	0.000000	0.018717	0.063021	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000030	0.000000	0.000000	0.000000

CHSDI) DP

S35	S36	S37	S38	S39	S40	S41	S42	S43	S44	S45	S46	S47	S48	S49	S50	S51	S52
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007586	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.028566	0.104998	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005524	0.091712	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010513	0.016365	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011682	0.010103	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000063	0.000000	0.000000	0.000012	0.000000	0.000000	0.000000	0.000034	0.000307	0.000000	0.000009	0.001365	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008711	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.095826	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.298980	0.000000	0.000000	0.000000	0.000000	0.015671	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005873	0.194260	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005318	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.005044	0.002124	0.009084	0.000609	0.000000	0.000000	0.005330	0.000000	0.000000	0.000000	0.001473	0.004154	0.000000	0.006052	0.003000	0.000000
0.000000	0.000000	0.000409	0.000385	0.000246	0.000000	0.000000	0.000000	0.000533	0.000000	0.000000	0.000000	0.000000	0.000609	0.000000	0.000549	0.000250	0.000000
0.000000	0.000000	0.000102	0.000096	0.000061	[illegible]	0.000000	0.000000	0.000133	0.000000	0.000000	0.000000	0.000000	0.000152	0.000000	0.000137	0.000062	0.000000
0.000000	0.000000	0.001462	0.006236	0.013703	[illegible]	0.000000	0.000000	0.002237	0.000000	0.000000	0.000000	0.001539	0.007180	0.000000	0.002517	0.001977	0.000000
0.000000	0.000000	0.000901	0.002734	0.037189	0.003738	0.000000	0.000000	0.000322	0.000000	0.000000	0.000000	0.005947	0.012081	0.000000	0.000305	0.000102	0.000000
0.000000	0.000000	0.000365	0.005168	0.018264	0.000916	0.000000	0.000000	0.000429	0.000000	0.000000	0.000000	0.000382	0.005013	0.000000	0.001140	0.001260	0.000000
0.000000	0.000000	0.000341	0.014816	0.006401	0.003248	0.000000	0.000000	0.001511	0.000000	0.000000	0.000000	0.004239	0.013569	0.000000	0.001942	0.009244	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000984	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.040676	0.036272	0.030978	0.013896	0.000000	0.000000	0.023954	0.000000	0.000000	0.000000	0.064034	0.097690	0.000000	0.001105	0.001591	0.000000
0.000000	0.000000	0.000000	0.000000	0.000038	0.000008	0.000000	0.000000	0.000278	0.000000	0.000000	0.000000	0.000000	0.004194	0.000000	0.000447	0.001669	0.000000
0.000000	0.000000	0.000000	0.000090	0.000130	0.000027	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000901	[illegible]	0.002743	0.000600	0.000000	0.000000	0.000031	0.000000	0.000000	0.000000	0.007820	0.001594	0.000000	0.000026	0.000000	0.000000
0.000000	0.000000	0.000276	0.000110	0.001945	0.001051	0.000000	0.000000	0.000016	0.000000	0.000000	0.000000	0.000424	0.000422	0.000000	0.000029	0.000024	0.000000
0.000000	0.000000	0.027385	0.011715	0.192589	0.104092	0.000000	0.000000	0.001591	0.000000	0.000000	0.000000	0.042045	0.041806	0.000000	0.002802	0.002453	0.000000
0.000000	0.000000	0.000000	0.000393	0.001722	0.000280	0.000000	0.000000	0.000015	0.000000	0.000000	0.000000	0.000043	0.000703	0.000000	0.000069	0.000000	0.000000
0.000000	0.000000	0.000024	0.001210	0.004932	0.000111	0.000000	0.000000	0.000038	0.000000	0.000000	0.000000	0.000646	0.000502	0.000000	0.000306	0.001100	0.000000
0.000000	0.000000	0.000000	0.000332	0.002972	0.009350	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000663	0.000009	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.065828	0.028577	0.005979	0.004642	0.000000	0.000000	0.000029	0.000000	0.000000	0.000000	0.015780	0.009120	0.000000	0.003223	0.000580	0.000000
0.000000	0.000000	0.034413	0.056154	0.017414	0.008491	0.000000	0.000000	0.000060	0.000000	0.000000	0.000000	0.008990	0.022359	0.000000	0.000257	0.000127	0.000000
0.000000	0.000000	0.000000	0.000000	0.000758	0.025480	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.156272	0.048194	0.102404	0.303260	0.000000	0.000000	0.025850	0.000000	0.000000	0.000000	0.067549	0.029649	0.000000	0.017009	0.002633	0.000000
0.000000	0.000000	0.000000	0.000016	0.000015	0.000513	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.012403	0.000000	0.006437	0.001485	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004036	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.004386	0.000000	0.041163	0.007092	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.332017	0.339256	0.007263	0.008032	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007517	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.070996	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.201184	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000002	0.000000	0.000000	0.000000	0.000000	0.127718	0.000000	0.000000	0.000000	0.000000	0.000033	0.000000	0.000000	0.000002	0.000060
0.000000	0.000000	0.000194	0.000256	0.000517	0.000258	0.000000	0.000000	0.041844	0.000000	0.000000	0.000000	0.000307	0.107194	0.000000	0.003412	0.000034	0.000000
0.000000	0.000000	0.000000	0.000002	0.000355	0.000022	0.000000	0.000000	0.012921	0.000000	0.000000	0.000000	0.000000	0.024070	0.000000	0.001578	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000061	0.000000	0.000000	0.016955	0.000000	0.000000	0.000000	0.000000	0.006206	0.000000	0.002100	0.002323	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003000	0.000000	0.000000	0.000000	0.000000	0.008125	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000021	0.000006	0.000013	0.000000	0.000000	0.000186	0.000000	0.000000	0.000000	0.000007	0.008544	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.001746	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.219145	0.007484	0.000010	[illegible]	0.000000	0.000000
0.000000	0.000000	0.003777	0.053305	0.030365	0.001296	0.000000	0.000000	0.002431	0.000000	0.000000	0.000000	0.106662	0.117848	0.000000	0.022386	0.045740	0.000000
0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000001	0.000000	0.011396	0.006451	0.000000
0.000000	0.000000	0.000000	0.000025	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000006	0.000010	0.000000	0.068377	0.030710	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.120220	0.166577	0.000000

CKSBIO DP

S53	S54	S55	S56	S57	S58	S59	S60	S61	S62	S63 ACF	S64 AGCF	S65 CCF	Q
0.006387	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.024166	0.011584	0.036248	0.133700	0.093483	
0.012459	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.023940	0.012328	0.021276	0.078500	0.038160	
0.011196	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007711	0.002163	0.014733	0.054300	0.017399	
0.012448	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008567	0.002403	0.016370	0.060400	0.020359	
0.000190	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007852	0.001814	0.009330	0.034400	0.028032	
0.000812	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000720	0.000776	0.028500	0.000000	
0.001188	0.000000	0.000000	0.000900	0.000000	0.000000	0.000000	0.000000	0.000000	0.000366	0.000775	0.002800	0.003086	
0.013074	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004033	0.008527	0.315700	0.007377	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000927	0.004099	0.015100	0.000000	
0.012145	0.000000	0.000000	0.000000	0.000600	0.000000	0.000000	0.000000	0.043231	0.031864	0.070121	0.258600	0.186535	
0.000000	0.010767	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001993	0.007300	0.000000	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014624	0.000000	0.000000	0.002913	0.010700	0.000000	
0.038666	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004714	0.000000	0.000000	
0.005272	0.000787	0.003591	0.002059	0.013431	0.010508	0.001999	0.000822	0.008074	0.001649	0.013167	0.000000	0.000000	
0.000727	0.000000	0.000000	0.000000	0.016138	0.000000	0.000000	0.000000	0.000000	0.000000	0.011946	0.000000	0.000000	
0.000181	0.000000	0.000000	0.000000	0.004034	0.000000	0.000000	0.000000	0.000000	0.003356	0.002987	0.000000	0.000000	
0.003998	0.088061	0.212259	0.242976	0.027872	0.046792	0.231307	0.003570	0.000000	0.001180	0.017541	0.000000	0.000000	
0.000394	0.000000	0.000000	0.001614	0.005167	0.096997	0.000000	0.027951	0.000000	0.000799	0.008176	0.000000	0.000000	
0.000983	0.002441	0.058272	0.003306	0.007037	0.760721	0.005680	0.174043	0.000000	0.003649	0.035226	0.000000	0.000000	
0.026647	0.000000	0.000000	0.000000	0.024887	0.000000	0.000000	0.002515	0.000000	0.001119	0.007698	0.000000	0.000000	
0.001344	0.000000	0.000000	0.000000	0.000000	0.000030	0.000000	0.000000	0.000600	0.012546	0.008977	0.000000	0.000000	
0.039420	0.000000	0.051604	0.001466	0.007829	0.058809	0.027190	0.008376	0.000000	0.002643	0.022517	0.000000	0.000000	
0.003702	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002081	0.000000	0.003955	0.005126	0.000000	0.011505	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001183	0.000000	0.000000	
0.000008	0.003837	0.000000	0.000000	0.002188	0.000000	0.000000	0.001769	0.000000	0.000117	0.009728	0.000000	0.000000	
0.000042	0.000000	0.000042	0.000126	0.000067	0.001087	0.000042	0.001485	0.000000	0.000030	0.000361	0.000000	0.000000	
0.004256	0.000000	0.004183	0.012506	0.006730	0.107648	0.004256	0.147100	0.000000	0.002934	0.035743	0.000000	0.000000	
0.000063	0.000000	0.000000	0.000000	0.000064	0.000000	0.000000	0.000000	0.000000	0.000000	0.001025	0.000000	0.000000	
0.000051	0.000000	0.000000	0.000000	0.000280	0.000000	0.000000	0.000000	0.000000	0.000000	0.002025	0.000000	0.000000	
0.000143	0.000000	0.000000	0.000000	0.000010	0.000000	0.000000	0.000000	0.000000	0.000000	0.002128	0.000000	0.000000	
0.000382	0.000000	0.000000	0.000000	0.008237	0.000000	0.000000	0.000000	0.000000	0.002471	0.002970	0.000000	0.000000	
0.000698	0.000000	0.000394	0.000000	0.007581	0.000000	0.000000	0.000000	0.000000	0.000419	0.014259	0.000000	0.000000	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.009819	0.000000	0.000000	
0.000014	0.000000	0.144203	0.000000	0.001289	0.000000	0.103579	0.095766	0.000000	0.000061	0.085897	0.000000	0.000000	
0.000000	0.000000	0.002126	0.000000	0.000000	0.000000	0.001577	0.000278	0.000000	0.000064	0.000254	0.000000	0.000000	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000978	0.000000	0.000026	0.001[illegible]23	0.000000	0.000000	
0.000000	0.000000	0.000000	0.002847	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000675	0.000000	0.000000	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003275	0.017683	0.000000	0.000000	
0.000000	0.015748	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002117	0.000000	0.000000	
0.000000	0.178715	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001924	0.000000	0.000000	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006652	0.000000	0.000000	
0.012624	0.000000	0.000000	0.000000	0.006749	0.000000	0.000000	0.009578	0.000000	0.006162	0.038661	0.000000	0.064808	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001309	0.008452	0.000000	0.022202	
0.000020	0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.002140	0.000000	0.000000	0.001761	0.000000	0.001941	
0.007312	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005411	0.000000	0.005428	0.014739	0.000000	0.045706	
0.000061	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001973	0.008668	0.000000	0.031351	
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.019027	0.014713	0.000000	0.039753	
0.114893	0.000000	0.017269	0.000000	0.022755	0.000000	0.000000	0.023632	0.000000	0.086173	0.056517	0.000000	0.147251	
0.005995	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002139	0.004374	0.000000	0.011655	
0.035973	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012837	0.026242	0.000000	0.077046	
0.000000	0.000000	0.000000	0.15020[illegible]	0.000000	0.000000	0.000000	0.023324	0.019118	0.010424	0.045003	0.000000	0.101875	

CHSEN3 DP

60	S54	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000201
61	S55	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001729	0.000090	0.014515
62	S56	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
63	S57	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002751	0.000000	0.005804
64	S58	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
65	S59	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
66	S60	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011726	0.000000	0.000000
67	S61	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
68-72	S62	0.000000	0.000000	0.000000	0.045034	0.022843	0.000000	0.000000	0.024090	0.000000	0.032540	0.000000	0.000000	0.027983	0.012407	0.000000	0.022215
ACF	S63	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
AGCF	S64	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CCF	S65	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

F MATRIX

FORE EXCHG	F1	1.692700	0.836900	1.009000	0.000000	0.000000	1.090100	1.684300	0.000000	1.501500	0.000000	0.579300	0.972100	0.000000	0.000000	3.815200	0.000000
TRANSFERS	F2	-0.692700	0.163100	-0.009000	0.030300	0.025000	-0.090100	-0.684300	0.017700	-0.501500	0.007700	0.420700	0.027900	0.019100	-0.031400	-2.815200	0.361300
LABOUR	F3	0.000000	0.000000	0.000000	0.678800	0.688900	0.000000	0.000000	0.751300	0.000000	0.473100	0.000000	0.000000	0.363100	0.365300	0.000000	0.050400
CAP CHARG	F4	0.000000	0.000000	0.000000	0.023100	0.029600	0.000000	0.000000	0.024300	0.000000	0.028300	0.000000	0.000000	0.337200	0.281700	0.000000	0.179700
ELECTRICITY	F5	0.000000	0.000000	0.000000	0.005700	0.035800	0.000000	0.000000	0.008800	0.000000	0.007000	0.000000	0.000000	0.003200	0.044800	0.000000	0.054500
RAILWAYS	F6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.016900	0.000000	0.009700
OTHERS	F7	0.000000	0.000000	0.000000	0.005841	0.019007	0.000000	0.000000	0.027020	0.000000	0.009184	0.000000	0.000000	0.031368	0.013329	0.000000	0.010715
TOTAL		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

T MATRIX

FORE EXCHG	T1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TRANSFERS	T2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
LABOUR	T3	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CAP CHARG	T4	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
ELECTRICITY	T5	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
RAILWAYS	T6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
OTHERS	T7	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CHSEX3 DP

0.000438	0.015913	0.066299	0.002204	0.000000	0.005002	0.010408	0.000000	0.000337	0.000000	0.000000	0.000000	0.000061	0.000000	0.000000	0.000000	0.000041	0.002491
0.000000	0.000000	0.000000	0.000236	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001992	0.002065	0.004219	0.004771	0.000000	0.001628	0.000619	0.000000	0.003576	0.000000	0.000514	0.000000	0.003112	0.000280	0.000000	0.000000	0.000579	0.000512
0.001198	0.027037	0.017158	0.005651	0.000000	0.002878	0.003479	0.000000	0.002439	0.000000	0.002504	0.006488	0.000003	0.018861	0.000000	0.000000	0.003082	0.009021
0.001648	0.000000	0.000000	0.000000	0.000000	0.000111	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000582
0.000000	0.000956	0.001743	0.003071	0.000000	0.004971	0.002222	0.000000	0.025534	0.000000	0.003158	0.000000	0.003388	0.000000	0.000000	0.000000	0.000000	0.001554
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018996	0.053264	0.037148	0.000102	0.000000	0.017352	0.023532	0.000000	0.065964	0.000000	0.023782	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008112
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	1.165200	0.000000	0.000000	1.457300	0.000000	1.890700	0.000000	0.000000	0.000000	0.000000	1.045800	0.813200	0.000000	0.000000
0.374700	-0.308501	0.192000	0.176500	-0.165200	0.230500	0.169200	-0.457300	-0.053200	-0.890700	0.192900	0.289500	0.160200	0.143900	-0.045800	0.186800	0.057800	0.270500
0.011300	0.247000	0.132700	0.081900	0.000000	0.045400	0.046400	0.000000	0.115100	0.000000	0.066100	0.123500	0.052200	0.060800	0.000000	0.000000	0.075500	0.120400
0.050700	0.149700	0.127400	0.133800	0.000000	0.069400	0.055700	0.000000	0.242100	0.000000	0.139700	0.130400	0.105200	0.101900	0.000000	0.000000	0.124100	0.000000
0.013000	0.016300	0.048300	0.075400	0.000000	0.044500	0.006200	0.000000	0.026200	0.000000	0.050400	0.032300	0.016100	0.149600	0.000000	0.000000	0.019500	0.012900
0.014700	0.015400	0.031400	0.014300	0.000000	0.007400	0.016200	0.000000	0.138100	0.000000	0.008000	0.020900	0.079000	0.027000	0.000000	0.000000	0.019900	0.015900
0.011622	0.041200	0.015603	0.004904	0.000000	0.015890	0.002003	0.000000	0.022376	0.000000	0.013204	0.042512	0.031510	0.031910	0.000000	0.000000	0.010331	0.012305
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CHSD13 DP

0.000000	0.000000	0.000097	0.006052	0.000161	0.000005	0.000000	0.000000	0.000524	0.000000	0.000000	0.000000	0.000460	0.039302	0.000000	0.013073	0.008521	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015960	0.000000
0.000000	0.000000	0.000000	0.000032	0.000000	0.005159	0.000000	0.000000	0.000033	0.000000	0.000000	0.000000	0.000570	0.001018	0.000000	0.003358	0.000307	0.000000
0.000000	0.000000	0.003338	0.000189	0.002296	0.001145	0.000000	0.000000	0.000605	0.000000	0.000000	0.000000	0.002821	0.003196	0.000000	0.004386	0.002237	0.000000
0.000000	0.000000	0.015037	0.000687	0.001731	0.001785	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000186	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005057	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000552	0.003625	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	[illegible]	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.012496	0.000000	0.026490	0.000000	0.000000	0.031387	0.000000	0.000000	0.000000	0.006673	0.035821	0.000000	0.041055	-0.001694	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.520500	0.775200	0.000000	0.000000	0.000000	0.000000	1.422400	1.386600	0.000000	0.997100	1.015100	1.264200	0.000000	0.000000	0.452300	0.000000	0.000000	0.708300
0.479500	0.224800	0.108400	0.286500	0.068900	-0.117000	-0.422400	-0.386600	0.237900	0.002900	-0.015100	-0.264200	0.357700	0.165700	0.547700	0.378200	0.125100	0.291700
0.000000	0.000000	0.042700	0.056700	0.117000	0.100700	0.000000	0.000000	0.063300	0.000000	0.000000	0.000000	0.048000	0.096100	0.000000	0.106400	0.068100	0.000000
0.000000	0.000000	0.093500	0.000000	0.156700	0.247100	0.000000	0.000000	0.074300	0.000000	0.000000	0.000000	0.000000	0.083300	0.000000	0.000000	0.048900	0.000000
0.000000	0.000000	0.005200	0.019400	0.019700	0.009800	0.000000	0.000000	0.006500	0.000000	0.000000	0.000000	0.010100	0.006800	0.000000	0.004900	0.004200	0.000000
0.000000	0.000000	0.011400	0.001700	0.023400	0.013600	0.000000	0.000000	0.004800	0.000000	0.000000	0.000000	0.006000	0.005300	0.000000	0.009200	0.004900	0.000000
0.000000	0.000000	0.033152	0.008817	0.003443	0.012368	0.000000	0.000000	0.004594	0.000000	0.000000	0.000000	0.008679	0.009185	0.000000	0.004620	0.006236	0.000000

1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

CHSDN3 DP

0.000958	0.000000	0.000000	0.000000	0.005366	0.000000	0.000000	0.000000	0.000000	0.002511	0.011990	0.000000	0.000000
0.202152	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911	0.017399	0.010836	0.000000	0.025278
0.000293	0.003508	0.000000	0.000000	0.000341	0.000000	0.000000	0.006629	0.000000	0.016610	0.003938	0.000000	0.000000
0.001603	0.000485	0.002109	0.000000	0.013106	0.000000	0.000000	0.000000	0.009456	0.028133	0.007136	0.000000	0.000000
0.001120	0.000000	0.000000	0.008457	0.000140	0.000000	0.000000	0.000000	0.000000	0.000000	0.002187	0.000000	0.000000
0.005429	0.001546	0.004084	0.000000	0.009224	0.000000	0.000000	0.001256	0.016464	0.000000	0.004191	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002050	0.000000	0.007697
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001867	0.000000	0.000000	0.003689	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.063083	0.000000	0.000000	0.124511	0.000000	0.000000
0.000000	0.000000	0.000000	0.094475	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004868	0.000000	0.017501
0.069867	0.007236	0.013545	0.000769	0.040762	0.002916	0.011715	0.013309	0.008090	0.000061	0.051838	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.193100	0.076000	0.087500	0.063500	0.055200	-0.528278	-0.007600	0.005400	0.038300	0.021600	0.000000	0.000000	0.000000
0.048600	0.148700	0.198100	0.045100	0.246000	0.419300	0.338900	0.204300	0.571400	0.275100	0.000000	0.000000	0.000000
0.077500	0.449300	0.191400	0.344700	0.325300	0.000000	0.224800	0.104700	0.191900	0.324200	0.000000	0.000000	0.000000
0.009500	0.001000	0.000700	0.005300	0.122000	0.007900	0.038200	0.012700	0.009000	0.003300	0.019004	0.000000	0.000000
0.009700	0.002900	0.000300	0.000000	0.007000	0.000000	0.000000	0.020900	0.000000	0.029000	0.013430	0.000000	0.000000
0.006418	0.008969	0.008319	0.020598	0.013212	0.015500	0.018355	0.020413	0.011820	0.028719	0.000000	0.000000	0.000000

1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.258810
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.250000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	3.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	2.500000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000

Case 1a

S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
1.458074	0.720897	0.869142	0.967300	1.040511	0.939001	1.450839	0.997124	1.293377	0.986731	0.499003	0.837357	0.981963	1.115068

S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28
3.286375	0.712324	1.330189	1.317875	0.887783	0.944044	1.003691	0.823082	0.814193	1.255303	1.288522	1.628630	0.899755	0.752652

S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39	S40	S41	S42
0.973675	1.187026	0.900841	0.700482	0.902245	0.671365	0.448353	0.667749	0.681157	0.540361	0.919489	1.036873	1.225241	1.194403

S43	S44	S45	S46	S47	S48	S49	S50	S51	S52	S53	S54	S55	S56
0.893456	0.858891	0.874396	1.088969	0.492811	0.796288	0.389606	0.587158	0.842497	0.610122	0.731903	0.959604	0.916888	0.998747

S57	S58	S59	S60	S61	S62	S63	S64	S65
1.206436	1.484210	1.111323	0.976587	0.981093	0.976700	0.999999	1.025865	0.925622

F1	F2	F3	F4	F5	F6	F7
0.86139	0	1.000804	1	2.776868	2.314056	1

CHINA SEMI INPUT OUTPUT DATA FOR DRC APPROACH

A MATRIX		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1	0.087543	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.030100	0.008405	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	2	0.000000	0.135357	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3a	3	0.010835	0.011925	0.048924	0.048924	0.003232	0.007292	0.012403	0.012403	0.011214	0.094541	0.000258	0.000000	0.001034	0.000000	0.000000	0.000000
3b	4	0.012038	0.013250	0.054360	0.054360	0.009146	0.008102	0.013781	0.013781	0.012460	0.105045	0.000387	0.000000	0.001149	0.000000	0.000000	0.000000
4	5	0.000000	0.000000	0.000000	0.000000	0.119159	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000003	0.000002	0.000002
5	6	0.000000	0.000000	0.000000	0.000000	0.000000	0.018747	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000000
6a	7	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005584	0.005584	0.000000	0.000043	0.000000	0.000016	0.000000	0.000000	0.000000	0.000000
6b	8	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.061433	0.061433	0.000000	0.000474	0.000000	0.000176	0.000000	0.000000	0.000000	0.000000
7	9	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.200494	0.000000	0.000000	0.000000	0.000000	0.000026	0.000000	0.000000
8-10	10	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.189076	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
12	11	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.160115	0.000000	0.000000	0.000000	0.000000	0.000000
13	12	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
14	13	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001179	0.000000	0.574342	0.199936	0.000000	0.000000	0.000000
15	14	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001342	0.000000	0.000000	0.060853	0.002011	0.002011
16a	15	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.009042	0.009042
16b	16	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002260	0.002260
17	17	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002226	0.002316	0.000000	0.000000	0.006482	0.015313	0.015313
19	18	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000013	0.000000	0.000000	0.000000	0.025045	0.003645	0.003645
20-23	19	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005500	0.005500	0.000000	0.000229	0.000000	0.000000	0.000000	0.016675	0.010756	0.010756
24-25	20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002087	0.002327	0.002327
26	21	0.086560	0.135035	0.079351	0.079351	0.032080	0.072412	0.041135	0.041135	0.000000	0.004159	0.027025	0.000000	0.010443	0.000000	0.000000	0.000000
27	22	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003567	0.011893	0.000000	0.000000	0.030017	0.016931	0.016931
28	23	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
29	24	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000130	0.000006	0.000006
30	25	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000366	0.000695	0.000695
31a	26	0.000046	0.000076	0.000090	0.000090	0.000035	0.000032	0.000047	0.000047	0.000000	0.000018	0.000000	0.000032	0.000030	0.000511	0.000660	0.000660
31b	27	0.004597	0.007558	0.008941	0.008941	0.003546	0.003189	0.004655	0.004655	0.000000	0.001852	0.000052	0.003169	0.003059	0.050641	0.065369	0.065369
32	28	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005169	0.000000	0.000000	0.000321	0.000236	0.000236
33	29	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000154	0.000152	0.000152
34	30	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000006	0.000000	0.000000	0.000000	0.000716	0.000226	0.000226
35	31	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000597	0.001315	0.001315
36	32	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000723	0.002301	0.002301
37	33	0.006666	0.009258	0.006476	0.006476	0.003404	0.004124	0.002252	0.002252	0.000000	0.000369	0.002456	0.000000	0.002398	0.000000	0.000000	0.000000
3839B40B41	34	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.065760	0.145440	0.145440
39a	35	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000106	0.000507	0.000507
40a	36	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000215	0.001046	0.001046
42	37	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000563	0.004486	0.004486
43-44	38	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
45	39	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
46	40	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014317	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
47	41	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000740	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
48	42	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005638	0.000733	0.000733
49	43	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001166	0.000051	0.000051
50	44	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001228	0.000000	0.000000	0.000000	0.000164	0.000011	0.000011
51	45	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006160	0.001035	0.001035
52	46	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
53	47	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012530	0.000000	0.000000	0.000000	0.000000	0.000000
54	48	0.000000	0.000000	0.013083	0.013083	0.008248	0.038945	0.000000	0.000000	0.000000	0.005753	0.000000	0.000000	0.000000	0.004412	0.003937	0.003937
55a	49	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000005	0.000000	0.000000
55b	50	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000033	0.000000	0.000000
56	51	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
57	52	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001388	0.000457	0.000457

58	53	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008942	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
60	54	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000201	0.000201
61	55	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002967	0.000000	0.001729	0.014515	0.014515
62	56	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
63	57	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002751	0.005804	0.005804
64	58	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
65	59	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
66	60	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011726	0.000000	0.000000
67	61	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
68-72	62	0.032825	0.030640	0.045034	0.045034	0.022843	0.027669	0.024090	0.024090	0.028409	0.032540	0.030706	0.013004	0.027983	0.012407	0.022215	0.022215
ACF	63	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
AGCF	64	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
CCF	65	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.900000	0.000000	0.000000

F MATRIX

FORE EXCHG	1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
TRANSFERS	2	0.032500	0.033300	0.030400	0.030300	0.025000	0.046800	0.017700	0.017700	0.012800	0.007700	-0.231449	-1.937000	0.019100	-0.031400	0.133600	0.3[illegible]1300
LABOUR	3	0.236900	0.242600	0.250000	0.678800	0.688900	0.330400	0.247300	0.751300	0.128600	0.473100	0.309400	1.232400	0.363100	0.365300	0.050400	0.050400
CAP CHARG	4	0.469600	0.357800	0.451900	0.023100	0.029600	0.407800	0.528300	0.024300	0.567000	0.028300	0.667100	1.089500	0.337200	0.281700	0.407400	0.179700
ELECTRICITY	5	0.010900	0.011500	0.005700	0.005700	0.035800	0.008800	0.008800	0.008800	0.000000	0.007000	0.000700	0.000000	0.003200	0.044800	0.054500	0.054500
RAILWAYS	6	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.016900	0.009700	0.009700
OTHERS	7	0.008990	0.011701	0.005741	0.005841	0.019007	0.025688	0.027020	0.027020	0.008923	0.009184	0.000000	0.021394	0.031368	0.013329	0.010715	0.010715
		1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
0.000000	0.000000	0.000000	0.000000	0.000000	0.022742	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000082	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000091	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000040	0.000008	0.000038	0.000041	0.004073	0.027514	0.088887	0.000021	0.000000	0.000010	0.000010	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000240	0.000000	0.000000	0.000443	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.128272	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.070063	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005396
0.000000	0.362710	0.010734	0.000354	0.000000	0.000000	0.000000	0.001145	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000028	0.021331	0.057907	0.027554	0.039486	0.008753	0.005580	0.010612	0.009853	0.007387	0.007387	0.018490	0.351331	0.010234	0.013596	0.004333	0.005448	0.006790
0.307821	0.000528	0.000777	0.003185	0.074208	0.003189	0.000665	0.004009	0.000035	0.000730	0.000730	0.002841	0.000000	0.003129	0.001658	0.000555	0.000221	0.000840
0.076955	0.000132	0.000194	0.000796	0.018552	0.000797	0.000166	0.001002	0.000008	0.000182	0.000182	0.000710	0.000000	0.000782	0.000414	0.000138	0.000055	0.000210
0.003936	0.032377	0.027259	0.023049	0.063251	0.023822	0.029616	0.044616	0.006455	0.018938	0.018938	0.026286	0.017021	0.008314	0.013801	0.005965	0.008325	0.012947
0.000441	0.158062	0.003666	0.014100	0.001870	0.022509	0.006108	0.007318	0.001746	0.001726	0.001726	0.002498	0.000391	0.001763	0.004523	0.001448	0.001210	0.003699
0.001881	0.005672	0.070621	0.013532	0.007814	0.002221	0.000377	0.008522	0.004327	0.009203	0.009203	0.051230	0.000671	0.015072	0.012895	0.003113	0.001770	0.003977
0.003459	0.003848	0.012835	0.102524	0.102588	0.029781	0.094876	0.005785	0.013081	0.005576	0.005576	0.001025	0.017908	0.018711	0.018569	0.008688	0.001478	0.002195
0.000000	0.001809	0.000011	0.001433	0.018989	0.001829	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001449	0.000523	0.000000	0.000000	0.000000
0.013220	0.052336	0.026674	0.028054	0.042311	0.179117	0.031253	0.030420	0.010093	0.007403	0.007403	0.007186	0.002222	0.002573	0.010700	0.002342	0.058695	0.048997
0.000000	0.000172	0.003857	0.003055	0.009621	0.007355	0.184911	0.000000	0.000000	0.000045	0.000045	0.000099	0.000000	0.000000	0.000038	0.000119	0.000137	0.000397
0.000000	0.000000	0.000721	0.002457	0.000009	0.000129	0.000001	0.070205	0.139076	0.033698	0.033698	0.003479	0.000000	0.122060	0.000065	0.000343	0.000036	0.000238
0.000037	0.000431	0.003085	0.000134	0.000156	0.000017	0.000005	0.000845	0.003233	0.096180	0.096180	0.000332	0.001712	0.033707	0.000637	0.000131	0.013994	0.013604
0.000148	0.000146	0.000369	0.000110	0.000177	0.000075	0.000022	0.000288	0.000129	0.001559	0.001559	0.000295	0.000157	0.002540	0.000192	0.000123	0.001623	0.001335
0.014746	0.014548	0.036640	0.010910	0.017588	0.007488	0.002190	0.028540	0.012848	0.154432	0.154432	0.029238	0.015632	0.025216	0.019067	0.012203	0.160752	0.132192
0.000179	0.000062	0.004649	0.000356	0.001338	0.000077	0.000020	0.001750	0.002731	0.011802	0.011802	0.114460	0.000194	0.005375	0.002619	0.000694	0.001064	0.001992
0.000198	0.000280	0.000713	0.012794	0.014737	0.007563	0.001826	0.000000	0.064887	0.011308	0.011308	0.018922	0.002905	0.033171	0.004609	0.005679	0.002487	0.000954
0.000000	0.000000	0.000376	0.000016	0.000164	0.000038	0.000004	0.000000	0.000000	0.013338	0.013338	0.000000	0.000038	0.018848	0.000790	0.000237	0.002801	0.003667
0.000311	0.001435	0.002355	0.007410	0.002413	0.007287	0.004457	0.002061	0.004232	0.017654	0.017654	0.007990	0.001421	0.150176	0.263766	0.513937	0.013111	0.024000
0.000376	0.000312	0.002117	0.000741	0.001114	0.001935	0.004891	0.000436	0.000380	0.003800	0.003800	0.000254	0.001156	0.009724	0.002837	0.011983	0.012466	0.027780
0.000000	0.005228	0.002072	0.000019	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.225426	0.004287
0.049334	0.061298	0.030169	0.002268	0.010892	0.004614	0.000010	0.042501	0.088147	0.095022	0.095022	0.061492	0.127506	0.002115	0.056987	0.064331	0.152451	0.211423
0.000000	0.000555	0.000179	0.000012	0.000009	0.000000	0.000000	0.000318	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000253	0.000054	0.000049	0.000940
0.000182	0.000083	0.000982	0.000084	0.000031	0.000018	0.000000	0.000088	0.000040	0.002531	0.002531	0.000000	0.000000	0.000000	0.000000	0.000000	0.006923	0.006189
0.000000	0.001297	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010728	0.001658	0.001658	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000661
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010548
0.000000	0.000322	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000622	0.000000	0.000000
0.000000	0.000000	0.000000	0.000264	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000049	0.000008	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000014
0.014482	0.000290	0.001094	0.001892	0.000440	0.075766	0.000075	0.000114	0.025596	0.003516	0.003516	0.000326	0.004952	0.000790	0.001714	0.004586	0.000108	0.008736
0.000662	0.000154	0.003118	0.004558	0.000005	0.000247	0.007562	0.000010	0.000000	0.000005	0.000005	0.000000	0.000000	0.000000	0.008405	0.000001	0.000001	0.000330
0.002466	0.000007	0.000635	0.000000	0.000978	0.000060	0.000001	0.003244	0.000000	0.000024	0.000024	0.000000	0.000006	0.000000	0.000304	0.000073	0.000533	0.000001
0.001827	0.000312	0.000932	0.000000	0.000000	0.000843	0.000000	0.007673	0.012629	0.001972	0.001972	0.000000	0.000019	0.000000	0.002156	0.000357	0.000000	0.007838
0.000000	0.000073	0.000066	0.000000	0.000129	0.000000	0.000000	0.000000	0.000000	0.000003	0.000003	0.000000	0.000000	0.000000	0.000000	0.000000	0.000001	0.000111
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.006965	0.013292	0.009535	0.023261	0.055265	0.029774	0.008330	0.001968	0.001220	0.000000	0.000000	0.007247	0.004946	0.000000	0.004192	0.000983	0.017977	0.003382
0.000001	0.000079	0.001631	0.000015	0.000000	0.000001	0.000130	0.000000	0.000000	0.000005	0.000005	0.000000	0.000005	0.000000	0.000009	0.000000	0.000003	0.000007
0.000011	0.000476	0.009790	0.000093	0.000000	0.000011	0.000781	0.000000	0.000000	0.000031	0.000031	0.000000	0.000033	0.000000	0.000058	0.000000	0.000022	0.000046
0.000000	0.000000	0.000000	0.212082	0.000000	0.018717	0.063021	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000438	0.015913	0.066299	0.002204	0.000791	0.005002	0.010408	0.000000	0.000337	0.000000	0.000000	0.000000	0.000061	0.000000	0.000000	0.000917	0.000041	0.002491

0.000000	0.000000	0.000000	0.000236	0.000210	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.001992	0.002066	0.004219	0.004771	0.007606	0.001628	0.000619	0.000000	0.003576	0.000514	0.000514	0.000000	0.003112	0.000280	0.000024	0.001681	0.000579	0.000512
0.001198	0.027037	0.017158	0.005651	0.013354	0.002878	0.003479	0.060743	0.002439	0.002504	0.002504	0.006488	0.000003	0.018861	0.003545	0.000776	0.003082	0.009021
0.001648	0.000000	0.000000	0.000000	0.000510	0.000111	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000500	0.000000	0.000582
0.000000	0.000956	0.001743	0.003071	0.000000	0.004971	0.002222	0.006146	0.025534	0.003158	0.003158	0.000000	0.003388	0.000000	0.000000	0.003178	0.000000	0.001554
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.018996	0.053264	0.037148	0.000102	0.000211	0.017352	0.023532	0.000000	0.065964	0.023782	0.023782	0.000000	0.000000	0.000000	0.000699	0.000000	0.000000	0.008112
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.374700	-0.308501	0.192000	0.176500	0.095600	0.230500	0.169200	0.048200	-0.053200	0.111000	0.192900	0.289500	0.160200	0.143900	0.064300	0.098400	0.057800	0.270500
0.011300	0.247000	0.132700	0.081900	0.065400	0.045400	0.046400	0.163800	0.115100	0.066100	0.066100	0.123500	0.052200	0.060800	0.124000	0.051400	0.075500	0.120400
0.050700	0.149700	0.127400	0.133800	0.214800	0.069400	0.055700	0.313600	0.242100	0.221600	0.139700	0.130400	0.105200	0.101900	0.231600	0.150600	0.124100	0.000000
0.013000	0.016300	0.048300	0.075400	0.074100	0.044500	0.006200	0.055500	0.026200	0.050400	0.050400	0.032300	0.016100	0.149600	0.100400	0.033900	0.019500	0.012900
0.014700	0.015400	0.031400	0.014300	0.019300	0.007400	0.016200	0.075100	0.138100	0.008000	0.008000	0.020900	0.079000	0.027000	0.014000	0.005800	0.019900	0.015900
0.011622	0.041200	0.015603	0.004904	0.019910	0.015890	0.002003	0.003420	0.022376	0.013204	0.013204	0.042512	0.031510	0.031910	0.016055	0.009810	0.010331	0.012305
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.018245	0.007586	0.000000	0.000000	0.000000	0.000000	0.000000	0.028566	0.028566	0.104998	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011736	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005524	0.005524	0.091712	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.010513	0.010513	0.016365	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.011682	0.011682	0.018183	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000042	0.000052	0.000012	0.000185	0.000013	0.000000	0.000034	0.000387	0.000009	0.000009	0.001365	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.055042	0.210935	0.000000	0.026719	0.000250	0.000144	0.000000	0.000004	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003691	0.000553	0.000000	0.030913	0.000000	0.018787	0.000000	0.000000	0.008711	0.008711	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.040607	0.006084	0.000000	0.340046	0.000000	0.206657	0.000000	0.000000	0.095826	0.095826	0.000008	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000978	0.000000	0.298980	0.000000	0.000000	0.008167	0.000000	0.015671	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005873	0.005873	0.194260	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005328	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.600000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.070787
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.003541	0.004083	0.005044	0.002124	0.009084	0.000609	0.017340	0.005282	0.005330	0.005458	0.004231	0.006822	0.001473	0.004154	0.006052	0.006052	0.003800	0.034558
0.000109	0.000475	0.000409	0.000385	0.000246	0.000000	0.021005	0.000063	0.000533	0.000000	0.000000	0.000000	0.000000	0.000609	0.000549	0.000549	0.000250	0.000844
0.000027	0.000118	0.000102	0.000096	0.000061	0.000000	0.005251	0.000015	0.000133	0.000000	0.000000	0.000000	0.000000	0.000152	0.000137	0.000137	0.000062	0.000211
0.013453	0.018710	0.001462	0.006236	0.013703	0.006347	0.004134	0.002091	0.002237	0.006343	0.001764	0.002889	0.001539	0.007188	0.002517	0.002517	0.001977	0.015050
0.002630	0.002149	0.000901	0.002734	0.037189	0.003738	0.006846	0.000218	0.000322	0.000172	0.000279	0.000459	0.005947	0.012081	0.000305	0.000305	0.000102	0.055780
0.003047	0.006966	0.000365	0.005168	0.018264	0.000916	0.001032	0.000487	0.000429	0.001595	0.000324	0.000400	0.000382	0.005013	0.001140	0.001140	0.001260	0.005404
0.000846	0.001663	0.000341	0.014816	0.006401	0.003248	0.036676	0.004580	0.001511	0.003413	0.005915	0.003187	0.004239	0.013569	0.001942	0.001942	0.009244	0.072284
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000904	0.000000	0.000000	0.000000	0.000000
0.122040	0.032811	0.040676	0.036272	0.030978	0.013896	0.313634	0.044472	0.023954	0.023582	0.031974	0.022009	0.064034	0.097690	0.001105	0.001105	0.001591	0.004802
0.000028	0.000111	0.000000	0.000000	0.000038	0.000008	0.000000	0.000039	0.000278	0.000445	0.000193	0.000000	0.000000	0.004194	0.000447	0.000447	0.001669	0.000000
0.000126	0.000155	0.000000	0.000000	0.000130	0.000027	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001480	0.000000	0.000000	0.000000	0.000000
0.004643	0.011039	0.000901	0.000008	0.002743	0.000600	0.000045	0.000015	0.000031	0.000028	0.000004	0.000043	0.007820	0.001594	0.000026	0.000026	0.000000	0.000000
0.001101	0.002125	0.000276	0.000118	0.001945	0.001051	0.000075	0.000017	0.000016	0.000016	0.000038	0.000019	0.000424	0.000422	0.000029	0.000029	0.000024	0.000061
0.109060	0.210407	0.027385	0.011715	0.192589	0.104092	0.007480	0.001773	0.001591	0.001680	0.003775	0.001886	0.042045	0.041806	0.002882	0.002882	0.002453	0.006136
0.001031	0.002164	0.000000	0.000393	0.001722	0.000280	0.000209	0.000014	0.000015	0.000003	0.000016	0.000007	0.000043	0.000702	0.000069	0.000069	0.000000	0.000236
0.000731	0.001180	0.000024	0.001218	0.004932	0.000111	0.000943	0.000055	0.000038	0.000144	0.000111	0.000077	0.000646	0.000502	0.000306	0.000306	0.001100	0.000257
0.002648	0.001313	0.000000	0.000332	0.002972	0.000350	0.000000	0.000000	0.000001	0.000000	0.000000	0.000000	0.000663	0.000009	0.000000	0.000000	0.000000	0.000013
0.013173	0.058243	0.065828	0.028577	0.005979	0.004642	0.000216	0.000012	0.000029	0.000133	0.000042	0.000089	0.015788	0.009120	0.003223	0.003223	0.000588	0.006776
0.015060	0.025423	0.034413	0.056154	0.017414	0.008491	0.000535	0.000086	0.000060	0.000047	0.000102	0.000120	0.008990	0.022359	0.000257	0.000257	0.000127	0.002935
0.009193	0.005084	0.000000	0.000000	0.000758	0.025480	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.287107	0.174063	0.156272	0.048194	0.102404	0.303260	0.000473	0.008295	0.025858	0.000062	0.013510	0.024284	0.067549	0.029649	0.017009	0.017009	0.002633	0.023712
0.003546	0.000059	0.000000	0.000016	0.000015	0.000513	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.003943	0.012403	0.000000	0.006437	0.001485	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004036	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.003666	0.004386	0.000000	0.041163	0.007092	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.002801	0.001077	0.332017	0.339256	0.007263	0.008032	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007517	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.070996	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.201184	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000002	0.000000	0.000000	0.054735	0.114104	0.127718	0.027757	0.082601	0.192194	0.000000	0.000033	0.000000	0.000000	0.000002	0.005511
0.004030	0.000044	0.000194	0.000256	0.000517	0.000258	0.033579	0.207190	0.041844	0.090081	0.354183	0.093963	0.000007	0.107194	0.003412	0.003412	0.000034	0.007157
0.000000	0.003296	0.000000	0.000002	0.000355	0.000022	0.000014	0.000251	0.012921	0.003927	0.067474	0.000018	0.000000	0.024070	0.001578	0.001578	0.000000	0.001585
0.000000	0.000000	0.000000	0.000000	0.000000	0.000061	0.000000	0.007605	0.016955	0.020015	0.000000	0.000000	0.000000	0.006206	0.002188	0.002188	0.002323	0.000000
0.007200	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.087285	0.000000	0.000000	0.008125	0.000000	0.000000	0.000000	0.000000
0.000000	0.000001	0.000000	0.000021	0.000006	0.000013	0.000000	0.000000	0.000186	0.001637	0.001882	0.149689	0.000007	0.008544	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.001746	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.219145	0.007484	0.000000	0.000000	0.000000	0.000000
0.003909	0.007686	0.003777	0.053305	0.030365	0.001296	0.015513	0.003770	0.002431	0.000382	0.000453	0.002010	0.106662	0.117848	0.022386	0.022386	0.045740	0.022146
0.000001	0.000002	0.000000	0.000004	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000008	0.000009	0.000001	0.000001	0.011396	0.011396	0.006451	0.000002
0.000008	0.000012	0.000000	0.000025	0.000000	0.000000	0.000000	0.000000	0.000001	0.000000	0.000052	0.000058	0.000006	0.000010	0.068377	0.068377	0.038710	0.000014
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.120220	0.120220	0.166577	0.000000
0.000219	0.002892	0.000097	0.006052	0.000161	0.000005	0.026707	0.000225	0.000524	0.000458	0.001526	0.000576	0.000460	0.039302	0.013073	0.013073	0.008521	0.119997

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.015960	0.000000
0.000000	0.000000	0.000000	0.000032	0.000000	0.005159	0.023538	0.000690	0.000033	0.000850	0.000001	0.000000	0.000570	0.001018	0.003358	0.003358	0.000307	0.013704
0.003481	0.013442	0.003338	0.000189	0.002296	0.001145	0.000117	0.000918	0.000605	0.005584	0.000871	0.000123	0.002821	0.003196	0.004386	0.004386	0.002237	0.036524
0.000000	0.000623	0.015037	0.000687	0.001731	0.001785	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000186	0.000000	0.000000	0.000000	0.000000
0.001153	0.001202	0.000000	0.000000	0.000000	0.000000	0.005334	0.008589	0.005057	0.000000	0.000000	0.000000	0.000000	0.000000	0.000552	0.000552	0.003625	0.009362
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.012496	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.007193	0.000000	0.000000	0.000000	0.000000	0.026490	0.000000	0.029885	0.031387	0.014076	0.000000	0.006644	0.006673	0.035821	0.041055	0.041055	-0.001694	0.046017
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.055900	0.048000	0.108400	0.286500	0.068900	-0.117000	0.072200	0.090100	0.237900	0.090300	0.086600	0.070500	0.357700	0.165700	0.126600	0.378200	0.125100	0.095500
0.044300	0.089600	0.042700	0.056700	0.117000	0.100700	0.043500	0.079300	0.063300	0.102200	0.088200	0.065100	0.048000	0.096100	0.106400	0.106400	0.068100	0.065000
0.249700	0.225300	0.093500	0.000000	0.156700	0.247100	0.166400	0.113600	0.074300	0.156000	0.152200	0.104600	0.000000	0.083300	0.251600	0.000000	0.048900	0.208000
0.011900	0.012600	0.005200	0.019400	0.019700	0.009800	0.023500	0.016100	0.006500	0.009200	0.005700	0.010100	0.010100	0.006800	0.004900	0.004900	0.004200	0.027900
0.008290	0.026000	0.011400	0.001700	0.023400	0.013600	0.004400	0.002900	0.004800	0.032400	0.002800	0.000200	0.006000	0.005300	0.009200	0.009200	0.004900	0.034900
0.006865	0.002283	0.033152	0.008817	0.003443	0.012368	0.014209	0.009654	0.004594	0.004149	0.005623	0.008170	0.008679	0.009185	0.004620	0.004620	0.006236	0.006835
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

53	54	55	56	57	58	59	60	61	62	63 ACT	64 AOCT	65 CCT
0.006387	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.024166	0.011584	0.036248	0.133700	[illegible]
0.012459	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.023940	0.012328	0.021276	0.078500	0.038160
0.011196	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007711	0.002163	0.014733	0.054300	0.017399
0.012440	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.008567	0.002403	0.016370	0.060400	0.020359
0.000190	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.007852	0.001814	0.009330	0.034400	0.028032
0.000812	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000720	0.000776	0.028500	0.000000
0.001188	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000366	0.000775	0.002800	0.003086
0.013074	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004033	0.008527	0.315700	0.007377
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000927	0.004099	0.015100	0.000000
0.012145	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.043231	0.031864	0.070121	0.258600	0.186535
0.000000	0.010767	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001993	0.007300	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.014624	0.000000	0.000000	0.002913	0.010700	0.000000
0.038666	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004714	0.000000	0.000000
0.005272	0.000787	0.003591	0.002059	0.013431	0.010608	0.001999	0.000822	0.008074	0.001649	0.013167	0.000000	0.000000
0.000727	0.000000	0.000000	0.000000	0.016138	0.000000	0.000000	0.000000	0.000000	0.000000	0.011946	0.000000	0.000000
0.000181	0.000000	0.000000	0.000000	0.004034	0.000000	0.000000	0.000000	0.000000	0.000000	0.002987	0.000000	0.000000
0.003998	0.088061	0.212259	0.242976	0.027872	0.046792	0.231307	0.003570	0.000000	0.003356	0.017541	0.000000	0.000000
0.000394	0.000000	0.000000	0.001614	0.005167	0.096997	0.000000	0.027951	0.000000	0.001180	0.008176	0.000000	0.000000
0.000983	0.002441	0.058272	0.003306	0.007037	0.760721	0.005680	0.174043	0.000000	0.000799	0.035226	0.000000	0.000000
0.026647	0.000000	0.000000	0.000000	0.024887	0.000000	0.000000	0.002515	0.000000	0.003049	0.007698	0.000000	0.000000
0.001344	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001119	0.008977	0.000000	0.000000
0.039420	0.000000	0.051604	0.001466	0.007829	0.058809	0.027190	0.008376	0.000000	0.012546	0.022517	0.000000	0.000000
0.003702	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002081	0.000000	0.002643	0.005126	0.000000	0.011505
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003955	0.001183	0.000000	0.000000
0.000008	0.003837	0.000000	0.000000	0.002188	0.000000	0.000000	0.001769	0.000000	0.000000	0.009728	0.000000	0.000000
0.000042	0.000000	0.000042	0.000126	0.000067	0.001087	0.000042	0.001485	0.000000	0.000117	0.000361	0.000000	0.000000
0.004256	0.000000	0.004183	0.012506	0.006730	0.107648	0.004256	0.147100	0.000000	0.000030	0.035743	0.000000	0.000000
0.000063	0.000000	0.000000	0.000000	0.000064	0.000000	0.000000	0.000000	0.000000	0.002934	0.001025	0.000000	0.000000
0.000051	0.000000	0.000000	0.000000	0.000280	0.000000	0.000000	0.000000	0.000000	0.000000	0.002025	0.000000	0.000000
0.000143	0.000000	0.000000	0.000000	0.000010	0.000000	0.000000	0.000000	0.000000	0.000000	0.002128	0.000000	0.000000
0.000382	0.000000	0.000000	0.000000	0.008237	0.000000	0.000000	0.000000	0.000000	0.000000	0.002970	0.000000	0.000000
0.000698	0.000000	0.000394	0.000000	0.007581	0.000000	0.000000	0.000000	0.000000	0.002471	0.014259	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000419	0.009819	0.000000	0.000000
0.000014	0.000000	0.144203	0.000000	0.001289	0.000000	0.103579	0.095766	0.000000	0.000000	0.085897	0.000000	0.000000
0.000000	0.000000	0.002126	0.000000	0.000000	0.000000	0.001577	0.000278	0.000000	0.000061	0.000254	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000978	0.000000	0.000064	0.001523	0.000000	0.000000
0.000000	0.000000	0.000000	0.002847	0.000000	0.000000	0.000000	0.000000	0.000000	0.000026	0.000675	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003275	0.017683	0.000000	0.000000
0.000000	0.015748	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002117	0.000000	0.000000
0.000000	0.178715	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001924	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.006652	0.000000	0.000000
0.012624	0.000000	0.000000	0.000000	0.006749	0.000000	0.000000	0.009578	0.000000	0.006162	0.038661	0.000000	0.064808
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001309	0.008452	0.000000	0.022202
0.000020	0.000000	0.000000	0.000000	0.000004	0.000000	0.000000	0.002140	0.000000	0.000000	0.001761	0.000000	0.001941
0.007312	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.005411	0.000000	0.005428	0.014739	0.000000	0.045706
0.000061	0.000000	0.017269	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001973	0.008668	0.000000	0.031351
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.019027	0.014713	0.000000	0.039753
0.114893	0.000000	0.000000	0.000000	0.022755	0.000000	0.000000	0.023632	0.000000	0.086173	0.056517	0.000000	0.147251
0.005995	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002139	0.004374	0.000000	0.011655
0.035973	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.012837	0.026242	0.000000	0.077046
0.000000	0.000000	0.000000	0.150201	0.000000	0.000000	0.000000	0.023324	0.019118	0.010424	0.045003	0.000000	0.101875
0.000958	0.003508	0.000000	0.000000	0.005366	0.000000	0.000000	0.000000	0.000000	0.002511	0.011990	0.000000	0.000000

0.202152	0.000485	0.002109	0.000000	0.000000	0.000000	0.000000	0.000000	0.000911	0.017399	0.010836	0.000000	0.025278
0.000293	0.000000	0.000000	0.000000	0.000341	0.000000	0.000000	0.006629	0.000000	0.016610	0.003938	0.000000	0.000000
0.001603	0.001546	0.004084	0.000000	0.013106	0.000000	0.000000	0.000000	0.009456	0.028133	0.007136	0.000000	0.000000
0.001120	0.000000	0.000000	0.008457	0.000140	0.000000	0.000000	0.000000	0.000000	0.000000	0.002187	0.000000	0.000000
0.005429	0.000000	0.000000	0.000000	0.009224	0.000000	0.000000	0.001256	0.016464	0.000000	0.004191	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.002050	0.000000	0.007697
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.001867	0.000000	0.000000	0.003689	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.063083	0.000000	0.000000	0.124511	0.000000	0.000000
0.000000	0.000000	0.000000	0.094475	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.004868	0.000000	0.017501
0.069867	0.007236	0.013545	0.000769	0.040762	0.002916	0.011715	0.013309	0.008090	0.000061	0.051838	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
0.193100	0.076000	0.087500	0.063500	0.055200	-0.528278	-0.007600	0.005400	0.038300	0.021600	0.000000	0.000000	0.000000
0.048600	0.148700	0.198100	0.045100	0.246000	0.419300	0.338900	0.204300	0.571400	0.275100	0.000000	0.000000	0.000000
0.077500	0.449300	0.191400	0.344700	0.325300	0.000090	0.224800	0.104700	0.191900	0.324200	0.000000	0.000000	0.000000
0.009500	0.001000	0.000700	0.005300	0.122000	0.007900	0.038200	0.012700	0.009000	0.003300	0.019004	0.000000	0.000000
0.009700	0.002900	0.000300	0.000000	0.007000	0.000000	0.000000	0.020900	0.000000	0.029000	0.013430	0.000000	0.000000
0.006418	0.008969	0.008319	0.020598	0.013212	0.015500	0.018355	0.020413	0.011820	0.028719	0.000000	0.000000	0.000000
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Mathematical Statement of SIO Model

The matrix **A** relates the intermediate inputs (**U**) to the intermediate outputs (**X**), thus:

$$\mathbf{U} = \mathbf{A} \,.\, \mathbf{X}$$

The matrix **F** relates the primary inputs (**P**) to intermediate outputs (**X**), thus

$$\mathbf{P} = \mathbf{F} \,.\, \mathbf{X}$$

We want, initially, the relationship between Final Use (**D**) and primary inputs (**P**). The intermediate outputs are divided into two uses - intermediate inputs, and final use, thus:

$$\mathbf{X} = \mathbf{U} + \mathbf{D} = \mathbf{A}.\mathbf{X} + \mathbf{D}$$

Therefore $\mathbf{D} = \mathbf{X} - \mathbf{A}.\mathbf{X} = (\mathbf{I} - \mathbf{A}).\mathbf{X}$

$$\mathbf{X} = (\mathbf{I} - \mathbf{A}).^{-1}\ \mathbf{D}$$

But $\mathbf{P} = \mathbf{F}.\mathbf{X}$

Therefore $\mathbf{P} = \mathbf{F}.\ (\mathbf{I} - \mathbf{A}).^{-1}\ \mathbf{D}$

or $\mathbf{P} = \mathbf{M}.\mathbf{D}$ where $\mathbf{M} = \mathbf{F}.\ (\mathbf{I} - \mathbf{A})^{-1}$

The relationship between the conversion factors for sectors (**SF**) and primary factors (**PF**) is given by

$$\mathbf{SF} = \mathbf{PF}.\mathbf{M} \quad \ldots\ldots\ldots \quad (I)$$

To find **SF**, we need values for **PF**. Some are known or defined as constants. In general, we can define the primary conversion factors in terms of a linear combination of sectoral conversion factors, and constants, thus:

$$\mathbf{PF}' = \mathbf{T} \,.\, \mathbf{SF}' + \mathbf{Q} \;.\;.\;. \quad (II)$$

where **T** defines the linear relationship between the PF and the SF, and **Q** is a vector of constants.

Solution of SF depends on the simultaneous solution of I and II. This can be achieved by iteration, thus:

Initial values for PF are guessed (as PF_0)

$$SF_1 = PF_0 \,.\, M$$

thus $PF'_1 = T.SF'_1 + Q$

thus $SF_2 = PF_1 M$ and so on, until a solution for SF and PF converges. An analytical solution can be derived from this convergence.

Generally from the above

$$PF'_N = T\ SF'_N + Q$$

$$SF_N = PF_{N-1}\ M$$

Therefore $SF_N = (T\ SF'_{N-1} + Q)'.M = (T\ SF'_{N-1})'\ M + Q'M$

$$SF_N = SF_{N-1}\ T'M + Q'M$$

Eventually $SF_N \cong SF_{N-1}$

so, $SF_N = SF_N\ T'\ M + Q'M$

so, $SF_N\ (I - T'M) = Q'M$

$SF_N = Q'M\ (I - T'M)^{-1}$ and $PF_N' = T\ SF_N' + Q$

Which can be simplified to

$$SF_N = Q'F\ (I - A - T'F)^{-1}$$

$$PF_N = SF_N\ T' + Q'$$

Knowledge of A, F, and Q therefore gives SF and PF.