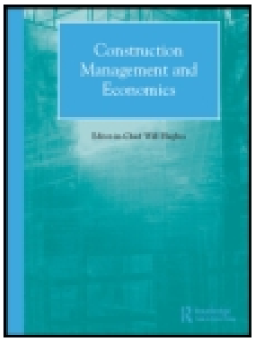

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Some new evidence of old trends: Japanese construction, 1960-1990

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Some new evidence of old trends: Japanese construction, 1960–1990

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Using the seven input–output tables compiled in Japan to date, this paper extends earlier analysis by adding the analysis of 1985 and 1990 tables. This paper shows that the Japanese construction sector's share in GNP has declined since 1980; the GNP share of manufacturing is continuing to decline and that of services is continuing to grow; the economy-wise effect of construction activity is continuing to decline; and the construction inputs from manufacturing are continuing to decline whereas the sector's inputs from services are continuing to grow. All these are signs of a growing 'maturity' of the Japanese economy, which in this regard appears to follow the path of other advanced industrial countries.

Introduction

This paper briefly analyses the changes in the economic rôle of the construction sector in the Japanese economy using the seven input–output (IO) tables compiled to date. It extends the analysis presented in several earlier papers based on the five IO tables compiled between 1960 and 1980 (Bon and Minami, 1986a, b; Bon and Pietroforte, 1990; Bon, 1991), to the analysis of the 1985 and 1990 IO tables. This paper shows that the Japanese construction sector's share in GNP has declined since 1980; the GNP share of manufacturing is continuing to decline and that of services is continuing to grow; the economy-wide effect of construction activity is continuing to decline; and in addition the construction inputs from manufacturing are continuing to decline whereas the sector's inputs from services are continuing to grow.

These are unambiguous signs of a growing 'maturity' of the Japanese economy. As an economy develops, the construction sector gradually changes its economic rôle. In this process, the construction sector gradually turns away from manufacturing, its main partner in the earlier phases of economic development, and toward services. For a more detailed discussion of this process, see for example Bon (1991, 1992), Bon and Pietroforte (1990, 1993) and Pietroforte and Bon (1995). These studies show many similarities between the US, the UK, Italy and Japan.

We will first briefly discuss the place of IO analysis in the study of construction technology, that is, the construction sector's input and output profiles. (For further detail see Bon (1988, 1991).) Then we will introduce the Japanese IO tables. We will proceed by examining the key findings of the present study of Japanese construction. Lastly we will offer our conclusions, together with suggestions for future research.

Input–output analysis of construction technology

Input–output analysis is based on the central insight that commodities are needed in the current production of other commodities. National income accounts provide the data required for IO analysis. We will briefly present here the prevalent accounting conventions as they apply to the structure of IO tables. An IO table shows the intersectoral flows for a particular year in monetary value terms. These flows represent the intermediate goods and services. In addition there is a final demand column to the right, showing where the final products go, and a value-added row below, showing where the primary

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inputs, or factors of production, come from. An IO table is thus square: it contains the same number of rows and columns.

The construction sector is represented in this framework by one row and column. The construction row shows where the construction sector's output goes, while the construction column shows where the construction inputs come from. The construction sector's column and row sums must be equal because the value of its purchases and sales, respectively, must be equal. This is true for all sectors, as well as for the sum of all inputs and outputs of the national economy. The construction sector's input and output profiles offer a *sui generis* representation of construction technology. Changes in that technology over time are the focus of the analysis presented here (for an economic conception of technology stemming from input–output analysis, see Bon (1991)).

Japanese input–output tables

In this paper we use seven Japanese input–output tables compiled between 1960 and 1990. The 1990 IO table became available in March 1994 (Management and Coordination Agency, 1994). These are all so-called benchmark tables, based on census data. The five tables compiled from 1960–1980 were discussed in several previous papers (Bon and Minami, 1986a, b; Bon and Pietroforte, 1990; Bon, 1991). In this paper we extend the data series by adding the 1985 and 1990 Japanese IO tables.

The input–output tables analysed here contain eight sectors: agriculture, mining, manufacturing, construction, utilities, transportation, services, and other (undistributed). The service sector includes the trade and finance sector, thus offering the widest possible definition of services. The aggregation scheme used is presented in the appendix. It should be noted that the aggregation scheme used here is far from arbitrary. It represents the basic structure of the economy. Further detail can easily be added by disaggregating the sectors into ther constituent industries. However, it is not attempted in this paper for reasons of space.

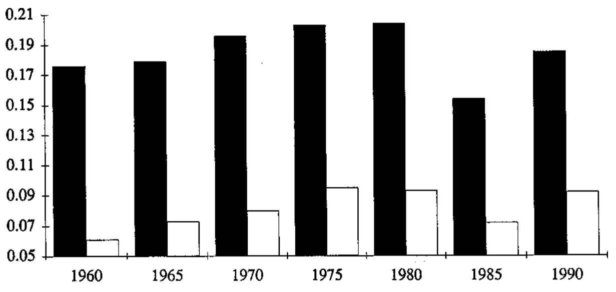

Figure 1 Construction sector's share in GNP and NI (■ = share in GNP; □ = share in NI)

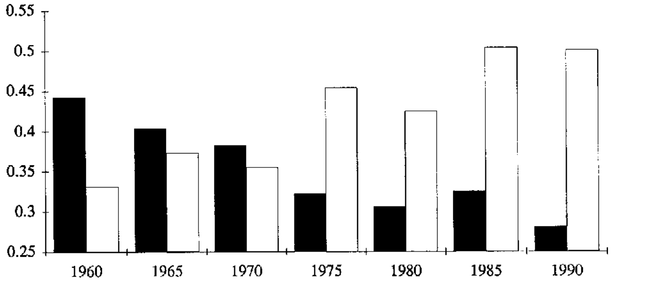

Figure 2 Shares of manufacturing and services in GNP (■ = share of manufacturing in GNP; □ = share of services in GNP)

Key findings

The data analysed here are presented in Table 1, showing the twelve data series from the seven Japanese input–output tables compiled between 1960 and 1990. The data are presented in pairs in six figures presented below.

Figure 1 shows the construction sector's share in GNP and national income (NI), both of which have dropped considerably in 1985 to increase again in 1990. However, the GNP shares of more than 20% are unlikely ever to return. The relatively high GNP share in 1990 is most likely due to the swell in investment demand generated by financial deregulation in the 1980s, a singular historical event. It goes without saying that IO tables are not necessary for the calculation of these shares; nevertheless, IO tables provide more accurate data than standard accounts because of the double-entry accounting rules under which they are compiled.

For comparison with the construction sector, the GNP shares of manufacturing and services are shown in Figure 2. The old and new engines of economic development are changing places. The 'change of guards' is amply in evidence. However, it should be borne in mind that the service sector includes trade and finance. In other words, the service sector is defined most liberally.

Figure 3 presents backward linkage indicators and output multipliers of the construction sector, both of which are declining over time. The backward linkage indicators measure the proportion of the sector's direct

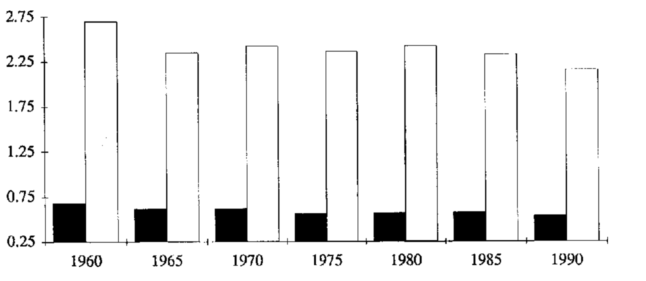

Figure 3 Construction backward linkage indicators and output multipliers (■ = backward linkage indicators; □ = output multipliers)

Table 1 Data series from Japanese input–output tables, 1960–1990

Year	1960	1965	1970	1975	1980	1985	1990
Share of construction in GNP	0.176	0.179	0.196	0.203	0.204	0.154	0.185
Share of construction in national income	0.061	0.073	0.080	0.095	0.093	0.072	0.092
Share of manufacturing in GNP	0.442	0.404	0.383	0.322	0.306	0.325	0.281
Share of services in GNP	0.331	0.373	0.355	0.454	0.425	0.504	0.501
Construction backward linkage indicators	0.680	0.620	0.620	0.560	0.570	0.573	0.539
Construction output multipliers	2.700	2.350	2.420	2.360	2.420	2.327	2.153
Construction forward linkage indicators	0.090	0.080	0.080	0.070	0.070	0.095	0.077
Construction input multipliers	1.190	1.170	1.160	1.150	1.160	1.180	1.151
Direct construction inputs from manufacturing	0.520	0.422	0.448	0.363	0.376	0.359	0.307
Total construction inputs from manufacturing	1.120	0.860	0.950	0.790	0.850	0.770	0.623
Direct construction inputs from services	0.064	0.082	0.093	0.101	0.114	0.115	0.149
Total construction inputs from services	0.150	0.170	0.200	0.230	0.250	0.270	0.322

inputs that come from other sectors of the national economy, rather than from primary inputs (land, labour, capital, etc). The output multipliers are also called the total backward linkage indicators because they measure the total effect of a monetary unit change in final demand for the goods and services of the construction sector on the output of all sectors. Both indicators are associated with the 'pull effect' of the construction sector.

Turning to the 'push effect' of the construction sector, Figure 4 shows its forward linkage indicators and input multipliers, both of which are showing little sign of change. The forward linkage indicators measure the proportion of a sector's direct output that goes to other sectors of the national economy, rather than to the final consumer. The input multipliers measure the effect of a monetary unit change in primary input available to the construction sector on the input of all industries* Both indicate the strength of the maintenance and repair (M&R) construction subsector (for greater detail, see Bon (1991) and Bon and Pietroforte (1993)). Surprisingly enough, these activities are not showing any sign of growth in Japan, as one would expect in an advanced industrial country.‡

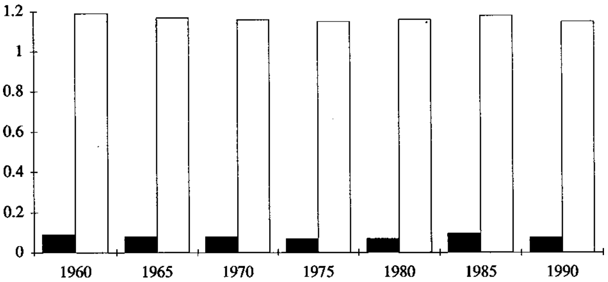

Figure 4 Construction forward linkages and input multipliers (■ = forward linkage indicators; □ = input multipliers)

Figure 5 presents direct and total construction inputs from manufacturing, both of which are declining. The direct inputs are also known as technical coefficients, showing the proportion of total direct inputs of the construction sector coming from manufacturing. The total manufacturing inputs represent the change in manufacturing output resulting from a monetary unit change in final demand for goods and services of the construction sector.

Lastly, direct and total construction inputs from services are shown in Figure 6, both of which are growing. The economic meaning of these indicators is exactly the same as in the previous case. It should be

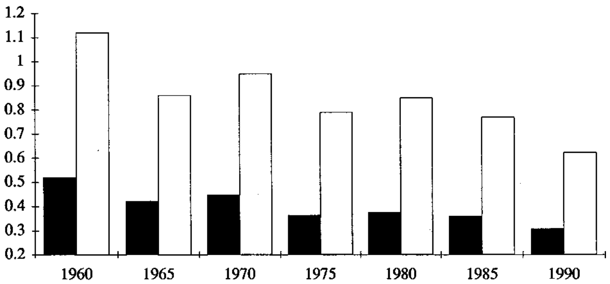

Figure 5 Direct and total construction inputs from manufacturing (■ = direct input from manufacturing; □ = total input from manufacturing)

* The pull and push effects outlined here form the basis of two families of input–output models: the so-called demand-side and supply-side models, respectively. Both can be used for forecasting purposes. The two families are based on alternative assumptions that column or row coefficients – that is, demand or supply patterns – are fixed over the forecasting period. However, in this paper the changes in the two patterns are analysed from year to year, so that the hypothesis of fixed demand or supply patterns is not required. For greater detail on demand-side and supply-side input–output models and their relative performance with the US, UK, and Japanese data, see Bon (1986), Bon and Xu (1993), and Bon and Yashiro (1995), respectively.

‡ It is instructive to compare Japan and the UK, an old industrial country, in this regard. In 1984 the UK forward linkage indicator and input multiplier were 0.260 and 1.380, respectively; in 1985 the same indicators were 0.095 and 1.180 for Japan. The comparison with the UK is relevant here because this country can be taken as a model for a 'mature' economy.

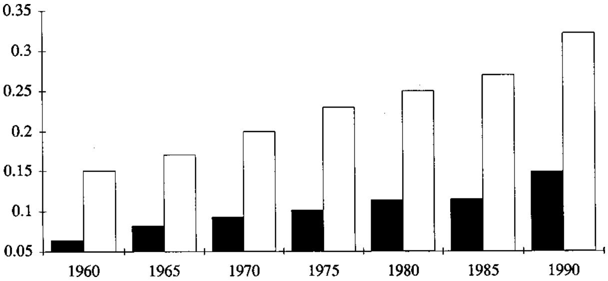

Figure 6 Direct and total construction inputs from services (■ = direct inputs from services; □ = total inputs from services)

emphasized again that we are using the widest possible definition of services, as the aggregation used here includes the trade and finance sector. The most important inputs from services thus defined come from trade and financial services.

Comparing Figures 5 and 6, we should be careful about the magnitudes on the two vertical axes. Although the manufacturing and service sectors seem at first to be changing places in relation to the construction sector, the total inputs from services in 1990 are approximately equal to the direct inputs from manufacturing, whereas the total manufacturing inputs are very much larger. Put differently, the service sector – no matter how liberally defined it happens to be in this analysis – is still far from replacing the manufacturing sector as the construction sector's main partner. This helps explain the declining output multiplier of the construction sector.

Conclusions

The analysis presented here confirms the general trends in construction technology discussed by Bon and Minami (1986a, b), Bon and Pietroforte (1990) and Bon (1991). Most important, these trends conform to those found in other advanced industrial countries, such as the United States, the United Kingdom, and Italy (Bon, 1988; Bon and Pietroforte, 1990; Bon, 1991; Bon and Pietroforte, 1993; Pietroforte and Bon, 1995).

The declining importance of the manufacturing sector in Japan is perhaps the most significant aspect of our findings, especially because it is often taken as an example of the 'manufacturing base' worth emulating by other advanced industrial countries. In fact, this sector has been declining in terms of its share in GNP since 1960, with the exception of 1985. More important for our present purposes, it is declining in terms of its share in the construction sector's inputs. Those nostalgic for the good old days when goods dominated services should keep these lessons in mind when they promote sundry schemes which they hope will reanimate the old engine of economic growth.

Future research in this field should be much more detailed in terms of the industrial structure. Our understanding of the broad trends regarding construction is somewhat coarse at this time. For example, we need to distinguish those manufacturing industries that are increasingly more important to the construction sector from those that are declining in importance (for an example of detailed analysis of input–output tables, see Bon and Pietroforte (1993)). Also, we need to understand how the shift from on-site to off-site construction redefines the relationship between construction and manufacturing. Similarly, we need to understand the separation of construction management and related services from construction proper, that is, assembly of materials and components on site. This kind of research is of ever greater importance given that an ever larger proportion of construction activity is performed off the construction site, and an increasing number of enterprises operating in this sector offer management services to the exclusion of direct labour. In both cases the construction sector is apparently shrinking in terms of the national output and income accounts because some of its activities are migrating to its suppliers.

Another research theme of ever greater importance is that of the environmental effect of construction activity, and especially off-site construction. Much of the current research in this area focuses on the direct environmental effects of construction activity to the neglect of the inter-sectoral and economy-wide effects, which can be appropriately analysed only with the help of IO analysis and its extensions, such as the social accounting matrices (SAMs) and computable general equilibrium (CGE) models.

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Appendix: Aggregation scheme used

Sectors	Industries
1. Agriculture	1. Agriculture
2. Mining	2. Mining
3. Manufacturing	3. Food
	4. Textile
	5. Pulp, paper and timber
	6. Chemicals
	7. Petroleum and coal products
	8. Glass and cement products
	9. Steel
	10. Non-ferrous metals
	11. Metal products
	12. General machines
	13. Electronic products
	14. Transport equipment
	15. Precise machines
	16. Other manufacturing products
4. Construction	17. Construction
5. Utilities	18. Electrical, gas and heating
	19. Water and waste
6. Transport	20. Transport
7. Services	21. Retail and wholesale trade
	22. Finance and insurance
	23. Real estate services
	24. Telecommunications
	25. Public services
	26. Education and research
	27. Medical and welfare services
	28. Other social services
	29. Industrial services
	30. Personal services
	31. Stationery and office services
8. Other	32. Other