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Projection of Sectoral Value-added: Comparative Analysis of Alternative Methods

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ABSTRAK

Kertas kajian ini membincangkan kesesuaian kaedah penganggaran nilai ditambah ekonomi Malaysia. Tiga kaedah penganggaran, kaedah blow-up KDNK, kaedah blow-up permintaan akhir dan kaedah input-output, dibandingkan di segi ketepatan dan kecekapan relatif. Perbincangan tertumpu kepada tiga perkara. Pertama, perbincangan tentang metodologi, manakala perkara kedua dan ketiga, masing-masing tentang ketepatan dengan menguji kesilapan minnya dan kecekapan dengan membanding variannya. Keputusan kajian menunjukkan bahawa kaedah input-output lebih baik di segi ketepatan (kesilapan min terendah) dan kecekapannya (varian terendah).

ABSTRACT

The paper discusses validation of methods used in projecting Malaysian value-added. Three methods of projection, the GDP blow-up, the final demand blow-up and the input-output methods are compared in terms of their accuracy and relative efficiency. The discussion focuses on three aspects. The first aspect deals with the methodological issues, while the second and third aspects, respectively, determine the accuracy by testing their mean errors and efficiency by comparing their variances. The results show that the input-output method is superior to the other two methods in terms of accuracy (lowest mean error) and efficiency (lowest variance).

INTRODUCTION

Almost all developing countries in the world rely greatly on economic planning to influence and control the level and growth of their principal economic variables to achieve a predetermined set of development objectives. The planning process itself involves preparation of an economic plan which contains a specific set of quantitative economic targets to be reached in a given time period. These targets are forecast or projected values of certain principal economic variables expected in the future, which even though unknown at the time of making the forecast, are nevertheless, important in deciding the future path of the economy. At the macro level, the forecast values which comprise Gross Domestic Product (GDP), employment, consumption (Private and Public), Investment, exports and imports are derived from a set of forecast values at the sectoral level.

Value-added forecast enables planners to chart the future statistical time path of the economy's key variables; particularly, if it is done at a sectoral level, it will provide a quantitative indication of rising and declining sectors. Industrialisation will see an increasing share of manufacturing and a declining share of agricultural value-added. An economy undergoing rapid transformation will generally experience a marked shift in the share of sectoral added value. Sectoral value-added forecast has been widely used in both developed countries such as the United States (Leontief, 1986), the United Kingdom (Gosh, 1964) and Netherlands (Theil, 1975) as well as in developing countries such as India (Slastry *et al.* 1975) and Malaysia (Aziz, 1984; and MIDA, 1985)[1]. The preparation of Malaysia's Industrial Master Plan, for instance, involves a projection of twelve, key economic variables of the sector and uses an

[1] The Central Planning Bureau of Netherlands provides annual Central Economic Planning which is essentially a multiple forecast of the following year's economic conditions. The Bureau uses the input-output techniques extensively in its forecasting of all the household, business, government as well as the international sectors. Theil (1975), pp. 44-77.

input-output technique; the forecast values become the important motivating factor that leads to the excellent performance of the plan as reported by the review of the plan.

The aim of making a forecast is to reduce uncertainty, which is easily verified by comparing the forecast values with the actual values. A forecast value which does not differ significantly from its actual value is described as an efficient forecast. In this paper, a set of projections of Malaysian sectoral value-added is made by using different methods, including that of input-output; and their forecast performance is validated against the actual values. Section 2 discusses the assumptions of input-output analysis and structure of the Malaysian input-output table. Section 3 presents the methodologies of value-added forecasting. The results and discussion are presented in Section 4, followed by a summary and conclusions of the paper in Section 5.

The results of our analysis show that the Malaysian input-output tables are consistent with those of other countries in terms of their predictive ability; and thus the tables can be used confidently as a basis of economic projection and planning.

Input-output tables are an accounting framework for assembling data on industry input and output, which reveal the many interrelated transactions occurring in the economy. The constructed tables closely reflect the national accounts which show the flow of final goods currently produced and the equivalent flow of factor and nonfactor income generated in the production of the output. National product, which equals the sum of the value-added in all individual industries, when broken down into contributions made to it by individual industries, is generally referred to as national product by industry of origin.

In input-output tables, the value of final goods and services produced by the business, personal, government and foreign sectors, as described by the national accounts, is found in the value-added row(s); when data are available the row(s) can be reduced to wages, depreciation, indirect taxes, and residual profits. From the table, value-added row(s) will show what value each separate industry adds to the final output; the value-added by each industry to the raw materials, or other goods and services that it bought from other industries is accumulative at each stage in the chain of production.

ASSUMPTIONS AND STRUCTURES OF INPUT-OUTPUT TABLES

There are important practical and theoretical objections to the use of input-output coefficients matrices in forecasting the impact of changes in one sector on gross output and thus on added value in the economy as a whole. In the simplest possible case where a single set of input-output coefficients from a previous year are used to forecast added value, limiting assumptions are required. In outline, these are: (i) each unit of commodity output is perfectly substitutable for every other unit of output produced; (ii) the production function in each sector is linearly homogeneous of degree one; in other words, there are constant returns to scale in all types of commodity production; (iii) there is perfect complementarity and zero subsitutability between commodity inputs to the production of each type of commodity, so that a change in the level of output requires changes in fixed proportion of the inputs consumed; (iv) prices are fixed (these are normally expressed in terms of 'Leontief units' such that the price of each commodity is equal to unity); and (v) supply is perfectly elastic. If these assumptions hold in the short run, the model has sufficient reality to provide an efficient added value forecast.

In the Malaysian 1983 input-output tables published by the Department of Statistics[2], value-added is shown as the difference between the total value of primary inputs, (the primary input's quadrant being not well developed as yet) and total imports and commodity taxes. Value-added will therefore include salary and wages, interest on capital, profits and depreciation charges. This definition is in line with that of another publica-

[2] The first input-output table of West Malaysian (Peninsular Malaysia only) economy was compiled by the Department of Statistics for the year 1960. Following this was the publication of input-output tables for the years 1965 and 1970. The first set of input-output tables for the whole of Malaysia were published by the same department for the year 1978, followed by that for 1983 which is the latest published.

tion of the Department, the Industrial Survey[3], which clearly defines value-added as the difference between the gross value of output and the cost of inputs.

Why are value-added projections important in the economic planning of a country ? The sectoral value-added forecast is important not only because it enables us to know the expected shifts in the economy's production structure which undergoes a process of transformation but also to quantify the anticipated sectoral value-added in the target year. The trend and magnitude of the shifts provide invaluable information for planning purposes; to minimise bottle-necks in a particular industry caused by the inability of its up-stream industries to supply the necessary intermediate inputs, and which consequently create another bottle-neck in its down-stream industries. The forecast is also important because it can identify both growing and shrinking industries, and thereby help prepare the economy for the anticipated organisational and administrative changes caused by structural changes.

GDP by industrial origin which is the total sum of sectoral value-added, will show the relative contribution of each sector to the economy's final output. When time-series data of the sectoral value added are available, it will show structural changes in the economy's final output. Table 1 shows Malaysian GDP by industrial origin, typfying a developing country striving for industrialization, where the agriculture sector is on the decline and manufacturing sectors are on the increase. The input-output tables will not only show value-added originating from each industry but also the share of each industry's value-added to its gross value of output. This information can be found in the economy's input structure as shown in Table 2. The table shows that despite the declining trends in the contributions from the agriculture and mining industries to the GDP, their proportions of value-added from total gross value of outputs remain the largest.

TABLE 1
Malaysian GDP by industrial origin

	Percentage share in GDP				Percentage growth	
	1979	1984	1987	1990	1979-84	1985-90
Agriculture	24.3	20.1	21.7	18.9	2.9	4.3
Mining	11.1	10.5	10.5	9.7	5.8	4.0
Manufacturing	19.3	20.3	22.6	26.9	7.9	10.6
Others	45.3	49.1	45.2	44.5	9.7	3.4
GDP	100	100	100	100		

Source: Ministry of Finance, *Economic Report*, various issues.

TABLE 2
Input structure of the Malaysian Economy 1978 and 1983 (%)

	Agriculture		Mining		Manufacturing		Others	
	1978	1983	1978	1983	1978	1983	1978	1983
Agriculture	1.03	3.43	0.14	0.03	11.72	10.36	0.70	0.47
Mining	0.02	0.03	0.27	0.52	4.97	4.70	1.12	0.85
Manufactg.	8.56	10.43	4.93	3.96	15.60	18.35	17.02	16.44
Others	3.25	4.91	8.61	8.83	9.71	10.11	15.55	16.05
Tot. intmd.	12.83	18.80	13.95	13.34	42.00	43.52	34.39	33.81
Comm. taxes	0.62	0.55	0.70	0.27	4.00	3.40	1.55	1.31
Imports	6.24	6.16	5.21	6.15	29.80	29.82	12.86	17.24
Value added	80.28	74.49	80.15	80.24	24.20	23.26	50.66	47.64
Total	100	100	100	100	100	100	100	100

Source: Department of Statistics, Input-output tables, 1978 and 1983.

[3] Industrial Survey (1987), p. xii

METHODOLOGY

The projections of 1983 sectoral value added of the Malaysian economy were compiled by using the 1978 input-output tables as the base. Information known at the time of making the projections is derived from the 1978 and 1983 input-output tables published by the Department of Statistics. Three methods of projection are used. The simplest and most straightforward method is by blowing-up the base year's sectoral value added in proportion to the growth of aggregate GDP of the economy during the 1978-83 period. This method of partial forecasting is similar to fitting a mathematical curve to an individual time series and extrapolating this curve to some future date. If aggregate GDP records a rise of 10 percent during the period, the present method will blow-up estimates of sectoral value-added by adding 10 percent to those of the base year.

The second method assumes that the base year's sectoral proportion of final demand to total output remains constant over the period of projection. Applying these proportions on the vector of final demand of the year of projection, the estimates of sectoral output can be obtained. Similarly, the method assumes invariant value-added coefficients of the base year. The estimates of sectoral value-added for the projected year are obtained by multiplying the fixed value-added coefficients by the initial estimates of sectoral total output of the projected year. That is:

(1) $$X_1 = \frac{X_0}{F_0} \cdot F_1$$

(2) and $$V_1 = \frac{V_0}{F_0} \cdot X_1$$

(3) $$= \frac{F_1}{F_0} \cdot V_0$$

where X = sectoral total output
F = sectoral final demand
and V = sectoral value added

The subscripts 0 and 1 refer to the base and projected years respectively.

It is important to note that the first method takes no account of final demand breakdown in the projected year and considers only a change in aggregate GDP. The second method, on the other hand, takes into account the changes in final demand over the period. In the above methods, the interdependence between the different sectors of the economy has been ignored.

The third method of forecasting, the input-output method which is also considered as consistent forecasting, ensures that the output of each industry is consistent with both final and intermediate demands. This means that the projection for individual industries will add up to a total projection (of Gross National Product, for example) if the structural relations of the economy remain the same over the projection period, or if allowance can be made for the anticipated changes in the structural relations.[4]

The balance equation of the static input-output model can be written as:

$$X_1 = a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n + F_1$$

(4) $$X_2 = a_{21}X_1 + a_{22}X_2 + \ldots + a_{2n}X_n + F_2$$
$$X_n = a_{n1}X_1 + a_{n2}X_2 + \ldots + a_{nn}X_n + F_n$$

For i^{th} industry, the above relationship can be expressed as:

(5) $$X_i = \Sigma_j^n a_{ij} X_j + F_i, \quad i = 1, \ldots, n.$$

where $a_{ij} = X_{ij}/X_j$ is the amount of output of industry i purchased by industry j per unit of output of industry j. Or equation (5) can simply be written as:

(6) $$X = AX + F$$

Where X and F are vectors of total output and final demand respectively and A is the structural matrix. By assuming exogenous final demand, the general solution of the balance equation can be shown as:

[4] One of the major problems involved in consistent forecasting is that of allowing for changes in the structural matrix, particularly when long term projections are being made. For short term forecasts, it is fairly safe to assume that the matrix remains the same or it does not change significantly. For long term projections, however, one normally does not assume the matrix to remain the same.

(7) $X = (I - A)^{-1}F$

While such a result would be tautological for the year for which the table is constructed, it would be substantive when the above computation is done for some other specified period.

By inserting projected year's final demand as an exogenous element in equation (7), given the base year's structural matrix, sectoral output for the projected year can be derived. And by assuming constant value-added ratio, projected sectoral value-added is derivable from the projected sectoral output. The estimation of projected value-added may be summarised by the following relationship:

(8) $V_i^t = k_i^o \sum_j^n b_{ij} F_j^t$

where V, k and b are the amount of value added, the value-added ratio and the inter-industry coefficient (elements of Leontief inverse matrix) respectively. The subscripts refer to industry while the superscripts refer to the base and projected years.

It is clear from equation (8) that estimates of value-added of sector i in year t is given by a linear combination of final demand deliveries in year t. The inter-industry coefficient is derived from technological relationship in year 0. In other words, the sectoral estimates of value added depends not only on the value-added to total output ratio but is also influenced by parameters expressing direct and indirect requirements of output to satisfy a unit worth of final demand of different industries.

RESULTS AND DISCUSSION

This section discusses the results of our analysis and presents the various estimates of value-added in 1983 by using the above three methods and comparing their relative efficiencies in projecting the economy's value-added. More specifically, the efficacy of each method of projection is examined in terms of the differences between their respective estimates and the actual values, or their errors. The best method would be the one that gives the smallest error. Table 3 compares the various estimates of value-added in 1983 computed by using the above three methods with the actual value-added published by the Department of Statistics. The sectoral value-added forecast for 1983 is obtained by multiplying the sectoral value-added for 1978 by the GDP average growth rate for the 1978-83 period, which is calculated to be 3.47 percent. A scrutiny of the table reveals that a particular method may provide the best estimate of value-added for one particular sector but may not for other sectors.

Invariably the input-output method of projecting the value added seems to provide the best estimate for other agriculture sector (Sector no. 1) in comparison to the final demand blow-up and GDP blow-up methods. The other agriculture sector's actual value added amounted to RM2268.4 million; estimates of value added by the input-output method is the closest to the actual, amounting to RM2260.4 million (about 0.35 percent error); while those of final demand blow-up and GDP blow-up methods amounted to RM2450.2 million (8.01 percent error) and RM4538.8 million (100.08 percent error) respectively.

In the case of the dairy products sector (Sector no. 8), the final demand blow-up method appears to be the best method followed by input-output and GDP blow-up methods. The dairy products sector's actual value added amounted to RM180.9 million; estimates of value added by final demand blow-up method is the closest to the actual, amounting to RM187.8 million (about 3.81 percent error); while those of input-output and GDP blow-up methods amounted to RM167.3 million (7.51 percent error) and RM766.7 million (323.8 percent error) respectively.

Similarly, the ordering of best method differs for the tobacco sector (Sector no. 16), where the GDP blow-up method ranked first, followed by the input-output and final demand blow-up methods. The tobacco sector's actual value-added amounted to RM339.2 million; estimates of value added by GDP blow-up method is the closest to the actual, amounting to RM358.7 million (about 5.74 percent error); while those of input-output and final demand blow-up methods amounted to RM220.3 million (35.05 percent error) and RM219.1 million (35.40 percent error) respectively.

TABLE 3
Gross Value-Added, 1983 Actual versus Estimates (RM million)

Sector No		Actual	Estimates		
			GDP blow-up method	Final-demand blow-up method	Input-output method
1	Other Agriculture	2268.4	4538.8	2450.2	2260.3
2	Rubber Planting	2472.4	5883.4	2223.0	2476.7
3	Oil Palm	2497.2	3968.2	1719.8	2207.4
4	Livestock	700.8	909.1	654.4	584.8
5	Forestry	2169.5	4196.4	2755.3	2585.9
6	Fishing	1674.1	4130.7	1428.5	1377.0
7	Mining	7272.8	9368.8	8414.1	6643.9
8	Dairy Product	180.9	766.7	187.8	167.3
9	Vegetables and Fruits	87.6	366.2	120.7	123.1
10	Oil and Fats	558.8	1581.4	1072.8	1061.1
11	Grain Mills	143.3	851.1	131.9	146.5
12	Baker Confectionery	140.7	211.1	133.2	129.9
13	Other Foods	258.7	433.5	230.7	221.2
14	Animal Feed	99.5	124.6	96.2	81.2
15	Beverages	271.4	367.0	252.7	232.8
16	Tobacco	339.2	358.7	219.1	220.3
17	Textiles	313.4	763.2	367.1	381.4
18	Wearing Apparel	247.2	495.9	310.7	298.4
19	Sawmills	788.5	1796.3	812.5	978.8
20	Furniture and Fixtures	84.5	133.8	85.0	84.9
21	Paper Printing	589.1	757.9	871.3	373.6
22	Industry Chemical	742.3	350.6	2336.8	442.6
23	Paints Etc.	40.6	86.2	-484.1	70.8
24	Other Chemical Prod.	230.0	387.5	205.4	201.9
25	Petrol Products	252.4	508.9	566.0	337.9
26	Rubber Processing	279.3	584.2	268.2	271.1
27	Rubber Products	409.9	566.2	361.5	331.7
28	Plastic Products	193.1	267.4	243.9	175.6
29	Glass Products	211.7	317.0	529.0	267.3
30	Cement	270.5	224.5	-783.6	209.5
31	Non Metallic	187.6	209.6	437.4	187.4
32	Basic Metal	522.1	888.0	235.3	330.5
33	Other Metal	312.3	451.6	376.8	323.7
34	Non Elec. Machine	322.4	423.8	344.8	298.6
35	Electrical Machine	1428.8	1526.4	1521.1	1456.5
36	Motor Vehicle	658.7	366.4	323.2	3122.6
37	Other Transport	236.9	321.3	344.4	274.5
38	Other Mfg. Prod.	170.1	254.0	161.1	149.6
39	Construction	3845.6	4494.3	4141.0	3770.5
40	Other Services	27952.1	41204.0	28171.3	4598.3
		61426.0	94437.2	63638.1	36649.1

Source: Zakariah *et al.* (1991), p. 6

Table 4 ranks the methods according to the number of sectors that give the smallest error for each method. Among the three methods, the input-output method has fourteen sectors with best estimates of value added while the final demand blow-up and the GDP blow-up methods have the best estimates in thirteen and three sectors respectively. These figures indicate that the input-output method gives the largest number of sectors whose projected value-added are closest to the actual value-added, followed by the final demand blow-up and GDP blow-up methods.

The absolute errors in the estimates value added of each method are in turn aggregated and presented in the table which show that the input-output method has the lowest aggregate absolute error. The input-output method has an aggregate of absolute errors of RM29.80 million with average errors per sector of RM2.12 million while those of final demand blow-up and GDP blow-up methods are RM32.84 million and RM34.47 million with average errors of RM2.52 million and RM11.49 million respectively. These findings would support the view that the input-output method provides the best method of projecting value added, followed by the final demand blow-up and GDP blow-up methods.

Expressing the absolute errors in terms of their percentages to the actual values, Table 5 distributes the results according to various 'class errors'. The first column of the table shows how much the estimated value added has deviated from its actual values in percentage terms while columns 2 - 4 show the number of sectors for each method of projection corresponding to the percentage error class. The table shows that for the final demand blow-up and input-output methods the lowest classes are also the modal classes whereas for the GDP blow-up method the highest class is its modal class.

TABLE 4
Evaluation of various methods of projecting Value Added

Methods	No. of Sectors best estimate	Aggregate absolute error (RM million)	Rank
GDP blow-up	3	34.47 (11.49)	3
Final demand blow-up	13	32.84 (2.52)	2
Input-output	14	29.80 (2.12)	1
Total	40	97.11	

Source: Computed from the models. Figures in parentheses indicate average errors.

TABLE 5
Distribution of the Errors in Projection

Percentage errors	Number of Sector		
	GDP blow-up	Final demand blow-up	Input-output
0 - 20	5	21	25
21 - 40	9	6	10
41 - 60	10	6	1
61 - 80	3	0	1
81 - 100	5	0	2
101 and above	12	7	1
Total	40	40	40

Source: computed from the models.

The table also shows that the input-output method has the lowest weighted mean percentage errors (24 percent), followed by final demand blow-up method (36.5 percent) and GDP blow-up method (70 percent). *Figure 1* which shows cumulative distribution of the errors in projection for the three methods substantiates this view by showing that the cumulative distribution curve for input-output method is located clearly above those for final demand blow-up and GDP blow-up methods, confirming that the input-output method has the largest number of sectors with the smallest percentage errors (the modal class of the input-output method is in the lowest class error).

Based on the above findings, we may conclude that of the three methods of projecting value-added, the input-output method is the best method of projection. We next tested the hypothesis that the mean errors of the three methods are significantly different from zero to find out which of the methods is the most efficient estimate of value added. A cursory look at the three arrays of projected value-added presented in Table 3 clearly shows that mean errors of the GDP blow-up method are significantly different from zero as the individual sector's errors are consistently positive (indication of over-forecast) for all the sectors except for three sectors: industrial chemicals, cement and motor vehicles.

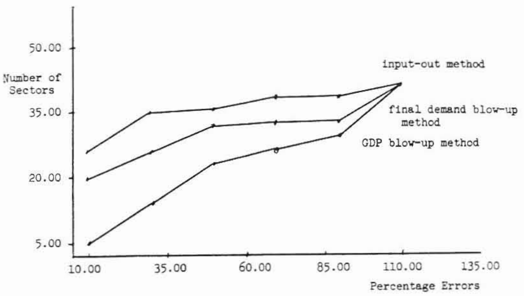

Fig 1: Percentage Errors of various methods compared

The above test on the remaining arrays of value-added projected was conducted by using the final demand blow-up and the input-output methods. Table 6 summarizes the results of the test of zero means on the two methods. The means of both methods are not significantly different from zero, leading us to infer that, on the average, the final demand blow-up method and input-output method would provide zero error in their projection of Malaysian sectoral value-added.

In assessing methods of projection of value-added between final demand blow-up and input-output methods, even though they are equally good methods in terms of giving zero mean error (on the average), we would be inclined to choose the one which is relatively more efficient. To determine the relative efficiency between the final demand blow-up method and the input-output method in projecting value-added, we would normally compare their variances.

Table 6 can be used to measure approximate relative efficiency of estimating value-added using the input-output method with respect to the final demand blow-up method by the following expression:

$$\frac{\text{Variance of final demand method}}{\text{Variance of input-output method}}$$

Relative efficiency of estimating value-added using the input-output method with respect to final demand blow-up method is approximately 175 percent, indicating the former is 75 percent more efficient than the latter (given the same sample size which is the number of sectors in the economy). This measure of relative efficiency lends us to conclude that in estimating sectoral value added of the Malaysian economy, the input-output method would give the best results.

TABLE 6

Mean and standard deviation of errors in Projection

Method	Mean	Standard Deviation
Final demand	346	1650
Input Output	-21	191
No. of sectors	39	39

Note: Not significantly different at one percent significant level. Sector 40 (Services sector) has been omitted to remove its extreme values from both arrays of value-added.

Having known that the best and most efficient method of estimating sectoral value added is the input-output method, we may then ask the question: will adjusting the value of the estimated value added by its mean error improve the estimates ? The answer is yes, if and only if, apart from having zero mean, the variance of the estimated errors are independent and serially uncorrelated. But due to the limited availability of input-output tables, which to-date are available only for 1978 and 1983, the test for independent variance and correlation as suggested by Theil (1975) could not be done.

To carry out the test, we need time series of errors in projection (which can be derived from Table 1 for 1983 only) for a reasonable number of years. At this juncture, we can only assume that the variances of the errors in projection are independent and uncorrelated; necessary adjustments, however, can be made to improve the forecast. Of course, violation of this assumption would increase the sampling variance and render the estimates inefficient.

SUMMARY AND CONCLUSIONS

The results of this study show that the input-output method of projecting Malaysia's sectoral value-added is the best and most efficient method of the three methods analysed, and are consonant with those of other studies. *A priori,* while final demand blow-up method has the advantage of allowing for different structures of final demand over the GDP blow-up method, the input-output method has the added advantage by taking into account inter-industrial relationship which the other two methods do not.

By using the Malaysian input-output tables for 1978 and 1983, our analysis shows that the input-output method has the largest number of sectors with estimates of sectoral value added being closest to the actual, rendering it to have the largest percentage mean errors and the lowest percentage errors class as its modal class. In addition, even though average errors of the input-output and final demand blow-up methods are not significantly different from zero, the former is found to be a more efficient estimator as its variance is lower than that of the latter.

We can infer from the above results that the input-output method is the best and most efficient method in projecting Malaysia's sectoral value added among the three methods considered. If the assumption of uncorrelated and independent variance among its errors is correct, adjusting the estimates with the error's factor will certainly improve the estimates.

Reiterating the basic assumptions, for input-output forecasts to be accurate, the productive sectors described must behave approximately according to the assumptions governing the Leontief production function. The assumption of constant returns to scale is often argued to be reasonable when it is the behaviour of the sector as a whole which is under consideration. This is especially so in the manufacturing sector where relatively large concentrations of fixed capital can produce short-run cost curves which may be described as flat-bottomed (Midmore, 1992). This lends support to the argument that, also in the short-run, the proportions of intermediate inputs used will be more or less fixed in response to changes in demand. Whilst such a rationalisation may be appropriate in genaral terms, it can be argued that it is not so in the specific case of agriculture which is characterised by the presence of many, relatively small producers with a range of potential alternative outputs. Varying returns to scale, the diversification of output in response to changes in demand, and the structural instability of input-output coefficients, however, should all tend to cause bias in forecasts.

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