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OCCASIONAL PAPERS

VOL. 17 NO. 1

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Published by A. Vasudevan for the Reserve Bank of India and printed by him at Vijay Corporation,
65 Ideal Industrial Estate, Lower Parel, Mumbai-400 013.

Alternate Measures of Deficit and Inflation Impact

Jeevan Kumar Khundrakpam*

The paper evaluates the alternate measures of government deficit in India with special emphasis on the impact of inflation on the ratio of fiscal deficit to GDP. The exercise conducted in the study reveals that fiscal adjustment criteria defined purely in terms of the ratio of fiscal deficit to GDP and without reference to price condition may not seem sufficient to evaluate the adjustment. The study finds that the level of fiscal deficit would have been significantly lower had the price rise been contained to a moderate level.

Fiscal deficit is a measure of the public sector's budget constraint. The measure, however, is fraught with various practical and conceptual problems. Furthermore, even if it is possible to resolve these problems, a single measure of fiscal deficit from a purely accounting point of view may fail to capture all the important macro-economic implications of fiscal policy. This follows from the fact that a given level of deficit having a variety of components can exercise varying impacts on different sectors of the economy. As a result, a purpose specific measure of deficit assumes importance.

The main purpose of this paper is to undertake an exercise of measuring alternate concepts of deficits in India, drawing on the vast literature on this subject and explore the impact of inflation on the fiscal deficit.

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The paper is divided into four sections. Section I briefly surveys the literature on the conceptual and methodological issues involved in measuring fiscal deficit. Section II deals with the measures of deficits as viewed in India. The conceptual differences that exist between the general literature and the Indian viewpoint are also dealt with in this section. In Section III, some alternate measures of deficit are suggested and compared with the official measures. In Section IV an attempt is made to estimate the impact of inflation on fiscal deficit to GDP ratio. The various implications that arise from the analysis are also discussed.

Section I

Fiscal Deficit : Some Conceptual Issues¹

The conventional measure of fiscal deficit is conceptually based on the accounting principle that the budget deficit is the difference between the government's income and outlays over a time period under consideration (Boskin, 1982, p-297). The deficit as defined on a cash basis is the difference between total government outlays (including interest but excluding amortization payments on the outstanding stock of public debt) and total cash receipts (including tax and non-tax revenue and grants but excluding borrowing). Thus worked out, budget deficit reflects the net borrowing requirements including direct borrowing from the Central Bank (Vito Tanzi *et. al.* 1988, p-5). However, this measure of deficit is not well defined for two reasons: a) the distinction between income and outlays can be ambiguous as it will depend upon the policy criterion chosen for the purpose, and b) it is not specified whether the resource used is to be measured on accrual or cash basis. For example, net lending could be clubbed under deficit side if the Government debt criterion is used for classification. By this criterion, deficit would be measured in terms of incremental public debt during the fiscal year. Therefore, transactions like net lending which neither create nor extinguish any liability would go below the line. On the other hand, amortization of debt would be an expenditure item by the public policy criterion as it would require the generation of resources to finance it. The problem of accrual and cash basis crops up for items like interest payments which are generally measured on accrual basis while deficits based on public sector borrowing requirements (PSBR) are normally measured on cash basis.

Though it is a consensus view that deficit and debt to be measured are for the public sector, there still exist operational difficulties of defining the scope of the public sector. Various direct and indirect functions of government and linkages between them make it difficult to provide an exhaustive list of government entities. Secondly, as the list expands, the data problem would become overwhelming. Thirdly, expanding the number of entities would often result in increase in intra-governmental transactions, which must be netted out. In view of these practical difficulties, deficits are calculated for various levels of government.

Yet another way of viewing deficit is the balance sheet approach which addresses the issue of sustainability and solvency of government debt. It requires the inclusion of valuation changes in government assets and liabilities as this affects the ability of the government to retire debts. The relevant question here is the solvency of the government which requires the present value of its spending programme to be equal to its comprehensive net worth. The measurement of net worth has at least two shortcomings : a) valuation of various government assets - both tangible and intangible - is quite cumbersome and may not be practically possible, and b) in this measure of deficit many of the important short-run to medium-run problems are brushed aside though they could be of immediate concern to the policy makers.

Of late, the concept of inter-generational accounting of government fiscal operations has been gaining ground. According to its proponents, a consensus among economists on the definition of a deficit is lacking and there is hardly any economic theory that suggests a well defined concept of deficit. Consequently, it is alleged that conventional deficit measure can be manipulated by the authority by labeling receipts and payments interchangeably. The proponents of inter-generational accounting concept tend to focus on government's inter-temporal budget constraint which requires that the present value of net tax payments by current and future generations must cover the present value of future government consumption, less government's net wealth, i.e.,²

$$\sum_{s=0}^D N_t, t-s + \sum_{s=1}^{\alpha} N_t, t+s = \sum_{s=1}^{\alpha} G_s (1+r)_{t-s} - W_t^g$$

where N is net taxes in present value term, summed over the remaining surviving years 0 to D in future for the current generation and from year 1 to α in future for the future generation, G is future government consumption, W_t is net wealth in year t , r and g are the respective rate of discount of government consumption and net wealth.

Some of the problems in this measure are the choice of an appropriate discount rate, the possibility of bequests and offsetting private inter-generational transfers.³

In addition to the conceptual issues discussed above on the aggregate measure of deficit, the issues relating to the economic significance of a deficit measure assumes considerable importance from the standpoint of evaluating the impact of fiscal policy on economic activity. The literature on this aspect is rich and exhaustive. We deal with only a few important measures of deficit, and the analytical basis of each of these deficit measures.

Current Deficit

Current deficit is the difference between the non-capital revenues and expenditures. It is contended that the current deficit is the true measure of a government's deficit as the capital account deficit does not change the net asset position of the government (Boskin, 1982). The measure is also a proxy estimate of the government saving though unlike the SNA system, it is measured on a cash basis. Certain shortcomings with this measure are: first, investment outlays such as human capital expenditures are considered current outlay; secondly, this measure can be manipulated by varying the current/capital component of any investment; and thirdly, it is not particularly suitable to address the macro-economic implications of deficit such as inflation, balance of payment deficit etc. It is, however, the most important indicator of prudence in resource management by a government.

Domestic Deficit and Foreign Deficit

Domestic deficit is calculated by including only those budgetary elements that directly affect the domestic economy while foreign deficit is directly connected to the external sector. These measures are important for a country with large external transactions, as a given size of overall deficit will have differing impact on the domestic economy depending upon the composition of external sector.

Structural and Cyclical Deficit

Fiscal deficit, at any point of time, is supposed to be composed of a long term trend component and a cyclical component. The cyclical component is also called the induced deficit which is linked to the business cycle and such other short-run disturbances. The built-in fiscal imbalance is given by the structural component which reflects the impact of discretionary fiscal operations. These concepts of deficit are important during periods of reforms because in the short-run the process of adjustment may itself cause the deficit to grow.

Primary Deficit

Primary deficit or non-interest deficit is calculated by deducting the interest component from the government transactions since interest payments reflect the consequences of past fiscal decisions. This measure of deficit is particularly useful for evaluating sustainability of public debt as it brings out the distinction between that part of fiscal deficit which is exogenously influenced and the other part which can be discretionarily influenced by current fiscal operations.

Operational Deficit

Operational deficit is defined as the primary deficit plus the real component of interest payments. Here, only the real interest payments are taken into account as inflation induced part of interest payments amounts to compensation to creditors for the erosion in the value of their assets and which do not add to their income and therefore aggregate demand. The basic shortcoming of this measure is that while it quantifies the effect of inflation on deficit, it only does so partially by ignoring the reverse relations that could exist.

Section II

Deficit Measures in India

In India, evaluation of various concepts of deficit is of recent origin. In the past, there was only the concept of budget/overall deficit. The overall deficit traditionally implied borrowing from the Central Bank or seignorage. The holding of large amount of government

securities by RBI, not as a matter of open market operation, but as a part of public debt management, led to expansion of reserve money which was much more than the overall deficit. Following the recommendation of the Chakravarty Committee Report 1985, the concept of monetized deficit was introduced. Fiscal deficit as defined in the literature and as mentioned in Section I also became an important concept, particularly in the light of the macro-stabilisation programmes. With the growing volume of public debt and the consequent rise in the volume of interest payments, the issue of sustainability of fiscal deficit has of late been receiving increasing attention in India. As a result, the concept of primary deficit now forms an important indicator of fiscal imbalance. Revenue account deficits remained largely an unknown feature till the beginning of the '80s. The continuous deterioration in this indicator and the growing interest in the economic use of resources have drawn the attention of many on the revenue account.

The methodology of arriving at these five measures of alternate deficits are briefly summarized below.

The traditional concept of budget deficit is measured by the difference between the total expenditure and the total receipts which is financed through net increase in 91-day Treasury bills and withdrawal of cash balances with RBI. Although this concept of deficit has lost much of its meaning in the recent years, it still serves as a useful indicator of the liquidity position of government and the need for accommodation by way of 91-day Treasury bills and issue of *ad hocs* to RBI. The RBI also holds 'dated' government securities which also lead to creation of reserve money. RBI's holdings of *ad hocs*, dated securities and 91 day Treasury bills and government's currency liabilities constitute the net RBI credit to central government which is the measure of monetized deficit in India.

Although current deficit as a measure of structural imbalance should in a true sense relate to budgetary savings of the Government, it has, in practice, been identified in India with the revenue deficit, which measures the difference between the receipts and expenditures in the revenue account. A measure of current account deficit of government administration is nonetheless available in the economic and functional classification of the budget.

At present, the fiscal deficit in India is measured by the excess of the sum of revenue expenditure, capital outlay and net lending over revenue receipts and non-debt capital receipts including proceeds from disinvestment. The inclusion of privatization proceeds as a deficit reducing item needs to be seen in the right perspective *i.e.*, in terms of the implications for cyclical and structural components of deficit. If the proceeds from the sale of financial assets (which were created through debt that was previously incurred) are used to finance current consumption, the structural component of deficit does not undergo any change. What is more if the debt is growing along an unsustainable path, such a measure of fiscal deficit/primary deficit, will give a misleading picture of the fiscal situation.

In the Indian context, primary deficit is viewed in either gross or net terms. Viewed analytically, both gross and net primary deficit have certain operational significance in terms of budgetary targeting. The gross primary deficit measure views interest receipts as something flowing as return on government assets – whether financial or physical – without being specific about that part of revenue receipts which cannot be influenced by current policy. Similarly in this concept of primary deficit net loans by government to other entities are treated as government's own expenditure even though government acts more like an intermediary between market and its borrowers. Gross measures can at best be considered a partial measure and budgetary targeting based on this concept may not adequately reflect the real picture on the government's borrowing and lending operations with implications for the sustainability of public debt. The net primary deficit, on the other hand, goes beyond the implied meaning of the gross measure, since it draws a distinction between the interest rates at which government conducts its borrowing and the rates at which lending operations are conducted – a distinction which is critical from the viewpoint of sustainability issue. For, a lending rate below the borrowing cost implies a deterioration in fiscal balance which is not related to the current fiscal policy, but to that of the past. The gross primary deficit measure deducts the *total* interest payments from the fiscal deficit (as defined by the Ministry of Finance) while the net concept deducts only the *net* interest payment from the net fiscal deficit (gross fiscal deficit less net lending of government) (RBI Bulletin). Furthermore, the gross primary deficit is a concept applicable

in a country like the USA where the Federal Government does not involve itself in any financial intermediation. Though it is true that irrespective of how the borrowed fund is used – whether for current consumption or direct capital formation or lending – debt has to be serviced at the terms of contract and therefore, is a non-discretionary expenditure. By the same argument, unlike other items of expenditure, lending has its terms of contract. The interest receipts thereon are also non-discretionary. In this context, primary deficit defined as net fiscal deficit less net interest payment provides a more meaningful measure of primary balance than the gross concept.

Section III

Suggestions About a Deficit Measure for India

An attempt is made here to adjust many of the existing measures of deficits and supplement them with an alternate measure to present a more realistic picture of the impact of fiscal policy on the economy. The revised measures are then compared with the existing official measures. We first deal with some accounting adjustments. Following the logic of argument given in Section II, privatization proceeds could be excluded from the receipts items of the official measures of deficits. Besides, an adjustment is made for the implicit interest payments arising out of zero coupon bonds and other small saving instruments viz., (National Saving Certificates, Indira Vikas Patra and Kissan Vikas Patra) which have been estimated by working out the total interest payment at the maturity of these saving instruments and then graduating them over the intervening period. Such an estimated interest payment or the implicit interest is taken as the interest obligation during each year and the bulk payment that arises at maturity is subtracted from the debt service obligation of the year⁴. This exercise is equivalent to maintaining a reserve fund. This adjustment will correct the deficit figure by including the accrued interests, even though these have not been disbursed. Consequently, interest payments and deficit in the years of maturity of these debts would be lower than those stated at present in official publications.

One additional deficit measure that needs to be continuously monitored is the primary revenue deficit. The rising interest payments

and the consequent adverse affect on revenue account necessitates correction in other discretionary component of revenue expenditure. This is captured by primary revenue deficit – defined as revenue deficit less net interest payments. The results are presented in Table-1 which are expressed as percentage to gross domestic product.

Apart from these accounting adjustments an exercise has been conducted by us to measure the impact of inflation on the ratio of fiscal deficit to GDP. The empirical exercise in the Indian context reveals that both output and price have a significant influence on the receipts and expenditures of the Government during the period 1975-76 and 1995-96. The estimated regression results are as follows:

(a) Government Non-interest Expenditure (GCC)

$$\ln GCC = -9.129 + 1.169 \ln RGDP + 1.139 \ln PRI - 0.363 DUME$$

(-2.16) (2.51) (4.12) (-5.542)

$$\bar{R}^2 = 0.991 \quad DW = 1.41 \quad SER = 0.081$$

(b) Government Gross Revenue Receipts (REVR)

$$\ln REVR = -14.13 + 1.76 \ln RGDP + 0.656 \ln PRI - 0.111 DUMR$$

(-5.66) (6.42) (4.08) (-2.90)

$$\bar{R}^2 = 0.997 \quad DW = 1.65 \quad SER = 0.048$$

where RGDP is real income, PRI is price index measured in terms of GDP deflator and DUMR is a dummy for revenue representing the structural shift in revenue since 1992-93 and DUME is dummy for expenditure representing adjustments beginning with 1991-92.

While real output tends to reduce the absolute amount of fiscal gap, inflation widens it. And, as the difference between the elasticities of receipts and expenditures is quite large, inflation may have a major adverse impact on the magnitude of fiscal deficit. While it appears plausible that the absolute level of fiscal deficit would change significantly due to inflation, it is also possible that the ratio of fiscal deficit to GDP may not increase significantly since inflation will also

increase the nominal GDP. Targeting a particular fiscal deficit to GDP ratio, or evaluating its impact, without reference to price situation can, therefore, be misleading. This calls for a correction in the fiscal deficit to GDP ratio, which will separate the real change in the ratio from the inflation induced change.

Table-1 presents the adjusted deficit as a ratio to GDP after making the accounting adjustments mentioned above. It may be observed that the adjusted fiscal deficit is significantly larger than the official level and was as high as 8.15 percent in 1993-94. Even this indicator of deficit showed reductions in the last two years i.e., 1994-95 and 1995-96, implying that in these years fiscal correction has resulted in the reduction of deficit even after correcting some accounting adjustments. The net fiscal deficit (GFD less net lending), however, showed no sign of reduction which implies that there has been reduction in the indirect capital formation or financial assets. It also implies a declining share of financial assets which can be set against the debt of the Government. The reduction in the indirect capital formation is also not offset by direct capital formation. This is seen in the rising ratio of revenue deficit to GDP (the level of 4.18 per cent and 3.75 per cent in 1993-94 and 1994-95 respectively, are the highest since 1980-81). In other words, the marginal decline in the total deficit has been brought about by reduction in capital formation.

Change in Net Liabilities as a Measure of Deficit

In Table-2 three alternate measures of change in net financial liabilities of central government are given. R.J. Modi (1991, 1992 and 1994) has argued that if the policy criterion of measuring the fiscal deficit is that of PSBR, the change in net financial liabilities is a better measure of deficit than the change in gross financial liabilities (GFD)⁵.

It has been argued that the issue of sustainability of the borrowing programme is better monitored by the change in net financial liabilities of government which provides an objective criterion of monitoring aggregate demand in the economy (Modi, 1992). In the methodology suggested by Modi (1991) to measure the change in net financial liabilities, only the non-plan component of lending is set

against the total loan recovery. However, if the aggregate demand effect is to be analyzed there is no a priori reason for assuming that non-plan loans do not affect aggregate demand while the plan component does. If this argument is accepted, then, the assertion that fiscal deficit has equivalent impact on aggregate demand and change in net financial liabilities does not hold good. It can be seen from Table-2 that Modi's estimate of net financial liabilities involves some amount of overestimation. The official measure is also marginally overestimated except for the year 1994-95, when the disinvestment proceeds exceeded the additional equity participation. The adjusted measure of change in net financial liabilities are lower than the official measure till 1993-94 since the equity participation in PSUs exceeded the disinvestment in PSUs⁶.

Sectoral Composition of Borrowing :

Does it Matter for the Deficit Measures?

The sectoral composition of borrowing to finance a given level of deficit also plays an important economic role. There has been a reduction in the monetized component of deficit which has been counter-balanced by market borrowing. When Government resorts to seignorage, additional purchasing power in the economy is created which would add to the aggregate demand in the economy. Given the level of supply there would be price rise which might lead to reduction in both private consumption and investment depending on their respective price elasticities of demand. In other words, the Government's draft on real resources in the economy is achieved through a reduction in both private consumption and investment. Another possibility is the reduction in the level of private saving which could arise as a result of the households' desire to maintain the level of real consumption as also because, the inflation tax will erode the real value of savings⁷. The overall level of investment in the economy can either fall or rise depending upon how the Government puts to use the funds so mobilized. In a saving-scarce economy where the public and private sectors compete for investible resources, at the margin, the real resources mobilized through money creation, may meet public investment needs, which would raise the level of overall investment in the economy and, therefore, growth. But, if they are

used to meet current consumption, the overall investment would fall since part of the *ex ante* private investment would become *ex post* consumption of the economy. If the resource gap is financed through market borrowing and other small savings instruments, there could be a decline in private investment, particularly if credit is rationed. However, to the extent that public investment goes up, the level of investment in the economy might not fall. Investment in the economy would fall if borrowing from the private sector by the public sector goes to meet the current consumption of the Government. When the Government indulges in current consumption, monetized deficit turns out to be an attractive source of financing at least on two counts: a) as said above, part of the private consumption is substituted by public consumption and b) the corresponding debt servicing burden is much less for the Government under deficit financing than under debt financing.

Ideally, disinvestment has been suggested to increase the share of private capital stock in the total capital stock. In the process of disinvestment, an amount of current private saving equivalent to the divested amount goes into the hands of the public sector. Private savings so mopped up can get back to the private sector by way of investment if the proceeds of disinvestment are used to retire public debt. This, at the same time would lower the debt servicing burden of the Government. If there is no retirement of debts, all it amounts to is converting part of current private saving to buy an existing asset. If government creates a new asset, the public-private distribution of productive assets in the economy would remain unaffected. And, as has been currently done, if it is used for current consumption, saving and investment in the economy would go down thus affecting the growth prospects of the economy. Against the above backdrop the fiscal correction exercise in India is clearly not yet complete.

A combination of a marginal reduction in fiscal deficit, a perceptible decline in gross primary deficit along with a rising primary revenue deficit have formed the basic contours of the fiscal adjustment process in India, although some commendable achievements have already been got out of micro aspects of reform such as policies with regard to tax system and public sector enterprises. The content of

adjustment has continued to be characterised by a deceleration in public capital formation and a large growth in public debt, both of which have the potential to make the fiscal system unsustainable.

The present pattern of fiscal imbalance has also an important implication for inter-generational equity. Borrowing to finance current consumption implies taxing future generation for the consumption of present generation and thereby reducing the welfare of the former at the cost of the latter.

Section IV

An Estimate of the Impact of Inflation on Fiscal Deficit to GDP Ratio

Table-3 to Table-5 help to assess the extent of fiscal adjustment after neutralizing the effect of inflation on the GFD to GDP ratio. GFD is defined as G (government expenditure, both non-interest and interest) less REC (government revenue receipts).

The problem of interest payment should be studied in relation to inflation. Where the volume of interest payment is not systematically related to inflation and a larger portion of the GFD is accounted by the interest component, it may be possible to restrict the GFD/GDP ratio through inflation, despite the adverse impact of price rise on primary deficit and the rate of interest. Inflation exercises a positive influence on both the non-interest expenditure and the revenue receipts of the Government, the extent of the impact being determined by their respective elasticities weighted by their relative magnitudes. In the Indian case, given that the price elasticity of non-interest expenditure is significantly higher than that of revenue, inflation would cause the primary deficit to grow. On the other hand, under the hitherto administered interest rate system, the debt servicing costs were almost insulated from inflation. The situation has altered drastically with the deregulation of interest rate, as a part of the financial sector reform. In recognition of the sensitivity of interest rate to inflation in the post reform period, an adjustment is made to neutralise the effect of inflation on the rate of interest and, therefore,

the total interest payment. Though the sensitivity, as referred to above, is evident only in recent years, the estimates are generated by using the historical data on the average interest cost and the inflation rate during the period 1975 to 1996. The regression result which is statistically significant is as follows:

$$\ln AI = -2.642 + 0.450 \ln AI_{(-1)} + 0.232 \ln P$$

(-2.58) (2.18) (2.53)

$$\bar{R}^2 = 0.975 \quad DW = 1.83 \quad SER = 0.0357$$

where, 'AI' stands for average interest rate (total interest payment in a year divided by the outstanding stock of debt at the end of last year) and 'P' is the price index measured in terms of GDP deflator.

The above analysis implies that under the historically fixed interest rate system, inflation did exercise an unfavorable impact on interest payments and hence on fiscal deficits but not to the extent expected under a fully market determined interest rate system. The estimates imply that in the long run the average interest rate responds to inflation to the extent of 0.42 per cent, which is significantly lower than what could be expected according to Fisher's hypothesis.

In Table-3 we present the adjusted deficit in the absence of price rise during a year. The long term effect of inflation on the GFD/GDP ratio is better captured with reference to a base year price. Table-4 presents inflation adjusted fiscal deficit ratio to GDP with reference to 1980-81 price conditions.

The estimates presented in Table-3 shows that had the price rise during the year been fully contained, the GFD/GDP ratio would have improved throughout the '80s till the year 1990-91 in the range of 0.15 to 0.42 percentage point. In other words, controlling the price rise during a given year in the '80s, would have lowered the ratio by about 0.15 to 0.42 percentage point from the ratios that have been reported in the budgets. If, however, the debt service were not postponed through the three small saving instruments, despite checking the price, the ratio would have still deteriorated from 1983-84, as the salutary effect of price control would have been more than offset by

the larger interest volume. In the reform period, the adverse effect of inflation on fiscal deficit to GDP ratio was much weaker. The rising volume of interest payment in GFD is an important factor. Being non-discretionary in nature, the Government did not have much control. Therefore, the brake applied on expenditure (reflected in the negative dummy coefficient) had to be made on the primary deficit component. This discretionary cut in the non-interest expenditure to some extent would have neutralised the adverse effect of inflation on primary deficit. The adjustment made in Table-3 is after accounting for inflation rate during the year. The cumulative effects are better studied with reference to the price condition prevailing in the base year. In other words, the question being asked here is: what would have happened to the fiscal deficit ratio to GDP had there been no change in prices over the base year, say 1980-81?

As can be seen from Table-4, assuming a zero inflation rate with reference to 1980-81 as the base year, the state of fiscal condition would have shown a significant improvement till 1990-91. In other words, the steady rise in the gross fiscal deficit to GDP ratio during the '80s to 8.33 percent in 1990-91, which was one of the important reasons for the observed economic crisis, would have been only 5.26 percent i.e. lower by 3.07 percentage point from the officially reported level. The implication that emerges is that control of inflationary pressure during the '80s could have proved an important beneficial factor in controlling government deficit. The implicit debt service payments or deferred interest payments were not enough to counter the ratio from rising as the adverse impact of price rise overshadowed it by about 0.17 to 2.20 percentage point through out the '80s. In the reform period, a non-inflationary situation since 1990-91 would have worsened the GFD/GDP ratio in some of the years. The reason is the same as explained above with the additional factor that the cumulative effect of price control would have been felt much more strongly on the nominal GDP. In fact, the exercise indicates that under such a non-inflationary situation, the expenditure reduction in the '90s would have improved the primary balance significantly. However, given the low growth of GDP in the initial years of reform, the nominal GDP (equal to real GDP at 1980-81 prices) would have been so low that despite the significant improvement in GFD due to price control, the ratio would still rise significantly in

some of the years. To put it differently, the adverse effect of inflation on expenditure, offset to some extent by the discretionary policy of expenditure cut of the Government itself, would have been much lower than the gain in nominal GDP due to price rise. Although uncharacteristic of a developing economy, the assumption of zero inflation rate not only highlights the obvious problem of the impact of inflation on fiscal deficit but also in targeting the fiscal deficit to GDP ratio in nominal terms and its usefulness in terms of an indicator of fiscal adjustment.

Assuming that a price rise of 4.0 per cent is tolerable, Table-5 estimates the effect of the excess inflationary pressure on GFD/GDP ratio. It is seen that avoiding this excess inflationary pressure during the '80s would have improved the GFD/GDP ratio in the range of 0.24 to 1.74 per centage point. Therefore, the containment of inflation at a consistent rate of 4.0 percent would have still improved the GFD/GDP ratio significantly.

Conclusion

The calculation of fiscal deficit continues to be beset with many conceptual and methodological problems. A number of alternate concepts have been shown to analyze the different aspects of the budgetary impact.

The exercise conducted in this study shows that the level of deficit would have been significantly lower than the actual deficit in the '80s had the price rise been contained to a moderate level. In the reform period, with the discretionary expenditure cut and the lower GDP growth in the initial years, the impact of inflation on the ratio was much more subdued. However, this could be a temporary phenomenon if the inflationary situation is not contained further before long. Once the expenditure growth stabilises on to a new trend path, the adverse impact of inflation on the GFD would be much more strong. It appears that such a tendency is already reflected in the 1995-96 budget estimate. Under the increasing access of government to market for funding the fiscal deficit and the emerging strong relationship between inflation and the interest rate, under the market related interest rate system, interest payments have been positively and

strongly influenced by the inflation rate. In this environment, the scope for inflation – induced amortization of public debt will decline to the extent that inflation could be anticipated by the bond holders. As a result, though the surprise inflation effects would continue to exist, the adverse impact of inflation on GFD would get stronger in the future. Furthermore, despite the shifting of interest burden to future, the proportion of revenue deficit to fiscal deficit would continue to be high.

The foregoing analysis also underlines the limitation of the ratio of fiscal deficit to GDP as an indicator of fiscal adjustment without taking into account the situation on the price front. As a result, the fiscal adjustment criterion defined purely in terms of the ratio of GFD to nominal GDP should not be taken as any more than one of the many indicators of fiscal health of the economy.

Appendix A:

A = Amount borrowed

t = maturity period

r = rate of interest

Debt Service at Maturity (D)

(1) if compounded

$$D = A*(r)^t$$

(2) if simple

$$D = A*r*t$$

Estimated Debt Service (GD)

$$GD_i = D/t \text{ where } i = 1, \dots, t$$

Adjusted Debt Service (ADS)

$$ADS = \text{Actual Interest Payment less } D \text{ plus } GD_i$$

Appendix B:

$$\ln E = a_e + b_e \ln Y + c_e \ln P + d_e \text{ DUM}_e - (1)$$

$$\ln R = a_r + b_r \ln Y + c_r \ln P + d_r \text{ DUM}_r - (2)$$

which are the relationships defined by the regression results, where E and R are expenditure and receipts, respectively. 'b', 'c', and 'd' are the co-efficients of Y (real GDP), P (price) and DUM (dummy), respectively with subscript 'e' and 'r' denoting expenditure and receipts, respectively.

The trend values of E and R are calculated from equations (1) and (2) using the observed values of independent variables and taking exponential i.e.,

$$E = e^{\ln E} \text{ and } R = e^{\ln R}$$

Assuming other things remaining the same, except price, which is our concern, we denote the expenditure and receipts under different price situation by the subscripts attached to them.

Let E_a and R_a denote the estimated values of expenditure and revenue based on the actual values of independent variables of equations (1) and (2). E_n and R_n denotes the estimates under different price assumptions.

When price between two adjacent years remain the same, the relationships in (1) and (2) are estimated with one year lag in 'P'. For constant base year price, 'P' is kept constant at the base year price and for 4.0 percent inflation, an index of 'P' is generated which constantly grows at 4.0 percent.

Then we proceed as follows

$PD_a = E_a - R_a$, where, PD_a is the estimated primary deficit based on observed values.

Similarly, $PD_n = E_n - R_n$ is the primary deficit under different price situations

Change in the level of primary deficit due to different price situation is denoted by

$$\delta PD = PD_a - PD_n \quad (3)$$

Let PD_0 denote the observed values of primary deficit for each of the year.

Denoting adjusted primary deficit by APD we get

$$APD = PD_0 - \delta PD$$

Adjusted GFD denoted by

$$AGFD = PD_0 - \delta PD + AIP = APD + AIP$$

where, AIP is the adjusted interest payment.

$$AIP = IP - \delta PD_{.1} * AI_p - \delta AI_p * AD_{.1}$$

where, 'AD' is the adjusted outstanding stock of debt estimated as actual outstanding debt of previous year less change in primary deficit and its associated change in interest payment less change in interest payment due to variation in the average interest rate, '-1' means one year lag, 'AI_p' is the average interest rate estimated under different price assumption based on the regression result of the average interest rate, 'ΔAI_p' is the difference in the average interest rate.

For the adjustment of GDP let the years be denoted by 0 ...i with '0' as the base year price i.e. 1980-81.

When inflation rate is zero throughout, the AGDP (adjusted GDP) is

$$\frac{\text{GDP}_{\text{mpi}}}{P_i}$$

where, GDP_{mp} is the gross domestic product at market price and P_i is the price index of year 'i'.

When inflation rate during a year is considered

$$\text{AGDP} = \frac{\text{GDP}_{\text{mpi}}}{P_i/P_{i-1}}$$

When inflation rate is 4.0 percent throughout

$$\text{AGDP} = \frac{\text{GDP}_{\text{mpi}}}{P_i/(P_{i-1} * 1.04)}$$

where, P₁ = P₀ * 1.04, P₂ = P₁ * 1.04and so on.

When price rise is 4.0 percent point to point

$$\text{AGDP} = \frac{\text{GDP}_{\text{mpi}}}{P_i/(P_{i-1} * 1.04)}$$

The respective adjusted ratios are then obtained as AGFD/AGDP.

Notes

1. For a survey of literature on analytical and methodological issues of measuring fiscal deficits, see Blejer and Cheasty, 1991.
2. See Aurbach, Gokhale and Kotlikoff, 1994.
3. For criticism and response, see Aurbach, Gokhale and Kotlikoff, 1994 and Robert Haveman, 1994.
4. Here we have assumed that the interest payment figure on these three saving instruments reported in the Budget Document are the payment at maturity during the year. The Report on Currency and Finance, RBI presents tables on the outstanding, the yearly mobilization of savings from these three instruments, the maturity period, the rate structure and the nature of accumulation of interest i.e., whether compounded or simple rate. From this information one can work out the payment in each of the years considered which can be graduated over the life span of the loan. This forms the logic behind Appendix A.
5. Where there is no financial intermediation by the Government, as in the case of Federal Government in USA, the distinction is redundant.
6. The adjusted measure of change in net financial liabilities would always be lower than the official measure whenever the equity participation in PSUs exceeds the amount of disinvestment in PSUs and *vice versa*.
7. The experience in the country has been that the private saving, rather than falling, has slightly risen till the recent past. This of course, largely owes to the tax saving instruments of the borrowing programme of the Government (see Bhattacharya, 1990). Private sector may substitute consumption for saving if deficit financing leads to a run-away inflation which will place the current consumption at a high premium as compared with future consumption.

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Table-1
Alternate Measures of Deficits — the Existing,
the Adjusted and Some Other Additional Measures
(as % of GDP)

Year	GFD		NFD		RD		PD		PRD	MD
	OFF	ADJ	OFF	ADJ	OFF	ADJ	OFF	ADJ		
1980/81	6.1	6.15	3.76	3.81	1.50	1.54	4.19	5.50	0.50	2.61
1981/82	5.42	5.47	2.87	2.92	0.25	0.30	3.38	4.77	-0.47	2.01
1982/83	5.97	6.06	3.35	3.44	0.73	0.82	3.72	5.32	0.06	1.89
1983/84	6.28	6.43	3.94	4.09	1.22	1.37	3.93	5.22	0.09	1.90
1984/85	7.53	7.76	4.74	4.97	1.83	2.06	4.95	6.62	0.62	2.62
1985/86	8.33	8.67	5.16	5.50	2.25	2.58	5.47	7.22	1.13	2.36
1986/87	9.00	9.45	5.82	6.28	2.65	3.11	5.84	7.66	1.32	2.42
1987/88	8.12	8.52	5.53	5.93	2.74	3.15	4.75	6.47	1.09	1.97
1988/89	7.82	8.24	5.24	5.66	2.62	3.06	4.20	5.96	0.81	1.64
1989/90	7.80	8.29	5.23	5.72	3.50	3.95	3.94	5.81	0.57	3.04
1990/91	8.33	8.81	5.73	6.21	3.49	3.91	4.35	5.99	1.10	2.77
1991/92	5.90	6.87	4.00	4.97	2.64	3.11	1.59	3.86	0.01	0.89
1992/93	5.72	6.19	4.30	4.77	2.63	2.85	1.30	3.35	0.00	0.60
1993/94	7.66	8.15	5.85	6.34	4.18	4.65	2.84	4.72	1.38	0.33
1994/95 (R.E.)	6.70	7.64	4.80	5.74	3.75	4.09	1.87	3.62	0.67	0.23.
1995/96 (B.E.)	5.50	6.20*	4.12	4.82	3.39	3.42*	0.54	2.33	0.19	N.A.

* Debt service of zero coupon bonds and from the three small saving instruments issued in 1994-95 are not worked out.

N.A. = Not accounted.

Note : GFD=Gross Fiscal Deficit; NFD=Net Fiscal Deficit; PD= Primary Deficit; PRD=Primary Revenue Deficit; RD=Revenue Deficit; MD=Moneitized Deficit; GDP=Gross Domestic Product at Market Prices; OFF=Official; ADJ=Adjusted.

Table-2
Alternate Measures of Change in Net Financial
Liabilities (as % GDP)

<i>Years</i>	<i>Official</i>	<i>R.J. MODI</i>	<i>Adjusted</i>
1988/89	5.24	6.47	4.11
1989/90	5.23	6.13	4.14
1990/91	5.77	6.53	4.81
1991/92	4.00	5.47	3.81
1992/93	4.28	5.47	3.97
1993/94 (R.E)	5.98	7.25	5.46
1994/95 (B.E)	4.89	6.10	4.92

Note : (a) Official = Official net fiscal deficit; R. J. MODI = Official GFD less non-plan loan less equity in PSUs plus loan recovery plus disinvestment in PSUs equity; Adjusted = Official net fiscal deficit less equity participation in PSUs plus disinvestment in PSUs equity.

(b) Equity participation figures are the revised estimate figures of the corresponding fiscal year.

Table-3
Comparison of Official Deficit to Debt Service and
Inflation Adjusted Deficit (% of GDP)
(Previous Year as the Base Year)

<i>Year</i>	<i>Inflation & Debt service Adjusted*</i>	<i>Inflation Adjusted</i>	<i>Official Deficit**</i>	<i>[(1)-(3)]</i>	<i>[(2)-(3)]</i>
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
1981-82	5.07	5.02	5.42	-0.35	-0.40
1982-83	5.75	5.64	5.97	-0.22	-0.33
1983-84	6.10	5.95	6.28	-0.18	-0.33
1984-85	7.55	7.33	7.53	0.02	-0.20
1985-86	8.51	8.14	8.33	0.18	-0.19
1986-87	9.30	8.85	9.00	0.31	-0.15
1987-88	8.25	7.85	8.12	0.13	-0.27
1988-89	7.94	7.50	7.82	0.12	-0.32
1989-90	7.89	7.45	7.80	0.09	-0.35
1990-91	8.34	7.91	8.33	0.01	-0.42
1991-92	6.76	6.27	6.39	0.37	-0.12
1992-93	5.99	5.78	6.00	-0.01	-0.22
1993-94	8.02	7.57	7.65	0.37	-0.08
1994-95 (R.E.)	7.55	7.24	7.33	0.22	-0.09
1995-96 (B.E.)	5.98	5.94	6.17	-0.19	-0.23

* Adjustment of debt service for 1995-96 is understated as it excludes the issue of the three saving instruments in 1994-95.

** The difference observed since 1991-92 is due to the exclusion of non-debt capital receipts.

Table-4
Comparison of Official Deficit to Debt Service
and Inflation Adjusted Deficit (% of GDP)
(1980-81 as the Base Year)

<i>Year</i>	<i>Inflation & Debt service Adjusted*</i>	<i>Inflation Adjusted</i>	<i>Official Deficit**</i>	<i>[(1)-(3)]</i>	<i>[(2)-(3)]</i>
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
1981-82	5.04	4.99	5.42	-0.38	-0.43
1982-83	5.33	5.21	5.97	-0.64	-0.76
1983-84	5.38	5.20	6.28	-0.90	-1.08
1984-85	6.83	6.55	7.53	-0.70	-0.98
1985-86	7.88	7.37	8.33	-0.45	-0.97
1986-87	8.82	8.14	9.00	-0.17	-0.85
1987-88	7.00	6.35	8.12	-1.12	-1.77
1988-89	6.22	5.46	7.82	-1.60	-2.36
1989-90	5.69	4.86	7.80	-2.11	-2.94
1990-91	6.13	5.26	8.33	-2.20	-3.07
1991-92	8.43	7.33	6.39	2.04	0.94
1992-93	5.58	5.03	6.00	-0.42	-0.97
1993-94	10.59	9.33	7.65	2.94	1.68
1994-95	9.33	8.39	7.33	2.00	1.06
(R.E.)					
1995-96 (B.E.)	4.56	4.42	6.17	-1.61	-1.75

* Adjustment of debt service for 1995-96 is understated as it excludes the issue of the three saving instruments in 1994-95.

** The difference observed since 1991-92 is due to the exclusion of non-debt capital receipts.

Table-5
Comparison of Official Deficit to Debt Service and
Inflation (at 4.0 per cent) Adjusted Deficit (% of GDP)

Year	Inflation & Debt service Adjusted*		Inflation Adjusted		Official Deficit**	(1-5)	(2-5)	(3-5)	(4-5)
	Base Previous Year	Base 1980-81	Base Previous Year	Base 1980-81					
	1	2	3	4					
1981-82	5.23	5.23	5.18	5.18	5.42	-0.19	-0.96	-0.24	-0.24
1982-83	5.90	5.68	5.80	5.57	5.97	-0.07	-0.29	-0.17	-0.40
1983-84	6.25	5.87	6.10	5.71	6.28	-0.03	-0.40	-0.17	-0.56
1984-85	7.66	7.27	7.45	7.03	7.53	0.13	-0.26	-0.08	-0.50
1985-86	8.59	8.23	8.23	7.80	8.33	0.25	-0.11	-0.10	-0.53
1986-87	9.36	9.04	8.92	8.50	9.00	0.37	0.04	-0.07	-0.50
1987-88	8.36	7.67	7.96	7.18	8.12	0.24	-0.45	-0.16	-0.94
1988-89	8.06	7.12	7.64	6.57	7.82	0.25	-0.70	-0.17	-1.25
1989-90	8.03	6.82	7.61	6.24	7.80	0.23	-0.98	-0.20	-1.56
1990-91	8.47	7.18	8.06	6.59	8.33	0.14	-1.15	-0.27	-1.74
1991-92	6.75	6.93	6.27	6.22	6.39	0.36	0.54	-0.12	-0.17
1992-93	6.06	5.29	5.85	4.94	6.00	0.06	-0.71	-0.15	-1.06
1993-94	8.02	8.32	7.59	7.57	7.65	0.37	0.67	-0.06	-0.08
1994-95	7.58	7.42	7.28	6.88	7.33	0.25	0.09	-0.05	-0.45
(R.E.)									
1995-96 (B.E.)	6.09	4.54	6.05	4.46	6.17	-0.08	-1.63	-0.12	-1.71

* Adjustment of debt service for 1995-96 is understated as it excludes the issue of the three saving instruments in 1994-95.

** The difference observed since 1991-92 is due to the exclusion of non-debt capital receipts.

Selection of Suitable Computer System Using Analytical Hierarchy Process

A. R. Dani & K. Rajkumar*

The study illustrates the application of Analytical Hierarchy Process (AHP) to a decision making problem. Multiple Criteria Decision Making (MCDM) refers to making decisions in the presence of multiple criteria. MCDM problems are classified in two categories: Multiple Objective Decision Making (MODM) and Multiple Attribute Decision Making (MADM). AHP is a popular and powerful method for solving MADM problems. The benefits of using AHP are its capability to accommodate subjectivity and inconsistency in human judgements. It can deal with ill-structured and multi-criteria problems without severe complexities. One such problem is illustrated in the present study.

Introduction

Multiple Criteria Decision Making (MCDM) refers to making decisions in the presence of multiple conflicting criteria. MCDM problems are common occurrences in every day life. MCDM problems are widely diversified. These diverse problems can be broadly classified into two categories: Multiple Objective Decision Making (MODM) and Multiple Attribute Decision Making (MADM). Analytic Hierarchy Process (AHP) is a popular and powerful method for solving Multiple Attribute Decision Making (MADM) problems. The Analytical hierarchy process known as AHP was developed by Prof. Thomas L. Saaty in mid 70's (Saaty, 1977), the method is meant for the selection of the best alternative out of several ones based upon a finite number of criteria. By the way of finding the most suitable alternative for some specific problem it obtains the ranking of all the

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present alternatives. Since its introduction by Thomas L. Saaty, AHP has been applied to many types of decision making problems viz., Accounting and Finance, Computers and Information Systems, Economics, Health Care, Marketing, Military and Multi Objective Optimisation. In this paper, AHP has been applied to the problem of selection of a suitable computer system for an organization. Section-I describes briefly the different steps to be followed in using AHP and its Axiomatic foundations. A computer selection problem as a case study is illustrated in Section-II. Conclusions are given in Section-III

Section - I : Steps in AHP

Multiple Attribute Decision Making (MADM) :

The distinguishing feature of a MADM problem is that there is usually a finite number of pre-defined alternatives: the alternatives have associated with them a level of achievement of the attributes based on which a decision is to be taken.

AHP solves a MADM problem in four steps.

Step-1 :

Decompose the problem at hand and find out the salient factors or elements (criteria, sub-criteria, alternatives, etc.) of the problem. Then construct the linear hierarchy of the problem consisting of a finite number of levels or components. Each level consists of a finite number of decision elements. Typically, the criteria and sub-criteria if any take their positions in the second and third levels respectively. Lastly, the decision alternatives or course of actions are placed at the lowest level of the hierarchy. In case of non existence of sub-criteria the problem will consist of only two levels viz., alternatives and criteria.

Step-2 :

Construct pairwise comparison matrices for all the criteria, sub-criteria, etc and alternatives.

Step-3 :

Determine the weights of the criteria, sub-criteria, alternatives,

etc. from the pairwise comparison matrices obtained from Step-2 by computing the eigenvector of the largest eigenvalue of the corresponding pairwise comparison matrix.

Step-4 :

Synthesize all the local set of weights to obtain a set of overall or global weights for the alternatives.

For better understanding of the method we need a bit elaborate discussion of the above steps.

A pairwise comparison matrix in Step 2 takes the form.

	F_1	F_2	.	.	.	F_j	.	.	.	F_n
F_1	a_{11}	a_{12}	.	.	.	a_{1j}	.	.	.	a_{1n}
F_2	a_{21}	a_{22}	.	.	.	a_{2j}	.	.	.	a_{2n}
.										
.										
F_i	a_{i1}	a_{i2}	.	.	.	a_{ij}	.	.	.	a_{in}
.										
.										
F_n	a_{n1}	a_{n2}	.	.	.	a_{nj}	.	.	.	a_{nn}

where F_i 's are the factors (by factor we mean either criteria or alternatives, etc.) whose weights are to be determined; $a_{ij} = w_i/w_j$ for all i, j $W = (w_1, w_2, \dots, w_n)$ is the underlying weight vector for the n factors. Each entry a_{ij} of A is the answer to a typical question, "between the two factors F_i and F_j which one is more dominant (or preferable or important) and how much more?" The answers are usually given verbally, like F_i is weakly more or strongly more dominant over F_j . Later these verbal qualitative phrases (weakly more or strongly more) are quantified by means of the (1 - 9) ratio-scale. For example, if F_i is strongly more dominant over F_j , then $a_{ij} = 5$.

The interpretations of the numerical judgment of the (1 – 9) scale is given below :

Table 1 : Scale of Relative Measurement of AHP

<i>Numerical Values</i>	<i>Definition</i>
1	Equally important or preferred.
3	Slightly more important or preferred.
5	Strongly more important or preferred.
7	Very strongly more important or preferred.
9	Extremely more important or preferred.
2, 4, 6, 8	Intermediate values to reflect comparison
Reciprocals	Used to reflect dominance or preference of the second alternative as compared to the first one.

We also note that $a_{ij} = (w_i/w_k) * (w_k/w_j) = a_{ik} * a_{kj}$. This is known as cardinal consistency relation. If all the elements of A satisfies this relation then we say that the matrix is consistent, otherwise inconsistent. It can be shown that for a cardinally consistent matrix the largest eigenvalue is the order of the matrix. In reality, especially within the framework of the AHP, the matrix A is hardly consistent. Therefore we measure the inconsistency by computing a consistency index (C.I) of the given pairwise comparison matrix A, which measures the deviation from consistency for the matrix A. The computed consistency index can then be compared with similar average indices from a large number of purely random matrices whose entries are also taken from the (1-9) ratio scale.

The Consistency Index (C. I) is given by

$$C. I = \text{Abs} (\mu_{\max} - n) / (n-1).$$

where μ_{\max} is the largest eigenvalue and n is the order of A.

The random indices are provided below :

Random Indices for Matrices of Various Size

n	1	2	3	4	5	6	7	8
R. I	0.0	0.0	0.58	0.90	1.12	1.24	1.32	1.41

n	9	10	11	12	13	14	15
R. I	1.45	1.49	1.51	1.48	1.56	1.57	1.59

The magnitude of consistency ratio $C.R = C.I/R.I$ gives the degree of consistency of the matrix A . From the above, it is clear that, a MADM problem using AHP can be stated as follows :

Let there be m (finite) number of given criteria, C_1, C_2, \dots, C_m and n (finite and predetermined) number of alternatives A_1, A_2, \dots, A_n . Let $A = (a_{ij})_{m \times m}$ denote the pairwise comparison matrix for the m criteria. Let $A^{(k)} = (a_{ij}^{(k)})_{n \times n}$ $k = 1, 2, \dots, m$ denote the pairwise comparison matrix for the n alternatives with respect to k th criteria. Given A and $A^{(1)}, A^{(2)}, \dots, A^{(m)}$ the objective is to obtain the ranking of the alternatives.

The AHP is based on a set of axioms which were first stated by Saaty (1986) and were described in detail by Harker and Verges (1987). These basic set of assumptions provide the theoretical basis on which the method is founded. Rather than stating these assumptions in their full mathematical form, we simply paraphrase them in order to understand their meaning.

Axiom 1 : Given any two alternatives (sub-criteria) i and j out of the set of alternatives F , the decision maker (DM) is able to provide a pairwise comparison a_{ij} of these alternatives under any criteria c from the set on the ratio-scale which is reciprocal, i.e.,

$$a_{ji} = 1/a_{ij} \text{ for all } i, j \in F.$$

Axiom 2 : When comparing any two alternatives $i, j \in F$, the DM never judges one to be infinitely better than another $c \in C$, i.e., $a_{ij} < \infty$ for all $i, j \in F$.

Axiom 3 : One can formulate the decision problem as a hierarchy.

Axiom 4 : All criteria and alternatives which impact the decision problem are represented in the hierarchy.

The first axiom is derived from the intuitive idea that if A is five times heavier than B, then it must be the case that B is one-fifth as heavy as A. The second axiom which deals with homogeneity simply states that the individuals are only capable of expressing meaningful intensities of preference if the elements are comparable. Clearly, it is difficult to make meaningful comparisons between vastly differing subjects (eg., comparison of weights of Sun and an atom). Thus, this axiom simply states that the elements of a particular level in a hierarchy must be comparable.

The meaning of Axiom 3 is that the elements of a particular level L_{k+1} are dependent on the elements belonging to the immediately higher level, i.e., L_k , but not conversely. If the converse is also true, i.e., criteria are dependent on the score of alternatives, then we have a system with feedback. In this case, the principle of hierarchical composition will not be valid. Axiom 4 simply asks to include everything that matters into the decision hierarchy. The reason for this assumption is that, the AHP can exhibit rank reversal (Belton and Gear, 1983, and Wilson 1971). That is, the method may give one ordering of the alternatives, if for example, five alternatives are available, and a different ordering if one is dropped.

Section II : Case Study

Computer systems of different types from Personal Computers (PCs) to large Super Computers have become an integral part of any organization. A computer system can be seen as a necessary equipment for the organization. As is the case with any other equipment different vendors are manufacturing different computer systems. Each of this computer system may have different properties. Some system may be suitable for scientific application whereas some systems may be better for routine data processing work. There may be other attributes of the system like capacity, processing power, cost, backup availability, vendor's support for maintenance for the system etc.. Some of these attributes can be mutually conflicting such as cost and performance. A decision about the selection of a suitable system for an organization has to be made based on some or more of these criteria.

The above problem of selecting the best suitable computer system for an organization depends on a number of factors that deter-

mine how well the computer system fits into the operational needs of the organisation. All of these factors cannot be evaluated at once by the decision maker. Thus, it is necessary to break down the complex problem into more manageable sub-problems through the multi-levels of a decision hierarchy. Hence the technique of Analytical Hierarchical Process (AHP) developed by Prof. Saaty can be used for this problem.

Formulation : In the present case study the problem of selecting a suitable system for an organisation is considered. The organisation needs a suitable computer system for routine data processing, on-line query jobs and research activities. Experts of the organisation studied the requirements and have arrived at the suitable hardware configuration viz., memory requirements, secondary storage requirements, input-output devices etc. The quotations are called from vendors. The quotations were examined by the experts and short listed vendors were selected for further examination. In case of present study after this process two vendors V_1 and V_2 were short listed.

The criteria identified for the final selection are cost, performance, availability of back up system in case of failure, portability from the existing system, system maintenance, training and openness/connectivity with the other system. Some of these criteria may be further divided. The problem now is to rank the two short-listed vendors based on the criteria described below.

(i) Cost (C) : The cost of the system is one of the most important factor in the selection. In general higher the cost better may be the performance of the system. The cost can also depend on the hardware configuration. In the present study it is assumed that cost relates to the specified configuration.

(ii) Performance (P) : The performance of the system is another important criterion in the selection. The performance of the system is measured by executing some standard programs written specifically to measure the performance of the system and by simulating the actual operational environment. In the first case some standard programs written by the experts are made available and used. In the second case some typical jobs, for which the system will be used, are executed. In both the cases how fast system is able to complete the given job is the main factor. It is also assumed that the jobs to be executed are selected by the system experts.

In the present study it was decided that the jobs will be executed in three steps, in step-1 all the jobs will be executed in single user mode. In this mode all the system resources are available to it and job timings for different machines will be available. In Step-2 all jobs will be started simultaneously. After some time one of these jobs may be completed and the number of active jobs in the system will be reduced. This will go on till the last job is completed. This will to a large extent simulate the general operational environment. The load on the system gradually decreases. The job timings are recorded for different machines. In Step-3 all the jobs are started and run for some specified period. If one of the job is completed it is started again immediately. All the jobs have to simultaneously run for the specified period which will be the same for all the machines. This will measure the performance of the system under peak load conditions. Thus the major criterion performance can be classified into three minor criteria viz., step-1 step-2 and step-3.

In the organization the different departments will be using the system. The needs of the departments are not identical. Some may require online queries, some may require to process large volume of data, while research department of the organization may use it for its research activities. Considering the divergent needs of the various departments the jobs to be executed on the machines can be broadly grouped into the following categories :

a) Input/Output Bound Jobs : These jobs may require very little CPU time but very large amount of input output time. The magnetic tape bound jobs such as backup on the tape and restoring from the magnetic tape will come under this category. This criterion is essential as the organisation needs backing up of data on magnetic tapes frequently.

b) Disk Bound Jobs : CPU time of the job is much less compared to the input output time but is not as small as in the earlier case. The jobs under this category are further subdivided as file creation jobs and batch jobs. These jobs are typical data processing jobs which do some complex processing on large volume of data. The file size used is again fixed by the experts and is decided after considering the

incremental load. These type of jobs are frequently executed in any real environment (eg., salary computations, survey processing etc.,)

c) Compilation Jobs : In any organization where software is developed, the system will be frequently used for compilation of programs. In this case study representative programs are selected and compiled. This sub-criterion can be further subdivided into the compilation of programs written in different programming languages. In the present study compilation for only two languages are considered. Compilation of programs is CPU bound activity.

d) Scientific Jobs : Scientific jobs usually require large amount of CPU time. The volume of data used is much less compared to typical data processing jobs. Large amount of computations are done on the data as against complex data processing. This criterion is included keeping in view of the organisation's research activities.

e) Sorting and Merging : The computer systems are frequently used for sorting jobs (i.e. arranging the records in a file in a specified order). Sorting jobs typically require CPU time as well as input output time. As sorting/merging form an essential part of routine data processing systems this criterion is included.

f) Database Jobs : The organisation frequently requires to obtain ad hoc information based on the large databases maintained by it, hence data base jobs form an essential criterion. The database jobs typically involve ad hoc queries\reports\updating databases etc. on the large data base. These jobs are highly CPU bound jobs.

The comparison of the performance of different machines is to be done based on job timings of different category of jobs mentioned above for each of the three minor criteria.

(iii) Back Up System (B) : Some jobs are of very sensitive nature. The job has to be completed irrespective of the status of the system. In such case the availability of a back up system helps. If a back up system is available and a machine fails, the job can be transferred to the other system.

(iv) Transfer of jobs from earlier system (T) : In some cases a system may be very good but transferring from existing system to the new system (i.e. porting) may be time consuming. In such a case there can be difficulties in running the existing jobs.

(v) Maintenance (M) : The maintenance of the system is also very important. If a system is standardized its spares can be easily obtained, on the other hand a proprietary system may be difficult to maintain. This criterion can further be subdivided into maintenance cost and service record of the vendor.

(vi) Training (TR) : The staff has to be trained for efficiently using the system and the various packages available on the system. This criterion is further classified into (1) cost of training and (2) training personnel.

(vii) Openness (O) : Openness is one of the important major criteria. If all components of the system are standardized, then the transfer of jobs across such systems is easy.

(viii) Connectivity with the available systems (CN) : How easily can a system be connected with the available systems is also an important factor for selection.

The pictorial representation of the different criteria described above is given in figure 5.

After the problem has been decomposed and structured into four level hierarchy, we need to estimate relative weights (priorities) of decision elements such as criteria, attributes and alternatives under each node of the hierarchy through pair-wise comparisons. Adequate care need to be taken to ensure that pair-wise comparison matrices formed satisfy the axioms of AHP stated in Section-I. In view of the above, it is ensured in this case study that different jobs were run on computer systems of different vendors of the same configuration. The Report of the "Technical Committee for the New Main Frame Computer System for DESACS 1994" is used as the source for data.

The pairwise comparison matrix at major criteria level is given below :

	C	P	B	T	M	TR	O	CN
Cost (C)	1	1	7	9	7	3	9	9
Performance (P)	1	1	7	7	7	3	9	9
Backup (B)	1/7	1/7	1	3	1/3	1	3	5
Porting (T)	1/9	1/7	1/3	1	1/5	1/3	3	3
Maintenance (M)	1/7	1/7	3	5	1	3	5	5
Training (TR)	1/3	1/3	1	3	1/3	1	3	5
Openness (O)	1/9	1/9	1/3	1/3	1/5	1/3	1	1
Connectivity (CN)	1/9	1/9	1/5	1/3	1/5	1/5	1/5	1

Consistency Index = 0.089

The pairwise comparison matrix at minor criteria level for the major criterion performance is given below :

	<i>Step-1</i>	<i>Step-2</i>	<i>Step-3</i>
Step-1	1	1/3	1/7
Step-2	1	1	1/3
Step-3	7	3	1

Consistency Index = 0.130

The pairwise comparison matrix at minor criteria level for the major criterion maintenance is given below :

	<i>Cost</i>	<i>Service</i>
Cost	1	3
Service	1/3	1

Consistency Index = 0.000

The pairwise comparison matrix at minor criteria level for the major criterion training is given below :

	<i>Cost</i>	<i>Personnel</i>
Cost	1	3
Personnel	1/3	1

Consistency Index = 0.000

The pairwise comparison matrix for the job groups is given below :

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>
<i>a</i>	1	1/5	1/3	1/5	1/3	1/5
<i>b</i>	5	1	3	3	5	1/3
<i>c</i>	3	1/3	1	1	1/3	1/5
<i>d</i>	5	1/3	1	1	1/3	1/5
<i>e</i>	3	1/5	3	5	1	1/3
<i>f</i>	5	3	5	5	3	1

Consistency Index = 0.167

The pairwise comparison matrix at sub-criteria level for the job group-B is given below :

	<i>File</i>	<i>Batch</i>
<i>File</i>	1	1/3
<i>Batch</i>	3	1

Consistency Index = 0.000

The pairwise comparison matrix at sub-criteria level for the job group-C is given below :

	<i>Language-1</i>	<i>Language-2</i>
<i>Language-1</i>	1	5
<i>Language-2</i>	1/5	1

Consistency Index = 0.000

The pairwise comparison matrices for various major-criteria / minor-criteria / sub-criteria are given below :

Major Criteria :- Cost

	<i>Vendor-1</i>	<i>Vendor-2</i>
<i>Vendor-1</i>	1	3
<i>Vendor-2</i>	0.333333	1

Consistency Index = 0.000

Major Criteria :- Back-up

	<i>Vendor-1</i>	<i>Vendor-2</i>
<i>Vendor-1</i>	1	0.9
<i>Vendor-2</i>	1.1	1

Consistency Index = 0.005

Major Criteria :- Connectivity

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	0.9
Vendor-2	1.1	1

Consistency Index = 0.005

Major Criteria :- Porting

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	1.1
Vendor-2	0.9	1

Consistency Index = 0.005

Major Criteria :- Openness

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	2
Vendor-2	0.5	1

Consistency Index = 0.000

The pairwise comparison matrix at minor-criteria level for the Major Criteria Maintenance are given below :

Minor Criteria :- Cost

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	5
Vendor-2	0.2	1

Consistency Index = 0.000

Minor Criteria :- Service

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	0.9
Vendor-2	1.1	1

Consistency Index = 0.005

The pairwise comparison matrix at minor-criteria level for the Major Criteria Training are given below :

Minor Criteria :- Cost

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	3
Vendor-2	1/3	1

Consistency Index = 0.000

Minor Criteria :- Personnel

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	0.9
Vendor-2	1.1	1

Consistency Index = 0.005

The pairwise comparison matrix at job group level for the Major Criteria Performance are given below :

Job Group A

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	9
Vendor-2	1/9	1
Consistency Index =	0.000	

Sub-Criteria : File Management (Job Group B)

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	3
Vendor-2	1/3	1
Consistency Index =	0.000	

Sub Criteria : Batch Processing (Job Group B)

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	2
Vendor-2	1/2	1
Consistency Index =	0.0000	

Sub Criteria : Language-1 (Job Group C)

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	3
Vendor-2	1/3	1
Consistency Index =	0.000	

Sub Criteria : Language-2 (Job Group C)

	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	7
Vendor-2	1/7	1
Consistency Index =	0.000	

Job Group D			Job Group E		
	<i>Vendor-1</i>	<i>Vendor-2</i>		<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	5	Vendor-1	1	1/4
Vendor-2	1/5	1	Vendor-2	4	1
Consistency Index = 0.000			Consistency Index = 0.000		

Job Group F		
	<i>Vendor-1</i>	<i>Vendor-2</i>
Vendor-1	1	4
Vendor-2	1/4	1
Consistency Index = 0.000		

Section III : Conclusions

Figures 1, 2, 3 and 4 help us to determine the most preferable vendor with reference to each of the major-criterion, minor-criterion and sub-criterion. For instance, the computer system provided by vendor-1 is consistently better than that of vendor-2 except for the sub-criterion 'job group-E' for each of the minor-criteria of major-criterion 'performance'. From figure-4 we can identify the computer system provided by vendor-1 as the most favorable solution for the organisation in the context of overall priority, with an overall priority score of 0.691893.

From the pairwise comparison matrices obtained at various levels, it is observed that 'cost' and 'performance' having equal importance, are two predominant major criteria for the selection of the computer system. Further it is noted that vendor-1 (V1) outperforms vendor-2 (V2) consistently for all the sub-criteria except 'job group-E'. Hence, only if the 'job-group-E' is rated as extremely important compared to all the other job-groups, then only vendor-2 (V2) will get higher ranking than vendor-1 (V1) for the major criterion 'performance'. Therefore, with a view to changing the final ranking of vendors, it is necessary that the relative importance of the major cri-

terion 'performance' should be made at least very strong as compared with major criterion 'cost'.

In this article, we demonstrated various benefits of using the AHP for the computer system selection problem. The benefits of the AHP are its capability to accommodate subjectivity and inconsistency in human judgments. More importantly, AHP can deal with ill-structured multi-factor and multi criteria decision-making problems without severe computational complexities. This is possible since AHP allows the decomposition of complex problems into smaller sub-problems in the form of simple hierarchy.

Annexure

Eigenvector Procedure

Although there is a plethora of methodologies, eigenvector method has been found to be most suitable to find out weights from the pairwise comparison matrices (Saaty, 1990a).

Let there are m (finite) number of criteria, $C_1, C_2 \dots C_m$ and n (finite and predetermined) number of alternatives $A_1, A_2 \dots A_n$. Let $A = (a_{ij})_{m \times m}$ denotes the pairwise comparison matrix for the m criteria. Let $A^{(k)} = (a_{ij}^{(k)})_{n \times n}$ $k = 1, 2 \dots m$ denotes the pairwise comparison matrix for the n Alternatives with respect to k th criteria. Given A and $A^{(k)}$ the objective is to obtain the ranking of the alternatives viz., $W = (W_1, W_2 \dots W_n)$.

Step-1 : Obtain the largest eigenvalue $\mu_{\max}^{(k)}$ and the corresponding eigenvector $\tau_{\max}^{(k)}$ based on Decision Matrix for the k -th Criteria $A^{(k)}$ for $k = 1, 2, \dots m$.

Step-2 : Construct the Priority matrix B based on the eigenvectors obtained above such that k -th column of B contains eigenvector $\tau_{\max}^{(k)}$ for $k = 1, 2, \dots m$.

Step-3 : Obtain the largest eigenvalue μ_{\max} and the corresponding eigenvector τ_{\max} based on Decision Matrix A .

Step-4 : Compute $\Omega = B * \tau_{\max}$ to get estimate of W.

In general, even if we have more than one level of Criteria, then we start from the lowest level and proceed to the top strictly following the hierarchy and also obtain the priority matrix at each level by the method described above.

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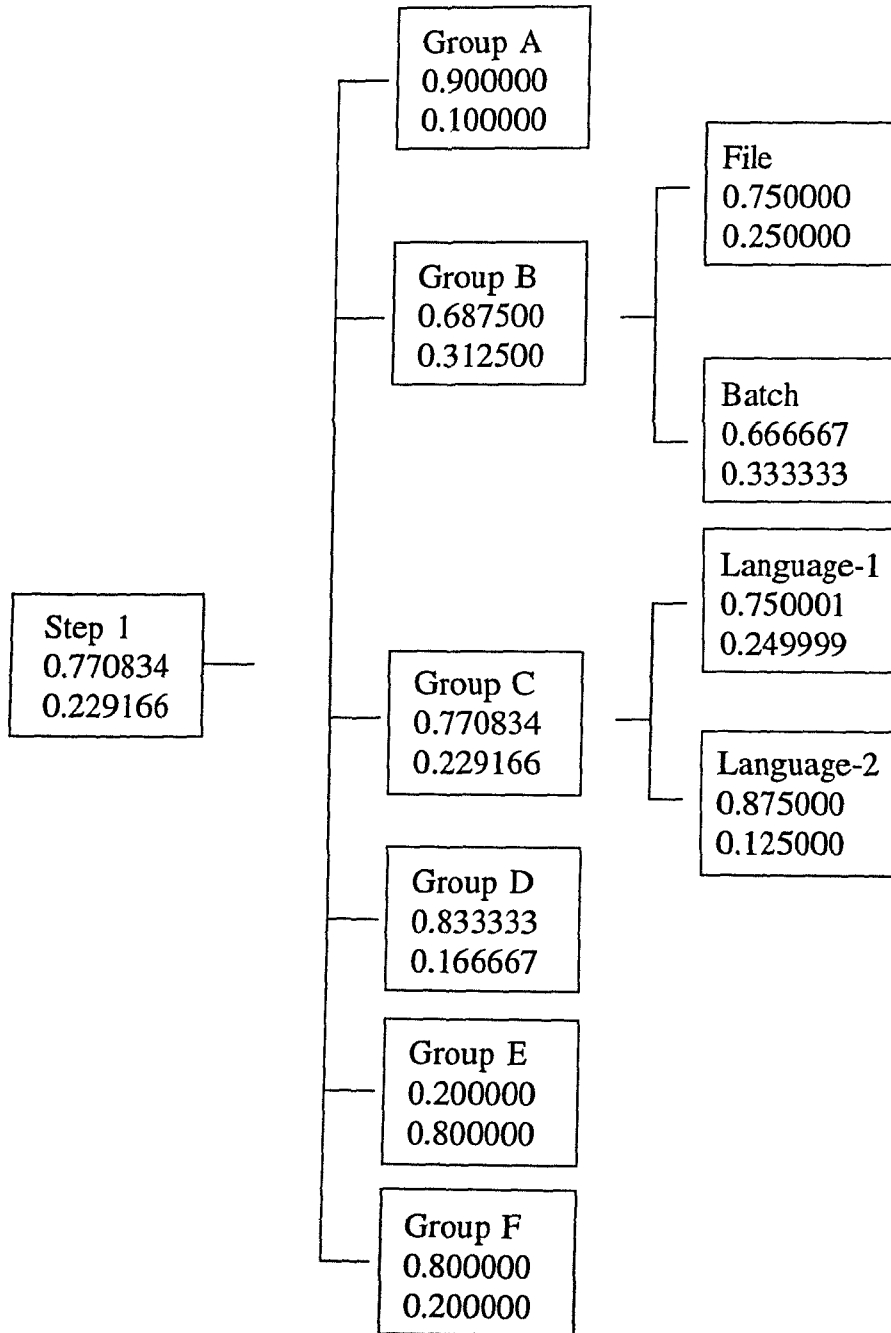
Figure-1 : Ranking of Vendors for Step-1

Figure-2 : Ranking of Vendors for Step-2

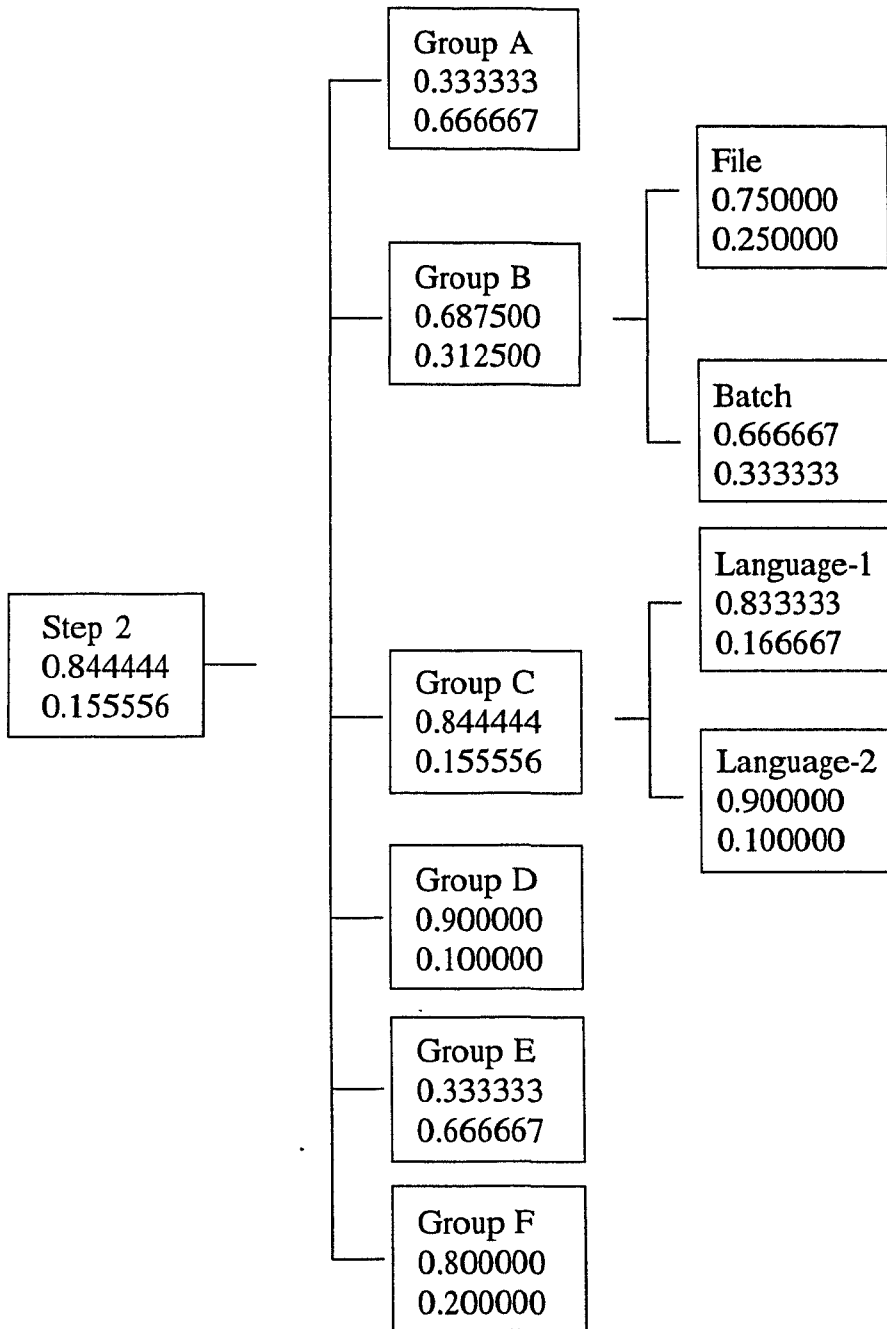


Figure-3 : Ranking of Vendors for Step-3

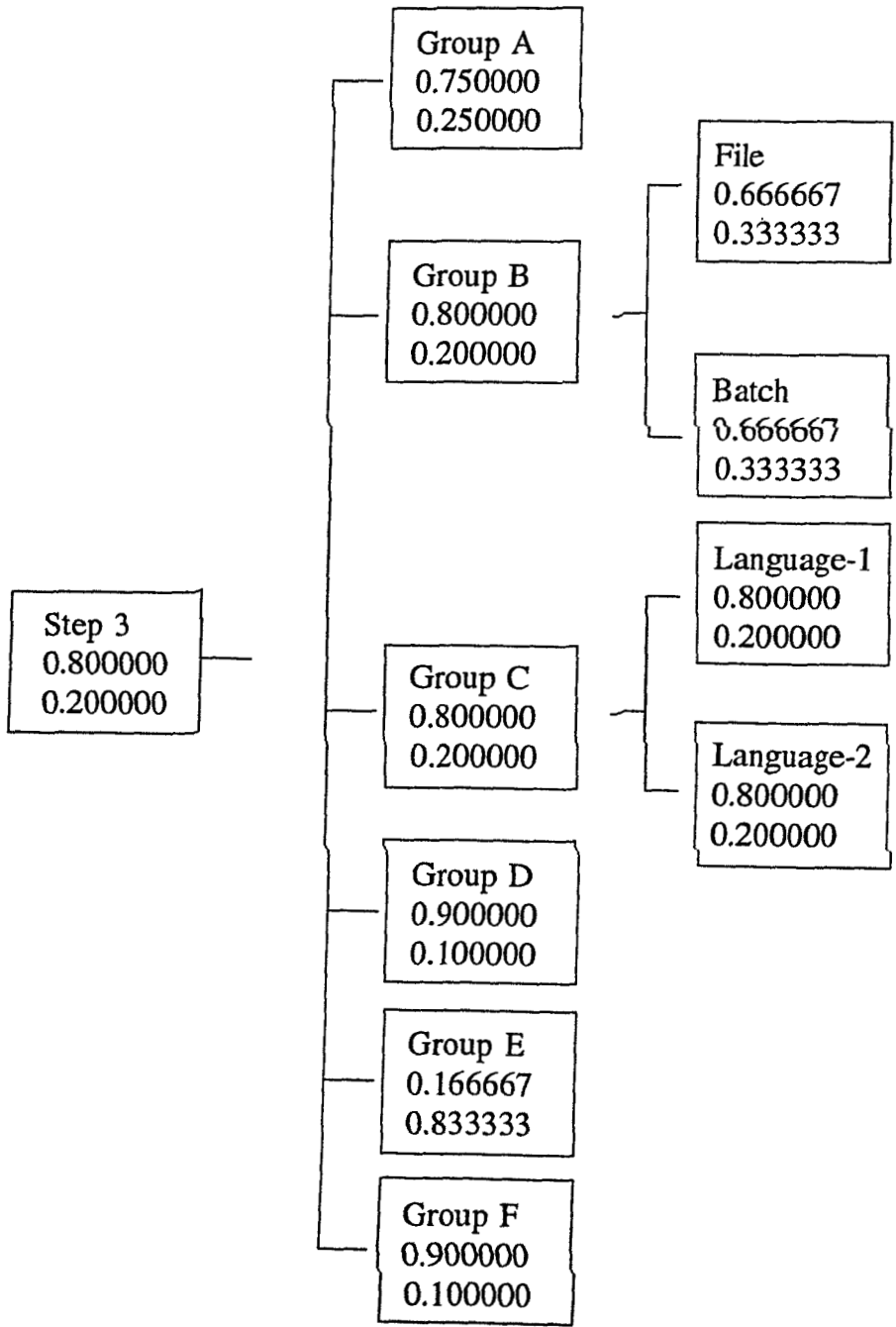


Figure-4 : Final Ranking of Vendors

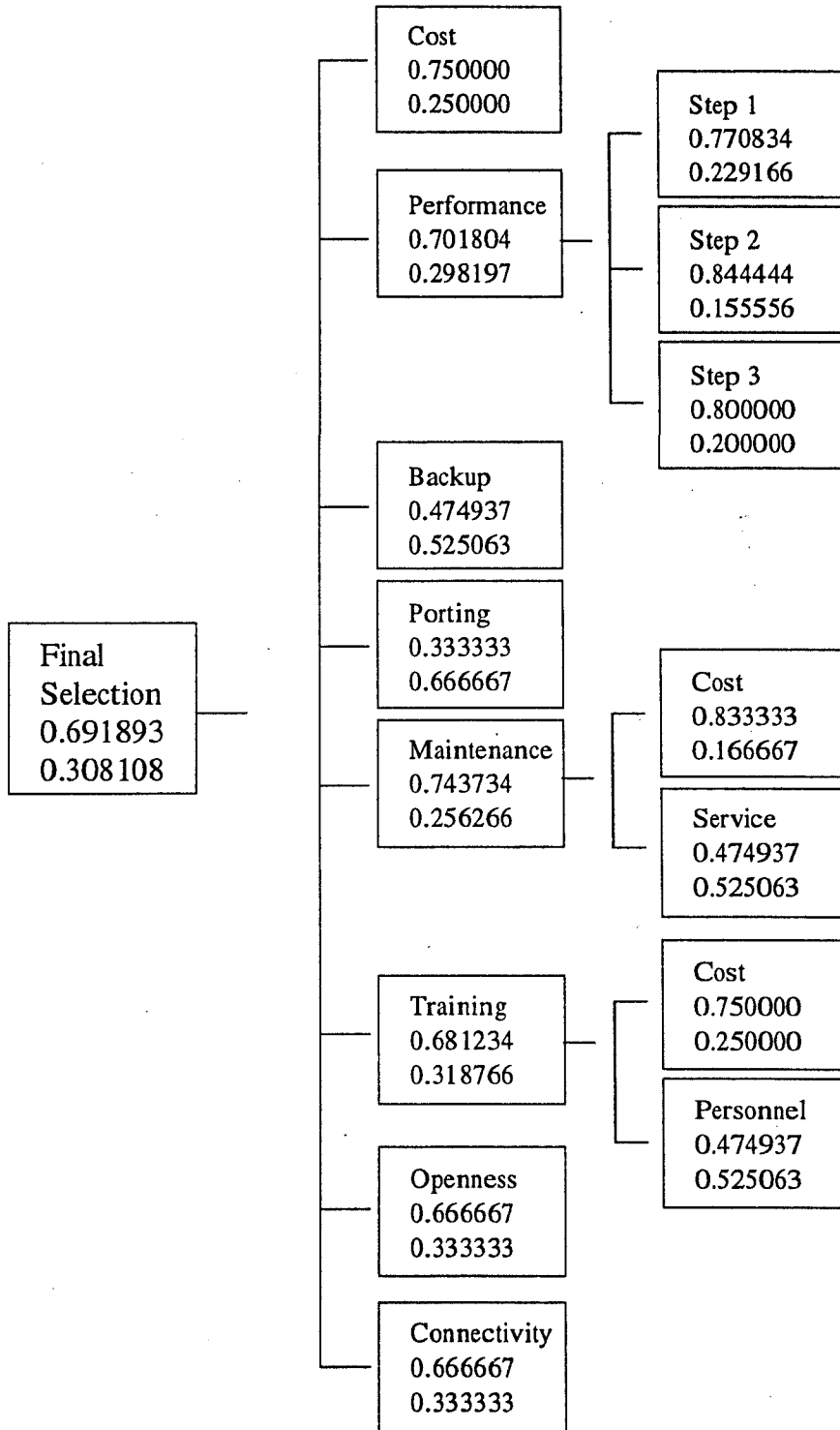
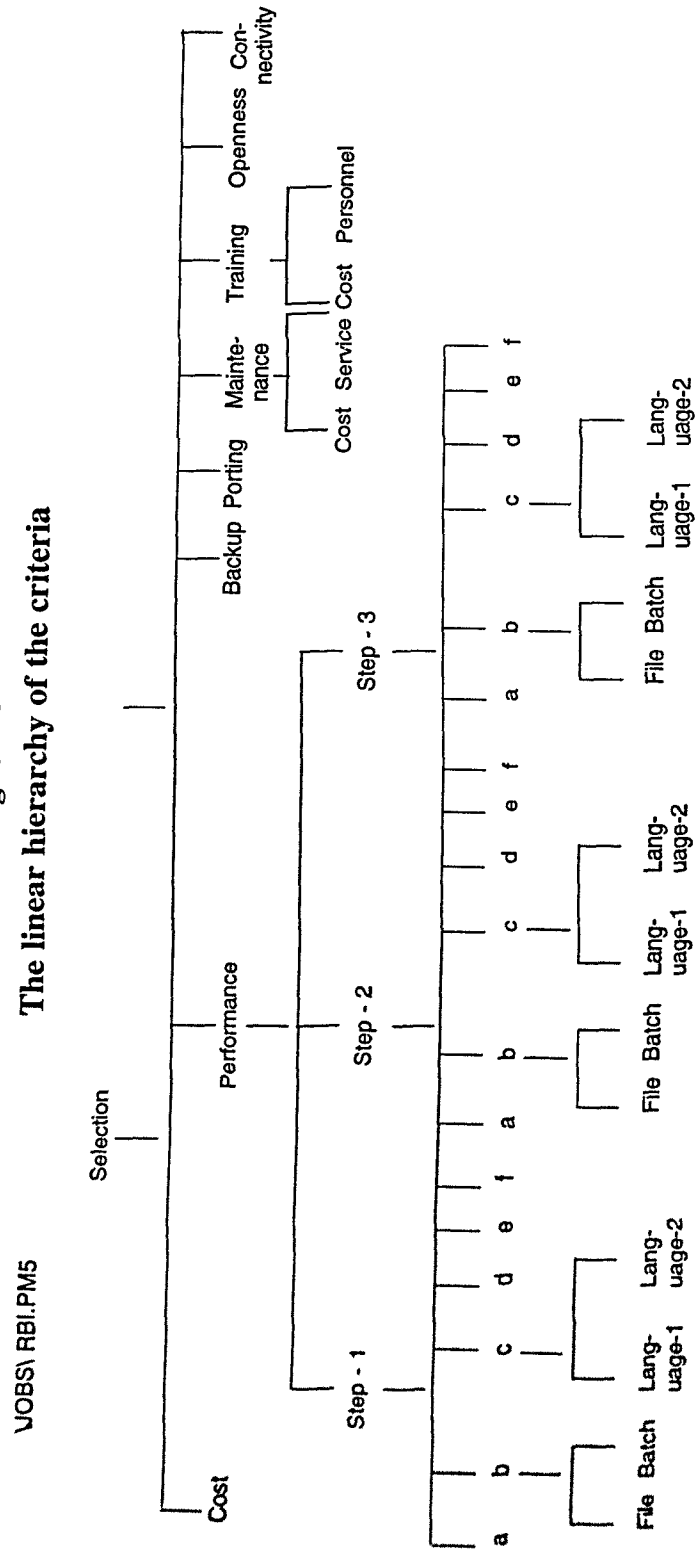
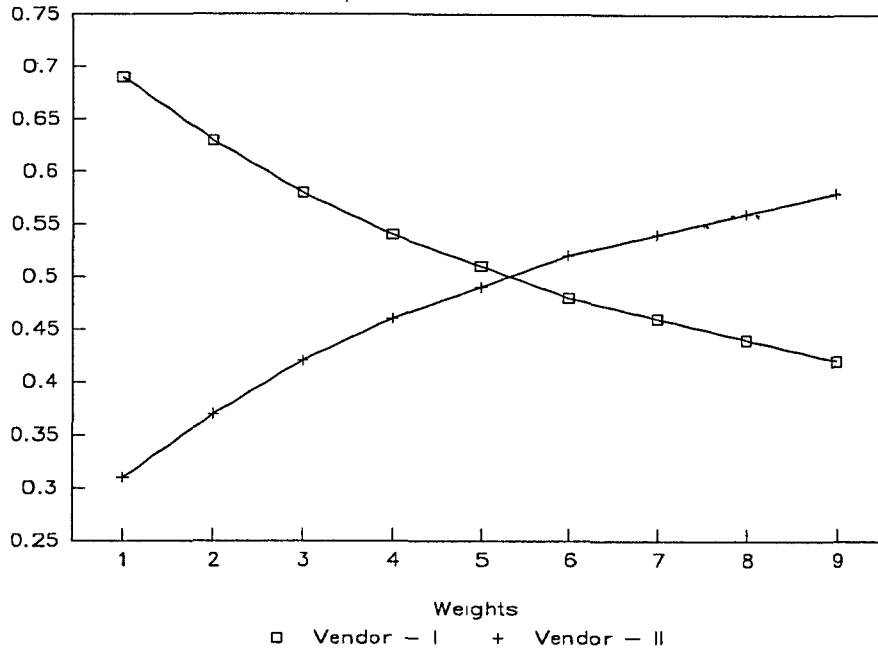


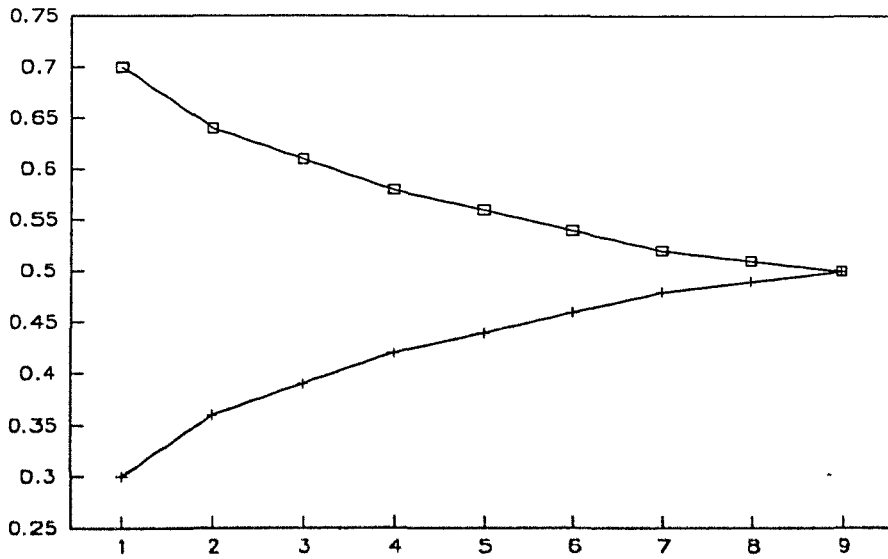
Figure - 5
The linear hierarchy of the criteria



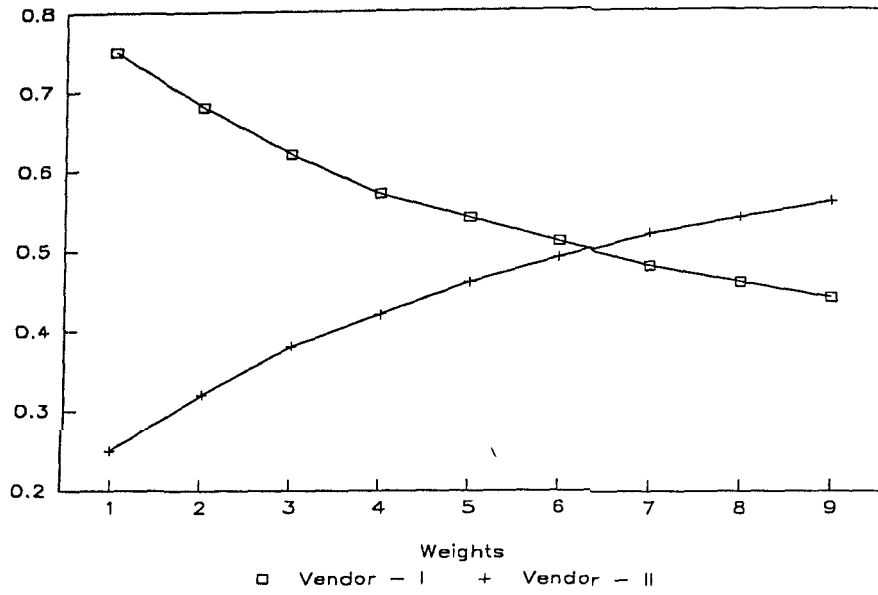
Step - I



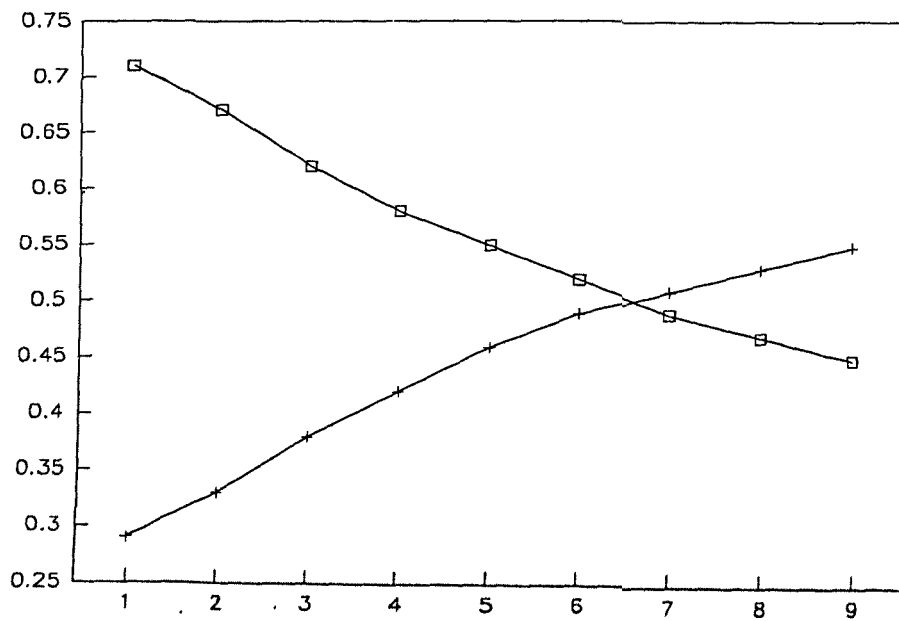
Step - II



Step - III



Performance



BOOK REVIEWS

Managing the World Economy – Fifty Years After Bretton Woods,
Edited Peter B.Kenen, Institute for International Economics,
Washington D.C., 1994

The title of the book under review promises excitement, especially as it is edited by a known specialist, and is clearly ambitious. A number of questions naturally arise: Who manages the world economy? How should it be managed, if at all it is decided that it should be managed? What would in the event be the scope of management? And why does one need to manage the world economy at this point of time?

The organisers of the seminar where the papers in the volume under review were presented must have asked the above questions. They decided to have one broad overview of the past situation in respect of the Bretton Woods ‘management’ of the world economy and a somewhat speculative treatment of the future of the world economy based on reforms of the present situation as proposed at the seminar. There are two major sections - one of them dealing with the management of the monetary system, the trading system and development and transition, and the other discussing the “new” international economic issues such as the market-led international financial system, international direct investment, global environmental organisation and migration. While the last two of the above issues are no doubt ‘new’, they are also novel and are required to be addressed at a level that is not merely imbued by the flavour of economics. We would not, therefore, touch upon them in this review.

The recount of the past of Barry Eichengreen and Peter Kenen (E&K) is impressive, even if one does not agree with all their interpretations. Rules and institutions, in the view of E & K, are important and have served the international economic system well. But their analysis is strongly anchored on the IMF, and less on the World Bank, even though both the institutions are supposed to give mutual

support to bring about not merely stabilisation but also 'development'. The authors however believe that the robust growth of the European economies in the post-war period upto 1970 has as much to do with "the relatively stable exchange rates of the Bretton Woods System" as to high investment and productivity-inducing trade liberalisation. One, however, wonders how much the Bretton Woods system has to do with the growth of the period, especially when it is well recognised that by the mid-to late-'fifties there have been in evidence strong strains on the international monetary system (IMS). The increase in capital mobility has finally led to the abandonment of the system of pegged exchange rates in the 'seventies. While this is known in its essence, the story of the replacement of the Bretton Woods system by a floating system, retaining at the same time arrangements for some international liquidity creation through the SDRs and for attenuating the problems of primary commodity producers through the CCF, needs to be unfurled in some detail, especially because of volatility and misalignment of exchange rates that characterised much of the period since 1973. The authors seem to be preoccupied with the idea of international commitment of member countries to increase IMF's influence and to work through 'coordination' in view of the domestic consensus on policies. This, however, does not mean that countries would readily sacrifice their national interests for some non-quantifiable 'coordination'. Yes, they will tender 'cooperation', a useful term in international economic relations, essentially to promote the national interests as they perceive them. If this is not so, how does one interpret the limited success of the Committee of Twenty ? How does one, to stretch this argument, view the Plaza and Louvre agreements which were arrived at by industrial countries without any direct involvement of the IMF ? And how does one regard the EMS which is also moving away from a system of adjustable pegs to somewhat rigidly fixed rates?

Indeed, this takes straight into the arena of attention of John Williamson and Randall Henning (W & H). They in fact believe that IMF would need to be involved in the G-7 meetings, with the Managing Director of the Fund, as a participant, an idea that was for long canvassed by the Group of Twenty Four representing developing countries. It is precisely for the reason that developing countries' interests would need to be considered, if such a proposal were to be

accepted, that G-7 will be least enthusiastic about it. But W & H go much beyond this problem. They provide a 'blue print' for policy coordination: identify the IMF as the best institutional locus for it, propose a system of target zones based on estimates of the fundamental equilibrium exchange rates (FEERs), support the target zone exchange rate management with appropriate fiscal policies, and have an agreement among countries for a regime for setting external current account targets so as to ensure that liberal trade and capital flows are not jeopardised. If the blue print is not adopted, there will, by implication, be continuation of the 'non-system' in vogue since 1973.

The intellectual stimulus of the target zone proposal has, by now, petered out despite repeated mention of it by scholars associated with the Institute for International Economics (see for instance Fred Bergsten's piece in the volume under review). Richard Cooper in his comment on the W & H paper has in fact given what this reviewer would call, for want of a better term, "the final" verdict. He rightly believes that there is no basis for establishing current account targets in today's world - a point that is at the very heart of the blue print and the FEER-determination. Even the so-called 'non-system' as in existence works because monetary authorities decide whether market exchange rates are desirable or not, before undertaking collective actions.

John Jackson's piece on managing the trading system is heavily descriptive, and is largely supportive of the WTO Charter and dispute settlement mechanisms. The WTO is a useful institutional innovation but may not necessarily take care of all concerns in these days of economic liberalisation. For example, there could be, as correctly pointed out by Alan Wm. Wolff in his comments, private restraints on trade. Yet another issue relates to the business of financial services and investment, on which many developing countries have genuine concerns, even as one accepts that markets are global and trade has to be non-discriminatory.

The paper on managing development and transition by Nicolas Ardito – Barletta is cast in very broad, general terms. As a result, there is no full scale treatment of any major issue(s). While the author argues for developing mechanisms that provide developing

countries and transition economies to have access to external finance, the treatment of the several issues - external resource transfers, project financing, human development and poverty alleviation, governance and institutions, financing of private economic activity, technical assistance, and protection of environment - has been devoid of insights that could be truly regarded as additional to what is generally found in the literature. The author feels that the international institutions have established "much value, resilience and flexibility" and need "not be subjected to major surgery, destruction and revision". But then as Moises Naim points out in his comment, there is some inward orientation of the IMF and WB which is essentially due to the visa status of the staff members - the 'G-4 effect' as he calls it. The dysfunctional aspect of this situation needs to be altered. Besides, Ardito-Barletta's defensive arguments in favour of the status quo regarding the institutional arrangements do not go far enough to address the concerns of a number of scholars about the management of development, especially in poor countries. Conditionality used along with external finance in support of policy frameworks has often been viewed as merely sustaining the multilateral institutions without releasing tangible dynamic impulses of growth. Indeed, there is growing evidence of liberalisation by developing economies in the last 15 years, and yet the gap between the industrial and developing economies has remained wide. These gaps do point to the inability of the international economic system to restructure itself.

The market-led international monetary system (M-IMS) as against the government-led international monetary system which resulted from the Bretton Woods has thrown up many implications for monetary cooperation, finance, and institutional arrangements. Padoa-Schioppa and Saccomanni, (PS & S) in a very erudite and perceptive paper, argue that monetary cooperation has, where initiatives were taken, been more in the nature of crisis management and has affected central banking rather than inter-governmental affairs. At the global level, the only strategy now available under M-IMS to stabilise exchange rates is through policy co-ordination. But experience has shown the limited relevance of IMF-WB in international monetary cooperation: this is in contrast to the region - level cooperation as evidenced by EMS and by the possibilities of a single monetary policy and a single currency in Europe with a European central bank.

PS & S also suggest that effective payments system cannot be left to 'market alone' and has to be undertaken through a 'public' institution, preferably the central bank, because payment systems "generate externalities that cannot be internalized by market mechanisms" and therefore require 'public' intervention. On the institution to manage M-IMS, PS & S clearly specify characteristics, all of which could have been well handled by the IMF. PS & S feel that only BIS came close to the ideal in this regard, especially because it regularly holds meetings of central bank Governors and closely monitors foreign exchange and financial market developments. While this may be the case, M-IMS cannot be solely looked after by the central banks alone, given the large number of financial instruments, innovations and derivatives.

One of the spill-overs of capital mobility is the large increase in international direct investment (IDI). This will go up in particular in the area of services in future. While GATS is a useful 'new' arrangement in this area, DeAnne Julius considers that multi-national corporations could be given access to the dispute settlement process in the WTO. This is somewhat contentious and need not necessarily be welfare enhancing for the developing countries.

What then remains of the future of the world economy? Fred Bergsten's analysis of the general lessons from the past is exceedingly interesting and perceptive. His proposals for the future take the form of a conversion to a target zone system, defended "primarily through agreed intervention strategies" and supported by "domestic monetary and fiscal policies". This is only a slight variant of the 'blue print' as enunciated by Williamson and Henning. Bergsten also pleads for a better coordination of activities of IMF and WB. This is not a 'novel' idea but how to achieve high quality coordination is the question that often crops up in serious economic system has to be done under a 'collective leadership'. But such a group does not exist.

In a world of ideas, there can never be a finality. The past can be analyzed and agreements could be obtained on some broad aspects. With regard to future, we are certain of only one thing: the need for enhanced international cooperation in the context of

globalisation of financial markets and the indefiniteness of market behaviour. Hopefully, this will provide the basis for working out solutions to problems that we come across as we move about in this vast area of international economic relations. The Institute of International Economics deserves kudos for bringing out the volume under review that makes us all to worry and work for viable solutions.

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The Indian Economy 1947-92 : Agriculture, V.M. Dandekar,
Sage Publications, New Delhi 1994, Pp. 405, Rs. 350

The book under review is a volume on agriculture that introduces the three volume series on the Indian economy by Professor V.M. Dandekar where he has brought together his writings on Indian agriculture over the years. The book is divided into six chapters. The first part of the first chapter gives an idea about how the ad hoc machinery that was assembled for revenue collection by the imperial power, had disrupted the self sufficient village and replaced it by a semi-feudal exploitative hierarchy. A large number of alternatives that were suggested ranged from collectivization to cooperative farming. Most of these alternatives missed the crucial consideration of instituting a system that would correct the 'dualistic' nature of the economy and resolve its innate conflicts, such as the conflict between agriculture and non-agriculture on the one hand, and between the viable and non-viable segments of agriculture on the other. The non-resolution of these conflicts at the very onset has created situations that are in the nature of policy compulsions in latter years, which eventually turned out to be in the nature of palliatives.

The second part of this chapter examines the issues put forward in the celebrated book by Professor T. W. Schultz, viz. 'Transforming Traditional Agriculture' where Professor Schultz has attempted to refute the doctrine of Labor of Zero Value. The main arguments of Professor Schultz are that labor in agriculture is efficient but poor, its productivity is comparable to that of labor in other sectors (i.e., not zero) and that traditional agriculture has a stagnant stock of capital. Professor Dandekar dismantling these arguments, illustrates how the doctrine of zero value of labor could still hold in India in the following way. While the arguments put forth by Schultz could hold for the viable section of agriculture, they are not valid for the non-viable segment of agriculture where the surplus population remains unabsorbed affecting its productivity. This is due to the family nature of the farm enterprise where labor which does not add to the total product (labor of zero value) cannot be discouraged from being employed.

This could result in income per head that is below subsistence level leading to dissaving and disinvestment and consequently negative rate of growth. This refutes the hypothesis that traditional agriculture was always in a 'stationary' equilibrium. The problem of over-population in the non-viable segment of agriculture also reduces the marginal productivity of labor in this sector below that of those in the rest of the economy unlike what Professor Schultz has claimed. Professor Dandekar shows how most of the arguments put forth by Professor Schultz reflect lack of recognition of the problem of over-population and other underlying complexities of traditional agriculture, leading to over-simplification of the causes of stagnation and highly simplified solutions to overcome it. This sub-section is a noteworthy illustration of Professor Dandekar's analytical ingenuity and insightful logic surrounding the empirical complexities of the problems of agriculture. However, it must be noted that the paper has become dated in that the gamut of arguments relating to raising the productivity of agriculture is largely technological.

Agricultural administration, research and education is the centre of focus of the second chapter of the volume. The British took the initiative of setting up agricultural department and Ministry of Agriculture and the Imperial Council of Agricultural Research, but these areas continued to be overcentralized even after independence, without fully absorbing the needs emerging from the technological breakthrough in raising foodgrain availability. Professor Dandekar laments over the process in which five year plans lay targets that involve not only government action but also planners' expectations of the response from millions of farmers (entrepreneurs), without ensuring any mechanism for their participation. In order to distinguish planning from speculative thinking about future and plan targets from statistical projections or economic forecasts, government should confine its planning exercise only to items it can control. Professor Dandekar takes the view that the government should undertake three functions, educating the farmers, reorganizing the production apparatus in agriculture so as to enable the farmer to make better use of his resources and creating appropriate institutions in order to improve decision-making in agriculture. These three would ensure creation of environment wherein farmers participate meaningfully in decision making and utilize science and technology to improve production.

The inflexibility of food administration in a situation that has undergone a sea change from one of stark scarcity to one of reasonable adequacy due to the technological breakthrough has impeded the development of an integrated national market, a fact that was brought out in a logical way in Chapter 3. The author advocates that the Food Corporation of India (FCI) has a limited role of stabilizing prices through the maintenance of adequate buffer stock, which should be rotated depending on the demands of the price situation. Such a role can be played by the FCI only if it has greater autonomy and is run along commercial lines.

Agricultural Marketing and Prices is a crucial chapter in the book; the main theme of which is the need to integrate the economy into a single market. For this to happen, the current market apparatus needs to be reorganized right from the district level into a fairly autonomous one with possibilities of some leverage for social control. The primary objective of this control would be to prevent and eliminate malpractices, and minimize the role of intermediaries with greater direct contact between the buyers and sellers to enable the tiller to get a relatively higher price, even if the terms of trade for agriculture are not altered. Another point where government needs to intervene to promote production is the maintenance of stable assured prices - the minimum support prices. Professor Dandekar favours payment of minimum support prices, and raising them gradually through the year while moving away from the harvest season so that the farmers get an incentive to hold on to the stocks beyond the harvest season and may also save cost/wastage by the FCI.

Professor Dandekar goes on then to critically examine certain theories which were widely accepted in the 50s and 60s. The foremost of these is the Mathur-Ezekiel hypothesis of the backward bending supply curve that rested crucially on the assumption of the fixed nature of the farmers' cash requirements. In Professor Dandekar's view this assumption was not realistic given the fact that more cash was always welcome to farmers both as consumers (for greater consumption/utility) and as investors (for more returns). This implies that the notion that farmers in underdeveloped countries respond irrationally to price signals is wrong. This chapter also dwells upon the debate between the author and Professor Dantwala on the author's view that the bad performance of Indian agriculture was attributable

to wrong policies. This section contains a series of articles written by both the Professors. Though dated, they illustrate the position of the two eminent agricultural economists on the agricultural policy in India.

The fifth chapter traces the development of the Agricultural Credit System beginning from the taccavi loans in 1793 which marked the first instance of official cognizance of the need to finance agriculture. It evaluates the progress of rural credit, starting from the Co-operative Societies Act, 1904, after which the co-operative movement spread rapidly till the great depression which gave it a setback and the setting up of the Indian Rural Credit Survey in 1954, which reviewed the policy progress and problems in the field. The chapter further traces the recommendations and findings of the various groups and committees right up to Khusro and Narasimham Committees. In the author's view the recommendations of these committees do not suggest concrete measures to correct the situation, which as pointed out by him is the result of the non-viability of the farmers and the agricultural production structure itself.

The last chapter of the book explores Professor Dandekar's vision of the agricultural policy for future. This chapter draws together his views on various issues including those dealt with in the earlier chapters. Central to this vision is the argument that agricultural policy should not choose the softer option of doling out subsidies. The FCI, Co-operatives and the other financial institutions should be run commercially. State's control over organizations such as the regulated market committees should be removed making their operations more decentralized. However, this move towards commercialization should not cast away the poor for whom there will have to be a safety net.

In the author's opinion net transfers into agriculture are justified, as the sector bears a disproportionately large burden of the country's population. Yet subsidies are not the best way of giving these transfers. If subsidies are not targetted properly, they would result in supporting the inefficient and reducing the sector's productivity. In order to avoid this the author goes on to suggest that the amount of money given as subsidy to the FCI could be given to labour as a support price. This scheme, however, may invite serious problems at the implementation stage. Secondly it does not support

the main theme of the book where the author has stressed that the poor should not be given dole but be made viable enough in order to make them earn and live with self-respect.

Regarding the policy on agricultural exports, Professor Dandekar argues that the policy of exporting only residual amounts would be detrimental to the establishment of an export market.

Written in Professor Dandekar's unique style, the book brings out a number of vital issues of Indian agriculture with clarity that is distinct and outstanding. What is more, the views hardly reflect any espousal of familiar 'doctrines' and ideologies. It is the authentic and penetrating analysis of the problems at the grassroot level that makes Professor Dandekar's writings so relevant even to contemporary situations.

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