Industry Structure and Inter-industry Relationships in China

Baiding Hu and Michael McAleer

Department of Economics, University of Western Australia (baidingh@melbpc.org.au)

Abstract: The fast and steady economic growth in China during the 1990s has attracted much international attention. Using the three most recent Chinese input-output tables, this paper investigates industry structure and inter-industry relationships and the relationship of both to economic growth. The input-output tables contain intermediate demand and final demand for six broad industries, namely, Agriculture, Industry, Construction, Transport, Post and Telecommunication, Services, and Other, for 1992, 1995 and 1997, which enables computing of input-output coefficients for three time periods. As direct and indirect input-output coefficients characterise industry structure during a particular time period, changes over time reflect the patterns in industry structure evolvement. Furthermore, output growth in a particular industry can be analysed from two different sources, namely the changes in input-output coefficients that reflect technological change, and the change in final demand. This paper sheds light on four different issues over the five-year period from 1992 to 1997: (1) Was growth driven by technological changes or final demand increases? (2) As a result of the interdependence of industries, how did an increase in final demand in one industry affect growth in another? (3) How has the bottleneck of an insufficient capability in the Transport, Post and Telecommunication sector to cope with demands from other sectors been affected during this period? (4) Has the industry structure of the economy been shifting in conformity with traditional growth theory, namely with a decline in the agricultural sector and a rise in the modern industrial sector?

Keywords: Input-output coefficients; Decomposition; Industry structure; Inter-industry relationship; Final demand

1. INTRODUCTION

The 1990s, particularly the eighth five-year plan period (1991-1995), is regarded as the most remarkable period for economic growth and development in China during the past fifty years. A significant achievement in this period has been the soft landing of the economy. Responsibility for this achievement has been government macroeconomic policies that aimed at sustainable growth by addressing, among other things, industry structure, such as bottlenecks in the economy, and inflationary pressure. Ma et al. [1997] summarised four characteristics for the period: (1) high economic growth, with an average annual growth rate of 12 per cent; (2) low fluctuations in the growth rate; (3) successful dampening of the worst ever inflation since the reforms; and 4) bottlenecks in the economy have been effectively treated. Apart from government policies, final demand plays an important role in economic growth. The study by Ri [1999] shows the time paths of the GDP growth rate, final demand, capital formation and net exports. Final consumption and capital formation reflect domestic demand for economic growth, while net export reflects foreign demand for economic growth. The paper shows that final demand is a dominant force in driving economic growth, even though its contribution has been declining over the 20 years to 1997. During the 7 years to 1997, it still accounts for 56.3 per cent of economic growth, on average.

Using the three most recent Chinese input-output tables, this paper investigates industry structure and inter-industry relationships and the relationship of both to economic growth. The input-output tables contain intermediate demand and final demand for six broad industries, namely, Agriculture, Industry, Construction, Transport, Post and Telecommunication, Services, and Other for 1992, 1995 and 1997, which enables computing of input-output coefficients for three time periods. As direct and indirect input-output coefficients characterise industry structure during a particular time period, changes over time reflect patterns in industry structure evolvement. Furthermore, output growth in a particular industry can be analysed from two different sources, namely the changes in input-output coefficients that reflect technological change, and the change in final demand.

This paper sheds light on four different issues over the five-year period from 1992 to 1997: (1) Was growth driven by technological changes or final demand increases? (2) As a result of the interdependence of industries, how did an increase in final demand in one industry affect growth in another? (3) How has the bottleneck of an insufficient capability in the Transport, Post and Telecommunication sector to cope with demands from other sectors been affected during this period? (4) Has the industry structure of the economy been shifting in conformity with traditional growth theory, namely with a decline in the agricultural sector and a rise in the modern industrial sector?

2. ANALYTICAL FRAMEWORK

The input-output technique is due to Leontief [1953]. A typical input-output model can be written as follows,

$$\underset{n\times 1}{Q_t} = \underset{n\times n}{A_t} * \underset{n\times 1}{Q_t} + \underset{n\times k}{F_t} * \underset{k\times 1}{\mathrm{i}_t} \qquad (1)$$

where the element in the ith row in Q_t, q_{it}, say, represents the total output of industry i in year t; the element in the ith row and jth column in A_t, $a_{ij,t}$, represents the amount of q_j required to produce a unit of q_i; and the element in the ith row and jth column in F_t, $f_{ij,t}$, represents the jth category of the final demand for the ith industry; and i is the unit vector.

Decomposition analysis for the input-output model was developed by Miller [1969] in studying interregional feedbacks. Various studies have since applied decomposition analysis to (1) to quantify the sources of structural change. Miyazawa [1976] used the technique to analyse income distribution, followed by Pyatt and Roe [1977] and Pyatt and Round [1979] in their social accounting matrix work for Sri Lanka and computing fixed price multipliers. Barker [1990] used decomposition analysis to study structural change for UK service industries for 1979-84. Karasz [1992] studied price elasticities which show a rigidity of important inter-industrial relationships in the Czechoslovak economy using the input-output decomposition technique. Han [1995] extended input-output decomposition analysis for a model which enables separation of changes in the labour requirement of an economy into the effects of occupational substitution, changes in labour productivity, and changes in material inputs. Korres [1996] analysed the sources of structural change in the Greek economy. Oosterhaven and van der Linden [1997] studied income growth using a set of EC intercountry input-output tables consisting of twenty-five sectors and eight EC countries. Macroeconomic demand growth is identified to be the most important factor in driving GDP growth. Oosterhaven and Hoen [1998] applied decomposition analysis to six EU countries for 1975 and 1985. They found that macroeconomic demand growth is the most important component at the aggregate country level to explain real income growth.

Equation (1) can also be written as:

$$Q_t = (I - A_t)^{-1} * F_t * \mathrm{i}_t = R_t * F_t * \mathrm{i}_t \qquad (2)$$

where the elements of the matrix R_t, $r_{ij,t}$, denote output generated in the ith industry when the final demand of the jth industry increases by one unit from year $t-1$ to year t. The growth from Q_{t-1} to Q_t, after re-evaluating Q_{t-1} in prices in year t or Q_t in prices in year $t-1$, is given as

$$\begin{aligned} Q_t - Q_{t-1} &= (R_t * F_t - R_{t-1} * F_{t-1}) * \mathrm{i} = \\ &((R_t - R_{t-1}) * F_{t-1} + R_t * (F_t - F_{t-1})) * \mathrm{i} \end{aligned} \qquad (3)$$

Thus, industry output growth is composed of changes in input-output coefficients holding the final demand constant at the base year level, and changes in the final demand holding the input-output coefficients constant at the current year level. The relationships between the output growth of a particular industry and the final demand in all industries in the economy can be described by the following equations:

$$\begin{aligned} q_{it} - q_{it-1} = \sum_l \sum_j \{&(r_{il,t} - r_{il,t-1}) * f_{lj,t-1} + \\ &r_{il,t} * (f_{lj,t} - g_l * f_{lj,t-1}) + r_{il,t} * (g_{lj} - 1) * f_{lj,t-1}\} \end{aligned} \qquad (4)$$

where l denotes industry l and j denotes category j in final demand; g_l is the average growth rate of final demand in industry l; and g_{lj} is the growth rate of category j in final demand in industry l.

Equation (4) indicates that output growth in an industry is determined by input-output coefficient change, $(r_{il,t} - r_{il,t-1})$, growth in final demand holding composition constant, $(f_{lj,t} - g_l * f_{lj,t-1})$, and compositional change in final demand, $(g_{lj} - 1) * f_{lj,t-1}$. Applying

equation (4) to the three input-output tables for *Agriculture, Industry* and *Transport, Post and Telecommunication (TPT)*, and calculating the shares of each component, results in the decompositions of industry growth presented in Tables 1 to 3.

3. EMPIRICAL RESULTS

3.1 Agriculture

Table 1 presents the breakdown of agricultural output growth and the links between its growth and the other industries.

It is clear that the bulk of growth is internal, and that the internal share was declining over the period 1992 to 1997. Internal contributions counted for 61.2 per cent of total output in 1992 and 57.0 per cent in 1997. This compares with 63.6 per cent in 1992 to 57.6 per cent in 1995. From 1995 to 1997, the internal share remained relatively constant. The major source behind agricultural output growth is final demand growth within agriculture for agricultural products. This contributed more than 56.7 and 57.1 per cent of the total increment in output attributable to final demand growth in the economy for 1992 to 1997 and 1995 to 1997, respectively.

Externally, over the period 1992 and 1997, the share of *Industry* contribution to *Agriculture* output increased from 21.2 per cent in 1992 to 24.9 per cent in 1997. A similar pattern is observed from 1992 to 1995, whereby the share of *Industry* rose from 21.4 per cent in 1992 to 26.9 per cent in 1995. A slight decline took place in 1997, whereby the share dropped to 24.9 per cent from 26.9 per cent in 1995. For all years, the dominant source of the *Industry* contribution is final demand growth in *Industry* for agricultural products; compositional change in final demand, however, worked against agriculture output growth.

Over the period 1992 to 1997, output increases due to input-output coefficient changes were recorded largely internally, with 52.0 per cent of the total increase generated within the *Agriculture* industry itself. This was followed by the *Services* industry, with a share of 18.0 per cent. The whole tertiary sector added more than 30 per cent of the output. During 1992 to 1995, the share from the internal source has reached 66.6 per cent, and *Industry* is second with 24.8 per cent. During the two years from 1995 to 1997, input-output coefficient changes have negatively affected output growth in *Agriculture*. The only positive contribution to growth was recorded from the *Services* and *Other* industries.

Table 1. Decomposition and link of output growth in *Agriculture* (per cent)[1]

	I						*Sum*
	agr	External to Agriculture					
		ind	*Con*	*tpt*	*Ser*	*oth*	
$r_{agr\ i,1992} * f_{agr,1992}$ (in 1997 prices)	61.2	21.2	6.9	1.0	3.9	5.8	100
$r_{agr\ i,1997} * f_{agr,1997}$	57.0	24.9	9.8	0.5	2.7	5.2	100
Growth 1992-1997	56.6	25.2	10.0	0.5	2.6	5.1	100
$(r_{agr\ i,1997} - r_{agr\ i,1992}) * f_{agr,1992}$	52.0	8.0	7.8	-0.3	18.0	14.6	100
$r_{agr\ i,1997} * \sum_j (f_{agr\ j,1997} - g_{agr} * f_{agr\ j,1992})$	34.5	50.0	4.1	0.4	2.9	8.0	100
$r_{agr\ i,1997} * \sum_j (g_{agr\ j} - 1) * f_{agr\ j,1992}$	86.0	-185.1	28.1	-0.4	-4.7	-23.9	-100
$r_{agr\ i,1992} * f_{agr,1992}$ (in 1995 prices)	63.6	21.4	6.9	0.6	3.0	4.5	100
$r_{agr\ i,1995} * f_{agr,1995}$	57.6	26.9	9.6	0.4	1.4	4.1	100
Growth 1992-1995	29.7	52.4	22.0	-0.8	-5.7	2.4	100
$(r_{agr\ i,1995} - r_{agr\ i,1992}) * f_{agr,1992}$	66.6	24.8	10.5	0.3	-6.3	4.1	100
$r_{agr\ i,1995} * \sum_j (f_{agr\ j,1995} - g_{agr} * f_{agr\ j,1992})$	-72.7	82.9	19.7	-0.6	1.1	69.6	100
$r_{agr\ i,1995} * \sum_j (g_{agr\ j} - 1) * f_{agr\ j,1992}$	428.7	-172.9	-0.1	-1.1	-26.6	-327.9	-100
$r_{agr\ i,1995} * f_{agr,1995}$ (in 1997 prices)	55.6	26.8	9.7	0.6	1.9	5.4	100
$r_{agr\ i,1997} * f_{agr,1997}$	57.0	24.9	9.8	0.5	2.7	5.2	100
Growth 1995-1997	57.1	24.7	9.8	0.5	2.7	5.2	100
$(r_{agr\ i,1997} - r_{agr\ i,1995}) * f_{agr,1995}$	-71.0	-97.7	-21.9	-2.2	60.6	32.3	-100
$r_{agr\ i,1997} * \sum_j (f_{agr\ j,1997} - g_{agr} * f_{agr\ j,1995})$	53.7	71.0	-48.5	0.9	13.6	9.3	100
$r_{agr\ i,1997} * \sum_j (g_{agr\ j} - 1) * f_{agr\ j,1995}$	61.6	-36.0	86.5	0.0	-11.7	-0.3	100

[1] A negative number indicates per cent increment.

Table 2. Decomposition and link of output growth in *Industry* (per cent)

	i						*Sum*
	ind	External to Industry					
		Agr	*Con*	*tpt*	*ser*	*oth*	
$r_{ind\ i,1992} * f_{ind,1992}$ (in 1997 prices)	54.8	5.9	16.9	2.5	6.6	13.4	100.0
$r_{ind\ i,1997} * f_{ind,1997}$	57.8	5.8	21.5	1.1	3.5	10.3	100.0
Growth 1992-1997	58.0	5.8	21.8	1.0	3.3	10.1	100.0
$(r_{ind\ i,1997} - r_{ind\ i,1992}) * f_{ind,1992}$	36.0	21.7	18.1	-0.2	6.2	18.3	100.0
$r_{ind\ i,1997} * \sum_j (f_{ind\ j,1997} - g_{ind} * f_{ind\ j,1992})$	77.7	2.3	6.0	0.7	2.5	10.7	100.0
$r_{ind\ i,1997} * \sum_j (g_{ind\ j} - 1) * f_{ind\ j,1992}$	-103.7	2.1	14.9	-0.2	-1.5	-11.5	-100.0
$r_{ind\ i,1992} * f_{ind,1992}$ (in 1995 prices)	58.1	6.4	17.7	1.7	5.3	10.8	100.0
$r_{ind\ i,1995} * f_{ind,1995}$	62.3	5.6	21.0	0.9	2.0	8.3	100.0
Growth 1992-1995	72.4	3.5	28.8	-1.1	-5.8	2.3	100.0
$(r_{ind\ i,1995} - r_{ind\ i,1992}) * f_{ind,1992}$	63.7	28.1	26.5	1.0	-23.0	3.7	100.0
$r_{ind\ i,1995} * \sum_j (f_{ind\ j,1995} - g_{ind} * f_{ind\ j,1992})$	52.0	-1.9	11.7	-0.4	0.4	38.2	100.0
$r_{ind\ i,1995} * \sum_j (g_{ind\ j} - 1) * f_{ind\ j,1992}$	-37.7	3.9	-0.0	-0.2	-3.5	-62.5	-100.0
$r_{ind\ i,1995} * f_{ind,1995}$ (in 1997 prices)	60.0	5.2	20.4	1.3	2.6	10.5	100.0
$r_{ind\ i,1997} * f_{ind,1997}$	57.8	5.8	21.5	1.1	3.5	10.3	100.0
Growth 1995-1997	57.6	5.8	21.6	1.1	3.6	10.3	100.0
$(r_{ind\ i,1997} - r_{ind\ i,1995}) * f_{ind,1995}$	7.1	16.1	13.1	-1.6	30.0	35.3	100.0
$r_{ind\ i,1997} * \sum_j (f_{ind\ j,1997} - g_{ind} * f_{ind\ j,1995})$	160.7	5.3	-103.5	1.9	17.5	18.0	100.0
$r_{ind\ i,1997} * \sum_j (g_{ind\ j} - 1) * f_{ind\ j,1995}$	-87.2	6.5	197.6	-0.1	-16.1	-0.6	100.0

3.2 Industry

Table 2 presents the breakdown of industrial output growth and the links between its growth and the other industries.

As for *Agriculture*, the bulk of growth comes internally, and the internal share was increasing over the periods 1992 to 1995 and 1992 to 1997. Internal contributions counted for 54.8 per cent of total output in 1992 and 57.8 per cent in 1997, an increase of 3 per cent. During the period 1992 to 1995, it rose from 58.1 per cent to 62.3 per cent. From 1995 to 1997, the internal share dropped slightly from 60.0 per cent to 57.8 per cent. The tables show that final demand growth within the sector is the predominant source of industrial output growth. Comparing input-output coefficient changes, final demand increase counts for more than 90 per cent of the total output increase.

Significant contributions were recorded for the *Construction* industry. In particular, the share of *Industry* output due to *Construction* increased from 16.9 per cent in 1992 to 21.5 per cent in 1997. This compares with 17.7 per cent in 1992 and 21.0 per cent in 1995. Over the period 1995 to 1997, it remained at around 21.5 per cent. The *Other* industry is also worth mentioning. It generally counts for 10 per cent of total *Industry* output for all periods. Final demand growth in *Construction* has been the source of the large contributions to *Industry*. For the two periods 1992 to 1997 and 1992 to 1995, pure final demand increases were responsible for the overall final demand growth in *Construction*. Compositional change had been making negative contributions until the period 1995 to 1997, when pure final demand decreased but overall final demand still increased due to the change in the composition of final demand.

Compositional changes in the final demand on the whole economy had a negative impact on *Industry* output until the period 1995 to 1997. On an individual industry basis, compositional changes in final demand in *Agriculture* and *Construction* resulted in sufficient total output increases in *Industry* that outweighed the negative impacts from the rest of the economy .

3.3 Transport, Post and Telecommunication (TPT)

Table 3 presents the breakdown of *tpt* output growth.

A steady decline in the share of internal contributions was recorded for all three periods. Internal contributions counted for 34 per cent of the total output in 1992 and dropped to 22 per cent in 1997. For the period 1992 to 1995 the internal

share declined from 27.6 per cent to 18 per cent, and from 23.7 per cent in 1995 to 22.5 per cent in 1997. Final demand growth within the sector is the predominant source of the *TPT* output growth, except during the period 1992 to 1995 when *TPT* output decreased. Output growth resulting from input-output coefficient changes is negligible.

Significant contributions were recorded from both *Industry* and *Construction*. In particular, 30 per cent of total *TPT* output growth from 1992 to 1997 was due to *Industry*; *Construction* counts for 21 per cent. The same was recorded for the period 1995 to 1997. During the period 1992 to 1995, *TPT* itself and *Services* had negative contributions to *TPT* output growth. Despite this, the industry still managed to grow at nearly 9 per cent due to *Industry* and *Construction*. Final demand growth in *Industry* and *Construction* has been the source of contributions to *TPT*. For the two periods 1992 to 1997 and 1992 to 1995, pure final demand increases were responsible for the overall final demand growth in both *Industry* and *Construction*. Compositional changes in final demand in the economy had been making negative contributions until the period 1995 to 1997.

Owing to the inclusion of the passenger transport industry, the *Other* industry, not surprisingly, also made noticeable contributions on the comparisons between 1992 to 1997 and between 1995 to 1997. In both periods, the *Other* industry counted for 19 per cent of total *TPT* output growth, which is close to *TPT* 's own contribution of 22 per cent. The share dropped to under 10 per cent in comparing 1995 and 1992. In all periods, final demand growth was the source of the contribution of the industry, which was driven exclusively by pure final demand increases.

Table 3 Decomposition and link of output growth in *TPT* (per cent)

	i						*Sum*
	TPT	External to *TPT*					
		agr	*ind*	*con*	*ser*	*Oth*	
$r_{tpt\ i,1992} * f_{tpt,1992}$ (in 1997 prices)	34.3	4.7	19.6	11.8	14.2	15.4	100.0
$r_{tpt\ i,1997} * f_{tpt,1997}$	22.5	5.7	28.6	20.6	4.2	18.4	100.0
Growth 1992-1997	21.4	5.8	29.5	21.4	3.2	18.7	100.0
$(r_{tpt\ i,1997} - r_{tpt\ i,1992}) * f_{tpt,1992}$	24.6	9.8	6.1	7.9	-222.9	74.6	-100.0
$r_{tpt\ i,1997} * \sum_j (f_{tpt\ j,1997} - g_{tpt} * f_{tpt\ j,1992})$	16.7	2.8	46.7	7.0	3.7	23.2	100.0
$r_{tpt\ i,1997} * \sum_j (g_{tpt\ j} - 1) * f_{tpt\ j,1992}$	-7.1	3.4	-83.2	23.1	-2.9	-33.2	-100.0
$r_{tpt\ i,1992} * f_{tpt,1992}$ (in 1995 prices)	27.6	6.0	24.2	14.5	13.3	14.5	100.0
$r_{tpt\ i,1995} * f_{tpt,1995}$	18.0	6.8	33.2	21.7	6.4	13.9	100.0
Growth 1992-1995	-94.1	16.8	138.6	106.2	-74.3	6.7	100.0
$(r_{tpt\ i,1995} - r_{tpt\ i,1992}) * f_{tpt,1992}$	-9.6	97.5	54.1	37.2	-238.7	-40.5	-100.0
$r_{tpt\ i,1995} * \sum_j (f_{tpt\ j,1995} - g_{tpt} * f_{tpt\ j,1992})$	-8.6	-2.5	29.3	12.8	1.4	67.5	100.0
$r_{tpt\ i,1995} * \sum_j (g_{tpt\ j} - 1) * f_{tpt\ j,1992}$	-3.6	3.5	-14.8	-0.0	-8.1	-77.0	-100.0
$r_{tpt\ i,1992} * f_{tpt,1992}$ (in 1997 prices)	23.7	5.7	28.6	19.0	7.2	15.7	100.0
$r_{tpt\ i,1995} * f_{tpt,1995}$	22.5	5.7	28.6	20.6	4.2	18.4	100.0
Growth 1995-1997	22.4	5.7	28.6	20.8	3.9	18.7	100.0
$(r_{tpt\ i,1995} - r_{tpt\ i,1992}) * f_{tpt,1992}$	272.9	-183.0	-133.7	-23.6	-1318.4	1285.9	-100.0
$r_{tpt\ i,1997} * \sum_j (f_{tpt\ j,1997} - g_{tpt} * f_{tpt\ j,1995})$	50.7	6.7	101.6	-126.8	26.8	41.1	100.0
$r_{tpt\ i,1997} * \sum_j (g_{tpt\ j} - 1) * f_{tpt\ j,1995}$	-1.8	4.9	-33.2	145.7	-14.8	-0.9	100.0

4. CONCLUSIONS

Using the input-output technique, this paper analysed industry output growth in connection with technological changes which are characterised by input-output coefficient changes and final demand changes in the economy. The data used are the three most recent Chinese input-output tables published in 1992, 1995 and 1997. The three tables entail three pairwise comparisons that cover most of the Eighth five-year plan period, namely 1991-1996.

The analysis reveals that final demand growth was the predominant force for output growth in all industries in China for the five-year period 1992 to 1997. In most cases, technological changes (input-output coefficient changes) appeared to be unimportant in boosting industry

output growth during the period. This lends support to the view that, whenever there is high economic growth, there is also high growth in final consumption.

The paper decomposed industry output growth in relation to other industries. It was found that *Agriculture* contributed less and less to its own growth, whereas *Industry* behaved in a reverse manner. For Services, internal contribution was significant during all periods. The major source behind the *Services* output growth was final demand growth within *Services* for *Services*. This seems to conform with the theory of structural change that under-developed economies are transformed from a heavy emphasis on traditional subsistence agriculture to a more modern, urbanised, and industrially diverse manufacturing and service economy.

It was recognised that *Transport, Post and Telecommunication* was one of the bottlenecks in the economy. The analysis shows that *Industry* and *Construction* count for more than 50 per cent of *Transport, Post and Telecommunication* output growth, indicating that greater final demand in *Industry* and *Construction* can lead to greater output in *Transport, Post and Telecommunication*. Thus, *Transport, Post and Telecommunication* is capable of meeting demand from *Industry* and *Construction* that comprise the bulk of the economy. This lets support for the research outcome in Ma *et al.* (1997) that the bottlenecks in the economy have been alleviated.

5. ACKNOWLEDGEMENT

The second author wishes to acknowledge the financial support of the Australian Research Council.

6. REFERENCES

Barker, T. Sources of Structural Change, Economic Systems Research, 2, 173-183, 1990.

Chenery, H. (1979) Structural Change and Development Policy. Baltimore: Johns Hopkins University Press, 1979.

Han, X. Structural Change and Labour Requirement of the Japanese Economy. Economic Systems Research. 7(1), 46-65, 1995.

Karasz, P. Influence of Interindustrial Relationships on Prices in Czechoslovakia. Economic Systems Research,. 4(4), 377-384, 1992.

Korres, G. Sources of Structural Change: An Input-Output Decomposition Analysis for Greece, Applied Economic Letters. 3(11), 707-710, 1996.

Lewis, A. W "Economic development with unlimited supplies of labor," Manchester School, 1954.

Ma, Hong, Liu, Zhong Yi and Lu, Bai Pu Report of China's Macroeconomic Policy 1997. China Finance and Economic Press. Beijing, 1997.

Miller, R.E. Interregional feedbacks in input-output models: some experimental results, Western Economic Journal, 7, 41-50, 1969.

Miyazawa, K. Input-Output Analysis: Foundation and Extensions. SpringerVerlag, Berlin, 1976.

Oosterhaven, J. and Hoen, A. Preferences, Technology, Trade and Real Income Changes in the European Union: An Intercountry Decomposition Analysis for 1975-1985, Annals of Regional Science, 32 (4), 505-524, 1998.

Oosterhaven, J. and van der Linden, J. European Technology, Trade and Income Changes for 1975-85: An Intercountry Input-Output Decomposition, Economic Systems Research. 9(4), 393-411, 1997.

Pyatt, G. and Roe, A. Social Accounting for Development Planning with Special Reference to Sri Lank. Cambridge University Press, Cambridge, 1977.

Pyatt, G. and Round, J.I. Accounting and fixed price multipliers in a SAM framework, Economic Journal, 89, 850-873, 1979.

Ri, C. China's Industrial Development Report, 1999.