

THE ROLE OF SERVICES IN THE STRUCTURE OF PRODUCTION AND TRADE: STYLIZED FACTS FROM A CROSS-COUNTRY ANALYSIS

Joseph F Francois and Kenneth A Reinert

Discussion Paper No. 1228
August 1995

Centre for Economic Policy Research
25–28 Old Burlington Street
London W1X 1LB
Tel: (44 171) 734 9110

This Discussion Paper is issued under the auspices of the Centre's research programme in **International Trade**. Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as a private educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions. Institutional (core) finance for the Centre has been provided through major grants from the Economic and Social Research Council, under which an ESRC Resource Centre operates within CEPR; the Esmée Fairbairn Charitable Trust; and the Bank of England. These organizations do not give prior review to the Centre's publications, nor do they necessarily endorse the views expressed therein.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

CEPR Discussion Paper No. 1228

August 1995

ABSTRACT

The Role of Services in the Structure of Production and Trade: Stylized Facts from a Cross-Country Analysis*

We examine the role of services in the structure of production and trade. Working with a cross-country sample of 17 social accounting matrices, we develop stylized facts relating upstream and downstream service linkages to incomes and the input-output structure of production. Expansion of services is related to expansion of private sector intermediate services, and to increased demand in manufacturing for service inputs. This growth in demand is more closely related to changes in the structure of production rather than to outsourcing or splintering processes. The embodied service component of exports is also strongly linked to the level of development.

JEL Classification: F14, O11, O57

Keywords: services and development, trade in services, production and services

Joseph F Francois
World Trade Organization
Rue de Lausanne 154
CH-1211 Geneva
SWITZERLAND
Tel: (41 22) 739 5278

Kenneth A Reinert
Kalamazoo College
Department of Economics
Kalamazoo, MI 49006
USA
Tel: (1 616) 337 7027

*This paper is produced as part of a CEPR research programme on *Market Integration, Regionalism, and the Global Economy*, supported by a grant from the Ford Foundation (no. 920-1265). It represents the opinions of the authors and is not meant to represent the views of any institution with which they may have ever been affiliated, particularly the WTO and its members. We attribute all remaining errors to our respective co-author.

Submitted 10 July 1995

NON-TECHNICAL SUMMARY

Services dominate the economic landscape of the post-industrial OECD economies, typically accounting for between 60% and 70% of employment and a comparable share of GDP. Growth of the service sector is also an important aspect of economic development and is strongly associated with income growth and economic modernization. Explanations for the importance of services in modern economies, relative both to low-income countries and to historic patterns within OECD countries themselves, have emphasized demand-side factors. Yet, while emphasis in the literature has been placed on final expenditure patterns and prices, some of the most striking aspects of service sector growth relate instead to the relationship of services to the production structure of economies, and particularly the relationship of the service sector to manufacturing. For example, the cross-country pattern of employment and GDP shares for producer services is strongly correlated with income levels. The share of producer services in total intermediate demand by manufacturing firms is also linked to income levels.

In this paper we explore the role of services in the structure of production and trade. In an effort to better understand the basic structural changes that relate to service sector growth and trade in services, our main objective is to develop a set of empirically-based stylized facts. We also examine the extent to which growth in intermediate services is simply related to splintering of otherwise unchanged activities, and the extent to which it represents a fundamental change in the organization of production. Working with a cross-country sample of 17 social accounting matrices, we explore upstream and downstream service linkages and their relationship to changes in income levels and the input-output structure of production.

What emerges is a set of stylized facts that closely match the historical experience of the OECD countries:

- I. Income levels are positively associated with employment shares for intermediate services and with the share of indirect labour in total manufacturing employment.
- II. The share of value added originating in services, including both private services and trade, transport and communications services, is also positively linked to the level of development.

- III. Income levels are strongly linked to intermediate demand for producer services, particularly in manufacturing.
- IV. While changes in the allocation of non-production activities between manufacturing and service firms may explain a small share of service sector growth, the basic story seems instead to be one of fundamental changes in the structure of production.
- V. The importance of services for export performance depends on the level of development. As we move from the middle-income to upper-income range of our sample, private services and trade, transport and communications services have become the most important sectoral elements of exports via inter-industry linkages.

The last result relates to the economic structure of the OECD economies. While their exports are concentrated in manufactures, their economies are concentrated in services. At the same time, however, our results serve as a reminder that, in terms of the intermediate structure of production, services are a major aspect of production, even for exportables. Hence, while Japan's exports in material terms are concentrated in transport equipment and other machinery and equipment, the activity composition of Japanese exports is actually concentrated in services, which are almost 50% more important than transport equipment and machinery and equipment. Similar patterns hold for Canada, the European Union, and the United States. Even for middle-income countries such as Korea, the significance of the service sector for overall exports is much greater than the direct trade balance suggests.

The Role of Services in the Structure of Production and Trade: Stylized Facts from a Cross-Country Analysis

Abstract: We examine the role of services in the structure of production and trade. Working with a cross-country sample of 17 social accounting matrices, we develop stylized facts relating upstream and downstream service linkages to incomes and the input-output structure of production. Expansion of services is related to expansion of private-sector intermediate services, and to increased demand in manufacturing for service inputs. This growth in demand is more closely related to changes in the structure of production rather than to outsourcing or splintering processes. The embodied service component of exports is also strongly linked to the level of development.

I. Introduction

Services dominate the economic landscape of post-industrial OECD economies, typically accounting for between 60 and 70 percent of employment and a comparable share of GDP. Growth of the service sector is also an important aspect of economic development and is strongly associated with income growth and economic modernization. Explanations for the importance of services in modern economies, relative both to low-income countries and to historic patterns within OECD countries themselves, have emphasized demand-side factors. Clark (1940) was the first to note a rising share of services associated with economic growth and attributed this to demand side factors. A related issue emphasized by Clark and later by Kravis, Heston, and Summers (1982) is the correlation between final-expenditure service price and income levels. The theoretical literature on income-price linkages includes Balassa (1964), Samuelson (1964), Bhagwati (1984a, 1985), and Panagariya (1988). Also in this vein, Baumol et al. (1985) relate the pattern of rising service prices to relative productivity differentials.

While emphasis in the literature has been placed on final expenditure patterns and prices, some of the most striking aspects of service sector growth relate instead to the relationship of services to the production structure of economies, particularly the relationship of the service sector to manufacturing. As discussed in the later sections of this paper, the cross-country pattern of employment and GDP shares for producer services is strongly correlated with income levels. The share of producer services in total intermediate demand by manufacturing firms is also linked with income levels. Katouzian (1970) and Greenfield (1966) have argued that we should expect to find that the demand for producer services grows with development. Both Katouzian and Francois (1990) link this expansion to growth in

round-about production and the associated conversion of local markets into national markets. Alternatively, Bhagwati (1984b) has suggested that such producer service growth may simply be related to “splintering,” wherein service activities once performed within manufacturing firms are spun off to specialized service providers.

Past empirical evidence on the rise of the service sector was indirectly provided by Chenery and Taylor (1968) through their examination of GNP shares for agriculture and manufacturing. Park (1989), Park and Chan (1989), and Uno (1989) empirically confirmed rising producer service inputs into manufacturing. The decline in manufacturing employment and the shift to service sector employment in the post-war period has been well documented (e.g. Sachs and Schatz, 1994, Francois, 1990, and Dighe, Francois, and Reinert, 1995). Much of this literature, and the related literature on wage trends in the OECD countries, has examined the link between globalization and employment patterns. This includes Lawrence and Krugman (1994), Lawrence and Slaughter (1993), Bhagwati and Dehejia (1993), Wood (1994), and Leamer (1993, 1994).

In this paper, we explore the role of services in the structure of production and trade. In an effort to better inform our understanding of the basic structural changes that relate to service sector growth and trade in services, our basic objective in this paper is to develop a set of empirically-based stylized facts. We also examine the extent to which growth in intermediate services is simply related to splintering of otherwise unchanged activities, and the extent to which it represent a fundamental change in the organization of production. Working with a cross-country sample of 17 social accounting matrices, we explore upstream and downstream service linkages and their relationship to changes in income levels and the input-output structure of production. The analysis provides five results which we interpret as tentative stylized facts for further testing and confirmation or refutation. First, the employment shares of services increase with the level of development, and within manufacturing there is an increase in indirect labour. Second, both value added in private services relative to manufacturing value added and intermediate demand for private services relative to intermediate demand for manufacturing rise with per capita income levels. Third, the relative importance of services is related to expansion of private-sector intermediate services and to increased demand in the manufacturing sector for service inputs. Fourth, while changes in the allocation of non-production activities between manufacturing and service firms may explain a small share of service sector growth, the basic story seems

instead to be one of fundamental changes in the structure of production. Finally, the embodied service component of exports is also strongly linked to the level of development, with the exports of the high income countries including the greatest level of embodied services.

II. Social Accounting Data

We work with national accounting data organized as social accounting matrices (SAMs). The SAMs are supplemented with data on employment from the OECD and ILO and data on purchasing power parity based income levels from the International Comparison Project (ICP) as published in the Penn World Tables (Summers and Heston; 1991, 1994). The SAM structure provides a comprehensive and consistent record of national income accounting relationships between different sectors and regions. They are based on a fundamental, general equilibrium principle of economics, namely that every income (receipt) has a corresponding expenditure (outlay).¹ The SAM is a form of single-entry accounting, where incomes or receipts are shown in the rows of the SAM while expenditures or outlays are shown in the columns. The strength of this framework is that it provides a comprehensive and consistent record of the interrelationships of an economy. For our purposes, it offers the advantage of linking consumption and external trade patterns to the inter-industry structure of intermediate demand. This allows for a fuller analysis than is possible when working with input-output tables.

The basic dataset includes 27-sector SAMs for 17 countries and regions, as detailed in Tables 1 and 2.² Each national SAM is a 37 x 37 matrix of national economic activity, and is a combination of the matrix of inter-sectoral expenditures and additional elements for households, government, investment, and trade. The SAMs are drawn from the Global Trade Analysis Project (GTAP) dataset (Gelhar et al., forthcoming), and are benchmarked to 1992 values for production, expenditures, and trade. Often, we will focus on what are termed *private services* in GTAP. These exclude utilities, construction, trade and transportation, and government. Private services *include* producer services which are the focus of much of the theoretical literature discussed in Section I.

¹ The basic principles of SAMs, with application to trade policy modelling, are summarized in Reinert and Roland-Holst (forthcoming).

² A concordance of SAM sectors to ISIC numbers is provided in the appendix.

Table 1

Countries and regions	sources of input-output data
Argentina	Secretaria de Planificacion (1986), Argentina
Australia	Kenderes and Strzelecki (1992)
Brazil	Secretaria de Planejamento e Coordenacao da Presidencia da Republica Fundacao (1980), Brazil
Canada	Statistics Canada (1987)
China	Department of Balances of National Economy of the of the State Statistical Bureau and Office of the National Input-Output Survey (1987), China
European Union	Ryan (1992)
Indonesia	Central Bureau of Statistics (1989), Indonesia
Japan	MITI (1989), Japan
Korea	Bank of Korea (1988)
Malaysia	Department of Statistics (1988), Malaysia
Mexico	Secretaria de Pramacion Y Presepuesto (1985) Burfisher et al (1992)
New zealand	Department of Statistics (1991), New Zealand
Philippines	National Economic and Development Authority (1988), Phillipines
Singapore	Department of Statistics (1987), Singapore
Taiwan	Directorate General of Budget, Accounting, and Statistics (1986)
Thailand	Institute for Developing Economies, Tokyo Socio Economic Policy and Forecasting Unit, Chulalongkorn University Social Research Institute, Thailand (1985)
United States	MITI (1989), Japan

Table 2
SAM sectors

Grains	Non-metallic mineral products
Other crops	Primary steel
Livestock	Primary non-ferrous metals
Forestry	Fabricated metal products
Fisheries	Transport equipment
Primary mining	Machinery and equipment
Processed food	Other manufactures
Textiles	Electricity, water, and gas
Clothing	Construction
Leather manufactures	Trade, transport, and communications
Lumber and wood products	Private services
Pulp, paper, and printing	Other services (government)
Petroleum and coal products	Ownership of dwellings
Chemicals	

III. Services and the structure of Production

In this section, we examine the role of services, particularly private services, in the structure of production and the manner in which this role changes with the level of development. We examine the role of services in the structure of production from four points of view: employment, demand for producer services, interindustry linkages, and splintering vs. structure of production.

Employment

We begin our exploration with employment shares. For our sample of countries and regions, we find that positive changes in the employment share of services (and conversely negative changes in manufacturing employment) are positively related to income levels. Even within manufacturing, there is a shift from direct production labour towards indirect labour. In other words, the rise in services employment is linked to an associated shift toward service activities within the "manufacturing" labour force. As developed further below, this is also related to an increased use (in relative terms) of services as an input by manufacturing firms. This pattern is illustrated in Figures 1 and 2. These figures are based on simple OLS-based analysis of correlation patterns between per-capita income levels measured in ICP dollars (see

Table 3
Service employment and income

	Employment in producer services	Indirect labour share of manufacturing employment
intercept	0.8625077	0.0805625
Std Err of Y Est	2.1045477	0.0955581
R Squared	0.7060449	0.6042142
No. of Observations	14	12
Degrees of Freedom	12	10
per-capita income	0.000561	2.125E-05
Std Err of income Coef.	0.000105	5.440E-06
t-ratio	(5.36867)	(3.90720)

Summers and Heston; 1991, 1994) on the one hand, and either producer service employment shares or the indirect labour share of manufacturing on the other. The OLS results are reported in Table 3.

Demand for Producer Services

An important feature of service sector growth in the OECD countries has been expansion of the intermediate service sector. We find a similar pattern here, when comparing across income levels. Figures 3 and 4 present the share of private/business services in value added relative to manufacturing, and the share of private/business services in total manufacturing demand, both plotted relative to per-capita income. Underlying OLS results are presented in Table 4. There is a strong correlation, within our sample, between per-capita income levels, rising relative demand for services by the manufacturing sector, and a rising share for intermediate services in total value added. In the case of relative manufacturing demand for services, the most significant changes occur in the income range above \$10,000 per capita.

Table 4
Demand for producer services

	value added relative to manufacturing	share of manufacturing demand for intermediates
Intercept	0.4243674	0.0215807
Std Err of Y Est	0.2273019	0.0313047
R Squared	0.549316	0.4732855
No. of Observations	17	17
Degrees of Freedom	14	15
per-capita income	-3.12E-05	5.244E-06
Std Err of Coef.	4.761E-05	1.428E-06
t-ratio	-0.654743	3.6712979
square of income	3.821E-09	
Std Err of Coef.	2.501E-09	
t-ratio	1.5274888	

Intermediate Linkages

We next turn to intermediate linkages. In an earlier cross-country comparison of input-output structures, Park and Chan (1989) found that services exhibit fewer interindustry linkages overall than manufacturing. At the same time, cross-country studies of the structure of demand point to non-homothetic preferences (e.g. Hunter and Markusen 1988 and Kravis, Heston, and Summers 1985). Cornwall and Cornwall (1994) have demonstrated that demand elasticities which are a function of income imply a demand-side shift in preferences from agriculture through manufacturing and into services as incomes rise. On net, we therefore expect a shifting pattern of production, driven both by demand and supply side changes, which will also lead to a consequent shift in the pattern of economy-wide, interindustry linkages. With development, an initial shift from agriculture implies increased density of the intermediate use matrix. This pattern may be reinforced by increased round-about production and the integration of internal markets (Katouzian 1970). With a further shift from manufacturing and into services, economy-wide density should fall again.³

To examine production linkages, we begin by denoting a country's $n \times n$ social accounting matrix by S and a column unit n -vector by e . Then $c = e'S$ is the column-sum vectors of S . If a $\hat{\cdot}$ over a vector is used to denote the corresponding n -dimensional diagonal matrix, then

$$(1) \quad A = \hat{S}c$$

represents the column-sum normalized SAM. An element A_{ij} is the proportion of sector j 's expenditure received by sector i . Working with the column-normalized A matrix, we examine correlations between cross-country per capita income levels and the basic density of the intermediate use matrix. Formally, we define the linkage index D as:

³ We may also expect density to fall, even within manufacturing, if development is also associated with a process of horizontal integration. We do find some evidence of such a pattern for the manufacturing sector in our data.

$$(2) \quad D = \frac{\sum_{j \in \lambda} \sum_{i \in \lambda} A_{ij}}{\sum_{j \in \lambda} \sum_{i \in \omega} A_{ij}}$$

where λ is the set of industry accounts and ω is the set of industry plus value-added accounts. The index D measures the relative density of the column-normalized intermediate use matrix. It reflects the importance of backward linkages between sectors, relative to the total level of production activity.

Table 5 presents the results of simple OLS analysis of the relationship between interindustry density and income levels. Data points and the estimated functional form in Table 5 are plotted in Figure 5. While there is a great deal of variability in the data, we do identify a pattern of rising economy-wide interindustry density through \$12,000 per-capita income, and a falling-off from that point on.

Table 5
Income and SAM density

Intercept	0.4408699
Std Err of Y Est	0.0609652
R Squared	0.1491858
No. of Observations	17
Degrees of Freedom	14
per-capita income	1.638E-05
Std Err of income variable	1.277E-05
t-ratio	1.2825422
square of income	-7.08E-10
Std Err of income square variable	6.709E-10
t-ratio	-1.055702

Splintering vs. the structure of production

We next turn briefly to the factors driving the apparent growth of demand for producer services, particularly with regard to demand from the manufacturing sector. As we noted in the Section I, explanations in the literature have included both (i) real changes related to a basic shift in the structure of production, or alternatively (ii) changes driven instead by the outsourcing of service-type activities by manufacturing firms.

To the extent that the changes can be explained by outsourcing or changes in the location of service production between firms, we should expect the share of indirect labour within manufacturing firms to fall as the share of services in intermediate demand by manufacturing rises. Alternatively, structural change related to income levels will be reflected in the correlation of demand growth with per-capita income levels. Table 6 and Figure 6 present the results of OLS-based analysis of relative movements between manufacturing demand for private services, on the one hand, and both income levels and indirect manufacturing employment levels, on the other.

Table 6
Manufacturing demand for producer services
(as a share of total intermediate demand)

Intercept	-0.003027
Std Err of Y Est	0.0241518
R Squared	0.7611628
No. of Observations	12
Degrees of Freedom	9
per-capita income	8.509E-06
Std Err of income coeff.	2.185E-06
t-ratio	3.8937628
indirect labour share	-0.057014
Std Err of labour share	0.079925
t-ratio	-0.71334

The results reported in Table 6 "explain" roughly 76 percent of the variation in intermediate demand for services. The estimated relationship is plotted in Figure 6 for the range of income levels and indirect labour shares covered by our sample. From the figure, it can be seen that, while falling indirect labour shares do "explain" a small rise in intermediate demand, this effect is far outweighed by a much stronger positive relationship between rising income levels and rising intermediate demand for services. This result does not, of course, in any way explain the pattern of changes underlying the positive relationship between producer service growth and income. It does, however, point strongly to real structural change rather than outsourcing as the most promising direction for further research on this data pattern.

IV. Services and the structure of trade

In this section, we turn to the role of services in the structure of trade. We divide the n accounts of a country's SAM into two groups: m endogenous accounts and k exogenous accounts. Following the standard convention, we define the k exogenous accounts as the government, capital, and rest-of-world accounts (see Robinson, 1989). All remaining accounts, including the consumption account, are endogenous. Define the submatrix of A consisting of the m endogenous accounts as A_{mm} . The multiplier matrix is given by

$$(3) \quad M = (I_m - A_{mm})^{-1}.$$

A representative element of the M matrix, M_{ij} , gives the direct and indirect effects on sector i income caused by an exogenous unit increase in sector j income.⁴

Following Reinert and Roland-Holst (1994), we derive direct and indirect trade linkages from the individual SAMs based on the M matrix and the trade vectors. Define f_i as the export final demand for commodity i and f as the column vector of these elements. The coefficient

$$(4) \quad \phi_i = f_i / F'e$$

⁴ The matrix M is not the standard Leontief multiplier matrix, since a number of institutional accounts are endogenous. For a more detailed discussion of this distinction, see Roland-Holst (1990).

Table 7
Direct and indirect trade linkages

	Argentina				Australia				Brazil			
	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ
Grains	0.098	0.164	0.001	0.275	0.032	0.044	0.001	0.153	0.001	0.089	0.031	0.274
Other crops	0.103	0.357	0.012	0.286	0.024	0.065	0.006	0.151	0.068	0.208	0.022	0.265
Livestock	0.011	0.238	0.004	0.276	0.068	0.131	0.003	0.155	0.004	0.126	0.003	0.254
Forestry	0.005	0.019	0.001	0.265	0.001	0.004	0.001	0.180	0.001	0.022	0.001	0.230
Fisheries	0.038	0.044	0.002	0.266	0.012	0.019	0.004	0.166	0.005	0.013	0.003	0.237
Primary mining	0.028	0.283	0.024	0.285	0.242	0.322	0.033	0.191	0.084	0.229	0.169	0.375
Processed food	0.301	1.181	0.039	0.320	0.107	0.283	0.032	0.200	0.176	0.562	0.062	0.328
Textiles	0.012	0.310	0.027	0.321	0.010	0.060	0.032	0.175	0.025	0.174	0.011	0.279
Clothing	0.002	0.103	0.016	0.301	0.003	0.027	0.018	0.156	0.008	0.066	0.003	0.235
Leather manufactures	0.047	0.101	0.008	0.306	0.005	0.019	0.014	0.138	0.050	0.086	0.010	0.267
Lumber manufactures	0.003	0.048	0.008	0.285	0.010	0.036	0.017	0.176	0.017	0.070	0.002	0.260
Pulp and paper	0.009	0.153	0.029	0.303	0.007	0.091	0.034	0.193	0.039	0.140	0.014	0.264
Processed petroleum and coal	0.033	0.342	0.005	0.285	0.012	0.096	0.014	0.209	0.007	0.206	0.015	0.293
Chemicals	0.054	0.582	0.123	0.428	0.055	0.200	0.106	0.263	0.065	0.397	0.126	0.400
Mineral products	0.005	0.047	0.008	0.284	0.004	0.019	0.013	0.177	0.010	0.042	0.006	0.266
Primary steel	0.042	0.153	0.028	0.298	0.022	0.060	0.013	0.177	0.109	0.314	0.010	0.302
Primary non-ferrous metals	0.011	0.049	0.011	0.286	0.057	0.086	0.007	0.176	0.041	0.120	0.014	0.295
Fabricated metal products	0.009	0.099	0.016	0.291	0.011	0.046	0.026	0.181	0.015	0.084	0.010	0.275
Transport equipment	0.027	0.253	0.133	0.450	0.022	0.083	0.130	0.266	0.087	0.207	0.079	0.344
Machinery and equipment	0.041	0.185	0.278	0.527	0.053	0.135	0.271	0.385	0.116	0.309	0.220	0.472
Other manufactures	0.003	0.013	0.035	0.184	0.006	0.020	0.036	0.093	0.005	0.100	0.017	0.278
Electricity, waer, and gas	0.007	0.199	0.012	0.284	0.004	0.124	0.002	0.160	0.005	0.090	0.011	0.256
Construction	0.006	0.008	0.012	0.293	0.003	0.023	0.003	0.188	0.001	0.060	0.011	0.279
Trade, transport, and communication	0.097	0.499	0.174	0.422	0.174	0.739	0.132	0.290	0.062	0.668	0.156	0.397
Private services	0.010	1.227	0.004	0.278	0.033	0.417	0.034	0.195	0.006	0.886	0.004	0.251
Government services	0.010	0.013	0.004	0.237	0.034	0.213	0.034	0.193	0.006	0.008	0.004	0.236
Dwellings	0.000	0.002	0.001	0.267	0.000	0.204	0.001	0.146	0.000	0.137	0.001	0.264

ϕ Share in total export demand
 Ω Weighted average direct and indirect effect of increased export demand
 γ Share of import expenditures
 μ Total direct and indirect import effects of exogenous increase in final demand

Table 7 -- continued
Direct and indirect trade linkages

	Canada				China				European union			
	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ
Grains	0.036	0.045	0.001	0.135	0.011	0.304	0.030	0.181	0.011	0.034	0.002	0.168
Other crops	0.010	0.040	0.018	0.125	0.022	0.252	0.011	0.146	0.010	0.053	0.028	0.188
Livestock	0.010	0.050	0.003	0.125	0.014	0.151	0.010	0.151	0.003	0.076	0.007	0.175
Forestry	0.002	0.031	0.002	0.122	0.001	0.023	0.005	0.137	0.001	0.007	0.002	0.161
Fisheries	0.012	0.016	0.004	0.116	0.012	0.045	0.003	0.139	0.003	0.014	0.009	0.148
Primary mining	0.101	0.187	0.045	0.154	0.038	0.119	0.034	0.191	0.024	0.195	0.120	0.304
Processed food	0.034	0.176	0.038	0.155	0.039	0.334	0.024	0.177	0.063	0.295	0.036	0.203
Textiles	0.008	0.037	0.021	0.114	0.073	0.377	0.104	0.277	0.029	0.094	0.019	0.177
Clothing	0.004	0.033	0.015	0.110	0.157	0.191	0.007	0.207	0.020	0.055	0.036	0.164
Leather manufactures	0.002	0.010	0.011	0.079	0.111	0.148	0.019	0.174	0.016	0.034	0.017	0.154
Lumber manufactures	0.056	0.084	0.020	0.128	0.015	0.037	0.012	0.172	0.014	0.050	0.022	0.180
Pulp and paper	0.082	0.161	0.031	0.146	0.006	0.068	0.025	0.182	0.020	0.103	0.032	0.195
Processed petroleum and coal	0.015	0.067	0.009	0.149	0.008	0.054	0.015	0.166	0.003	0.119	0.012	0.193
Chemicals	0.061	0.155	0.091	0.194	0.051	0.314	0.131	0.300	0.118	0.309	0.064	0.240
Mineral products	0.006	0.018	0.014	0.115	0.016	0.046	0.006	0.180	0.016	0.047	0.007	0.179
Primary steel	0.020	0.051	0.018	0.121	0.013	0.078	0.051	0.213	0.029	0.039	0.015	0.175
Primary non-ferrous metals	0.037	0.055	0.013	0.120	0.007	0.037	0.023	0.161	0.012	0.024	0.020	0.165
Fabricated metal products	0.016	0.046	0.029	0.129	0.023	0.063	0.015	0.190	0.024	0.076	0.016	0.202
Transport equipment	0.221	0.367	0.211	0.360	0.043	0.074	0.111	0.239	0.107	0.177	0.066	0.243
Machinery and equipment	0.137	0.221	0.311	0.399	0.167	0.382	0.309	0.503	0.274	0.397	0.213	0.384
Other manufactures	0.009	0.041	0.030	0.116	0.127	0.159	0.024	0.197	0.026	0.041	0.035	0.162
Electricity, water, and gas	0.052	0.119	0.008	0.111	0.001	0.053	0.032	0.165	0.012	0.081	0.001	0.185
Construction	0.091	0.034	0.001	0.137	0.001	0.001	0.001	0.194	0.001	0.036	0.002	0.174
Trade, transport, and communication	0.068	0.570	0.069	0.191	0.056	0.338	0.011	0.161	0.173	0.577	0.140	0.296
Private services	0.006	0.439	0.001	0.136	0.001	0.147	0.001	0.145	0.003	0.539	0.046	0.191
Government services	0.006	0.060	0.001	0.113	0.001	0.053	0.001	0.172	0.003	0.059	0.046	0.197
Dwellings	0.000	0.178	0.001	0.101	0.000	0.037	0.001	0.152	0.000	0.128	0.001	0.128

ϕ Share in total export demand
 Ω Weighted average, direct and indirect effect of increased export demand

γ Share of import expenditures
 μ Total direct and indirect import effects of exogenous increase in final demand

Table 7 -- continued
Direct and indirect trade linkages

	Indonesia				Japan				Korea			
	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ
Grains	0.001	0.117	0.017	0.110	0.001	0.041	0.014	0.217	0.001	0.076	0.018	0.111
Other crops	0.058	0.249	0.030	0.121	0.001	0.034	0.022	0.236	0.006	0.115	0.018	0.112
Livestock	0.003	0.044	0.002	0.104	0.001	0.026	0.007	0.287	0.001	0.041	0.016	0.130
Forestry	0.001	0.047	0.001	0.099	0.001	0.008	0.011	0.216	0.001	0.014	0.008	0.089
Fisheries	0.031	0.060	0.001	0.098	0.002	0.025	0.033	0.223	0.013	0.030	0.006	0.119
Primary mining	0.317	0.393	0.046	0.134	0.003	0.072	0.170	0.303	0.002	0.113	0.144	0.211
Processed food	0.044	0.303	0.033	0.144	0.005	0.254	0.061	0.312	0.012	0.261	0.028	0.142
Textiles	0.072	0.288	0.046	0.189	0.022	0.062	0.015	0.270	0.087	0.230	0.031	0.166
Clothing	0.060	0.063	0.001	0.167	0.002	0.042	0.032	0.273	0.052	0.073	0.003	0.148
Leather manufactures	0.045	0.054	0.012	0.127	0.002	0.012	0.016	0.213	0.074	0.110	0.009	0.139
Lumber manufactures	0.128	0.144	0.003	0.121	0.002	0.026	0.025	0.260	0.004	0.018	0.010	0.112
Pulp and paper	0.011	0.027	0.021	0.103	0.008	0.106	0.011	0.269	0.007	0.067	0.018	0.135
Processed petroleum and coal	0.032	0.106	0.037	0.137	0.003	0.056	0.020	0.272	0.014	0.092	0.024	0.179
Chemicals	0.050	0.172	0.120	0.220	0.059	0.279	0.059	0.317	0.066	0.319	0.087	0.227
Mineral products	0.009	0.014	0.008	0.126	0.010	0.037	0.006	0.274	0.007	0.039	0.012	0.147
Primary steel	0.010	0.017	0.053	0.109	0.038	0.115	0.016	0.280	0.050	0.200	0.047	0.206
Primary non-ferrous metals	0.014	0.020	0.016	0.096	0.007	0.056	0.026	0.271	0.006	0.038	0.023	0.126
Fabricated metal products	0.007	0.017	0.027	0.119	0.017	0.071	0.009	0.264	0.022	0.049	0.015	0.154
Transport equipment	0.014	0.045	0.082	0.177	0.226	0.265	0.039	0.298	0.098	0.130	0.040	0.230
Machinery and equipment	0.034	0.074	0.336	0.380	0.428	0.587	0.108	0.368	0.240	0.413	0.299	0.469
Other manufactures	0.018	0.024	0.011	0.113	0.059	0.078	0.022	0.267	0.055	0.067	0.017	0.143
Electricity, water, and gas	0.001	0.030	0.001	0.141	0.002	0.122	0.001	0.239	0.003	0.068	0.007	0.125
Construction	0.004	0.023	0.001	0.134	0.006	0.038	0.001	0.262	0.060	0.080	0.018	0.169
Trade, transport, and communication	0.049	0.426	0.105	0.202	0.108	0.757	0.286	0.512	0.115	0.362	0.110	0.215
Private services	0.001	0.205	0.001	0.113	0.001	0.751	0.001	0.229	0.009	0.293	0.003	0.118
Government services	0.001	0.031	0.001	0.093	0.001	0.106	0.001	0.215	0.009	0.084	0.003	0.132
Dwellings	0.000	0.001	0.001	0.087	0.000	0.001	0.001	0.198	0.000	0.049	0.001	0.101

ϕ Share in total export demand
 Ω Weighted average, direct and indirect effect of increased export demand

γ Share of import expenditures
 μ Total direct and indirect import effects of exogenous increase in final demand

Table 7 -- continued
Direct and indirect trade linkages

	Malaysia					Mexico					New Zealand				
	ϕ	Ω	γ	μ	μ	ϕ	Ω	γ	μ	μ	ϕ	Ω	γ	μ	μ
Grains	0.001	0.052	0.013	0.123	0.123	0.001	0.056	0.015	0.188	0.188	0.001	0.012	0.004	0.173	0.173
Other crops	0.029	0.075	0.013	0.126	0.126	0.028	0.106	0.019	0.193	0.193	0.027	0.050	0.010	0.185	0.185
Livestock	0.006	0.031	0.003	0.141	0.141	0.007	0.097	0.007	0.198	0.198	0.087	0.282	0.003	0.207	0.207
Forestry	0.041	0.064	0.001	0.122	0.122	0.001	0.013	0.001	0.186	0.186	0.024	0.044	0.001	0.179	0.179
Fisheries	0.006	0.034	0.004	0.107	0.107	0.006	0.016	0.001	0.207	0.207	0.045	0.060	0.002	0.248	0.248
Primary mining	0.105	0.165	0.018	0.143	0.143	0.153	0.217	0.010	0.196	0.196	0.020	0.081	0.047	0.184	0.184
Processed food	0.076	0.237	0.043	0.178	0.178	0.020	0.358	0.055	0.252	0.252	0.273	0.493	0.039	0.244	0.244
Textiles	0.014	0.056	0.040	0.104	0.104	0.013	0.065	0.022	0.202	0.202	0.011	0.060	0.035	0.171	0.171
Clothing	0.024	0.033	0.004	0.112	0.112	0.017	0.056	0.017	0.197	0.197	0.006	0.036	0.016	0.155	0.155
Leather manufactures	0.005	0.008	0.003	0.072	0.072	0.008	0.035	0.008	0.199	0.199	0.014	0.028	0.009	0.170	0.170
Lumber manufactures	0.062	0.077	0.003	0.136	0.136	0.020	0.049	0.019	0.185	0.185	0.025	0.067	0.007	0.205	0.205
Pulp and paper	0.006	0.039	0.021	0.123	0.123	0.005	0.057	0.027	0.197	0.197	0.041	0.169	0.037	0.224	0.224
Processed petroleum and coal	0.010	0.073	0.037	0.142	0.142	0.010	0.051	0.014	0.190	0.190	0.006	0.088	0.012	0.195	0.195
Chemicals	0.036	0.141	0.081	0.179	0.179	0.045	0.209	0.089	0.263	0.263	0.048	0.212	0.115	0.268	0.268
Mineral products	0.006	0.013	0.012	0.129	0.129	0.011	0.038	0.008	0.195	0.195	0.003	0.030	0.011	0.187	0.187
Primary steel	0.006	0.032	0.051	0.098	0.098	0.016	0.051	0.030	0.200	0.200	0.016	0.041	0.018	0.168	0.168
Primary non-ferrous metals	0.008	0.026	0.021	0.091	0.091	0.014	0.031	0.031	0.182	0.182	0.031	0.062	0.013	0.179	0.179
Fabricated metal products	0.008	0.023	0.023	0.102	0.102	0.017	0.048	0.029	0.199	0.199	0.011	0.063	0.023	0.195	0.195
Transport equipment	0.024	0.078	0.079	0.159	0.159	0.117	0.178	0.129	0.281	0.281	0.008	0.082	0.127	0.223	0.223
Machinery and equipment	0.366	0.586	0.445	0.598	0.598	0.273	0.344	0.316	0.444	0.444	0.038	0.139	0.210	0.321	0.321
Other manufactures	0.059	0.082	0.031	0.247	0.247	0.024	0.042	0.023	0.168	0.168	0.007	0.027	0.029	0.106	0.106
Electricity, water, and gas	0.001	0.038	0.002	0.148	0.148	0.012	0.046	0.009	0.190	0.190	0.002	0.112	0.002	0.179	0.179
Construction	0.001	0.013	0.003	0.223	0.223	0.003	0.003	0.009	0.218	0.218	0.043	0.156	0.003	0.218	0.218
Trade, transport, and communication	0.111	0.325	0.039	0.168	0.168	0.162	0.836	0.120	0.299	0.299	0.137	0.690	0.159	0.351	0.351
Private services	0.001	0.087	0.011	0.177	0.177	0.016	0.367	0.003	0.194	0.194	0.045	0.567	0.040	0.235	0.235
Government services	0.001	0.014	0.011	0.149	0.149	0.016	0.080	0.003	0.192	0.192	0.046	0.220	0.040	0.220	0.220
Dwellings	0.080	0.040	0.001	0.117	0.117	0.800	0.001	0.001	0.178	0.178	0.000	0.192	0.001	0.192	0.192

ϕ Share in total export demand
 Ω Weighted average direct and indirect effect of increased export demand

γ Share of import expenditures
 μ Total direct and indirect import effects of exogenous increase in final demand

Table 7 -- continued
Direct and indirect export linkages

	Philippines				Singapore				Taiwan			
	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ
Grains	0.001	0.012	0.021	0.173	0.001	0.002	0.002	0.009	0.001	0.059	0.012	0.140
Other crops	0.045	0.050	0.010	0.185	0.001	0.016	0.017	0.039	0.019	0.079	0.016	0.148
Livestock	0.002	0.282	0.003	0.207	0.001	0.007	0.004	0.066	0.003	0.081	0.007	0.178
Forestry	0.001	0.044	0.003	0.179	0.001	0.001	0.001	0.096	0.001	0.008	0.003	0.113
Fisheries	0.028	0.060	0.004	0.248	0.006	0.012	0.007	0.037	0.014	0.047	0.005	0.148
Primary mining	0.045	0.081	0.129	0.184	0.005	0.052	0.086	0.098	0.003	0.052	0.026	0.149
Processed food	0.094	0.493	0.069	0.244	0.032	0.073	0.036	0.091	0.025	0.290	0.033	0.187
Textiles	0.011	0.060	0.065	0.171	0.015	0.046	0.016	0.060	0.085	0.186	0.024	0.210
Clothing	0.104	0.036	0.006	0.155	0.020	0.038	0.016	0.058	0.034	0.064	0.007	0.185
Leather manufactures	0.026	0.028	0.009	0.170	0.003	0.008	0.007	0.032	0.041	0.066	0.006	0.182
Lumber manufactures	0.036	0.067	0.004	0.205	0.010	0.018	0.009	0.075	0.028	0.050	0.013	0.156
Pulp and paper	0.005	0.169	0.019	0.224	0.011	0.032	0.013	0.090	0.010	0.089	0.018	0.174
Processed petroleum and coal	0.011	0.088	0.019	0.195	0.122	0.173	0.034	0.128	0.002	0.093	0.014	0.148
Chemicals	0.036	0.212	0.109	0.268	0.060	0.139	0.072	0.139	0.066	0.365	0.102	0.296
Mineral products	0.007	0.030	0.012	0.187	0.004	0.008	0.011	0.054	0.011	0.037	0.012	0.171
Primary steel	0.006	0.041	0.046	0.168	0.009	0.031	0.026	0.095	0.013	0.149	0.050	0.222
Primary non-ferrous metals	0.020	0.062	0.013	0.179	0.010	0.025	0.018	0.043	0.008	0.050	0.029	0.149
Fabricated metal products	0.007	0.063	0.017	0.195	0.012	0.032	0.018	0.104	0.043	0.091	0.015	0.186
Transport equipment	0.008	0.082	0.064	0.223	0.024	0.049	0.059	0.109	0.030	0.096	0.091	0.227
Machinery and equipment	0.261	0.139	0.318	0.321	0.423	0.823	0.381	0.705	0.350	0.567	0.323	0.559
Other manufactures	0.001	0.027	0.013	0.106	0.040	0.084	0.046	0.104	0.069	0.091	0.020	0.196
Electricity, water, and gas	0.001	0.112	0.001	0.179	0.011	0.032	0.007	0.109	0.003	0.089	0.009	0.159
Construction	0.002	0.156	0.002	0.218	0.013	0.019	0.007	0.173	0.025	0.053	0.024	0.212
Trade, transport, and communication	0.206	0.690	0.057	0.351	0.152	0.323	0.094	0.213	0.112	0.474	0.148	0.280
Private services	0.005	0.567	0.001	0.235	0.015	0.095	0.003	0.152	0.009	0.202	0.003	0.169
Government services	0.005	0.220	0.001	0.220	0.015	0.022	0.003	0.184	0.009	0.072	0.003	0.168
Dwellings	0.000	0.192	0.001	0.192	0.000	0.005	0.001	0.105	0.000	0.096	0.001	0.143

ϕ Share in total export demand
 Ω Weighted average, direct and indirect effect of increased export demand
 γ Share of import expenditures
 μ Total direct and indirect import effects of exogenous increase in final demand

Table 7 -- continued
Direct and indirect export linkages

	Thailand				United States			
	ϕ	Ω	γ	μ	ϕ	Ω	γ	μ
Grains	0.006	0.063	0.005	0.070	0.022	0.042	0.001	0.186
Other crops	0.658	0.137	0.018	0.087	0.020	0.049	0.013	0.156
Livestock	0.002	0.059	0.007	0.085	0.005	0.048	0.004	0.185
Forestry	0.001	0.023	0.006	0.064	0.005	0.016	0.001	0.164
Fisheries	0.050	0.084	0.024	0.085	0.006	0.010	0.009	0.109
Primary mining	0.032	0.100	0.080	0.125	0.017	0.148	0.091	0.217
Processed food	0.140	0.366	0.027	0.099	0.042	0.214	0.030	0.191
Textiles	0.034	0.189	0.033	0.120	0.013	0.045	0.014	0.170
Clothing	0.079	0.139	0.001	0.099	0.008	0.045	0.039	0.161
Leather manufactures	0.040	0.061	0.008	0.085	0.004	0.015	0.028	0.095
Lumber manufactures	0.020	0.036	0.013	0.076	0.014	0.037	0.021	0.165
Pulp and paper	0.003	0.027	0.017	0.077	0.025	0.138	0.021	0.181
Processed petroleum and coal	0.005	0.098	0.038	0.118	0.011	0.155	0.014	0.194
Chemicals	0.035	0.162	0.114	0.167	0.089	0.194	0.065	0.226
Mineral products	0.009	0.024	0.015	0.095	0.006	0.026	0.010	0.165
Primary steel	0.006	0.030	0.078	0.111	0.011	0.063	0.018	0.183
Primary non-ferrous metals	0.003	0.013	0.021	0.039	0.011	0.037	0.015	0.171
Fabricated metal products	0.011	0.023	0.024	0.082	0.016	0.072	0.019	0.179
Transport equipment	0.010	0.034	0.100	0.160	0.131	0.210	0.147	0.306
Machinery and equipment	0.217	0.286	0.345	0.411	0.291	0.438	0.279	0.435
Other manufactures	0.070	0.095	0.021	0.078	0.022	0.043	0.051	0.147
Electricity, water, and gas	0.001	0.051	0.010	0.109	0.021	0.169	0.036	0.199
Construction	0.033	0.043	0.001	0.103	0.001	0.038	0.001	0.183
Trade, transport, and communication	0.136	0.512	0.009	0.084	0.155	0.856	0.087	0.234
Private services	0.006	0.160	0.001	0.083	0.033	0.928	0.001	0.149
Government services	0.006	0.025	0.001	0.070	0.033	0.232	0.001	0.141
Dwellings	0.000	0.001	0.001	0.057	0.000	0.001	0.001	0.133

ϕ Share in total export demand
 Ω Weighted average direct and indirect effect of increased export demand

γ Share of import expenditures
 μ Total direct and indirect import effects of exogenous increase in final demand

gives the share of commodity i in total export demand, and the column vector ϕ contains the full set of these coefficients. This vector represents direct export shares. To account for intermediate linkages, we also define the column vector

$$(5) \quad \Omega = M\phi$$

which gives the weighted average direct and indirect effect on sector i of increasing export demand by one dollar, holding its sectoral composition constant. On the import side, we define γ_j as the share of expenditures by endogenous sector j to the rest of the world (import leakages) and γ as the row vector of such expenditure shares. The leakage multiplier is then given by

$$(6) \quad \mu = \gamma M.$$

This row vector gives the total import leakages resulting from the direct and indirect effects of a dollar increase in the exogenous demand for good i .

Table 7 presents the direct and indirect trade linkages. One of the most interesting patterns in the table relates to export linkages. In particular, from the matrix ϕ , we have a measure of the direct trade pattern. Not surprisingly, trade is concentrated in manufactures, and the importance of high-end manufactures (like machinery and transport equipment) rises with income. However, the picture changes when we introduced the full set of intermediate linkages. In particular, the matrix Ω gives the sectoral intensity of the overall export pattern. What stands out is the relative service intensity of exports in the high income countries.

To illustrate this point, Figure 7 plots the pattern of total export intensity against income. The underlying OLS estimates are presented in Table 8. Based on net shares, the exports of the high income countries are concentrated in the upper-end of the manufacturing spectrum. However, on an activity basis, where we account for the full set of economy-wide intermediate linkages, we find that the most important sectors for export performance are the service sectors. In terms of income levels, we find middle income countries (defined as up to \$10,000 per year in per capita income)

Table 8
Direct and indirect private service exports

<i>Full-sample</i>	
intercept	0.5309738
Std Err of Y Est	0.3353899
R Squared	0.0915832
No. of Observations	17
Degrees of Freedom	14
per-capita income	-4.47E-05
Std Err of income coeff.	7.026E-05
t-ratio	-0.636597
per-capita income squared	3.099E-09
Std Err of squared income coeff.	3.691E-09
t-ratio	0.8398162
<i>Sample excluding Argentina, Brazil</i>	
Intercept	0.3634881
Std Err of Y Est	0.1892783
R Squared	0.5101662
No. of Observations	15
Degrees of Freedom	12
per-capita income	-4.71E-05
Std Err of income coeff.	3.974E-05
t-ratio	-1.185327
per-capita income squared	3.998E-09
Std Err of squared income coeff.	2.091E-09
t-ratio	1.911787

concentrated in exports of manufacturing activities. In Korea, for example, the most important sector for both direct and indirect exports is machinery and equipment. Beyond this point, economies shift in relative terms from exporting manufacturing activities to exporting service activities. Hence, while the net composition of exports is concentrated in tangible exports, the leading cost component of these export is actually service activities in the OECD economies.

V. Summary

Services are the dominant feature of the post-industrial OECD economies, and growth of the sector is an important feature of economic development. Working with a cross-country sample of social accounting data, we have examined changes in the structure of production and trade, and the overall relationship of services to these patterns. What emerges is a set of stylized facts that match closely the historical experience of the OECD countries. To summarize:

- (i) Income levels are positively associated with employment shares for intermediate services and with the share of indirect labour in total manufacturing employment.
- (ii) The share of value added originating in services, including both private services and trade, transport, and communications services, is also positively linked to the level of development.
- (iii) Income levels are strongly linked to intermediate demand for producer services, particularly in manufacturing.
- (iv) While changes in the allocation of non-production activities between manufacturing and service firms may explain a small share of service sector growth, the basic story seems instead to be one of fundamental changes in the structure of production.
- (v) The importance of services for export performance depends on the level of development. As we move from the middle-income to upper-income range of our sample, private services and trade, transport, and communications services become the most important sectoral elements of exports via interindustry linkages.

The last result relates to the economic structure of the OECD economies. While their exports are concentrated in manufactures, their economies are concentrated in services. At the same time, however, our results serve as a reminder that, in terms of the intermediate structure of production, services are a major aspect of production, even for exportables. Hence, while Japan's exports in material terms are concentrated in transport equipment and other machinery and equipment, the activity composition of Japanese exports is actually concentrated in services, which are almost 50 percent again more important than transport equipment and machinery

and equipment. Similar patterns hold for Canada, the European Union, and the United States. Even for middle-income countries such as Korea, the significance of the service sector for overall exports is much greater than the direct trade balance suggests.

References

Argentina Secretaria de Planificacion, *Input-Output Table for Argentina, 1984*, 1986.

Balassa, B. "The Purchasing Power Parity Doctrine: A Reappraisal," *Journal of Political Economy*, 72, 1964, 564-96.

Bank of Korea, *1985 Input-Output Tables of Korea*, Seoul, 1988.

Baumol, W.J., S.A.B. Blackman, and E.N. Wolff, "Unbalanced Growth Revisited: Asymptotic Stagnancy and New Evidence," *American Economic Review*, 75:4, September 1985, 806-817.

Bhagwati, J.N., "Why Are Services Cheaper in the Poor Countries?" *Economic Journal*, 94, 1984a, 279-286.

Bhagwati, J.N., "Splintering and Disembodiment of Services and Developing Nations," *World Economy*, 7:2, 1984b, 133-143.

Bhagwati, J.N., "Trade in Services and Developing Countries," London: Tenth Annual Geneva Convention at the London School of Economics, 1985.

Bhagwati, J.N. and V. Dehejia, "Freer Trade and Wages of the Unskilled: Is Marx Striking Again?" conference paper, American Enterprise Institute, 1993.

Brazil Secretaria de Planejamento E Coordenacao Da Presidencial Da Republica, "Matriz de Insumo-Producto Brazil 1980," Fundacao Instituto Brasileiro De Geografia E Estatistica, Departamento De Contas Nacionais. Series Relatorios Metologicos vol. 7, 1980.

Burfisher, M.E., K.E. Thierfelder, and K. Hanson, "Data base for a Computable General Equilibrium Analysis of a U.S.-Mexico Free Trade Agreement," Economic Research Service, U.S. Department of Agriculture, Washington DC, Staff Report no. AGES-9225, 1992.

Chenery, H.B. and L. Taylor, "Development Patterns Among Countries and Over Time," *Review of Economics and Statistics*, 50:4, November 1968, 391-416.

China Department of Balances of National Economy of the State Statistical Bureau and Office of the National Input-Output Survey, *Input-Output Table of China*, China Statistical Publishing House, 1987.

Clark, C., *The Conditions of Economic Progress*, Macmillan, London, 1940.

Cornwall, J. and W. Cornwall, "Growth Theory and Economic Structure," *Economica*, 61:242, May 1994, 237-251.

Dighe, R.S., J.F. Francois, and K.A. Reinert, "The Role of Services in U.S. Production and Trade: An Analysis of Social Accounting Data for the 1980s," in P.T. Harker (ed.), *The Service Productivity and Quality Challenge*, Kluwer, Boston, 1995, 43-80.

Francois, J.F., "Producer Services, Scale, and the Division of Labor," *Oxford Economic Papers*, 42:4, October 1990, 715-729.

Gehlhar, M.J., D. Gray, T.W. Hertel, K. Huff, E. Ianchovichina, B.J. MacDonald, R. McDougall, M.E. Tsigas, and R. Wigle, "Overview of the GTAP Data Base," in T.W. Hertel (ed.), *Global Trade Analysis: Modeling and Applications*, Cambridge University Press, Cambridge, forthcoming.

Greenfield, H.I., *Manpower and the Growth of Producer Services*, London: Columbia University Press, 1966.

Hunter, L. and J.R. Markusen, "Per-Capita Income as a Determinant of Trade," in R. Feenstra (ed.), *Empirical Methods for International Economics*, MIT Press, Cambridge, Massachusetts, 1988, 89-109.

Indonesia Central Bureau of Statistics, *Asian International Input-Output Series No. 7, Some Aspects of the 1985 Indonesian Input-Output Table*, 1989.

Institute for Developing Economics, Tokyo and Socio-Economic Policy and Forecasting Unit, Chulalongkorn University Social Research Institute, Bangkok, *Input-Output Table of Thailand*, 1985.

Katouzian, M.A., "The Development of the Service Sector: A New Approach," *Oxford Economic Papers*, 22:3, November 1970.

Kenderes, M. and Strzelecki, A. *Listing of the 1986-87 ORANI Database*, Research Memorandum No. OA-569, Industry Commission, Canberra, 1992.

Kravis, I.B., A. Heston, and R. Summers, *World Product and Income: International Comparison of Real Gross Product*, Johns Hopkins University Press, Baltimore, Maryland, 1982.

Kravis, I.B., A. Heston, and R. Summers, *World Product and Income: An International Comparison of Real Gross Domestic Product*, Baltimore: Johns Hopkins University Press, 1982.

Lawrence, R.Z. and M.J. Slaughter, "International Trade and American Wages in the 1980s: Giant Sucking Sound or Small Hiccup?" *Brookings Papers on Economic Activity: Microeconomics*, 2, 1993, 161-226.

Leamer, E.E., "Wage Effects of a U.S.-Mexican Free Trade Agreement," in P.M. Garber (eds.), *The Mexico-U.S. Free Trade Agreement*, MIT Press, Cambridge, 1993.

Leamer, E.E., "Trade, Wages, and Revolving Door Ideas," *NBER Working Paper* no. 4716, 1994.

Malaysia Department of Statistics, *1983 Input-Output Tables*, 1988.

Mexico Secretaria de Pramacion Y Presupuesto, "Matrix de Insumo-Producto de Mexico," 1985.

Ministry of International Trade and Industry, *The 1985 Japan-U.S. Input-Output Table*, Research and Statistics Department, Japan, 1989.

New Zealand Department of Statistics, *Inter-Industry Study of the New Zealand Economy 1987*, 1991.

Panagariya, A., "A Theoretical Explanation of Some Stylized Facts of Economic Growth," *Quarterly Journal of Economics*, 103, 1988, 509-526.

Park, S.-H., "Linkages between Industry and Services and their Implications for Urban Employment Generation in Developing Countries," *Journal of Development Economics*, 30, April 1989, 359-379.

Park, S.-H. and K.S. Chan, "A Cross-Country Input-Output Analysis of Intersectoral Relationships between Manufacturing and Services and their Employment Implications," 17:2, February 1989, 199-212.

Philippines National Economic and Development Authority, *The 1985 Interindustry (Input-Output) Accounts of the Philippines*, 1988.

Reinert, K.A. and D.W. Roland-Holst, "Structural Change in the United States: Social Accounting Estimates for 1982-1988," *Empirical Economics*, 19:3, 1994, 429-449.

Reinert, K.A. and D.W. Roland-Holst, "Social Accounting Matrices," in J.F. Francois and K.A. Reinert (eds.), *Applied Methods for Trade Policy Analysis*, Cambridge University Press, Cambridge, forthcoming.

Robinson, S., "Multisectoral Models," in H.B. Chenery and T.N. Srinivasan (eds.), *Handbook of Development Economics*, North Holland, Amsterdam, 1989, 885-947.

Roland-Holst, D.W., "Interindustry Analysis with Social Accounting Methods," *Economic Systems Research*, 2:2, 1990., 125-145.

Ryan, C. *The SALTER Model: Construction of the European Database*, SALTER Working Paper No. 10, Industry Commission, Canberra, 1992.

Sachs, J.D. and H.J. Schatz, "Trade and Jobs in U.S. Manufacturing," *Brookings Papers on Economic Activity*, 1, 1994, 1-84..

Samuelson, P., "Theoretical Notes on Trade Problems," *Review of Economics and Statistics*, 46, 1964, 145-54.

Singapore Department of Statistics, *Singapore Input-Output Tables 1983*, 1987.

Statistics Canada, *The Input-Output Structure of the Canadian Economy*, Minister of Supply Services, Canada N.B., 1986.

Summers, R. and A. Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988," *Quarterly Journal of Economics*, May 1991. (with revisions released as PWT 5.6 through NBER), November 1994.

Taiwan Directorate General of Budget, Accounting and Statistics, *1986 Input-Output Tables, Taiwan, Taiwan Area, Republic of China*, Executive Yuan, Republic of China, 1986.

Uno, K., *Measurement of Services in an Input-Output Framework*, North Holland, Amsterdam, 1989.

Wood, A., *North-South Trade, Employment and Inequality*, Oxford: Clarendon Press, 1994.

Figure 1

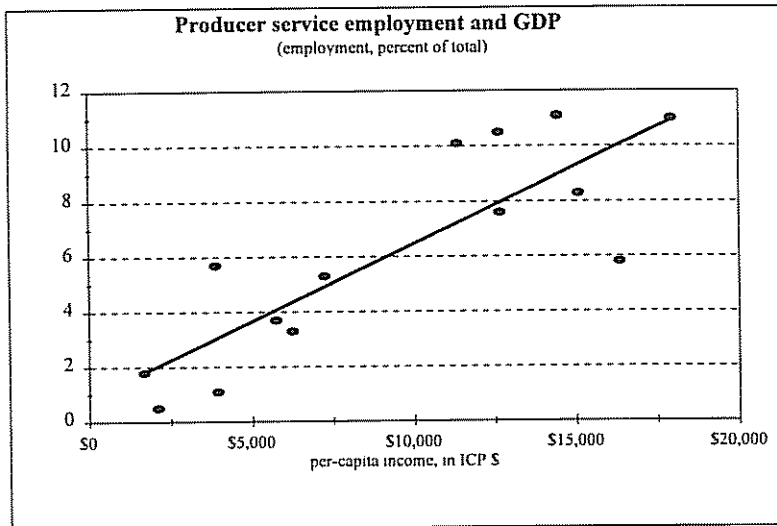


Figure 2

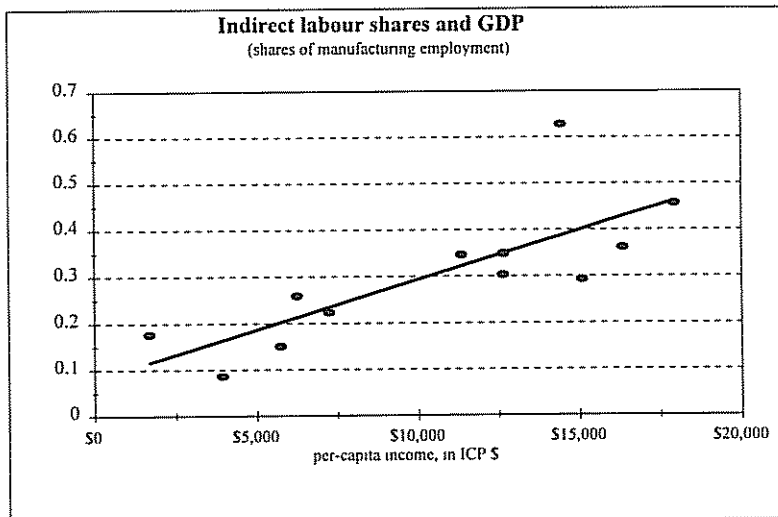


Figure 3

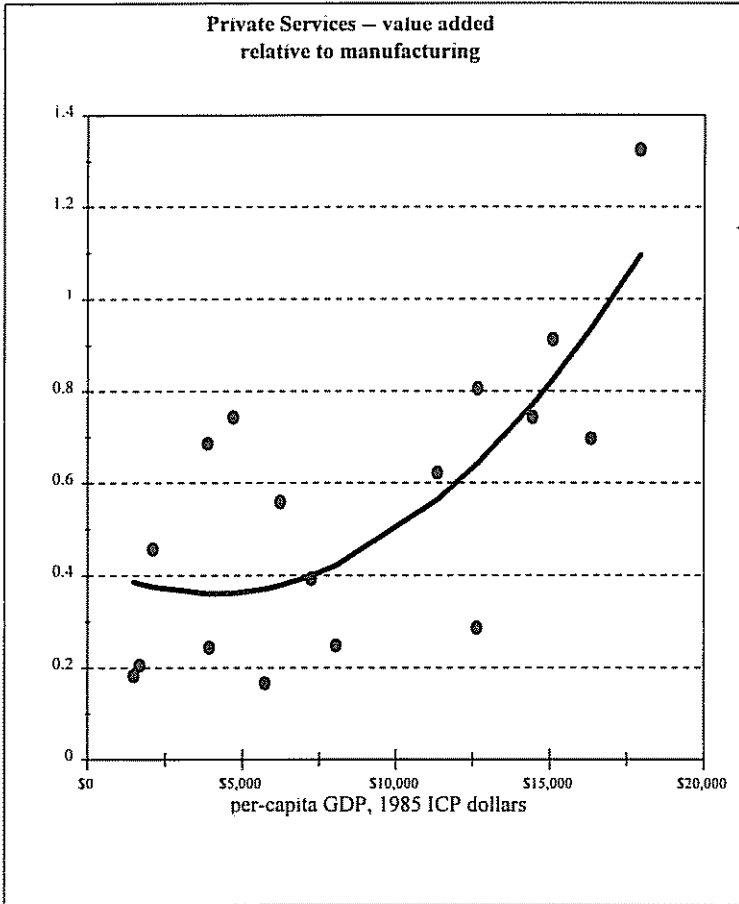


Figure 4

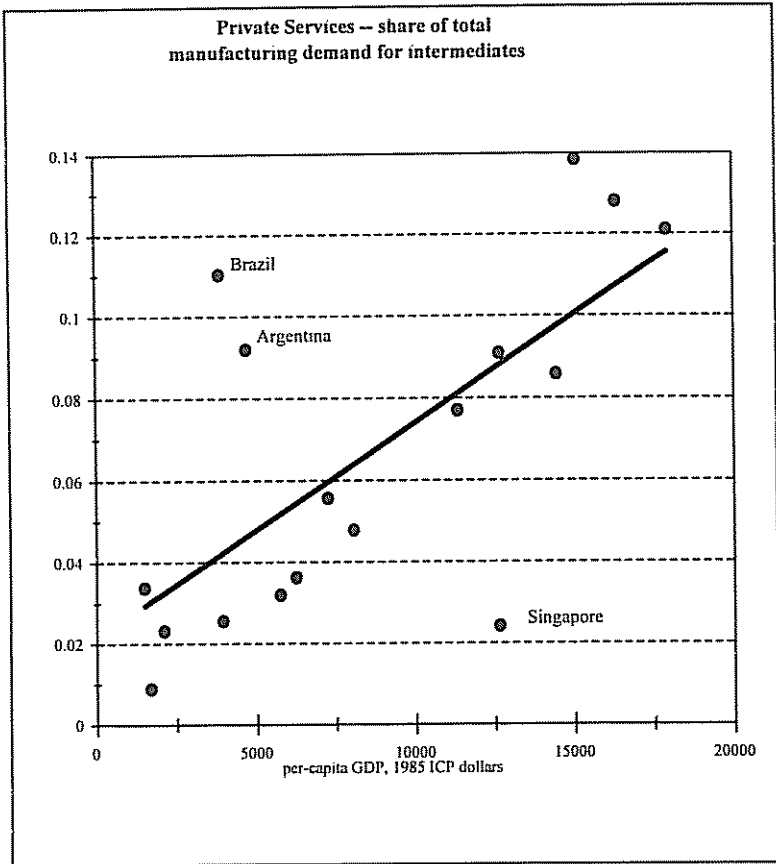


Figure 5

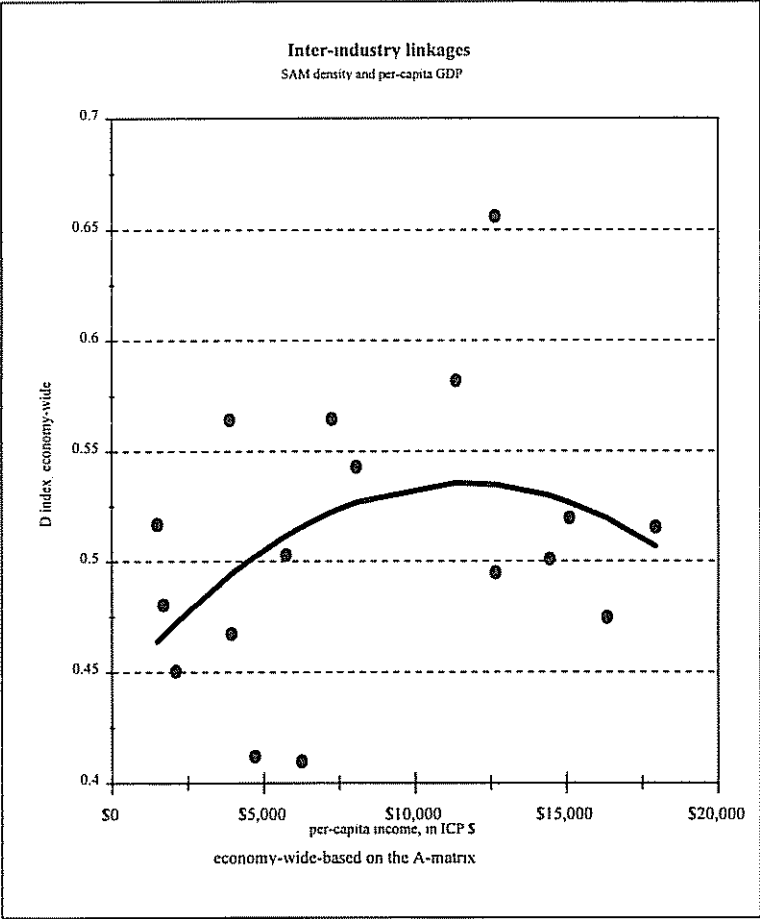


Figure 6

Private services as a share of manufacturing intermediate demand

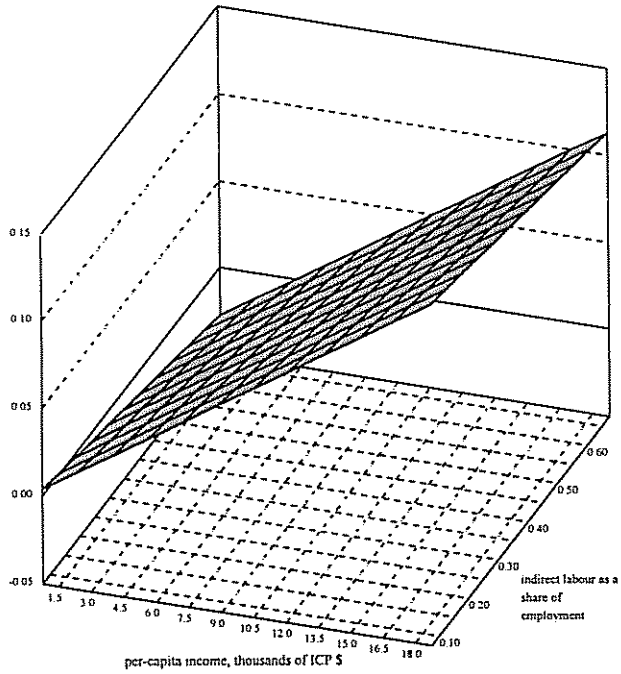
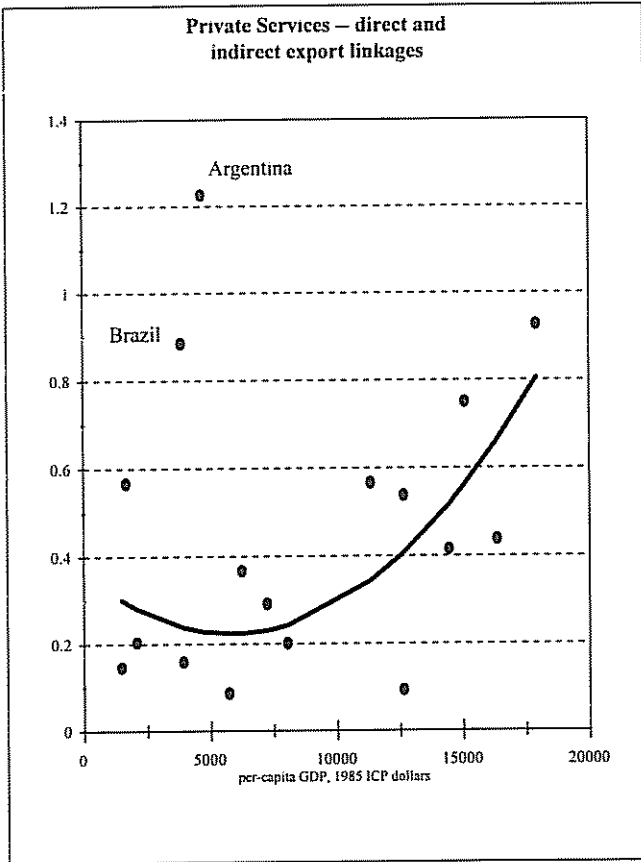


Figure 7



Appendix Table A-1
Concordance of SAM sectors to ISIC sectors*

SAM sector	ISIC number and description, (p) = part pertaining to description
Grains	<p>(p) 1110 Agricultural & livestock production (paddy rice only)</p> <p>(p) 1120 Agricultural services (servicing paddy rice production only)</p> <p>(p) 1110 Agricultural & livestock production (wheat only)</p> <p>(p) 1120 Agricultural services (servicing wheat production only)</p> <p>(p) 1110 Agricultural & livestock production (grains except wheat & rice only)</p> <p>(p) 1120 Agricultural services (servicing production of grains, except wheat & rice only)</p>
Other crops	<p>(p) 1110 Agricultural & livestock production (non-grain crops only)</p> <p>(p) 1120 Agricultural services (servicing non-grain crops production only)</p> <p>(p) 1110 Agricultural & livestock production (wool only)</p> <p>(p) 1120 Agricultural services (servicing wool production only)</p>
Livestock	<p>(p) 1110 Agricultural & livestock production (other livestock production only)</p> <p>(p) 1120 Agricultural services (servicing other livestock production only)</p> <p>1130 Hunting, trapping & game propagation</p>
Forestry	<p>1210 Forestry</p> <p>1220 Logging</p>
Fisheries	<p>1301 Ocean and coastal fishing</p> <p>1302 Fishing n.e.c.</p>
Primary mining	<p>2100 Coal mining</p> <p>(p) 3540 Manufacture of miscellaneous products of petroleum and coal (briquettes only)</p> <p>(p) 2200 Crude petroleum & natural gas production (oil only)</p> <p>(p) 2200 Crude petroleum & natural gas production (gas only)</p> <p>(p) 3530 Petroleum refineries (LPG only)</p> <p>2301 Iron ore mining</p> <p>2302 Non-ferrous ore mining</p> <p>2901 Stone quarrying, clay and pits</p> <p>2902 Chemical and fertiliser mineral mining</p> <p>2903 Salt mining</p> <p>2909 Mining and quarrying n.e.c.</p>

SAM sector	ISIC number and description, (p) = part pertaining to description
-------------------	--

Processed Food

- (p) 3116 Grain mill products (processed rice only)
- 3111 Slaughtering, preparing and preserving meat
- 3112 Manufacture of dairy products
- 3113 Canning and preserving of fruits and vegetables
- 3114 Canning, preserving & processing of fish, crustaceans and similar foods
- 3115 Manufacture of vegetable and animal oils & fats
- (p) 3116 Grain mill products (except processed rice)
- 3117 Manufacture of bakery products
- 3118 Sugar factories and refineries
- 3119 Manufacture of cocoa, chocolate & sugar confectionery
- 3121 Manufacture of food products n.e.c.
- 3122 Manufacture of prepared animal feeds
- 3131 Distilling, rectifying & blending spirits
- 3132 Wine industries
- 3133 Malt liquors and malt
- 3134 Soft drinks & carbonated waters industries
- 3140 Tobacco manufactures

Textiles

- 3211 Spinning, weaving & finishing textiles
- 3212 Manufacture of made-up textile goods excluding wearing apparel
- 3213 Knitting mills
- 3214 Manufacture of carpets & rugs
- 3215 Cordage, rope & twine industries
- 3219 Manufacture of textiles n.e.c.

Clothing

- 3220 Manufacture of wearing apparel, except footwear

Leather

- 3231 Tanneries & leather finishing
- 3232 Fur dressing & dyeing industries
- 3233 Manufacture of products of leather & leather substitutes, except footwear and wearing apparel
- 3240 Manufacture of footwear, except vulcanised or moulded rubber or plastic footwear

Lumber and wood products

- 3311 Sawmills, planing & other wood mills
- 3312 Manufacture of wooden & cane containers & small cane ware
- 3319 Manufacture of wood & cork products n.e.c.
- 3320 Manufacture of furniture & fixtures, except primarily of metal

SAM sector	ISIC number and description, (p) = part pertaining to description
Pulp, paper, and printing	3411 Manufacture of pulp, paper & paperboard 3412 Manufacture of containers & boxes of paper and paperboard 3419 Manufacture of pulp, paper & paperboard articles n.e.c. 3420 Printing, publishing & allied industries
Petroleum and coal products	(p) 3530 Petroleum refineries (except LPG) (p) 3540 Manufacture of miscellaneous products of petroleum and coal (except briquettes)
Chemicals	3511 Manufacture of basic industrial chemicals except fertilisers 3512 Manufacture of fertilisers and pesticides 3513 Manufacture of synthetic resins, plastic materials and man-made fibres except glass 3521 Manufacture of paints, varnishes and lacquers 3522 Manufacture of drugs and medicines 3523 Manufacture of soap and cleaning preparations, perfumes and cosmetics 3529 Manufacture of chemical products n.e.c. 3551 Tyre and tube industries 3559 Manufacture of rubber products n.e.c. 3560 Manufacture of plastic products n.e.c.
Non-metallic mineral products	3610 Manufacture of pottery, china and earthenware 3620 Manufacture of glass and glass products 3691 Manufacture of structural clay compounds 3692 Manufacture of cement, lime and plaster 3699 Manufacture of non-metallic mineral products n.e.c.
Primary steel	3710 Iron and steel basic industries
Primary non-ferrous metals	3720 Non-ferrous metal basic industries
Fabricated metal products	3811 Manufacture of cutlery, hand tools and general hardware 3812 Manufacture of furniture and fixtures primarily of metal 3813 Manufacture of structural metal products 3819 Manufacture of fabricated metal products except machinery & equipment n.e.c.

SAM sector	ISIC number and description, (p) = part pertaining to description
Transport equipment	3841 Ship building and repairing 3842 Manufacture of railroad equipment 3843 Manufacture of motor vehicles 3844 Manufacture of motorcycles and bicycles 3845 Manufacture of aircraft 3849 Manufacture of transport equipment n.e.c.
Machinery and equipment	3821 Manufacture of engines and turbines 3822 Manufacture of agricultural machinery and equipment 3823 Manufacture of metal and wood working machinery 3824 Manufacture of special industrial machinery and equipment except metal and wood working machinery 3825 Manufacture of office, computing and accounting machinery 3829 Machinery and equipment except electrical n.e.c. 3831 Manufacture of electrical industrial machinery and apparatus 3832 Manufacture of radio, television and communication equipment and apparatus 3833 Manufacture of electrical appliances and housewares 3839 Manufacture of electrical apparatus and supplies n.e.c. 3851 Manufacture of professional and scientific, and measuring and controlling equipment, n.e.c. 3852 Manufacture of photographic and optical goods 3853 Manufacture of watches and clocks
Other manufactures	3901 Manufacture of jewelry and related articles 3902 Manufacture of musical instruments 3903 Manufacture of sporting and athletic goods 3909 Manufacturing industries n.e.c.
Electricity, water, and gas	4101 Electric light and power 4102 Gas manufacture and distribution 4103 Steam and hot water supply 4200 Water works and supply
Construction	5000 Construction
Trade, transport, and communication	6100 Wholesale trade 6200 Retail trade 6310 Restaurants, cafes, and other eating and drinking places

SAM sector	ISIC number and description, (p) = part pertaining to description
------------	---

6320 Hotels, rooming houses, camps and other lodging places
7111 Railway transport
7112 Urban, suburban and inter-urban highway passenger transport
7113 Other passenger land transport
7114 Freight transport by road
7115 Pipeline transport
7116 Supporting services to land transport
7121 Ocean and coastal transport
7122 Inland water transport
7123 Supporting services to water transport
7131 Air transport carriers
7132 Supporting services to air transport
7191 Services incidental to transport
7192 Storage and warehousing
7200 Communication

Other private services

0 Activities not adequately defined
8101 Monetary institutions
8102 Other financial institutions
8103 Financial services
8200 Insurance
8310 Real estate
8321 Legal services
8322 Accounting, auditing and bookkeeping services
8323 Data processing and tabulating services
8324 Engineering, architectural and technical services
8325 Advertising services
8329 Business services, except machinery and equipment rental and leasing, n.e.c.
8330 Machinery and equipment rental and leasing
9411 Motion picture production
9412 Motion picture distribution and projection
9413 Radio and television broadcasting
9414 Theatrical producers and entertainment services
9415 Authors, music composers and other independent artists n.e.c.
9420 Libraries, museums, botanical and zoological gardens, and other cultural services, n.e.c.
9490 Amusement and recreational services n.e.c.
9511 Repair of footwear and other leather goods
9512 Electrical repair shops
9513 Repair of motor vehicles and motorcycles
9514 Watch, clock and jewelry repair
9519 Other repair shops n.e.c.
9520 Laundries, laundry services, and cleaning and dyeing plants
9530 Domestic services
9591 Barber and beauty shops
9592 Photographic studios, including commercial photography
9599 Personal services n.e.c.

SAM sector	ISIC number and description, (p) = part pertaining to description
------------	---

Other services (government)

- 9100 Public administration and defence
- 9200 Sanitary and similar services
- 9310 Education services
- 9320 Research and scientific institutes
- 9331 Medical, dental and other health services
- 9332 Veterinary services
- 9340 Welfare institutions
- 9350 Business, professional and labour associations
- 9391 Religious organisations
- 9399 Social and related community services n.e.c.
- 9600 International and other extra-territorial bodies

Ownership of dwellings

* This concordance is based on the concordance from SAM sectors to GTAP/SALTER sectors, and from GTAP/SALTER sectors to ISIC sectors, on the basis of a concordance provided to the GTAP consortium by the Australian Industry Commission.