An International Comparison of Real Output, Purchasing Power and Labour Productivity in Manufacturing Industries

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An International Comparison of Real Output, Purchasing Power and Labour Productivity in Manufacturing Industries: Brazil, Mexico and the USA in 1975 (second edition)

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AN INTERNATIONAL COMPARISON OF REAL OUTPUT, PURCHASING POWER AND LABOUR PRODUCTIVITY IN MANUFACTURING INDUSTRIES: BRAZIL, MEXICO AND THE USA IN 1975

(second edition)

by

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and
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The Nature of Our Revisions

This paper is a revision of our comparison of manufacturing output, productivity and PPPs in Brazil, Mexico and the USA (Maddison and Van Ark, 1987 and 1988). The original study was a pioneering exercise in developing general guidelines for manufacturing comparisons in the framework of our ICOP (International Comparisons of Output and Productivity) project, which now covers 20 countries for manufacturing (for a review of our work since the outset of ICOP, see Maddison and Van Ark, 1994. See also Van Ark, 1993).

The new elements in the revision are (i) a sample of 27 industries instead of the original 17; (ii) adjustment of labour productivity for differences in working hours (chapter 7); and (iii) an extrapolation of the branch results from 1975 to 1985 (chapters 4 and 7). We have dropped the original chapter 4 reporting the results of a direct comparison between Brazil and Mexico. For this the reader should refer to our 1987 study.

The overall results on the comparative levels of output and productivity in the manufacturing sectors of Brazil, Mexico and the USA for 1975 in this paper are not very different from those in our original study in 1987. Our present estimate of value added (former national accounts concept) in Brazil is 9.9 per cent of the US level (see table 8.3, which shows the geometric average of our estimate at Brazilian weights and at US weights) compared to 10.5 per cent in our first edition. Value added per person employed in Brazil is 48.6 per cent of the US level in the present study compared to 49.3 per cent in our 1987 edition. For Mexico, manufacturing value added is now 3.5 per cent of the USA and labour productivity 37.2 per cent in 1975, which was slightly lower than the 3.8 per cent for value added and the 38.5 per cent for labour productivity in our 1987 edition.

We have prepared an updated statistical appendix to this report which includes the basic information on quantities and values of products, gross value of output, value added and employment, the basic product PPPs and the calculations of comparative output and productivity. This is available on request.

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CHAPTER I

THE PURPOSE OF THE PRESENT STUDY AND PREVIOUS RESEARCH ON PURCHASING POWER AND PRODUCTIVITY

The Two Basic Problems - Measuring Real Output and Purchasing Power

This study is concerned with the conceptual and measurement problems which arise in comparisons of levels of per capita output and productivity in different countries. The most direct way of doing this is to use the exchange rate to convert GDP in one country's prices into the prices of another country, and, in multicountry comparisons, to use some key currency, such as US dollars, as the numéraire. However, the essence of our problem is that exchange rates do not indicate the average purchasing power of currencies over all goods and services, but mainly reflect their purchasing power over tradeable goods and services. Furthermore exchange rates are subject to fluctuation, and capital movements may play a major role in determining their level, so that even for tradeables, they may be substantially misleading as indicators of purchasing power. Hence the measurement of real output across countries is closely intertwined with the assessment of purchasing power.

The Expenditure Approach to the Problem

Research on purchasing power parities (PPPs) to replace exchange rates has been under way for four decades in international agencies concerned with burden sharing or with relative need for aid. Hence the early work of OEEC (1954, 1958, 1959) for Western countries, of Gosplan (1965) for the CMEA countries, and ECLA (1963) for Latin America. This kind of measure is also useful for analysing military or geopolitical power potential (see the CIA studies of Block (1981) and Schroeder and Edwards (1981); and the US Congress Joint Economic Committee studies (1981) and (1982) on Eastern Europe and the USSR).

Most of the above studies estimate purchasing power parities (PPPs) for final demand components (consumption, investment, etc.). The largest and most sustained scholarly effort using this "expenditure approach" has been the International Comparisons Project (ICP) of the United Nations. The results of the first four phases are published in Kravis, Kenessey, Heston and Summers (1975), Kravis, Heston and Summers (1978) and (1982), and UN (1986). ICP methods are now used on a regional basis by Eurostat (1983) and OECD (Ward, 1985).

It should be stressed that the ICP evaluation of a country's relative standing can be very different from one derived from exchange rate comparisons, and the difference is usually bigger, the poorer a country happens to be. It is for this reason that this topic has more than academic interest. For Brazil, Mexico and India, ICP evaluation of per capita GDP performance in 1975 was 25.2, 34.7 and 6.6 per cent of US levels whereas exchange rate comparisons showed 16.0, 20.4 and 2.0 per cent respectively (see Kravis, Heston and Summers, 1982, p. 22).

The Alternative "Industry-of-Origin" Approach

The expenditure approach is useful for analysis of macro economic performance, but cannot be directly used for sectoral analysis as it does not show real product by industry. This handicaps comparative structural analysis, work on labour or total factor productivity, growth accounting, and studies of technological performance. It does not help in deriving weights for world production indices for sectors such as agriculture or manufacturing, nor does it make a clear breakdown between tradeable and non-tradeable goods and services which is needed for analysis of competitiveness. The industry of origin approach, which is used here, promises to yield solutions to these problems, as well as providing a crosscheck on ICP results which are still a subject of controversy.

One way of illustrating the difference between the expenditure and the industry of origin approaches is presented in table 1.1. This is derived from the Mexican input-output table for 1975. Ideally, the industry of origin approach should derive PPPs (purchasing power parities) for column (1) of table 1.1 for GDP at factor cost. For agriculture (see Van Ooststroom and Maddison, 1985, and Maddison and Van Ooststroom, 1993) this is possible, but for manufacturing most of our price (unit value) information refers to column (3).

What the expenditure approach does, is to estimate PPPs for the last column of table 1.1, i.e. final expenditure at market prices. In table 1.1, final demand is allocated according to the corresponding production sector for convenience of comparison, but in fact the expenditure approach breaks down final demand by components of private consumption, government consumption, investment, etc. In the expenditure approach of ICP for 1975, 151 categories of final demand were distinguished, of which 82 had a substantial manufacturing content.

TABLE 1.1

Reconciliation of Production and Expenditure Approach to GDP - Mexico 1975

(million pesos)

	GDP by Industry of Origin (1)	Intermediate Inputs (2)	Gross Value of Output (3)	Imports c.i.f. (4)	Distributive Costs, incl. import duty (5)	Intermediate Uses (6)	Final Demand (7)
Agriculture, Forestry & Fishing	123,153	48,232	171,385	9,303	37,770	112,325	106,133
Mining	31,730	12,896	44,625	3,304	5,006	39,734	13,202
Manufacturing	256,701	409,750	666,451	69,921	273,538	419,491	590,419
Electricity	9,793	3,507	13,300	5	0	9,168	4,138
Construction	65,811	66,048	131,859	0	0	0	131,859
Commerce Restaurants & Hotels	277,033	44,849	321,882	0	0	275,706	46,177
Transport, Storage & Communication	62,612	30,539	93,151	2,751	0	54,092	41,810
Financial Services	104,286	12,436	116,722	3,028	0	44,312	75,438
Other Services	181,055	58,753	239,807	146	0	60,621	179,333
Total	1,100,050	699,133	1,799,182	105,821[a]	316,314	1,015,447	1,205,871[a]

a) includes 17,363 million pesos of imports going directly to final demand.

Source: Sistema de Cuentas Nacionales de Mexico, Tomo 1, Resumen General, pp, 106, 138. The figures include indirect taxes and subsidies. When imports are deducted from the total in the last column, it is equal to the total in the first column.

Proxies and Shortcut Measures of Output Levels in Manufacturing[1]

The need for measures of comparative performance by industry of origin is amply demonstrated by the frequency with which proxies for such estimates are used. Thus the American Productivity Center and the Asian Productivity Organisation regularly provide the "equilibrium" exchange rate comparisons shown in table 1.2. They use 1975 exchange rates because in their view, exchange cross-rates were in a better "equilibrium" then than in later years. This is, of course, an untested hypothesis, unless we conduct exercises of the present type.

Other economists have manipulated real expenditure levels to produce proxy estimates of real output levels by sector (see bottom half of table 1.2). They usually do this by treating final expenditures PPPs as if they were PPPs for value added in analogous production sectors. Thus Simon Kuznets (1972) used OEEC and ECLA real expenditure studies to derive estimates of real output for agriculture and industry. Jones (1976) used some of the Kravis, Kenessey, Heston and Summers (1975) expenditure PPPs to estimate manufacturing output levels, A.D. Roy (1982) used the same procedure with Kravis, Heston and Summers (1978), and S. Prais (1981) followed a more detailed procedure, using about half of the expenditure items listed in Kravis, Kenessey, Heston and Summers (1975) to derive a weighted average PPP for manufacturing. Klodt (1984), Jorgenson, Kuroda and Nishimizu (1986), D.J. Roy (1987) and Hooper and Larin (1989) are the latest in this tradition.

Proxy procedures of this type need to be crosschecked with independent estimates by industry of origin such as we present here. Until this is done for a reasonable sample of countries, one must be sceptical about such proxies. As we demonstrate later, we feel that they are not valid in the case of Mexico, and the results of Van Ooststroom and Maddison (1985) showed that such a procedure was misleading, when applied to agriculture.

Finally, at the bottom of table 1.2, we list three short-cut estimates using limited information for representative commodities as a substitute for more detailed and comprehensive estimates. Here again the validity of such short-cut methods needs to be tested against more refined evidence of the type we present in the following chapters, and the studies listed in table 1.3.

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[1] Here we discuss shortcut procedures for manufacturing only. There is also a substantial literature on shortcuts for comparative levels of GDP as a whole: see Kravis, Heston and Summers (1978b), Summers and Heston (1984) for regression methods using ICP benchmarks; Beckerman (1966), Ehrlich (1967), and ECE (1980) for the physical indicators approach. For critical comments on alternative shortcut procedures, see Ahmad (1980), Beckerman (1984) and Marer (1985).

TABLE 1.2
International Comparisons of Real Output Levels in Manufacturing
Using "Equilibrium" Exchange Rates or PPP Proxies

"EQUILIBRIUM" EXCHANGE RATE COMPARISONS

Sadler and Grossman (1982)	Output per man hour and joint factor productivity for main economic sectors and 10 branches of manufacturing in the USA and Japan in 1975 prices converted to U.S. dollars at 1975 exchange rates.
Sadler (1986)	Updates former to 1983.
Asian Productivity Organisation (periodically)	Output per employee in main economic sectors (including manufacturing as a whole) for 12 Asian countries, 1971-83 in 1975 prices converted to U.S. dollars at 1975 exchange rates.

PROXY COMPARISONS USING ANALOGOUS ICP EXPENDITURE COMPONENTS

Kuznets (1972)	Used reweighted OEEC and ECLA expenditure PPPs to estimate sector PPPs for large groups of countries.
Jones (1976)	Used reweighted Kravis et al. (1975) expenditure PPPs to derive sector PPPs.
Prais (1981)	Used reweighted Kravis et al. (1975) expenditure PPPs to derive PPPs for 10 manufacturing industries in Germany, U.K. and U.S.A.
Roy, A.D. (1982)	Used reweighted Kravis, Heston and Summers (1978) expenditure PPPs to derive sector PPPs.
Klodt (1984)	Applied Kravis, Heston and Summers (1978) PPPs to 16 branches of manufacturing for Germany, Japan and U.S.A., 1960, 1970 and 1978.
Guinchard (1984)	Uses Kravis, Heston and Summers (1982) expenditure PPPs (with adjustment for taxes and trade margins) to derive PPPs for some branches of manufacturing. For intermediate products he used the exchange rate.
Jorgenson, Kuroda and Nishimizu (1986)	Applied "remapped" Kravis et al. (1975, 1978) PPPs to estimate productivity differentials in Japan and USA (1960-79).
Roy, D.J. (1987)	Used reweighted expenditure PPPs from ICP IV, derived from a tape provided by UNSO, for 60 countries for 1980.
Hooper and Larin (1989)	Used reweighted expenditure PPPs from ICP IV (UN, 1987)

SHORTCUTS USING LIMITED INDUSTRY OF ORIGIN INFORMATION

Shinohara (1966)	Used 53 "representative" commodities for 89 countries in 1968 from UN Statistics of the kind now published in the Yearbook of Industrial Statistics with value added weights from the Japanese, UK, and US census of manufactures.
Maddison (1970)	Used a trade adjusted version of Shinohara's estimates at US prices for 29 countries for 1965.
Blades (1982)	Used 54 commodities to compare USA and USSR in 1970, 1975 and 1978.

Previous Real Product Estimates for Manufacturing

The present study is not the first to use the industry of origin approach to derive PPPs and measure real output levels in manufacturing. Table 1.3 lists 18 non-ICOP international comparisons of levels of output or productivity in manufacturing[1] which have appeared over the past four decades with the present study. They all use information derived from production censuses, and they are all restricted to two or three countries.

Our approach was given its initial impetus by Rostas (1948). Maddison (1952), Galenson (1955), Frankel (1957) and Yukizawa (1973, 1978) more or less replicated his method for measuring real output, which concentrates on comparisons of "physical" gross output of different countries (with or without coverage adjustments for non-sampled products within an industry). Paige and Bombach called this the "single indicator" approach, and they themselves devoted considerable space to discussing an alternative "double indicator" method, which would involve separate estimation of inputs across countries as well as gross output. This approach, if fully implemented, involved a double deflation procedure, i.e. separate calculation of PPPs for output and inputs, to arrive at a true comparison of value added in real terms.

In fact, Paige and Bombach did not achieve their goal of double deflation for manufacturing (though they did it for agriculture and part of transport), and were able only to make a very partial input PPP for fuel use. Subsequent researchers have also failed to achieve the goal of double deflation even for countries which provide a substantial amount of detailed information on inputs, because the structure of inputs is so heterogeneous.

The most ambitious studies in terms of sample size were those by Paige and Bombach (1959), the Conference of European Statisticians (1969a, b and c), Smith, Hitchens and Davies (1982), Smith (1985)[2], and Davies and Caves (1987). Table 1.3 shows their coverage so far as we could determine. Another indicator of the adequacy of their sample is the number of items matched (first column of table 1.3). On the latter criterion, our study is amongst the most comprehensive.

Some of the studies cited in table 1.3 used a mixed methodology, in the sense that they combined independently determined PPPs by industry of origin with some proxy PPPs derived from expenditure studies. This was true in particular of Paige and Bombach (1959), to a smaller extent of Smith, Hitchens and Davies (1982) and Davies and Caves (1987). In our study we stick strictly to the industry of origin approach, without using proxy PPPs.

The different studies vary in the way they summarize their results for manufacturing as a whole. In most cases, the sample results themselves are presented as representative. Paige and Bombach, the Czech-French study, West and our study are the only ones to adjust the sample in order to present a blown-up estimate for manufacturing as a whole (see end of chapter III for details).

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[1] For the 20 ICOP comparisons, see Maddison and Van Ark, 1994. See also table 7.5.

[2] In fact Smith (1985) is derived from the same data set as Davies and Caves (1987).

TABLE 1.3
Previous Non-ICOP Studies of Real Output Levels in Manufacturing

Author	Number of Products Sampled	Size of Sample	Country Coverage	Reference Years
Rostas (1948)	108	22% of 1937 US employment	UK/USA	1935 to 1939
Maddison (1952)	34	15% of Canadian, 14% of UK, 8% of US 1935 employment	Canada/UK/USA	1935
Galenson (1955)	23	17% of US industrial gross output in 1939[a]	USSR/USA	1936 to 1939
Frankel (1957)	50[b]	18% of 1947 US, 16% of 1948 UK employment	UK/USA	1948/7
Heath (1957)	50[b]	21% of 1948 UK employment[c]	UK/Canada	1948
Maizels (1958)	30[b]	19% of Canadian, 17% of UK manufacturing value added	Canada/ Australia	1950/1950-51
Paige and Bombach (1959)	380	51% of UK, 48% of US manufacturing value added	UK/USA	1950
Mensink (1966)	78	14% of UK 1958 employment	Netherlands/UK	1958
Kudrov (1969)	224[d]	substantial, but not stated	USSR/USA	1963
Conference of European Statisticians (1969a, b and 1970)	303[g]	substantial, but not stated	Czechoslovakia/ France; Czechoslovakia/Hungary; Hungary/Austria	1962 & 1967
West (1971)	150[b]	31% of US shipments[c]	Canada/USA	1963
Yukizawa (1973)	18	not stated	Japan/USA	1935
Sturm (1974)	219	48% of East German sales in industry	East Germany/ West Germany	1964
Frank (1977)	150[b]	about 38% of US shipments[c]	Canada/USA	1977
CSO Budapest (1977)	620	75% of gross value of out- in Austria, and 80% of Hungarian gross value of output	Hungary/Austria	1975
Yukizawa (1978)	60	26% of Japanese, 24% of US manufacturing value added in 1972	Japan/USA	1958/9, 1963, 1967, 1972
Smith, Hitchens, and Davies (1982)	487[def] 350[def]	66% of UK, 64% of US manufacturing value added[f] 31% of German, 37% of UK manufacturing value added[f]	UK/USA Germany/UK	1968/7 1967/8
Smith (1985)	386[def]	55% of UK, 53% of US manufacturing value added[f]	UK/USA	1977
Davies and Caves (1987)	398[def]	60% of UK, 61% of US manufacturing value added[f]	UK/USA	1977

(table continued)

TABLE 1.3 (continued)
Previous Non-ICOP Studies of Real Output Levels in Manufacturing

(a) Galenson includes three mining industries (coal, iron ore, oil and natural gas).
(b) In the absence of information from the authors, these are rough estimates.
(c) Author does not say how big the sample is, but we derived sample size by comparing the industries sampled with the information for total manufacturing in the production censuses.
(d) Information supplied by the authors.
(e) Refers to number of 'matches' instead of number of matched products.
(f) These figures refer only to directly derived PPPs.
(g) For Czechoslovakia/France comparison. Other studies not stated.

The Present Study

This study has a twofold objective:

a) substantive analysis of real output levels, PPPs, and labour productivity in Brazilian, Mexican and US manufacturing;
b) a methodological survey of the analytical problems inherent in such an exercise for any group of countries, in order to facilitate the task of researchers who may wish to replicate our approach.

Thanks to the availability of computer technology we have been able to present our methodology and the underlying data in a more or less fully transparent way. We also offer some shortcuts and guidelines not previously available, and we deliberately tried to reduce the ad hoc element which loomed rather large in previous studies.

We used the benchmark year 1975 in order to facilitate comparison with the results of the third phase of the ICP, which is also based on that year. The basic sources for this study are the censuses of manufacturing of the individual countries. These provide information on quantities and gross value of output in considerable detail as well as information on employment and on value added and inputs at national prices. This material is used to derive PPPs for particular products, and relative output levels for the corresponding industries. These are aggregated to derive estimates of value added, labour productivity and purchasing power ratios for 17 branches of manufacturing.

We carried out the quantitative comparison across countries for gross output, and derived PPPs which we also used for inputs and value added in each industry. Although our PPPs are the same for gross output, input and value added in each industry, the quantity relation between countries which we have for value added is different from that for gross output, as the ratio for value added to gross output varies between countries (for details see chapter III).

The reasons for choosing these three countries for the present pilot project are as follows:

1) they are all big countries with better-than-average industrial statistics;
2) Brazil and Mexico are interesting because the ICP showed Mexico to have a higher per capita product than Brazil whereas an earlier "industry of origin" study (Maddison 1970) showed Brazil ahead of Mexico (see Maddison 1983);
3) the USA is interesting because it is the country with the highest real income and labour productivity levels, and generally serves as a benchmark in identifying the technological frontier.

Given the much higher number of industrial products compared to those in agriculture (13,000 opposed to 150), it was not easy to find a reasonably representative minimum sample for all the major manufacturing branches. Table 1.4 shows that we succeeded in this respect for Brazil and Mexico for most branches, where our total sample covered 38 and 47 percent of total value added respectively. For the USA our sample coverage was 25 percent.

TABLE 1.4
The Size of Our Sample in Terms of Value Added (US Census Concept) by Manufacturing Branch, (1975), (national currencies and percentages)

	Brazil			Mexico			USA		
	Universe (mill. cruzeiros)	Sample	%	Universe (mill. pesos)	Sample	%	Universe (mill. US$)	Sample	%
Food Products	37,658[a]	15,519	41.2	29,132[a]	12,231	42.0	39,985	11,243	28.1
Beverages	5,494	2,022	36.8	12,994[b]	6,875[b]	52.9	8,110	2,130	26.3
Tobacco	3,212	3,212	100.0	1,817[b]	1,817[b]	100.0	3,722	3,722	100.0
Textiles	18,829	9,848	52.3	14,079	8,365	59.4	12,044	6,217	51.6
Wearing Apparel	8,418[c]	1,436	17.1	5,599	1,717	30.7	14,749	3,166	21.5
Wood Products	15,053	5,303	35.2	4,821	2,184	45.3	16,646	3,770	22.6
Paper Products	19,033	4,648	24.4	12,984	4,704	36.2	42,585	7,626	17.9
Chemicals	45,575[a]	21,002	46.1	40,166[abd]	23,140[bd]	57.6	55,476	19,470	35.1
Leather, Rubber and Plastic Goods	16,825[c]	7,678	45.6	11,605	5,832	50.4	16,786	6,052	36.1
Stone, Clay & Glass Products	19,161	7,516	39.2	11,930	4,317	36.2	14,849	2,167	14.6
Basic Metals and Metal Products	38,781	16,185	41.7	31,280	14,120	45.1	64,570	17,243	26.7
Electrical Machinery	17,655	3,836	21.7	13,430	2,854	21.2	34,845	2,362	6.8
Machinery & Transport Equipment	51,192	18,680	36.5	26,743	15,408	57.6	96,381	25,365	26.3
Other	10,005	-----	----	3,241	----	----	21,738	----	----
Total	306,891	116,883	38.1	219,820	103,584	47.1	442,486	110,533	25.0

a) vegetable and animal fats and oils were reallocated from chemicals to food products (2,977.4 million cruzeiros and 168.1 million pesos in Brazil and Mexico respectively.
b) indirect taxes and subsidies are deducted (see table 2.4).
c) the footwear industry (3,188 million cruzeiros) was reallocated from wearing apparel to footwear and leather.
d) includes 7,148.0 million pesos (excl. indirect taxes and subsidies) for petroleum refining which are not shown in the Resumen General but taken from Sistema de Cuentas Nacionales de Mexico, 1981.

Source: Figures derived from the production censuses, i.e. Censo Industrial for Brazil, Resumen General for Mexico and Annual Survey of Manufactures for the USA; see for the universe table 2.1 (Brazil), table 2.4 (Mexico) and table 2.7 (USA); see for the sample figures tables 3.11 and 3.12

CHAPTER II

THE RECONCILIATION OF INDUSTRIAL CENSUS DATA WITH THE NATIONAL ACCOUNTS

If comparisons using the "industry of origin" approach are to have their full usefulness in growth accounts or are to be crosschecked with ICP results, it is essential to scrutinise the consistency of the information in censuses of manufacturing with estimates of manufacturing output in the national accounts. This is best done before embarking on very detailed commodity comparisons.

Coverage of Industrial Censuses and Their Relation to National Accounts

In the case of Brazil, the national accounts for manufacturing are based directly on the manufacturing census, and there are no serious problems of reconciliation. In the U.S.A., the link is not direct as the national accounts are not derived from the industrial census results; we were able to make a rough reconciliation with the help of information supplied by the US Dept. of Commerce, but the census unfortunately does not contain as wide a range of information on inputs as is the case in Brazil and Mexico. In Mexico the national accounts make extensive allowance for informal economic activity; as a consequence the national accounts valuation of manufacturing value added is 38 per cent above that in the census. The country notes in this chapter explain these discrepancies in detail by industry branch.

Definitions of Value Added in Industrial Censuses and National Accounts

The most readily collectable information on manufacturing output refers to physical product at producer prices. This kind of information is available in fairly comprehensive form in most censuses of production and can often be monitored successfully in intercensal years. This measure is usually called gross output, and refers to aggregate shipments by manufacturing establishments plus net changes in manufacturers' inventories.

However, this measure contains a good deal of duplication, and comparisons between countries on this basis can be misleading. In two countries producing a similar value added, the one with the most specialised plants will have a higher gross output because there will be more interplant shipments for intermediate processing.

In order to eliminate this type of duplication and other differences in the degree to which plants use external inputs, the concept of value added was developed, and has now become quite familiar to the general public, because tax systems, particularly in EC countries, use this concept to measure economic activity. With the value added concept, the intermediate inputs used by a manufacturing establishment are deducted before arriving at the measure of output. All the manufacturing censuses we used show value added as well as gross output.

One major problem which arises in reconciling the census information with the national accounts, is that industrial census definitions of value added are less sophisticated and less standardised.

We cite below guidelines of the United Nations Statistical Office for defining value added according to "census" concepts and "national accounts" concepts. The "national accounts" concept is designed to avoid duplication for the economy as a whole, and the "census" concept is concerned mainly to avoid duplication of output within the industrial sector. This "census" concept of value added has very little legitimacy as a construct for avoiding duplication because manufacturing has very big inputs from the rest of the economy. There are large and increasing purchases of services such as advertising, accountancy, cleaning, transport, etc. In fact, one of the reasons why modern economies are apparently increasingly concentrated on services, is that manufacturers now purchase these services externally whereas they previously produced them within their enterprises.

For these reasons, the old "census" definitions of value added are becoming increasingly anachronistic. Furthermore, the definitions of census value added vary between countries. This is not so important if the census contains enough information to permit estimation of value added on national accounting definitions, but unfortunately the US census information is not adequate for this, as we shall see below.

For our purposes, the most useful value added concept is that used in the national accounts and in particular what we have called the "former national accounts" concept, where deduction is made at the industry level for inputs of intermediate financial services. In most countries, these intermediate financial services are usually deducted at a global level for all industries combined.

In practice in the detailed analysis of chapter III we had to settle for comparisons using the US Census of Manufactures definition of value added which shows value added inclusive of industrial and non-industrial services, and switch to our preferred concept only at the level of manufacturing branches and manufacturing as a whole.[1]

Input-Output Tables Potentially Useful for Double Deflation

We were not able to make much use at this stage of the input-output tables (Brazil table 2.3, Mexico table 2.6, USA table 2.9). This was partly because in the US they were not readily reconcilable with the census information. However, these tables will be most useful for purposes of double deflation (see chapter III and VIII) at a later stage.

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[1] The US census value added concept is therefore not identical to the UN definition cited on the next page, which defines value added inclusive of non-industrial services but exclusive of industrial services.

Table 2
United Nations Definitions of Value Added

General Definition

"Value added is the increment to the value of commodities and services that is contributed by the producing establishment, that is, the value created by the establishment. Aggregated for all establishments in a given industry, value added is the incremental value of goods and services attributable to that industry".

"Value added avoids the duplication in the value of shipments (or production) which results from the inclusion of shipments of establishments producing materials and components together with the shipments of establishments producing finished products. Therefore, value added is considered to be the best value measure for comparing the relative economic importance of different industries and geographical areas".

Census Concept of Value Added

"Respondents do not report value added but rather the items required for the calculation of value added. Value added, in the census concept, is defined as the value of output less the cost of materials and industrial services used. The calculation of value added is made by the national statistical organisation in the processing of the establishment data".

National Accounts Concept of Value Added

"Value added, defined in the above manner, is not net value created in relation to the economy as a whole but is net only in terms of the agricultural and industrial sectors of the economy. To derive a wholly net value added, it is necessary to exclude, in addition to the cost of materials and purchased industrial services, the purchases of non-industrial services, and to include non-industrial receipts. This additional calculation moves towards value added in the national accounting sense. The national income concept in the national accounts also excludes depreciation charges, that is, the consumption of fixed capital".

"The collection of data on the cost of non-industrial services at the establishment level is, however, fraught with difficulty in the case of multi-unit enterprises. In such enterprises, data are only available at that level for certain non-industrial services, such as communication costs and rental payments. Other non-industrial services, such as advertising or legal, accounting and other professional services, are charged at the enterprise or divisional level. Such charges might be allocated back to the individual establishment of the enterprise, either according to the proportion of total enterprise wages and salaries or value added represented by each establishment, or by assigning to each establishment of the multi-unit enterprise estimated costs for the specified service as reported by single-unit enterprises of similar size and in the same type of industry. Alternatively, total payments for non-industrial services might be estimated by the national accounts staff. To some extent, the same situation exists in relation to the collection of data on receipts for non-industrial services, and corresponding solutions should be attempted".

Source: Abstract of paras. 162-7 of United Nations, Statistical Papers, Series M No. 71 (Part 1), Recommendations for the 1983 World Programme of Industrial Statistics, Part One, General Statistical Objectives, New York, 1981.

Brazil

Brazil has a very extensive system of economic censuses which are the main basis for national accounts estimates for benchmark years, but its input-output table for 1975 is not yet available.

The 1975 Censo Industrial (IBGE, 1981a and 1981b), which covers mining as well as manufacturing, uses the same concept of value added as the US industrial census which we will henceforth refer to as the "US census concept". In Brazil, the latter concept is called "valor de transformacão". This value amounted to 306,893 million cruzeiros for manufacturing in 1975, as compared with 268,927 million in the national accounts estimate (Gusmao Veloso, 1987) of manufacturing's contribution to GDP at factor cost. The difference between the two is due to miscellaneous costs for service inputs. These are not deducted from "valor de transformacão" but the census contains information on these cost items (there are 15 of them, as noted below). In the national accounts these items are deducted as inputs. As in the USA, Brazilian output is valued at producer prices excluding indirect taxes (IPI and ICM), but the output data refer to production including net changes in stocks, whereas US output figures refer to shipments from the establishment, and do not take account of changes in stocks.

Thus, the Brazilian census information is reasonably congruent with the national accounts. Our adjusted estimate of gross value added in column (2) of table 2.1 is 263,269 million cruzeiros for 1975. This compares with 268,927 million in the national accounts. The remaining difference is due to the imputation for "autonomos" (i.e. non-census establishments) and to a small national accounts adjustment for differences in costs as recorded by companies and establishments.

Although we arrived at a reasonable reconciliation of the two sources, it seems clear that the Brazilian national accounts understate industrial output by relying almost exclusively on activity as recorded in the industrial census. This understatement of output in the national accounts has been stressed by several observers, e.g. Merrick and Graham (1979), Pfeffermann and Webb (1979), and by the World Bank team who recommended changes in the national accounts (Tyler, Goldberg, Blazic-Metzner, 1984).

There is also a very big discrepancy (see table 2.2) between employment in manufacturing as recorded in the 1980 industrial census (4,839,253) and employment as recorded in the population census (6,939,421) and a similar discrepancy in 1950, 1960 and 1970 as well. As there was no population census in 1975, we cannot check for that year, but it seems clear that the national accounts adjustment for activity by "autonomos" is too small.

Finally, it should be noted that the Brazilian industrial census and the national accounts treat certain primitive agricultural transformation processes (e.g. the more rudimentary kinds of flour milling) as agricultural activities, and some dressmaking activities are included in "commerce" rather than manufacturing. On the other hand, some repair work, e.g. on motor vehicles is treated as a manufacturing rather than a service activity.

Procedure Used to Estimate the National Accounts Concept of Gross Value Added (Contribution to GDP at factor cost) for Establishments Covered by the Brazilian Industrial Census

1) Gross Value of Output = "Valor de Producão";
2) US Value Added Concept = "Valor de Transformacão Industrial";
   "Valor de Transformacão Industrial" = "Valor de Producão" minus "Despesas, com as operacões industriais";
   "Despesas, com as operacões industriais" = US Cost of Materials concept
3) In order to arrive at the present national accounts concept of gross value added (i.e. the contribution to GDP at factor cost before deduction for imputed financial services), we must deduct 15 of the 20 items which the Brazilian census calls "Despesas Diversas"[1]. These are shown only for the 24 major industry groups (not for individual industries), so we had to use branch ratios, i.e. the ratio of the value of the 15 to the 20 items, to derive a rough estimate of these inputs for industries within each branch.
   These 15 items are:
   a) "Alugeis e Arrendamentos" (rents);
   b) "Royalties" (royalties);
   c) "Manutencão e Reparacão de Equipamentos e Instalacões" (repair and maintenance);
   d) "Manutencão de meios de transporte proprio" (maintenance of the enterprise's own transport equipment);
   e) "Publicidade e Propaganda" (advertising);
   f) "Despesas com comunicacão" (expenses for communications);
   g) "Fretes e carretos" (freight and carriage);
   h) "Servicos Professionais e de Assistencia Tecnica" (professional services and technical assistance);
   i) "Premios de Otros Seguros" (insurance for other risks);
   j) "Despesas com viagens e representacão" (travel and entertainment costs);
   k) "Indenizacão por dispensa" (reimbursement of expenses);
   l) "Imposto Predial e Territorial Urbano" (urban real estate taxes);
   m) "Impostos e taxas" (excise duty and other indirect taxes);
   n) "Combustiveis e Lubrificantes consumidas no transporte proprio" (gasoline and oil consumption for enterprise vehicles);
   o) "Outros despesas" (other costs);
4) In order to arrive at the former national accounts concept of value added we must further deduct "juros e correcão monetaria e despesas bancarias" (interest and monetary correction payments and bank service charges);

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[1] See table 15 of Censo Industrial (1981a), which gives the figures for firms with 5 employees or more (or a gross output more than 640 times the minimum wage). Table 35 gives similar information in more aggregated form for firms with less than 5 employees (or with a gross output less than 640 minimum wages)

TABLE 2.1
Brazilian "Valor de Transformacão", Gross Value Added, Employment and Productivity in 1975

	Industrial Census Concept of Gross Value Added "Valor de Transformacão"	Col.(1) adjusted to Present National Accounts Concept of Gross Value Added at factor cost	Ratio Col.(2) to Col.(1)	Employment (average for the year)	Present National Accounts Concept of Gross Value Added per Person Employed	Present National Accounts Concept of Gross Value Added per Person Employed[a]
	(million cruzeiros)				(cruzeiros)	(US $)
	(1)	(2)	(3)	(4)	(5)	(6)
Food & Kindred Products	34,681	28,724	82.8	482,434	59,540	7,324
Beverages	5,494	4,647	84.6	52,080	89,230	10,975
Tobacco	3,212	3,018	94.0	23,965	125,925	15,489
Textiles	18,829	16,448	87.4	324,682	50,658	6,231
Clothing & Footwear	11,606	10,261	88.4	278,269	36,875	4,536
Wood products	8,954	7,360	82.2	192,695	38,194	4,698
Furniture	6,099	5,104	83.7	127,176	40,133	4,936
Paper & Allied Products	7,750	6,394	82.5	82,972	77,061	9,479
Printing & Publishing	11,283	9,715	86.1	121,559	79,923	9,831
Chemicals	48,552	43,276	89.1	177,920	243,231	29,918
Rubber Goods	5,119	4,490	87.7	45,700	98,247	12,085
Plastic Goods	6,909	6,040	87.4	75,166	80,350	9,883
Leather & Leather Products	1,609	1,375	85.4	33,873	40,596	4,993
Stone, Clay and Glass Products	19,161	15,678	81.8	311,361	50,350	6,193
Metal Products	38,781	32,050	82.6	429,539	74,615	9,178
Machinery (except Electric)	31,692	27,715	87.5	377,555	73,407	9,029
Electric Machinery & Equipment	17,655	15,757	89.2	170,425	92,455	11,372
Transport Equipment	19,500	16,984	87.1	218,025	77,897	9,581
Miscellaneous Manufactures	5,915	5,105	86.3	78,411	65,102	8,008
Supportive Industries	4,090	3,131	76.6	67,849	46,150	5,676
Total[b]	306,893	263,269	85.8	3,671,656	71,703	8,820

a) converted at official exchange rate of 8.13 cruzeiros to one US $.
b) excludes head office and auxiliary units located outside establishments. At the end of 1975 these activities employed 152,682 persons, who earned 6,550 million cruzeiros.

Source: Figures derived from Censo Industrial (1981a), column (1) from table 1, column (2) derived from tables 1, 15 and 35, column (4) from table 2 (annual average of monthly figures).

TABLE 2.2
Employment in Brazilian Manufacturing 1980
As Recorded by Demographic Census and Industrial Census

	Demographic Census	Industrial Census	Ratio Demographic/ Industrial
Food and Kindred Products	904,328	604,484	149.6
Beverages	115,850	58,962	196.5
Tobacco Products	42,144	25,306	180.8
Textiles	613,331	379,484	161.6
Clothing and Footwear	551,810	449,136	122.9
Wood Products	538,774	252,569	213.3
Furniture	307,918	170,268	180.8
Paper and Allied Products	138,071	106,485	129.7
Printing and Publishing	231,696	138,843	166.9
Chemicals	402,400	162,687	247.3
Rubber Goods	66,745	55,917	119.4
Plastic Goods	139,324	116,606	119.4
Leather and Leather Products	48,243	42,537	113.4
Stone, Clay and Glass Products	546,969	427,728	127.9
Metal Products	945,936	523,212	180.8
Machinery (except electric)	335,683	530,119	63.3
Electric Machinery and Equipment	302,590	238,972	126.6
Transport Equipment	466,064	276,508	168.6
Miscellaneous Manufactures	241,545	106,406	227.0
Total Manufacturing	6,939,421	4,839,253	143.4

Source: Population census figures from IBGE (1983). Industrial census figures from IBGE (1984).

TABLE 2.3
Brazilian Input-Output Structure at Factor Cost in 1975
(million cruzeiros)

	Manufacturing	Utilities	Agri-Culture	Mining	Services incl. Construction	National Inputs	Imports	Indirect Taxes and Subsidies	Value Added	Total Gross Output
Food Products	36,044	876	52,065	468	8,683	98,136	3,257	-5,603	34,973	130,763
Beverages	2,596	76	734	324	442	4,172	611	- 125	5,498	10,156
Tobacco	1,522	17	1,412	0	131	3,082	27	24	3,239	6,372
Textiles	28,545	523	4,180	2	2,657	35,907	455	217	19,280	55,859
Clothing	9,140	55	2	4	758	9,959	48	20	7,463	17,490
Footwear and Leather	4,896	69	36	11	569	5,581	65	23	4,777	10,446
Wood Products	7,928	269	3,234	86	2,774	14,291	88	72	15,003	29,454
Paper Products	7,888	317	177	55	1,930	10,367	535	114	6,991	18,007
Printing and Publishing	4,496	87	0	0	1,026	5,609	619	74	11,477	17,779
Chemicals, incl Petroleum Refining	32,101	824	7,965	3,646	12,727	57,263	34,234	1,732	47,384	140,613
Rubber and Plastic Products	11,596	244	159	49	1,843	13,891	1,225	271	11,937	27,324
Stone, Clay and Glass Products	4,091	569	151	4,878	2,845	12,534	416	354	18,270	31,574
Basic metals	34,529	1,046	1,262	1,734	4,711	43,282	3,399	571	20,483	67,735
Metal Products	13,344	276	10	76	3,144	16,850	1,797	180	16,376	35,203
Machinery	22,217	382	8	190	5,312	28,109	2,313	473	31,289	62,184
Electrical Engineering	13,703	156	1	323	2,800	16,983	3,859	770	17,745	39,357
Transport Equipment	39,760	258	14	306	5,895	46,233	3,220	391	19,763	69,607
Other Manufacturing	2,746	55	14	172	591	3,578	294	93	5,790	9,755
Total Manufacturing	277,142	6,099	71,424	12,324	58,838	425,827	56,462	- 349	297,738	779,678

Source: Computer diskettes of IBGE (1987), Matriz de Relacoes Intersetoriais Brasil 1975, Rio de Janeiro, prepared by Peter Palesch, Santiago.

Mexico

The sources for Mexican national accounts estimates have been more carefully described than those of our other countries. For the period 1970-78, there is a massive 8 volume study (SPP, 1981) prepared by the Mexican authorities with the help of a team of foreign experts. This study is a major revision of the national accounts, with increases in the estimates of GDP level, and changes in growth of real product. The two volumes on manufacturing contain 1,441 pages of statistics and source description. These permit a detailed confrontation by branch of gross values, input values, value added, wages and salaries, indirect taxes, gross profits and employment with the figures in the tenth industrial census in Mexico (SPP, 1979a and 1979b). Mexico also has an input-output table for 1975 (table 2.6 below).

The national accounts estimate of manufacturing value added for 1975 is 38 per cent higher than that of the census when one adds petroleum refining, which is excluded from the census because output is largely confined to one government enterprise, PEMEX. The differences by branch can be seen in detail in table 2.4 in which the industrial census figures are adjusted to the same conceptual basis as the national accounts, the difference between the two sources being due to inadequate coverage of informal activity in the industrial census.

The national accounts estimates are based on a variety of sources including the census, and in many cases it is explicitly stated that output is inadequately covered in the census. The ratio of the national accounts estimates to the census figures varies considerably from industry to industry. For food products, the national accounts figure is 229.7 per cent of the census, whereas for primary metals and metal products it is lower than that of the census. The underestimation in the census does not seem to be confined to small establishments. One can infer this from the fact that output per person employed is generally lower in the census than in the national accounts figures. One usually expects small firms to have lower labour productivity than big ones (see table 2.5). The paradoxical productivity figures for the informal sector may be due to the fact that the national accounts includes only paid employees, whereas in the informal sector there is probably a fairly high proportion of unpaid family workers.

The Mexican census definition of gross value added, "Valor Aggregado Censal Bruto" is netter than the Brazilian "Valor de Transformacao Industrial" or the US census definition. However, the census contains enough information to arrive at an estimate of value added which corresponds with the national accounts concept or to one which corresponds with the Brazilian and US industrial census definitions. As in Brazil, the Mexican output figures refer to production including output which goes to inventory, whereas US figures refer to shipments. The Mexican value figures in some cases include indirect taxes. The most notable cases, for which we have made a correction are alcoholic beverages and tobacco and tobacco products where the incidence of excise taxes was 28.1 and 192.7 per cent (see table 2.4). For petroleum refining and products we also deducted indirect taxes, which we derived from national accounts information. Elsewhere we did not think this problem was significant.

Procedures Used to Estimate the National Accounts Concept of Gross Value Added (contribution to GDP at factor cost) for Establishments Covered by the Mexican Industrial Census

Mexico

1) Gross Value of Output = "Produccion Bruta Total";
2) US Value Added Concept = "Produccion Bruta Total" minus the following six items:
   a) "Materias Primas y Auxiliares Consumidas" (raw and intermediate materials used);
   b) "Envases y Empaques" (packaging);
   c) "Combustibles y Lubricantes" (fuels consumed);
   d) "Energia Electrica" (electric energy used);
   e) "Refacciones Accessorios y herriamientas" (repairs, accessories and tools);[1]
   f) "Pagos por Maquila" (payment for contract work);
   Together these six items correspond to the US Cost of Materials Concept (see table 19 of Resumen General);
3) In order to arrive at the present national accounts concept of value added (i.e. the contribution to GDP at factor cost before deduction for imputed financial services), we must further deduct three items which the census includes under the heading "Otros Insumos". These are:
   a) "Pagos por comisiones sobre rentas" (sales commissions);
   b) "Pagos por Servicios de Propaganda" (advertising costs);
   c) "Otros bienes y servicios" (other goods and service inputs);
   When these three items are deducted, we arrive at the Mexican census concept of value added ("Valor Aggregado censal bruto"), but this concept is grosser than what we want for national accounts purposes, so we must further deduct three items:
   a) "Gastos por Uso de Patentes y Marcas, Asistencia Tecnica y Transferencia de Technologia" (cost of patents, licences, technical assistance and transfer of technology);
   b) "Gastos por alquiler de maquineria y equipo" (costs of renting machinery and equipment);
   c) "Gastos por otros alquileres" (other rental costs);
4) In order to arrive at the former national accounts concept of value added, we must further deduct the item "Gastos por intereses sobre creditos y prestamos" (interest costs of credits and loans);
   In the Mexican case all this detailed information is available for individual industries (see tables 19 and 20 of Resumen General).

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[1] This item partly consists of repairs, which are industrial services, which we could not split off, but we consider this item to be of minor importance.

TABLE 2.4
Comparison of Mexican National Accounts and Industrial Census Estimates for Manufacturing Gross Value Added 1975

	Census Estimate (US Census) Concept) of Gross Value Added at factor cost (million pesos) (1)	Census Estimate (Present National Accounts Concept) of Gross Value Added at factor cost (million pesos) (2)	National Accounts Estimate (present concept) of Contribution to GDP at factor cost (million pesos) (3)	Ratio of Value Added (Present National Accounts Concept) National Accounts/ Census Values (4)
Food Products	28,963.6	22,111.8[a]	50,794.0	229.7
Beverages	12,993.8[a]	8,546.3[a]	12,635.4	147.8
Tobacco	1,816.8[a]	1,323.2[a]	1,348.2	101.9
Textiles	14,078.8	11,837.9	15,992.9	135.1
Clothing	5,598.8	4,412.1	10,946.3	248.1
Footwear & Leather	3,329.5	2,558.2	7,553.1	295.3
Wood Products	2,826.8	2,141.3	3,175.8	148.3
Furniture	1,994.1	1,605.0	4,618.3	287.7
Paper & Allied Products	6,980.0	5,385.3	6,605.1	122.7
Printing & Publishing	6,004.4	4,585.7	5,204.3	113.5
Chemicals & Allied Products	40,334.0[ab]	28,185.0[ac]	30,201.1	107.2
Rubber and Plastic Products	8,275.8	6,459.1	6,967.7	107.9
Stone, Clay and Glass Products	11,930.2	9,486.9	13,605.0	143.4
Primary Metals	17,956.8	14,760.1	14,138.1	95.8
Metal Products	13,322.7	10,984.7	9,949.9	90.6
Machinery except Electric	10,532.7	8,518.7	7,676.1	100.2
Electrical Machinery & Equipment	13,429.5	10,053.3	12,532.7	114.8
Motor Vehicles & Equipment	14,534.6	11,016.1	11,374.2	103.3
Other Transport Equipment	1,675.5	1,523.9	1,507.5	98.9
Other Manufacturing	3,241.1	2,605.6	5,251.6	201.6
Total[d]	219,819.5[ab]	168,100.4[ac]	232,077.4	138.1

a) excludes indirect taxes and subsidies, as taken from the detailed national accounts document Sistema de Cuentas Nacionales de Mexico, 1981: 3,545.1 million pesos for alcoholic beverages, 2,598.0 million pesos for tobacco, and 4,836.2 million pesos for petroleum refining.

b) includes 7,148.2 million pesos (excluding indirect taxes and subsidies) for petroleum refining, which are not shown in the census, but taken from the detailed national accounts document Sistema de Cuentas Nacionales de Mexico, 1981.

c) includes 4,545.1 million pesos (excluding indirect taxes and subsidies) for petroleum refining, which are not shown in the census, but taken from the detailed national accounts document Sistema de Cuentas Nacionales de Mexico, 1981.

d) excludes activities of head offices and auxiliaries with payrolls of 5,816 million pesos.

Sources: Column (1) and (2) (except figures mentioned under footnotes a) to c)) calculated from Resumen General (see text); column (3) from Sistema de Cuentas Nacionales de Mexico.

TABLE 2.5
Mexican Employment and Productivity in 1975 According to "Censo Industrial" and National Accounts

	"Censo Industrial" Employment	National Accounts Employment	Census Gross Value Added (Present National Accounts Concept) Per Person Employed (US $)[a]	National Accounts GDP (Present National Accounts Concept) per Person Employed (US $)[a]
Food Products	309,651	411,899	5,713	9,865
Beverages	69,392	94,353	9,853	10,713
Tobacco	8,645	9,442	12,245	11,423
Textiles	138,421	157,480	6,842	8,124
Clothing	90,606	112,084	3,896	7,813
Footwear & Leather	48,101	118,292	4,255	5,108
Wood Products	30,663	54,237	5,587	4,684
Furniture	44,452	51,452	2,889	7,181
Paper & Allied Products	39,164	42,130	11,001	12,542
Printing & Publishing	50,316	56,603	7,291	7,355
Chemicals & Allied Products	157,170[b]	165,571	14,346	14,593
Rubber and Plastic Products	53,363	57,138	9,683	9,756
Stone, Clay & Glass Products	100,714	129,766	7,536	8,387
Primary Metals	79,035	75,331	14,940	15,014
Metal Products	127,474	118,246	6,894	6,732
Machinery, except Electric	68,009	70,111	10,021	8,759
Electrical Machinery & Equipment	114,382	124,301	7,031	8,066
Motor Vehicles & Equipment	94,110	96,375	9,364	9,442
Other Transport Equipment	16,559	16,319	7,362	7,390
Other Manufacturing	34,113	41,380	6,111	10,153
Total	1,674,340[c]	2,002,510	8,032	9,271

a) converted at the official exchange rate of 12.50 pesos to one US $.
b) includes 25,989 employees in petroleum refining which is an industry not covered in the industrial census Resumen General, but taken from SPP (1981).
c) excludes 69,445 head office and auxiliary personnel.

Sources: As for table 2.4

TABLE 2.6

Mexican Input-Output Structure at Producers' Prices[(a)], 1975

(million pesos)

	Manufacturing	Utilities	Agriculture Forestry, Fishery	Mining	Services	Total National Inputs	Total Imports	Value Added	Total Gross Output
Food Products	38,547	951	73,910	85	14,685	128,177	6,742	52,088	187,008
Beverages	8,487	129	1,249	10	4,324	14,198	603	18,717	33,518
Tobacco	475	11	831	0	489	1,805	3	3,946	5,754
Textiles	12,802	373	4,026	1	5,420	22,622	436	16,636	39,694
Clothing	12,463	86	14	0	3,288	15,850	158	11,753	27,762
Footwear and Leather	5,977	84	93	142	2,014	8,311	351	7,741	16,403
Wood Products	4,059	92	2,601	0	3,013	9,764	235	8,119	18,119
Furniture	2,003	20	0	31	352	2,405	39	1,733	4,177
Paper and Allied Products	6,670	271	134	90	2,393	9,558	974	6,991	17,523
Printing and Publishing	3,483	63	0	25	1,951	5,522	1,183	5,552	12,256
Chemicals and Allied Products	24,146	641	504	16,571	11,150	53,012	8,344	37,015	98,372
Rubber and Plastic Products	4,625	174	228	30	2,649	7,707	1,329	7,629	16,665
Stone, Clay and Glass Products	4,924	568	1	2,618	3,338	11,449	639	14,291	26,379
Primary Metals	13,644	676	0	4,708	5,229	24,257	4,389	14,585	43,230
Metal Products	6,238	159	0	301	3,065	9,763	1,669	9,366	20,798
Machinery, except Electric	4,595	86	0	37	2,315	7,033	1,323	8,253	16,610
Electrical Machinery and Equipment	8,968	168	0	243	4,939	14,318	1,194	13,181	28,693
Motor Vehicles and Equipment	13,342	193	0	66	6,535	20,136	8,045	11,958	40,139
Other Transport Equipment	852	10	0	0	345	1,207	408	1,556	3,171
Other Manufacturing	1,873	45	64	301	1,220	3,502	1,089	5,592	10,183
Total Manufacturing	178,173	4,799	83,653	25,259	78,714	370,598	39,153	256,701	666,451

(a) includes excise taxes collected and paid by the producer

Source: SPP (1981), Vol. VII, Matriz de Insumo-Producto

United States

The 1977 Census of Manufactures is held every five years as in Brazil and Mexico, but the dates are different. The nearest census to 1975 is 1977. The Annual Survey of Manufactures 1975-76 (ASM) can be used to retropolate to 1975 for output and input values and for employment, but it contains no information on the quantity of output. In order to link 1975 and 1977 in quantitative terms, we were advised to use the detailed indices of shipments in constant 1972 dollars which are contained in the 1982 US Industrial Outlook for 200 Industries with Projections for 1986 (US Dept. of Commerce, 1982, pp. 431-8), rather than the detailed releases of the Federal Reserve Bank, which is responsible for the monthly index of industrial production.

The 1977 Census of Manufactures presents cost information only for inputs which are directly related to the production process as well as fuel and energy consumption and contract work. It does not provide information on the cost of most purchased services, as is done in Brazil and Mexico. As a result, the census definition of value added is bigger than that in the National Accounts. This is indicated in the introductory notes to the General Summary volume of the Census reports (pp. XXV-XXVII of the 1977 Census), which gives a very rough reconciliation of the census information and the national accounts. The treatment there is rather perfunctory, given the wealth of statistical information at the disposal at the US Dept. of Commerce and the existence of a very detailed (537 industry) input-output table for 1977 (see below).

The Bureau of Economic Analysis (BEA) was kind enough to provide detail by major branch which permitted a somewhat better reconciliation for 1975 than in the published sources. This information was used in table 2.7 to adjust the national accounts figures for the 21 branches to eliminate the impact of their inventory valuation adjustment[1] and the impact of indirect taxes and subsidies. After eliminating these items in column 5, we arrive at the residual national accounts figure which roughly represents what the census figures would be if purchased services were deducted.

This reconciliation is rough for particular branches because the BEA calculates value added as the sum of income flows. Wages and salaries are collected from Bureau of Labor Statistics (BLS) information based on unemployment insurance data. BEA and BLS use the same classification system as the census but establishments whose output-mix is varied, may well be classified in different industries from the census. Profits, depreciation and interest estimates are derived from income tax sources for companies (not establishments). For profits and depreciation there is an attempt to convert to an establishment basis using the "Census-Internal Revenue Service Link Project", but this is not done for interest payments. Hence some of the industry variation in our coefficients in table 2.7 is due to possible

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[1] The census gives the value of inventory changes as reported by the manufacturer. BEA modifies these "book values" with an adjustment which converts them to a replacement cost valuation consistent with its definition of GDP.

differences in the allocation of output by branch. In some cases the two different sources may draw a different boundary between manufacturing and non-manufacturing as well as between branches within manufacturing[1].

A further difference between the two sources is that BEA includes firms without employees whereas these are not included in the Census, but output of these firms was less than 0.5 per cent of the manufacturing total.

Table 2.8 presents a confrontation of employment and productivity derived from the Annual Survey of Manufactures (ASM), and the National Income and Product Accounts (NIPA). The productivity figures from ASM are higher than NIPA for two reasons. The ASM measure of output is bigger as already noted, and the ASM employment figure is lower than in NIPA. The reason for the latter difference is not clear. Both sources exclude unpaid family helpers, and although NIPA includes self-employed people without employees, this accounts for only a small part of the difference.

Table 2.9 presents a consolidated version of the US input-output table for 1975, which is an updated summary version of the 1972 input-output table. Broadly speaking the inputs in the first five columns are those which are excluded from the US Census definition of value added, whereas the national accounts definition of value added also involves deduction of service inputs (column (6)). In table 2.9 total value added (US$ 333,077 million) is the national accounts definition, the US census definition would be more or less equivalent to 460,793 million US dollars (i.e. the national accounts value added - US$ 333,077 million - plus service inputs - US$ 127,716 million-). The ratio of the national accounts to the US census concept of value added would therefore be 72.3 per cent according to the input-output table for 1975, i.e. not too different from the ratio of 77.1 in the bottom right of table 2.7.

In the case of our detailed comparisons involving the USA in chapter III, it was not operationally possible to use a national accounts concept of value added, as we would have preferred. This was due to the impossibility of reconciling the US census material with the national accounts and the input-output table. However, we were able to put our comparison of Brazil/USA and Mexico/USA on an national accounts basis at the branch level and for manufacturing as a whole.

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[1] A reconciliation of the census and national accounts approach for major branches of manufacturing for 1977 and 1982 can be found in Board of Governors of the Federal Reserve System (1986), pp. 52-7.

Components of US Census of Manufactures Definition of Gross Value Added

1) Gross Value of Output = Gross Value of Shipments (excludes sales and excise taxes[1])
2) US Value Added = Value of Shipments minus Cost of Materials
   US Cost of Materials =
   a) all raw materials, semi-finished goods, parts, containers, scrap, and supplies put into production or used as operating supplies and for repair and maintenance during the year;
   b) electric energy purchased;
   c) fuels consumed for heat, power or generating electricity;
   d) work done by others on materials or parts furnished by manufacturing establishments (contract work);
   e) products bought and resold in the same condition;
3) No National Accounts Concept of Value Added derivable from the census;

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[1] see p. XXVII of General Summary volume.

TABLE 2.7
Reconciliation of US Census of Manufactures and National Accounts Estimates for 1975

	ASM Census Concept of Gross Value Added at Factor Cost (mill. US$) (1)	BEA National Accounts Concept of Gross Value Added at Market Prices (mill. US$) (2)	BEA Inventory Valuation Adjustment (mill.US$) (3)	Taxes Minus Subsidies (mill.US$) (4)	Col.(2) Minus Col.(3)&(4) at Factor Cost (mill.US$) (5)	Ratio of Adjusted National Accounts to Census Values (per cent) (6)
Food & Kindred Products	39,985	}39,135	}1,263	}5,842	}32,030	}66.6
Beverages	8,110	}	}	}	}	}
Tobacco Products	3,722	5,103	- 87	2,416	2,774	74.5
Textile Mill Products	12,044	10,072	- 21	243	9,850	81.8
Apparel, Other Textile Products	14,749	11,499	15	113	11,371	77.1
Lumber and Wood Products	10,356	10,422	- 133	269	10,286	99.3
Furniture & Fixtures	6,290	5,019	- 60	77	5,002	79.5
Paper and Allied Products	17,944	13,875	- 236	423	13,688	76.3
Printing and Publishing	24,641	18,560	- 52	346	18,266	74.1
Chemical, Allied Products	44,976	30,005	- 668	889	29,784	66.2
Petroleum and Coal Products	10,500	9,857	- 191	4,678	5,370	51.1
Rubber, Miscellaneous Plastic Products	13,599	10,406	- 83	854	9,635	70.9
Leather, Leather Products	3,187	2,469	- 40	28	2,481	77.8
Stone, Clay, Glass Products	14,849	11,532	- 202	355	11,379	76.6
Primary Metals	30,367	28,522	- 352	910	27,964	92.1
Fabricated Metal Products	34,203	27,403	- 350	559	27,194	79.5
Machinery, except Electric	51,044	41,706	-1,425	749	42,382	83.0
Electric, Electronic Equipment	34,845	28,279	- 292	505	28,066	80.5
Motor Vehicles & Equipment	21,466	19,887	- 192	941	19,138	89.2
Other Transportation Equipment	23,871	16,844	-1,049	145	17,748	74.3
Instrument, Related Goods	14,158	10,189	- 243	146	10,286	72.7
Miscellaneous Manufacturing Goods	7,580	6,528	- 40	139	6,429	84.8
Total	442,485[a]	357,312	-4,438	20,627	341,123	77.1

a) excludes US$ 19,014.9 million payrolls of head office and auxiliary personnel.

Source: Annual Survey of Manufactures 1975-1976, Bureau of Census, US Dept. of Commerce, May 1979; columns (2) to (4) from BEA, "Gross National Product by Industry and Type of Income in Current Dollars, 1947-1986", processed and supplied by Robert Parker (July 1987).

TABLE 2.8
US Employment and Productivity in 1975 According to Annual Survey of Manufactures and National Accounts

	ASM Employment (1000)	Nat. Accounts Employment (1000)[b]	ASM Gross Value Added Per Person Employed	National Accounts Adjusted GDP per Person Employed
	(1)	(2)	(3)	(4)
Food & Kindred Products	1,321	}1,691	}31,538	}18,941
Beverages	204	}	}	}
Tobacco Products	66	73	56,394	38,000
Textile Mill Products	835	873	14,424	11,283
Apparel, Other Textile Products	1,214	1,266	12,149	8,982
Lumber & Wood Products	588	695	17,612	14,800
Furniture & Fixtures	396	426	15,884	11,742
Paper & Allied Products	589	643	30,465	21,288
Printing & Publishing	1,070	1,141	23,029	16,009
Chemicals, Allied Products	842	1,026	53,416	29,029
Petroleum & Coal Products	141	189	74,468	28,413
Rubber, Miscellaneous Plastic Products	585	603	23,247	15,978
Leather, Leather Products	240	252	13,280	9,845
Stone, Clay, Glass Products	589	642	25,210	17,724
Primary Metal Industries	1,089	1,144	27,885	24,444
Fabricated Metal Products	1,417	1,477	24,138	18,412
Machinery, Except Electric	1,967	2,100	25,950	20,182
Electric, Electronic Equipment	1,524	1,706	22,864	16,451
Motor Vehicles & Equipment	699	787	30,710	24,318
Other Transportation Equipment	906	919	26,348	19,312
Instruments, Related Goods	500	551	28,316	18,668
Miscellaneous Manufactured Goods	393	454	19,288	14,161
Total	17,174[a]	18,685	25,765	18,283

a) excludes 1,128,400 employees with a payroll of US$ 19,014.9 in administrative offices and auxiliaries located outside establishments.
b) full-time and part-time employees plus self-employed persons; self-employed persons derived as the differential between total persons engaged and full-time equivalent employees.

Source: column (1) from Annual Survey of Manufactures 1975-1976; column (2) from National Income and Product Accounts of the United States 1929-82; columns (3) and (4) derived from table 2.7 and columns (1) and (2).

TABLE 2.9
U.S. Input-Output Structure at Producers' Prices, 1975
(million US$)

	Manufacturing	Utilities	Agriculture Forestry, Fishery	Mining	Maintenance, Repair, Construction	Services	Total Inputs	Value Added	Gross Value of Output
Food Products and Beverages	53,496	1,532	48,759	105	296	18,879	123,067	33,174	156,241
Tobacco Products	3,400	30	1,891	4	10	1,145	6,480	4,603	11,083
Textile Mill Products	13,231	510	1,539	27	60	2,707	18,074	8,124	26,198
Apparel, Other Textile Products	20,300	304	109	6	30	4,212	24,961	13,200	38,161
Lumber and Wood Products	11,127	357	2,475	91	92	2,958	17,100	10,970	28,070
Furniture and Fixtures	5,256	126	4	10	26	1,660	7,082	4,945	12,027
Paper and Allied Products	19,101	1,122	38	387	310	5,506	26,464	11,958	38,422
Printing and Publishing	11,776	298	8	1	130	8,015	20,228	15,475	35,703
Chemicals and Allied Products	31,133	2,640	157	1,792	496	14,817	51,035	24,823	75,858
Petroleum and Coal Products	9,776	1,213	4	43,410	742	4,606	59,751	10,386	70,137
Rubber, Miscellaneous Plastic Products	10,740	508	8	84	124	3,544	15,008	10,963	25,971
Leather, Leather Products	3,124	52	0	6	10	770	3,962	2,346	6,308
Stone, Clay and Glass Products	7,020	1,244	13	1,634	188	4,275	14,374	11,235	25,609
Primary Metal Industries	31,587	3,109	20	6,756	688	10,858	53,018	26,276	79,294
Fabricated Metal Products	25,407	786	27	74	165	6,295	32,754	22,614	55,368
Machinery, except Electric	36,158	906	10	37	227	10,066	47,404	36,766	84,170
Electric Machinery and Electronic Equipment	24,305	695	11	22	154	8,865	34,052	28,325	62,377
Motor Vehicles and Equipment	40,020	466	4	57	121	7,251	47,919	24,109	72,028
Other Transport Equipment	17,241	334	9	9	105	4,610	22,308	14,458	36,766
Instruments and Related Goods	5,959	163	4	18	75	2,761	8,980	8,841	17,821
Miscellaneous Manufacturing Goods	5,678	143	31	18	43	2,833	8,746	4,961	13,707
Ordnance and Accessories	2,585	118	1	11	41	1,083	3,839	4,525	8,364
Total Manufacturing	388,420	16,656	55,122	54,559	4,133	127,716	646,606	333,077	979,683

Source: Paula C. Young and Shirley F. Loftus, "Summary Input-Output Tables of the U.S. Economy: 1973, 1974 and 1975", Bureau of Economic Analysis, Staff Paper 037, October 1981.

CHAPTER III

BINARY COMPARISONS OF REAL OUTPUT AND PURCHASING POWER BRAZIL/USA AND MEXICO/USA IN 1975

Introduction

This study applies the "industry of origin" approach to 3 countries, namely Brazil, Mexico and the United States. The sample covers 27 industries representing 25 to 47 per cent of manufacturing output (see table 1.4). This chapter explains the methodological and empirical problems which we encountered, and the procedures we used to overcome them. We have tried to make our procedure completely transparent to facilitate the task of those who wish to criticise, replicate, augment, truncate or otherwise modify it.

The year 1975 was chosen as the basis for comparison, so that the results can be compared with ICP Phase III (1982). One of the major problems in comparisons with the United States is that the nearest US census figures refer to 1977, so that price and volume adjustments had to be made to bring the US estimates to a 1975 base.

Scope of the Production Census and Definition of the Products

Detailed analysis of production census material was the basis for comparing the manufacturing sector. Census data have a distinct advantage over other sources. Large amounts of information on gross output values and quantities, input values and (sometimes) quantities, and employment are available from a single source covering the same establishments. The reliability of the information is backed up by legal penalties for non- or inaccurate reporting. A higher degree of internal consistency can, therefore, be assumed than when making use of different sources to compare sectors. Census material, however, is not perfect or always ideally suited for our purposes, as will be shown below.

With regard to the scope of the production census, it should be emphasized that physical quantities and output values are not specified separately for all individual commodities of an industry. For some items only value figures are provided, and some items are not specified individually at all. This latter point is one reason for differences sometimes found between total output values in the summary volume of the census and the values specified in the detailed volumes. These census limitations require an adjustment of the "matched" output to total output of an industry, which we will discuss below.

With regard to the definition of "industries" and "commodities" Rostas already recognized difficulties when he wrote in 1948:

> "These difficulties are mainly due to the fact that individual industries, as classified by the censuses, each produce a group of products and by-products which are not identical in the different countries, either as regards type or quality or as regards the relative importance of individual types within the group."
> (Rostas, 1948, p. 11).

One of the major definitional problems arises from the differences in level of detail at which a "product" is specified. On the concept of the "product", one can usefully cite the 1977 Census of Manufactures as follows:

> "A "product" as used in the Census of Manufactures is the finest level of detail for which output information was requested. It is not necessarily synonymous with the term "product" as used in the marketing sense. In some cases it may be more detailed and in other cases, it may be more aggregative. For example, there is a long list of pharmaceutical preparations but a single item for all canned meats."
> (1977 Census of Manufactures, p. XXII, 1981a).

This creates the problem that in one country several heterogeneous products (in the marketing sense) may be regarded as one "product" in the census, while in the other country these products are specified separately. This problem is dealt with extensively in chapter VI.

Another important definitional problem concerns the different industrial classifications used in the countries involved. The United Nations Yearbook of Industrial Statistics classifies commodities according to ISIC. Unfortunately, none of the countries included in this comparison applies the ISIC classification. A strict adherence to ISIC by all countries would indeed simplify the process of international comparison, but the national statistical offices usually claim that their country's output structure is unique and specific enough to warrant a separate national classification system.

Data for the United States were taken from the 1977 Census of Manufactures (1981a and 1981b). In this census, information is classified according to the American Standard Industrial Classification (SIC), which assigns some 13,000 product items to approximately 1,500 product groups according to a 7 digit classification. Not all information is published by the census. Data are withheld for national security reasons for certain products. When the number of establishments reporting is limited, information is withheld so as not to violate the privacy of individual firms by providing classified information to their competitors. The census includes all establishments employing one person or more at any time in the census year, but in a limited number of cases, single-establishment companies with fewer than 5 employees were not required to report to the census bureau. Generally speaking, the quantity and value of output of these latter establishments are estimated by the census bureau. Because we had to adjust the 1977 figures for the United States to a 1975 level we also used 1975 value figures at the SIC level from the Annual Survey of Manufactures 1975-76 (1979). Figures on quantity movements between 1975 and 1977 were taken from the 1982 US Industrial Outlook (1982). The adjustment procedures are explained in detail below.

In Brazil there is no analytic coding in the census. The detailed information on quantities and values by product in the volume Producão Fisica (vol. 2, part II, Rio, 1981b) is presented with a sequence of numbers from 1 to 13,678. Some of these numbered items refer to production in Brazil as a whole and others to production by state. The other main volume, Censo Industrial (vol. 2, part I, Rio, 1981a) gives an analytic breakdown of value, census value added, employment, and inputs for 24 major industry groups, of which 23 are part of the manufacturing sector. The numbering system in Censo Industrial is different from Producão Fisica, though the same sequence of branches is used in the two volumes. Table 3 of the Censo Industrial gives information for 1,299 "industries", but the finer breakdown

for inputs ("despesas diversas") into 20 categories is given only for the 24 major industry groups (see table 15 of the Censo Industrial). The information published in Producão Fisica refers to firms with 5 employees or more and/or a gross value of output that exceed 640 times the highest minimum wage in 1975. Only these firms were required to fill in census forms. However, in part 1 estimates are published for the smaller firms as well in separate tables so that the aggregate figures we use give a complete picture.

The information for Mexico was derived from the X Censo Industrial 1976 (1979a and 1979b), which refers to 1975. Here the CMAE-classification (Catalogo Mexicano de Actividades Economicas) was applied. It has a 4 digit classification for product groups; over 15,000 commodity items are specified but they share the generic number of the industry category into which they fall. There are two volumes, the Resumen General (1979a), containing general information for product categories, and the Desglose (1979b), in which detailed information on quantity and gross value of output at the product level is published. In the latter only the information on product groups which exceed 1 million pesos is published. Information on petroleum refining was not presented in the industrial census, but was derived from the detailed Mexican national accounts, Sistema de Cuentas Nacionales de Mexico (SPP, 1981). We derived information on indirect taxes and subsidies from this latter source in order to adjust the values to a producer price basis, which was the valuation basis used elsewhere in this study.

Measurement of the Relative Level of Gross Output within Industries

The basic procedure involved weighting physical output of individual product items in 1975 by a common set of price weights. These "prices" were unit values, derived from production censuses by dividing gross value of output by the corresponding quantities. Two sets of binary comparisons were made, i.e. Brazil/USA and Mexico/USA. Each involved (a) unit value weights of country X (Brazil or Mexico) to compare gross volume of output of that country with that in the United States:

$$\frac{\Sigma\,(Q_y^X * P_y^X)}{\Sigma\,(Q_y^U * P_y^X)} \qquad (3.1a)$$

or (b) unit value weights of the USA to derive the quantity ratio between country X and the United States as follows:

$$\frac{\Sigma\,(Q_y^X * P_y^U)}{\Sigma\,(Q_y^U * P_y^U)} \qquad (3.1b)$$

with Q_y = quantity of product y

P_y = unit value of product y

X = country X

U = United States

It is usually not possible to make these quantitative comparisons for all products of an industry, because:

a) one cannot always match each product with a corresponding one in the US census;
b) several products in an industry are only specified by value and not by quantity.

Therefore we cannot arrive directly at the formulae given above for output comparison of country X with country U, but only at a comparison of the covered part of output. The components of (3.1a) and (3.1b) which refer to the quantity at a country's own prices, i.e. $\Sigma (Q_y^X * P_y^X)$ and $\Sigma (Q_y^U * P_y^U)$, are taken directly from the production censuses. The problem is how to estimate the quantity at prices of the other country, i.e. $\Sigma (Q_y^U * P_y^X)$ and $\Sigma (Q_y^X * P_y^U)$, when we only have a figure for $\Sigma (Q_y^U * P_y^X)_c$ and $\Sigma (Q_y^X * P_y^U)_c$, where "c" indicates the "covered" (or matched) part of output.

Two alternative solutions are available. One may assume that the quantity relationship between matched output in country X and country U applies to the industry as a whole, according to the following equations:

$$\frac{\Sigma (Q_y^X * P_y^X)_c}{\Sigma (Q_y^U * P_y^X)_c} = \frac{\Sigma (Q_y^X * P_y^X)}{\Sigma (Q_y^U * P_y^X)} \qquad (3.2a)$$

and

$$\frac{\Sigma (Q_y^X * P_y^U)_c}{\Sigma (Q_y^U * P_y^U)_c} = \frac{\Sigma (Q_y^X * P_y^U)}{\Sigma (Q_y^U * P_y^U)} \qquad (3.2b)$$

If, for example, country X's matched output at unit values of country U came to one half of matched output in country U, then country X's total output at US unit values is assumed to be one half of total output in country U. It follows from the equations (3.2a) and (3.2b) that on the basis of this assumption the output value of one country in prices of the other country can be obtained by blowing up the value of its covered output by the ratio of total to covered output in the other country:

$$\Sigma (Q_y^U * P_y^X) = \Sigma (Q_y^U * P_y^X)_c * \frac{\Sigma (Q_y^X * P_y^X)}{\Sigma (Q_y^X * P_y^X)_c} \qquad (3.3a)$$

and

$$\Sigma (Q_y^X * P_y^U) = \Sigma (Q_y^X * P_y^U)_c * \frac{\Sigma (Q_y^U * P_y^U)}{\Sigma (Q_y^U * P_y^U)_c} \qquad (3.3b)$$

The alternative procedure assumes that the price (or unit value) relationship we find for the covered (i.e. matched) part of output is representative for the entire industry. In other words, the average purchasing power parity (PPP) for the covered part of output weighted by either US quantities or country X quantities is assumed to be identical to the corresponding weighted average PPP for the industry as a whole, i.e.:

$$\frac{\Sigma\,(Q_y^U * P_y^X)_c}{\Sigma\,(Q_y^U * P_y^U)_c} = \frac{\Sigma\,(Q_y^U * P_y^X)}{\Sigma\,(Q_y^U * P_y^U)} \qquad (3.4a)$$

and

$$\frac{\Sigma\,(Q_y^X * P_y^X)_c}{\Sigma\,(Q_y^X * P_y^U)_c} = \frac{\Sigma\,(Q_y^X * P_y^X)}{\Sigma\,(Q_y^X * P_y^U)} \qquad (3.4b)$$

This leads to a procedure in which the value of covered output expressed in unit values of the other country is blown up by the ratio of its own total output to its covered output. The total US quantity in unit values of country X is thus derived as follows:

$$\Sigma\,(Q_y^U * P_y^X) = \Sigma\,(Q_y^U * P_y^X)_c * \frac{\Sigma\,(Q_y^U * P_y^U)}{\Sigma\,(Q_y^U * P_y^U)_c} \qquad (3.5a)$$

The formula for total output in country X at US unit values is:

$$\Sigma\,(Q_y^X * P_y^U) = \Sigma\,(Q_y^X * P_y^U)_c * \frac{\Sigma\,(Q_y^X * P_y^X)}{\Sigma\,(Q_y^X * P_y^X)_c} \qquad (3.5b)$$

Thus, for example, if only one third of country X's gross output could be matched, the final term in formula (3.5b) will take the value of 3. The dollar value of output for the entire industry is then assumed to be three times as great as the dollar value found for the covered part of the industry's output.

Equations (3.3) and (3.5) differ only in the third term. If we compare for example (3.3b) and (3.5b), the value of covered output in country X at country U's unit values is blown up by the inverse of country U's coverage ratio according to the "quantity indicator" method, while in the "price indicator" method the blow-up factor refers to country X's coverage ratio. For (3.3a) and (3.5a) a similar statement can be made. This leads to the conclusion that the results of both methods do not differ at all if the coverage ratios for both countries are the same and provided the covered items in both comparisons are the same. However, if they differ, we have to make a choice between the two methods. This problem has been rather substantially discussed in the literature on measurement of production trends since Mills first raised the issue (Mills, 1932). Burns (1934, p. 260-1) stressed that the prices of different commodities are likely to be under the general influence of "common monetary factors", whereas there is no such "single dominant force acting pervasively" on quantitative movements for different commodities. Fabricant (1940) also preferred price indicators because "prices probably move together within closer limits than do quantities". Richard Stone (1956) stated that completeness of coverage is of

less importance with price indicators compared to quantity indicators, because "prices charged for close substitutes by different firms or in different parts of a country are likely, in many cases, to show similar movements even if their absolute level is a little different". We agree with the statements above. Therefore the calculations in this study are entirely based on the price indicator method. However, in table 7 for individual industries in the Statistical Appendix we also present, pro memoria, results using the quantity indicator method.

Levels of Real Output in 27 Industries

Our detailed analysis covered 27 industries in Brazil, Mexico and the USA. We covered a sample of 276 Brazilian product items and 417 US product items for the Brazil/USA comparison, and 252 Mexican product items and 451 US product items for the Mexico/USA comparison. This section describes the calculation procedures, and summarizes the estimates of relative output and purchasing power parity (PPP). On the basis of these initial results we try to discern what patterns can be detected.

Table 3.1 shows total gross value of output for the 27 industries as derived from the industrial censuses, expressed in national currencies. For the United States we had to use figures for 1977 from the 1977 Census of Manufactures. For Mexico we added the gross value of output for petroleum refining, which was not presented in the industrial census, presumably because all this output is produced by one firm - PEMEX, the government monopoly. These figures were taken from from the detailed national accounts document Sistema de Cuentas Nacionales de Mexico (1981). We deducted also indirect taxes and subsidies which were included in the Mexican census figures for malt and malt beverages, tobacco and tobacco products and petroleum refining and products (see also industries A6, A7 and A18 in the Statistical Appendix). Table 3.1 also shows total gross value of output of manufacturing to demonstrate the size of the sample.

In table 3.2 the figures for Brazil and Mexico are converted into US dollars at the average exchange rates for the year 1975 as given by IMF (8.13 cruzeiros and 12.50 pesos to the US dollar respectively). These can be compared with 1975 output values for the United States as derived from the Annual Survey of Manufactures.

Tables 3.3 and 3.4 represent the first stage in the calculation procedure. These tables show the covered part of gross value of output of Brazil and Mexico for 1975, and the gross value of the corresponding items in the United States for 1977. Comparisons are made at 1975 national unit values of Brazil and Mexico according to formula (3.6a):

$$\frac{\Sigma \left(Q^{X}_{y,75} * P^{X}_{y,75}\right)_c}{\Sigma \left(Q^{U}_{y,77} * P^{X}_{y,75}\right)_c} \qquad (3.6a)$$

and at 1977 US unit values, as indicated by formula (3.6b):

$$\frac{\Sigma \left(Q^{X}_{y,75} * P^{U}_{y,77}\right)_c}{\Sigma \left(Q^{U}_{y,77} * P^{U}_{y,77}\right)_c} \qquad (3.6b)$$

with $Q^X_{y,75}$ = quantity of product y in 1975 for country X

$Q^U_{y,77}$ = quantity of product y in 1977 for United States

$P^U_{y,77}$ = unit value of product y in 1977 for United States

$P^X_{y,75}$ = unit value of product y in 1975 for country X

"c" indicates covered output

The details on matching for the individual industries are shown in tables 5 and 6 in each industry appendix (Statistical Appendix, tables A1 to A27) for the Brazil/USA comparison and the Mexico/USA comparison respectively.

Methodological problems with regard to matching are reviewed in chapter V. It also discusses the sensitivity of the results of alternate matching procedures. For the moment we can report as follows. For the small industries included in our study (sugar and sugar products, malt and malt beverages, tobacco and tobacco products, tires and tubes, cement, and bricks) we matched as many items as possible. For all the other industries with a more heterogeneous product-mix, we applied a short-cut method, only matching items which individually contributed more than 1 per cent to the total value of output of the industry.

We adjusted the covered output at Mexican pesos for malt and malt beverages, tobacco and tobacco products and petroleum refining and products (see tables A6.6, A7.6 and A18.6 in the Statistical Appendix) in order to exclude indirect taxes and subsidies. We made also an adjustment for the "match" of passenger cars because of obvious quality differences of this commodity item between the USA on the one hand and Brazil and Mexico on the other (see "Note on the Adjustment for Unit Value Bias for Passenger Cars" in the Statistical Appendix).

Table 3.5 presents the coverage ratios of matched value of output to total gross value of output for the countries involved. In only two cases, i.e. the Brazilian motor vehicle industry and petroleum refining industry, was coverage below 40 per cent -because of the unusually large amount of "non-specified" output[1].

After matching the products in the sample, we had to make volume and unit value adjustments to the 1977 US census figures, in order to make them comparable with those for Brazil and Mexico which are for our preferred benchmark year 1975. The volume adjustments for the USA from 1977 to 1975 were derived from the 1982 US Industrial Outlook, in which gross value of output is shown at constant 1972 US$ for separate product groups. These ratios (see first column of table 3.6), were applied to the 1977 US Census figures. The resulting 1975 figures at 1977 prices were compared with the product group figures for 1975 at 1975 prices derived from the Annual Survey of Manufactures 1975-1976 (ASM). From this latter confrontation we derived our unit value indices for 1975 relative to 1977, which are presented in the second column of table 3.6.

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[1] Fabricant (1940, p. 364-6) suggested a 40 per cent minimum coverage ratio.

Since we prefer to use the method which assumes the price relationships for covered output in the industry to be representative for the industry as a whole, we restate formulae (3.5a) and (3.5b), as a consequence of the US quantity and unit value adjustments, as follows. In formula (3.7a) US gross quantities for 1977 are adjusted to 1975 using the factor "q" derived from the first column in table 3.6:

$$\Sigma (Q^U_{y,75} * P^X_{y,75}) = \Sigma (Q^U_{y,77} * P^X_{y,75})_c * q * \frac{\Sigma (Q^U_{y,77} * P^U_{y,77})}{\Sigma (Q^U_{y,77} * P^U_{y,77})_c} \qquad (3.7a)$$

In formula (3.7b) gross quantity of output in Brazil and Mexico is weighted at 1977 US unit values, so that we had to apply the term "p" in table 3.6 to convert the comparison to 1975 US unit values:

$$\Sigma (Q^X_{y,75} * P^U_{y,75}) = \Sigma (Q^X_{y,75} * P^U_{y,77})_c * p * \frac{\Sigma (Q^X_{y,75} * P^X_{y,75})}{\Sigma (Q^X_{y,75} * P^X_{y,75})_c} \qquad (3.7b)$$

The last term in both equations, the inverse of the coverage ratios, can be derived from table 3.5.

The results for the "adjusted" gross value of output comparison between Brazil and the USA and Mexico and the USA are presented in table 3.7 and 3.8 respectively. The figures for the countries in their "own" currencies are taken from the industrial censuses, i.e. Censo Industrial for Brazil, Resumen General for Mexico (except the adjustments for indirect taxes and subsidies for malt beverages, tobacco and petroleum refining, and the value added figure for petroleum refining, which we derived from Sistema de Cuentas Nacionales de Mexico) and Annual Survey of Manufactures 1975-1976 for the USA in 1975. The estimates for the USA at Brazilian and Mexican unit values are derived from formula (3.7a), and the estimates for Brazil and Mexico in US dollars from formula (3.7b).

Adjustment of Comparisons of Gross Value of Output to a Value Added Basis

In order to avoid double-counting in aggregating the individual industry results, it is desirable to measure value added rather than gross output. This requires separate comparisons of output and inputs separately. Unfortunately, the Brazilian and Mexican production censuses do not give figures for individual inputs at the product level, and the product detail given for "materials consumed" in the US census cannot be related to output of individual commodities. This problem can be met only by adjusting the gross output comparisons by the value added - gross output ratios for the countries, as explained below.

A second important point is that there are differences in the definition of value added in the three countries involved in our comparison (see also chapter II above). In the United States manufacturing census, only inputs directly related to the production process (i.e. raw materials, energy consumption, and packing expenses) are reported. Information on overheads and general expenses, which cannot be allocated directly to a product group is not given. So the "US census concept" of value added is gross of these non-allocable inputs, and is therefore a grosser concept than used in the national accounts.

In the Brazilian census the standard concept of value added ("valor de transformacao") is the same as in the US Census. However, at the level of major industry groups, of which there were 24 (including mining) in Brazil, enough detailed information is provided to permit derivation of a concept of value added compatible with that in the national accounts (see also chapter II for a discussion of this point).

In the Mexican census a distinction is made between direct inputs ("materias primas y auxiliares consumidas") and other costs ("otros insumos"). The first category is smaller than US or Brazilian census inputs so the Mexican census concept of value added is different from that in the USA and Brazil (see chapter II). However, there is enough detail in the Mexican census to permit construction of a measure of value added conceptually equivalent to that in the US census (which we use here) or alternatively to measure Mexican value added in a national accounts sense.

For the detailed value added comparisons in this chapter for our 27 industries, we use the "US census concept" of value added. However, in the final section where we make estimates at branch levels and for manufacturing as a whole we were able to make estimates on a national accounts basis.

Paige and Bombach discussed the possibilities of making value added (or to use their terminology "net output") comparisons (see also chapter I). One possible approach is the "double deflation" method, which makes separate measurements for output and inputs.

The formula for this is[1]:

$$\frac{\Sigma\,[(Q_y^X * P_y^U) - \Sigma\,(Q_i^X * P_i^U)]}{\Sigma\,[(Q_y^U * P_y^U) - \Sigma\,(Q_i^U * P_i^U)]} \qquad (3.8)$$

with Q_y = quantity of product y
P_y = unit value of product y
Q_i = quantity of input i
P_i = unit value of input i
X = country X
U = United States

As already noted, the lack of detailed information on inputs makes it impossible to apply this method.

The alternative method, the "single indicator" method, is based on the assumption that the ratio of the levels of real gross value of output in countries X and U is the same as the corresponding ratio of value added levels.

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[1] Formulae $(3.8)_U$ and (3.9) refer to the comparison at US unit value weights. If the term P^U is replaced by P^X, the formulae refer to the comparison at country's X unit value weights.

Our basic comparison of value added uses PPPs for gross value of output, but the quantity comparisons are adjusted by each country's ratio of value added to gross output at national prices, i.e.[1]:

$$\frac{\Sigma\,(Q_y^X * P_y^U)}{\Sigma\,(Q_y^U * P_y^U)} * \frac{\Sigma\,(V_y^X - \Sigma\,V_i^X) \,/\, \Sigma\,V_y^X}{\Sigma\,(V_y^U - \Sigma\,V_i^U) \,/\, \Sigma\,V_y^U} \qquad (3.9)$$

with V_y = value of product Y ($P_y * Q_y$) in national currencies

V_i = value of input i in product y ($P_i * Q_i$) in national currencies.

Levels of Value Added in 27 Industries

Table 3.9 shows Brazilian and Mexican value added in US dollars at official exchange rates, compared with US figures for value added derived from the Annual Survey of Manufactures.

Table 3.10 shows value added (US census concept) as a percentage of gross value of output. These percentages were applied to the gross output figures for Brazil and the USA in table 3.7 and for Mexico and the USA in table 3.8. The results for the two countries are presented, respectively, in table 3.11 and 3.12.

Complementarity of Price and Quantity Relatives

The previous sections showed the results for our sample of 27 industries in terms of quantity relatives, according to the formulae (3.1a) and (3.1b). It is also possible to present the corresponding price relatives, i.e. the purchasing power parities (PPPs), according to the following formulae:

$$\frac{\Sigma\,(Q_y^U * P_y^X)}{\Sigma\,(Q_y^U * P_y^U)} \qquad (3.10a)$$

and

$$\frac{\Sigma\,(Q_y^X * P_y^X)}{\Sigma\,(Q_y^X * P_y^U)} \qquad (3.10b)$$

The price relatives are complementary to the quantity relatives. If a quantity relative of the Paasche type, i.e. unit value weights of the country in the denominator of the formula, is multiplied by a price relative of the Laspeyres type, i.e. quantity weights of the base country, the result is the value ratio between both countries:

$$\frac{\Sigma (Q_y^X * P_y^X)}{\Sigma (Q_y^U * P_y^X)} * \frac{\Sigma (Q_y^U * P_y^X)}{\Sigma (Q_y^U * P_y^U)} = \frac{\Sigma (Q_y^X * P_y^X)}{\Sigma (Q_y^U * P_y^U)} \qquad (3.11a)$$

The same is true for a combination of a Laspeyres quantity index and a Paasche price index, i.e.:

$$\frac{\Sigma (Q_y^X * P_y^U)}{\Sigma (Q_y^U * P_y^U)} * \frac{\Sigma (Q_y^X * P_y^X)}{\Sigma (Q_y^X * P_y^U)} = \frac{\Sigma (Q_y^X * P_y^X)}{\Sigma (Q_y^U * P_y^U)} \qquad (3.11b)$$

Naturally one can also calculate Fisher indices of both the price relatives and the quantity relatives, which are geometric averages of the Paasche and Laspeyres indices.

Purchasing Power Parities in 27 Industries

The price relatives (PPPs) for the industries can be derived directly from tables 3.11 and 3.12, by calculating for each country the ratios between value added in currencies of country X and value added in currencies of the US. Table 3.13 presents the PPP estimates in terms of the currency of country X to the US dollar for the 27 individual industries for 1975. Thus the PPPs in the first and fourth columns of table 3.13 are price relatives weighted by US quantities, and those in the second and fifth columns have quantity weights of each of the Latin American countries. The geometric average (Fisher index) of the two PPPs is also presented in the third and sixth columns.

The average PPPs for the sample as a whole can also be taken from table 3.11 and 3.12. In fact these averages can be calculated by weighting the PPPs for the individual industries by their value added (at the US census concept). Thus the average PPP at US quantity weights is calculated according to the following formula:

$$\frac{\Sigma (VA^U * PPP^U)}{\Sigma VA^U} \qquad (3.12a)$$

The average PPP with quantity weights of country X is calculated as follows:

$$\frac{\Sigma VA^X}{\Sigma (VA^X / PPP^X)} \qquad (3.12b)$$

with VA^U and VA^X = value added (US census concept) in country U and country X

PPP^U and PPP^X = purchasing power parity with quantity weights of country U and country X

The PPPs for the individual industries show that 47 of the 81 PPPs were below the exchange rate for the Brazil/USA comparison and 37 of the 81 PPPs for the Mexico/USA comparison. On average the PPPs are below or above the exchange rate depending on the quantity weights used for the comparisons. In the Brazil/USA comparison the average PPP at US weights is just above the exchange rate, but clearly below the exchange rate in case of Brazilian

weights, as is the geometric average PPP. The average PPP at US weights in the Mexico/USA comparison is clearly above the exchange rate, but slightly below the exchange rate in case of Mexican weights. In contrast to the Brazil/USA comparison, the geometric average PPP for Mexico compared to the USA is slightly above the exchange rate.

Blowing-Up Our Sample to Get an Estimate for Total Manufacturing

In this section we blow up our sample results for 27 industries to arrive at estimates for the manufacturing sector as a whole.

Previous investigators followed different options in order to blow up their sample for manufacturing as a whole. Rostas (1948), Maddison (1952), Galenson (1955), Frankel (1957), Mensink (1966), and Yukizawa (1978) simply assumed that their sample results were representative for manufacturing as a whole (either explicitly or implicitly). They presented their overall result in terms of labour productivity, not output or PPPs. Sometimes, as with Rostas, and Yukizawa, their aggregate results were derived by using labour weights.

Three other studies explicitly discuss the aggregation problem in all three dimensions (output, PPPs and labour productivity), i.e. Paige and Bombach (1959), the Conference of European Statisticians (1969a) and West (1971), but they each followed different methods.

Paige and Bombach covered about half of output in their two countries, i.e. the UK and the USA, and their average result is very similar to that for their sample, as they predominantly assumed their quantitative relationships to be representative (see p. 102). They got their total for manufacturing by blowing up the industries they covered to represent the situation by major branch (using quantity relationships of their sample in 59 per cent of cases, PPP relatives for 19 per cent, other price information for 10 per cent, and employment for 12 per cent).

West did not make estimates by major branch, but assumed the average PPP for his sample (with value added weights) was representative for the non-sampled industries, using the sample average PPP to derive real output in the non-covered sector (see p. 26). His overall labour productivity result was significantly lower than that for his sample.

The authors of the Czech-French study (Conference of European Statisticians, 1969a) used an unweighted average of their sample PPPs (by branch) to get a PPP for each branch, with output derived for the branch by applying this PPP to calculate branch value added in real terms. Their manufacturing total was derived by summing the branch totals. A similar procedure was used by Smith, Hitchens and Davies (1982) and Smith (1985).

Our approach comes closest to that of the Czech-French study. We have assumed that the PPPs for our sample were representative for the non-sampled industries in the same manufacturing branch. For reasons already explained above (see p. 35), we feel that the PPP relationships are more representative than the quantitative relationships which Paige and Bombach predominantly used to establish their aggregate result. Unlike the Czech-French study, we used a weighted average of our individual industry PPPs to arrive at the PPP for each branch. For example our PPP for the food manufacturing branch is the weighted average of five price ratios, i.e. for dairy

products, fats and oils, grain mill products, cane sugar and products, and cocoa, chocolate and confectionery products. Table 3.14 shows our PPPs for 14 manufacturing branches. In some cases we combined divisions, because PPPs were not available for each division separately (for example for paper products and printing and publishing). These branch PPPs were used to convert branch value added at national prices to a common currency unit (see the quantity relatives in tables 3.15 and 3.16).

In tables 3.15 and 3.16 we moved to a national accounts basis which was not possible in our detailed calculations for the sample industries.

Comparison with ICP III Results

It is not possible to make a direct or detailed confrontation of our results with those of ICP. This is partly because its expenditure approach breaks down economic activity in a different way from our value added approach as demonstrated in the input-output table 1.1 in our chapter I. There is also the problem that the ICP national price data for consumption items are confidential and could not be consulted at the UN Headquarters, or retrieved from the archives when we visited Brazil and Mexico. UNSO was able to let us have a copy of their own estimates of prices for capital goods, which enabled us to make some rather partial cross-checks.

One can, however, get a rough idea of the ICP results for manufacturing by grouping the PPPs for the 82 ICP items with a manufacturing content, using a similar technique to researchers who have mined the ICP results as proxies for the kind of study we have made (see table 1.2).

The confrontation of our results with the ICP can be seen in table 3.17. Whilst our estimate of the ICP result for manufacturing is rather crude and is not presented in this way in the ICP itself, nevertheless it is an acceptable and indeed the only way of comparing the two sets of results. In the case of Brazil our results and those of ICP are strikingly similar. In the case of Mexico, the results differ substantially.

It should be recalled that one of our original reasons for including Mexico in the pilot study was that there was the same type of discrepancy between the results of an earlier industry-of-origin study and ICP III (see Maddison 1970, and 1983), and it also seemed most unlikely that Mexico would be in such a favourable PPP position after 22 years of a fixed rate for the dollar and on the eve of a major devaluation.

TABLE 3.1
Gross Value of Output in Brazil and Mexico (1975) and the USA (1977)
(national currencies)

	Brazil 1975 (million cruzeiros)	Mexico 1975 (million pesos)	USA 1977 (million dollars)
Total Manufacturing Output	782,698.5	480,048.2[ab]	1,358,526.4
Dairy Products	16,335.0	10,231.2	26,009.8
Fats and Oils	21,353.8	10,521.4	14,480.0
Grain Mill Products	7,546.3	10,337.4	5,698.1
Sugar & Sugar Products	12,142.4	6,596.3	2,964.0
Cocoa, Chocolate and Confectionery Products	3,712.6	2,883.0[a]	6,897.9
Malt and Malt Beverages	3,429.0	10,973.8[a]	7,151.9
Tobacco and Tobacco Products	6,118.4	3,847.4[a]	9,050.6
Textiles	28,067.8	17,909.9	21,448.1
Men's Clothing	3,584.9	3,877.5	8,127.4
Leather Products	2,980.6	1,385.0	1,456.1
Footwear	6,798.2	4,293.8	4,408.7
Sawmill Products	10,271.1	3,502.0	15,943.8
Pulp and Paper	10,731.1	14,607.1	21,828.7
Soap and Detergents	3,626.9	6,335.6	6,087.2
Paints	5,908.4	3,460.2	6,629.7
Agricultural Fertilizers	12,096.1	4,865.7	7,151.7
Synthetic Fibres	4,875.7	7,443.4[ab]	7,378.6
Petroleum Refining and Products	47,547.5	26,502.0	93,333.5
Tires and Inner Tubes	7,209.0	4,969.8	8,971.0
Cement	5,688.3	5,648.6	3,042.3
Bricks	6,041.1	1,636.9	1,637.4
Iron and Steel	48,216.3	32,836.9	50,582.0
Bolts, Nuts, Rivets and Washers	2,605.0	978.1	3,319.5
Agricultural Machinery	11,697.0	1,850.7	10,281.7
Radio and TV Receivers	9,003.6	4,854.5	5,732.6
Electric Lamps and Bulbs	523.2	455.5	1,651.4
Motor Vehicles	57,791.5	39,425.6	117,746.5
Total in our sample	355,900.7	242,229.3	469,010.2
as % of Total Manufacturing Output	45.47	50.46	34.52

a) indirect taxes and subsidies are deducted (see table 2.4).
b) includes 25,004.7 million pesos (excl. indirect taxes and subsidies) for petroleum refining, which are not shown in the census Resumen General but taken from Sistema de Cuentas Nacionales de Mexico.

Source: Figures for Brazil from Censo Industrial, figures for Mexico from Resumen General (except for figures mentioned under footnotes a) and b)), and figures for USA from the 1977 Census of Manufactures.

TABLE 3.2
Gross Value of Output in Brazil, Mexico and the USA in 1975
at official exchange rates (1975 US dollars)

	Brazil (million dollars)	Mexico (million dollars)	USA (million dollars)
Total Manufacturing Output	96,272.8	38,403.9[ab]	1,039,377.4
Dairy Products	2,009.2	818.5	22,668.0
Fats and Oils	2,626.5	841.7	12,781.4
Grain Mill Products	928.2	827.0	6,469.3
Sugar & Sugar Products	1,493.5	527.7	4,490.8
Cocoa, Chocolate and Confectionery Products	456.7	230.6[a]	5,368.7
Malt and Malt Beverage	421.8	877.9[a]	6,232.2
Tobacco and Tobacco Products	752.6	307.8[a]	8,059.9
Textiles	3,452.4	1,432.8	15,770.8
Men's Clothing	440.9	310.2	6,590.1
Leather Products	366.6	110.8	1,091.8
Footwear	836.2	343.5	3,975.5
Sawmill Products	1,263.4	280.2	9,725.4
Pulp and Paper	1,319.9	861.7	17,335.5
Soap and Detergents	446.1	506.8	5,006.0
Paints	726.7	276.8	5,149.9
Agricultural Fertilizers	1,487.8	389.3	6,971.0
Synthetic Fibres	599.7	595.5[ab]	5,770.1
Petroleum Refining and Products	5,848.4	2,120.2	66,429.4
Tires and Inner Tubes	886.7	397.6	7,143.1
Cement	699.7	451.9	2,334.3
Bricks	743.1	130.9	1,410.7
Iron and Steel	5,930.7	2,626.9	42,211.7
Bolts, Nuts, Rivets and Washers	320.4	78.2	2,581.3
Agricultural Machinery	1,438.7	148.1	8,530.9
Radio and TV Receivers	1,107.4	388.4	4,443.6
Electric Lamps and Bulbs	64.4	36.4	1,211.7
Motor Vehicles	7,108.4	3,154.1	70,031.8
Total in our sample	43,776.1	19,071.5	349,784.9
as % of Total Manufacturing Output	45.47	49.66	33.65

a) indirect taxes and subsidies are deducted (see table 2.4).
b) includes 363.6 million US$ (excl. indirect taxes and subsidies) for petroleum refining, which are not shown in the census Resumen General but taken from Sistema de Cuentas Nacionales de Mexico.

Note: Figures are converted at the official exchange rate of 8.13 cruzeiros to the US$ and 12.50 pesos to the US$.

Source: Brazil and Mexico: derived from table 3.1; US figures from Annual Survey of Manufactures 1975-1976.

TABLE 3.3
Quantities (Matched Output), Brazil (1975)/USA (1977)

	at Brazilian "prices"			at US "prices"		
	Brazil 1975 (1975 Cr.	USA 1977 million)	Brazil/ USA (%)	Brazil 1975 (1977 US$	USA 1977 million)	Brazil/ USA (%)
Dairy Products	13,818.8	110,294.5	12.53	2,082.2	15,596.8	13.35
Fats and Oils	12,418.8	69,172.9	17.95	1,355.7	9,268.7	14.63
Grain Mill Products	6,177.9	30,139.3	20.50	726.3	3,216.9	22.58
Cane Sugar and Products	11,714.4	10,408.6	112.55	2,674.8	2,146.2	124.63
Cocoa, Chocolate and Confectionery Products	1,455.4	5,422.8	26.84	353.0	1,421.0	24.84
Malt and Malt Beverages	3,019.0	41,437.1	7.29	532.4	6,699.0	7.95
Tobacco and Tobacco Products	5,516.0	33,944.4	16.25	1,484.3	8,123.6	18.27
Textiles	26,736.4	170,919.1	15.64	4,147.2	17,802.9	23.29
Men's Clothing	2,721.1	23,818.2	11.42	388.8	3,403.3	11.42
Leather Products	1,247.4	2,605.9	47.87	315.8	654.0	48.28
Footwear	5,713.9	17,106.6	33.40	1,273.4	3,660.4	34.79
Sawmill Products	7,968.1	101,254.1	7.87	960.1	10,710.3	8.96
Pulp and Paper	7,064.8	131,561.4	5.37	856.3	13,296.5	6.44
Soap and Detergents	3,437.9	19,666.5	17.48	814.8	2,717.4	29.99
Paints	3,537.6	14,482.0	24.43	773.5	2,972.2	26.02
Agricultural Fertilizers	4,899.3	49,083.5	9.98	402.0	4,213.8	9.54
Synthetic Fibres	4,117.3	68,497.1	6.01	303.4	4,976.4	6.10
Petroleum Refining and Products	18,443.4	908,976.1	2.03	1,548.8	74,147.1	2.09
Tires and Inner Tubes	5,729.5	60,102.4	9.53	562.2	5,212.7	10.79
Cement	4,928.6	16,563.8	29.76	588.4	1,977.6	29.76
Bricks	4,401.1	3,710.9	118.60	1,364.0	1,069.5	127.54
Iron and Steel	30,021.2	222,892.8	13.47	4,638.3	30,059.3	15.43
Bolts, Nuts, Rivets and Washers	1,969.3	5,088.4	38.70	479.9	1,194.6	40.17
Agricultural Machinery	5,464.8	12,772.3	42.79	836.7	1,914.4	43.71
Radio and TV Receivers	5,521.0	40,909.5	13.50	520.1	3,363.6	15.46
Electric Lamps and Bulbs	318.0	4,544.2	7.01	54.9	759.5	7.23
Motor Vehicles	19,769.7	461,396.9	4.28	3,564.9	81,084.0	4.40

Source: See tables 4 for industries A1 to A27 in Statistical Appendix. Includes adjustment for quality differences in the motor vehicles industry.

TABLE 3.4
Quantities (Matched Output), Mexico (1975)/USA (1977)

	at Mexican "prices"			at US "prices"		
	Mexico 1975 (1975 Ps. million)	USA 1977	Mexico/ USA (%)	Mexico 1975 (1977 US$ million)	USA 1977	Mexico/ USA (%)
Dairy Products	6,489.6	200,631.0	3.23	535.2	14,310.6	3.74
Fats and Oils	2,771.0	157,121.7	1.76	186.4	10,181.4	1.83
Grain Mill Products	5,928.1	54,130.5	10.95	380.8	3,321.2	11.46
Cane Sugar and Products	5,188.7	9,252.1	56.08	832.0	1,483.5	56.00
Cocoa, Chocolate and Confectionery Products	1,009.8	11,243.9	8.98	163.8	1,731.1	9.46
Malt and Malt Beverages	9,775.6	88,671.1	11.02	739.4	6,699.0	11.04
Tobacco and Tobacco Products	3,772.3	64,377.6	5.86	582.5	8,123.6	7.17
Textiles	7,202.1	240,724.7	2.99	532.1	17,509.5	3.04
Men's Clothing	1,393.1	45,691.1	3.05	103.8	3,403.3	3.05
Leather Products	632.0	2,793.8	22.62	117.1	603.5	19.41
Footwear	2,893.4	37,768.2	7.66	274.6	3,660.4	7.50
Sawmill Products	2,497.0	186,143.5	1.34	148.2	11,733.4	1.26
Pulp and Paper	7,210.8	327,741.4	2.20	451.9	15,148.7	2.98
Soap and Detergents	5,216.8	43,097.2	12.10	597.6	4,170.2	14.33
Paints	2,397.6	44,100.5	5.44	170.9	3,136.0	5.45
Agricultural Fertilizers	3,498.6	51,679.6	6.77	323.5	4,191.5	7.72
Synthetic Fibres	5,447.1	131,476.1	4.14	252.1	5,827.5	4.33
Petroleum Refining and Products	20,156.7	677,467.8	2.98	2,223.8	72,852.0	3.05
Tires and Inner Tubes	2,421.1	137,548.3	1.76	94.4	4,806.5	1.96
Cement	3,054.5	20,319.9	15.03	297.3	1,977.6	15.03
Bricks	964.5	7,077.2	13.63	91.8	855.2	10.73
Iron and Steel	23,834.3	310,852.4	7.67	2,411.5	27,770.9	8.68
Bolts, Nuts, Rivets and Washers	367.4	11,561.8	3.18	38.0	1,194.6	3.18
Agricultural Machinery	1,081.6	32,975.1	3.28	113.5	1,609.5	7.05
Radio and TV Receivers	3,291.4	55,328.7	5.95	143.5	3,513.6	4.08
Electric Lamps and Bulbs	351.5	12,096.7	2.91	23.7	759.5	3.12
Motor Vehicles	23,598.5	946,475.6	2.49	1,986.1	78,512.6	2.53

Source: See tables 5 for industries A1 to A27 in Statistical Appendix. Includes adjustments for indirect and subsidies for malt and malt beverages, tobacco and tobacco products and petroleum refining and products, and for quality differences in the motor vehicles industry.

TABLE 3.5

Coverage Ratios: Gross Value of Matched Items as a percentage of Total Gross Value of Output (national currencies)

	Brazil/USA		Mexico/USA	
	Brazil 1975	USA 1977	Mexico 1975	USA 1977
Dairy Products	84.60	59.97	63.43	55.02
Fats and Oils	58.16	64.01	26.34	70.31
Grain Mill Products	81.87	56.46	57.35	58.29
Cane Sugar and Products	96.48	72.41	78.66	50.05
Cocoa, Chocolate and Confectionery Products	39.20	20.60	35.03	25.10
Malt and Malt Beverages	88.05	93.67	89.08	93.67
Tobacco and Tobacco Products	90.15	89.76	98.05	89.76
Textiles	95.26	83.00	40.21	81.64
Men's Clothing	75.91	41.87	35.93	41.87
Leather Products	41.85	44.91	45.64	41.45
Footwear	84.05	83.03	67.38	83.03
Sawmill Products	77.58	67.18	71.30	73.59
Pulp and Paper	65.83	60.91	66.94	69.40
Soap and Detergents	94.79	44.64	82.34	68.51
Paints	59.87	44.83	69.29	47.30
Agricultural Fertilizers	40.50	58.92	71.90	58.61
Synthetic Fibres	84.45	67.44	73.18	78.98
Petroleum Refining and Products	38.79	79.44	76.06	78.06
Tires and Inner Tubes	79.48	58.11	48.72	53.58
Cement	86.64	65.00	54.07	65.00
Bricks	72.85	57.75	58.92	46.18
Iron and Steel	62.26	59.43	72.58	54.90
Bolts, Nuts, Rivets and Washers	75.60	35.99	37.57	35.99
Agricultural Machinery	46.72	18.62	58.44	15.65
Radio and TV Receivers	61.32	58.67	67.80	61.29
Electric Lamps and Bulbs	60.84	45.99	77.16	45.99
Motor Vehicles	34.21	68.86	59.86	66.68
Weighted Average 27 industries	61.29	89.10	63.95	88.36

TABLE 3.6
Volume and Unit Value Movements in the USA, 1975 as a percentage of 1977

	1975 Volume 1977=100 "q"	1975 Unit Values 1977=100 "p"
Dairy Products	96.60	90.22
Fats and Oils	98.87	89.28
Grain Mill Products	87.06	130.41
Cane Sugar and Products	80.49	188.25
Cocoa, Chocolate and Confectionery Products	85.37	91.17
Malt and Malt Beverages	87.82	99.22
Tobacco and Tobacco Products	105.01	84.80
Textiles	83.14	88.45
Men's Clothing	95.17	85.20
Leather Products	98.81	75.88
Footwear	101.95	88.47
Sawmill Products	84.76	71.96
Pulp and Paper	84.37	94.12
Soap and Detergents	92.63	89.00
Paints	84.87	91.53
Agricultural Fertilizers	84.94	114.75
Synthetic Fibres	83.06	94.14
Petroleum Refining and Products	85.02	83.72
Tires and Inner Tubes	90.94	87.56
Cement	90.70	84.59
Bricks	91.34	83.39
Iron and Steel	95.67	87.23
Bolts, Nuts, Rivets and Washers	78.33	99.28
Agricultural Machinery	93.75	88.50
Radio and TV Receivers	72.77	106.52
Electric Lamps and Bulbs	85.70	85.61
Motor Vehicles	67.81	87.71

Source: Figures for the quantity adjustment are from US Department of Commerce, 1982 US Industrial Outlook; figures for unit value adjustment from 1977 Census of Manufactures, after quantity adjustment from 1977 to 1975, and Annual Survey of Manufactures 1975-1976.

TABLE 3.7
Quantities (Gross Output), Brazil/USA, 1975

	at Brazilian "prices"			at US "prices"		
	Brazil 1975 (1975 Cr. million)	USA 1975	Brazil/ USA (%)	Brazil 1975 (1975 US$ million)	USA 1975	Brazil/ USA (%)
Dairy Products	16,335.0	177,674.9	9.19	2,220.6	22,668.0	9.80
Fats and Oils	21,353.8	106,841.2	19.99	2,081.2	12,781.4	16.28
Grain Mill Products	7,546.3	46,476.1	16.24	1,157.0	6,469.3	17.88
Cane Sugar and Products	12,142.4	11,569.6	104.95	5,219.2	4,490.8	116.22
Cocoa, Chocolate and Confectionery Products	3,712.6	22,471.2	16.52	821.1	5,368.7	15.29
Malt and Malt Beverages	3,429.0	38,851.5	8.83	600.0	6,232.2	9.63
Tobacco and Tobacco Products	6,118.4	39,714.0	15.41	1,396.2	8,059.9	17.32
Textiles	28,067.8	171,188.9	16.40	3,850.7	15,770.8	24.42
Men's Clothing	3,584.9	54,130.3	6.62	436.4	6,590.1	6.62
Leather Products	2,980.6	5,733.0	51.99	572.5	1,091.8	52.44
Footwear	6,798.2	21,005.0	32.36	1,340.4	3,975.5	33.72
Sawmill Products	10,271.1	127,760.9	8.04	890.7	9,725.4	9.16
Pulp and Paper	10,731.1	182,234.7	5.89	1,224.3	17,335.5	7.06
Soap and Detergents	3,626.9	40,809.5	8.89	765.1	5,006.0	15.28
Paints	5,908.4	27,415.8	21.55	1,182.3	5,149.9	22.96
Agricultural Fertilizers	12,096.1	70,762.1	17.09	1,139.0	6,971.0	16.34
Synthetic Fibres	4,875.7	84,361.9	5.78	338.2	5,770.1	5.86
Petroleum Refining & Products	47,547.5	972,747.8	4.89	3,342.6	66,429.4	5.03
Tires and Inner Tubes	7,209.0	94,064.8	7.66	619.3	7,143.1	8.67
Cement	5,688.3	23,112.7	24.61	574.5	2,334.3	24.61
Bricks	6,041.1	5,869.4	102.93	1,561.4	1,410.7	110.68
Iron and Steel	48,216.3	358,813.7	13.44	6,498.4	42,211.7	15.39
Bolts, Nuts, Rivets and Washers	2,605.0	11,074.7	23.52	630.2	2,581.3	24.41
Agricultural Machinery	11,697.0	64,312.6	18.19	1,585.0	8,530.9	18.58
Radio and TV Receivers	9,003.6	50,735.5	17.75	903.5	4,443.6	20.33
Electric Lamps and Bulbs	523.2	8,467.9	6.18	77.3	1,211.7	6.38
Motor Vehicles	57,791.5	454,325.6	12.72	9,140.8	70,031.8	13.05
Total in our sample	355,900.7	3,272,525.4	10.88	50,167.9	349,784.9	14.34

Source: derived from tables 3.3, 3.5 and 3.6.

TABLE 3.8
Quantities (Gross Output), Mexico/USA, 1975

	at Mexican "prices"			at US "prices"		
	Mexico 1975 (1975 Ps. million)	USA 1975	Mexico/ USA (%)	Mexico 1975 (1975 US$ million)	USA 1975	Mexico/ USA (%)
Dairy Products	10,231.2	352,247.6	2.90	761.2	22,668.0	3.36
Fats and Oils	10,521.4	220,927.9	4.76	631.9	12,781.4	4.94
Grain Mill Products	10,337.4	80,850.2	12.79	865.9	6,469.3	13.39
Cane Sugar and Products	6,596.3	14,878.3	44.34	1,991.0	4,490.8	44.34
Cocoa, Chocolate and Confectionery Products	2,883.0	38,246.6	7.54	426.3	5,368.7	7.94
Malt and Malt Beverages	10,973.8	83,138.3	13.20	823.6	6,232.2	13.21
Tobacco and Tobacco Products	3,847.4	75,320.1	5.11	503.8	8,059.9	6.25
Textiles	17,909.9	245,144.8	7.31	1,170.3	15,770.8	7.42
Men's Clothing	3,877.5	103,839.7	3.73	246.3	6,590.1	3.74
Leather Products	1,385.0	6,660.6	20.79	194.8	1,091.8	17.84
Footwear	4,293.8	46,375.2	9.26	360.5	3,975.5	9.07
Sawmill Products	3,502.0	214,393.2	1.63	149.6	9,725.4	1.54
Pulp and Paper	10,771.5	398,470.4	2.70	635.4	17,335.5	3.67
Soap and Detergents	6,335.6	58,274.5	10.87	645.9	5,006.0	12.90
Paints	3,460.2	79,125.8	4.37	225.8	5,149.9	4.38
Agricultural Fertilizers	4,865.7	74,901.1	6.50	516.3	6,971.0	7.41
Synthetic Fibres	7,443.4	138,278.3	5.38	324.4	5,770.1	5.62
Petroleum Refining and Products	26,502.0	737,885.8	3.59	2,447.7	66,429.4	3.68
Tires and Inner Tubes	4,969.8	233,466.4	2.13	169.7	7,143.1	2.38
Cement	5,648.6	28,354.0	19.92	465.0	2,334.3	19.92
Bricks	1,636.9	13,998.8	11.69	129.9	1,410.7	9.21
Iron and Steel	32,836.9	541,646.8	6.06	2,898.2	42,211.7	6.87
Bolts, Nuts, Rivets and Washers	978.1	25,163.8	3.89	100.3	2,581.3	3.89
Agricultural Machinery	1,850.7	197,493.8	0.94	171.8	8,530.9	2.01
Radio and TV Receivers	4,854.5	65,688.6	7.39	225.5	4,443.6	5.07
Electric Lamps and Bulbs	455.5	22,541.7	2.02	26.3	1,211.7	2.17
Motor Vehicles	39,425.6	962,493.3	4.10	2,910.5	70,031.8	4.16
Total in our sample	238,393.6	5,059,805.7	4.71	20,017.8	349,784.9	5.72

Source: derived from tables 3.4, 3.5 and 3.6.

TABLE 3.9
Value Added (US Census Concept) in Brazil, Mexico and the USA in 1975, at official exchange rates (1975 US dollars)

	Brazil (million dollars)	Mexico (million dollars)	USA (million dollars)
Total Manufacturing Value Added	37,748.2	17,585.6[ab]	442,485.2
Dairy Products	390.9	190.4	4,941.8
Fats and Oils	528.5	169.6	1,649.1
Grain Mill Products	241.7	244.4	1,587.8
Cane Sugar and Products	571.4	257.3	933.9
Cocoa, Chocolate and Confectionery Products	176.3	116.8	2,130.4
Malt and Malt Beverage	248.7	550.0[a]	2,129.8
Tobacco and Tobacco Products	395.0	145.3[a]	3,721.5
Textiles	1,211.3	669.2	6,217.3
Men's Clothing	176.7	137.4	3,166.2
Leather Products	150.6	46.2	443.5
Footwear	405.2	185.7	2,146.0
Sawmill Products	652.3	174.7	3,770.3
Pulp and Paper	571.6	376.3	7.626.1
Soap and Detergents	169.7	216.3	2,419.7
Paints	275.9	127.8	2,126.3
Agricultural Fertilizers	445.5	180.9	3,306.1
Synthetic Fibres	234.9	316.1	2,285.8
Petroleum Refining and Products	1,457.4	623.2[ab]	9,332.3
Tires and Inner Tubes	388.6	236.4	3,462.8
Cement	382.3	276.0	1,332.9
Bricks	542.2	69.4	834.0
Iron and Steel	1,795.4	1,082.8	15,783.2
Bolts, Nuts, Rivets and Washers	195.4	46.8	1,459.8
Agricultural Machinery	525.0	69.3	3,898.6
Radio and TV Receivers	447.3	205.3	1,542.5
Electric Lamps and Bulbs	24.5	23.0	819.2
Motor Vehicles	1,772.6	1,163.3	21,465.9
Total in our sample	14,376.8	7,899.8	110,532.8
as % of Total Manufacturing	38.09	44.92	24.98

a) indirect taxes and subsidies are deducted (see table 2.3).
b) includes 571.8 million US$ (excl. indirect taxes and subsidies) for petroleum refining, which are not shown in the census Resumen General but taken from Sistema de Cuentas Nacionales de Mexico.

Notes: Figures are converted at the exchange rate of 8.13 cruzeiros to the US$ and 12.5 pesos to the US$.

Source: Figures for Brazil from Censo Industrial, figures for Mexico from Resumen General (except for figures mentioned under footnotes a) and b)), and figures for USA from the Annual Survey of Manufactures 1975-1976.

TABLE 3.10
Value Added (US Census Concept) as a percentage of Gross Value of Output, 1975, in national currencies

	Brazil	Mexico	USA
Total Manufacturing	39.21	45.79	42.57
Dairy Products	19.45	23.26	21.80
Fats and Oils	20.12	20.15	12.90
Grain Mill Products	26.04	29.55	24.54
Cane Sugar and Products	38.26	48.76	20.80
Cocoa, Chocolate and Confectionery Products	38.60	50.65	39.68
Malt and Malt Beverages	58.97	62.65	34.17
Tobacco and Tobacco Products	52.49	47.22	46.17
Textiles	35.08	46.70	39.42
Men's Clothing	40.06	44.28	48.04
Leather Products	41.07	41.74	40.62
Footwear	48.46	54.05	53.98
Sawmill Products	51.63	62.36	38.77
Pulp and Paper	43.31	43.67	43.99
Soap and Detergents	38.04	42.68	48.34
Paints	37.96	46.16	41.29
Agricultural Fertilizers	29.94	46.48	47.43
Synthetic Fibres	39.16	53.08	39.61
Petroleum Refining and Products	24.92	29.39	14.05
Tires and Inner Tubes	43.82	59.45	48.48
Cement	54.63	61.07	57.10
Bricks	72.97	52.98	59.12
Iron and Steel	30.27	41.22	37.39
Bolts, Nuts, Rivets and Washers	60.98	59.84	56.55
Agricultural Machinery	36.49	46.83	45.70
Radio and TV Receivers	40.39	52.85	34.71
Electric Lamps and Bulbs	38.07	63.18	67.61
Motor Vehicles	24.94	36.88	30.65
Weighted average 27 industries	*32.84*	*41.42*	*31.60*

Source: Derived from tables 3.2 and 3.9.

TABLE 3.11
Quantities (Value Added, US Census Concept), Brazil/USA, 1975

	at Brazilian "prices"			at US "prices"		
	Brazil 1975 (1975 Cr.	USA 1975 million)	Brazil/ USA (%)	Brazil 1975 (1975 US$	USA 1975 million)	Brazil/ USA (%)
Dairy Products	3,177.9	38,734.5	8.20	432.0	4,941.8	8.74
Fats and Oils	4,297.1	13,785.0	31.17	418.8	1,649.1	25.40
Grain Mill Products	1,965.1	11,406.9	17.23	301.3	1,587.8	18.97
Cane Sugar and Products	4,645.4	2,406.0	193.07	1,996.7	933.9	213.80
Cocoa, Chocolate and Confectionery Products	1,433.2	8,917.2	16.07	317.0	2,130.4	14.88
Malt and Malt Beverages	2,021.9	13,277.2	15.23	353.8	2,129.8	16.61
Tobacco and Tobacco Products	3,211.7	18,337.2	17.51	732.9	3,721.5	19.69
Textiles	9,847.6	67,487.5	14.59	1,351.0	6,217.3	21.73
Men's Clothing	1,436.2	26,006.8	5.52	174.8	3,166.2	5.52
Leather Products	1,224.2	2,328.8	52.57	235.2	443.5	53.02
Footwear	3,294.5	11,338.6	29.06	649.6	2,146.0	30.27
Sawmill Products	5,303.0	49,529.8	10.71	459.9	3,770.3	12.20
Pulp and Paper	4,647.5	80,167.3	5.80	530.2	7,626.1	6.95
Soap and Detergents	1,379.8	19,725.7	6.99	291.0	2,419.7	12.03
Paints	2,243.0	11,319.5	19.82	448.9	2,126.3	21.11
Agricultural Fertilizers	3,621.5	33,560.0	10.79	341.0	3,306.1	10.31
Synthetic Fibres	1,909.4	33,419.6	5.71	132.5	2,285.8	5.80
Petroleum Refining and Products	11,848.5	136,656.0	8.67	833.0	9,332.3	8.93
Tires and Inner Tubes	3,159.1	45,600.3	6.93	271.4	3,462.8	7.84
Cement	3,107.7	13,197.5	23.55	313.9	1,332.9	23.55
Bricks	4,408.5	3,470.0	127.05	1,139.4	834.0	136.62
Iron and Steel	14,596.4	134,162.5	10.88	1,967.2	15,783.2	12.46
Bolts, Nuts, Rivets and Washers	1,588.5	6,263.0	25.36	384.3	1,459.8	26.33
Agricultural Machinery	4,268.4	29,390.7	14.52	578.4	3,898.6	14.84
Radio and TV Receivers	3,636.9	17,611.7	20.65	365.0	1,542.5	23.66
Electric Lamps and Bulbs	199.2	5,724.9	3.48	29.4	819.2	3.59
Motor Vehicles	14,411.4	139,258.3	10.35	2,279.4	21,465.9	10.62
Total in our sample	116,883.4	985,082.5	12.01	17,327.9	110,532.8	15.68

Source: Derived from tables 3.7, 3.10 and Censo Industrial. Includes adjustment for quality differences in the motor vehicles industry.

TABLE 3.12
Quantities (Value Added, US Census Concept), Mexico/USA, 1975

	at Mexican "prices"			at US "prices"		
	Mexico 1975 (1975 Ps. million)	USA 1975	Mexico/ USA (%)	Mexico 1975 (1975 US$ million)	USA 1975	Mexico/ USA (%)
Dairy Products	2,379.4	76,792.7	3.10	177.0	4,941.8	3.58
Fats and Oils	2,120.1	28,504.9	7.44	127.3	1,649.1	7.72
Grain Mill Products	3,054.8	19,843.6	15.39	255.9	1,587.8	16.12
Cane Sugar and Products	3,216.1	3,094.1	103.95	970.7	933.9	103.95
Cocoa, Chocolate and Confectionery Products	1,460.1	15,177.3	9.62	215.9	2,130.4	10.14
Malt and Malt Beverages	6,874.8	28,411.8	24.20	515.9	2,129.8	24.22
Tobacco and Tobacco Products	1,816.8	34,777.6	5.22	237.9	3,721.5	6.39
Textiles	8,364.7	96,643.1	8.66	546.6	6,217.3	8.79
Men's Clothing	1,717.0	49,889.5	3.44	109.1	3,166.2	3.44
Leather Products	578.1	2,705.6	21.37	81.3	443.5	18.33
Footwear	2,320.7	25,033.6	9.27	194.8	2,146.0	9.08
Sawmill Products	2,183.7	83,115.0	2.63	93.3	3,770.3	2.47
Pulp and Paper	4,704.3	175,292.0	2.68	277.5	7,626.1	3.64
Soap and Detergents	2,704.2	28,167.6	9.60	275.7	2,419.7	11.39
Paints	1,597.0	32,669.6	4.89	104.2	2,126.3	4.90
Agricultural Fertilizers	2,261.7	35,523.0	6.37	240.0	3,306.1	7.26
Synthetic Fibres	3,951.1	54,778.4	7.21	172.2	2,285.8	7.53
Petroleum Refining and Products	7,789.5	103,661.5	7.51	719.4	9,332.3	7.71
Tires and Inner Tubes	2,954.4	113,178.8	2.61	100.9	3,462.8	2.91
Cement	3,449.5	16,190.3	21.31	284.0	1,332.9	21.31
Bricks	867.2	8,276.1	10.48	68.8	834.0	8.25
Iron and Steel	13,535.1	202,524.9	6.68	1,194.6	15,783.2	7.57
Bolts, Nuts, Rivets and Washers	585.3	14,230.8	4.11	60.0	1,459.8	4.11
Agricultural Machinery	866.6	90,254.2	0.96	80.5	3,898.6	2.06
Radio and TV Receivers	2,565.7	22,802.4	11.25	119.2	1,542.5	7.73
Electric Lamps and Bulbs	287.8	15,239.9	1.89	16.6	819.2	2.03
Motor Vehicles	14,541.6	295,020.1	4.93	1,073.5	21,465.9	5.00
Total in our sample	98,746.6	1,671,798.2	5.91	8,312.8	110,532.8	7.52

Source: Derived from tables 3.8, 3.10 and Resumen General. Includes adjustments for indirect taxes and subsidies for malt and malt beverages, tobacco and tobacco products and petroleum refining and products, and for quality differences in the motor vehicles industry.

TABLE 3.13
Purchasing Power Parities, Brazil/USA (Cruzeiros to the US$) and Mexico/USA (Pesos to the US$), 1975

	PPP: Cruzeiros/US $			PPP: Pesos/US $		
	US Quantity Weights (1)	Brazil Quantity Weights (2)	Geometric Average (3)	US Quantity Weights (4)	Mexico Quantity Weights (5)	Geometric Average (6)
Dairy Products	7.84	7.36	7.59	15.54	13.44	14.45
Fats and Oils	8.36	10.26	9.26	17.29	16.65	16.97
Grain Mill Products	7.18	6.52	6.85	12.50	11.94	12.21
Cane Sugar and Products	2.58	2.33	2.45	3.31	3.31	3.31
Cocoa, Chocolate, Confectionery	4.19	4.52	4.35	7.12	6.76	6.94
Malt and Malt Beverages	6.23	5.71	5.97	13.34	13.32	13.33
Tobacco and Tobacco Products	4.93	4.38	4.65	9.35	7.64	8.45
Textiles	10.85	7.29	8.90	15.54	15.30	15.42
Men's Clothing	8.21	8.21	8.21	15.76	15.74	15.75
Leather Products	5.25	5.21	5.23	6.10	7.11	6.59
Footwear	5.28	5.07	5.18	11.66	11.91	11.79
Sawmill Products	13.14	11.53	12.31	22.04	23.42	22.72
Pulp and Paper	10.51	8.77	9.60	22.99	16.95	19.74
Soap and Detergents	8.13	4.74	6.21	11.61	9.81	10.67
Paints	5.32	5.00	5.16	15.36	15.32	15.34
Agricultural Fertilizers	10.15	10.62	10.38	10.74	9.42	10.06
Synthetic Fibres	14.62	14.41	14.52	23.96	22.95	23.45
Petroleum Refining and Products	14.64	14.22	14.43	11.11	10.83	10.97
Tires and Inner Tubes	13.17	11.64	12.38	32.68	29.29	30.94
Cement	9.90	9.90	9.90	12.15	12.15	12.15
Bricks	4.16	3.87	4.01	9.92	12.60	11.18
Iron and Steel	8.50	7.42	7.94	12.83	11.33	12.06
Bolts, Nuts, Rivets and Washers	4.29	4.13	4.21	9.75	9.75	9.75
Agricultural Machinery	7.54	7.38	7.46	23.15	10.77	15.79
Radio and TV Receivers	11.42	9.96	10.67	14.78	21.53	17.84
Electric Lamps and Bulbs	6.99	6.77	6.88	18.60	17.31	17.95
Motor Vehicles	6.49	6.32	6.40	13.74	13.55	13.64
Weighted average PPP for sample (value added -US census concept-weights)	8.80	6.75	7.71	15.12	11.83	13.37
Exchange Rates	8.13	8.13	8.13	12.50	12.50	12.50

Source and note:
Cruzeiros/US$ PPPs derived from table 3.11; Pesos/US$ PPPs derived from table 3.12. Includes adjustments for indirect taxes and subsidies for malt and malt beverages, tobacco and tobacco products and petroleum refining and products in the Mexico/USA comparison, and for quality differences in the motor vehicles industry in both country comparisons.

TABLE 3.14
Purchasing Power Parities by Major Branch of Manufacturing
Brazil/USA (Cruzeiros to the US$) and Mexico/USA (Pesos to the US$), 1975

	PPP: Cruzeiros/US $			PPP: Pesos/US $		
	US Quantity Weights	Brazil Quantity Weights	Geometric Average	US Quantity Weights	Mexico Quantity Weights	Geometric Average
Food Products	6.69	4.48	5.47	12.76	7.00	9.45
Beverage Products	6.23	5.71	5.97	13.34	13.32	13.33
Tobacco Products	4.93	4.38	4.65	9.35	7.64	8.45
Textiles	10.85	7.29	8.90	15.54	15.30	15.42
Wearing Apparel	8.21	8.21	8.21	15.76	15.74	15.75
Wood Products and Furniture	13.14	11.53	12.31	22.04	23.42	22.72
Paper Products, Printing and Publishing	10.51	8.77	9.60	22.99	16.95	19.74
Chemical Products	12.05	10.26	11.12	13.09	11.82	12.44
Footwear, Leather, Rubber and Plastic Products	9.79	6.64	8.06	23.28	15.53	19.01
Stone, Clay and Glass Products	7.69	5.17	6.31	11.29	12.24	11.75
Basic Metals and Metal products	8.14	6.88	7.49	12.57	11.25	11.89
Machinery and Transport Equipment	6.65	6.54	6.59	15.19	13.35	14.24
Electric Engineering	9.88	9.73	9.80	16.11	21.01	18.40
Other Manufacturing[a]	8.82	6.88	7.79	15.54	11.92	13.61
Total Manufacturing weighted at value added (US census concept)	8.82	6.88	7.79	15.54	11.92	13.61
weighted at value added (former national accounts concept)	8.77	6.91	7.79	15.62	11.97	13.67

a) weighted at value added (US census concept).

Source and note:
PPPs from table 3.13. The PPP for food products is the weighted average for dairy products, fats and oils, grain mill products, sugar and cocoa, chocolate and confectionery products. The PPP for footwear, leather, rubber and plastic products is the weighted average for leather products, footwear and tires and tubes. The PPP for chemical products is a weighted average for soap and detergents, paints, agricultural fertilizers, synthetic fibres and petroleum refining and products. The PPP for stone, clay and glass products is a weighted average for cement and bricks. The PPP for basic metals and metal products is a weighted average for iron and steel and bolts, nuts etc.. The PPP for electric engineering is the weighted average for radio and TV receivers and electric lamps and bulbs. The PPP for machinery and transport equipment is the weighted average for agricultural machinery and motor vehicles. In all cases value added figures (US census concept) were used as weights, but for total manufacturing we also show the cruzeiro/US$ PPPs and peso/US$ PPPs which are derived by weighting the PPPs at value added (former national accounts concept).

TABLE 3.15
Quantities (Value Added, Former National Accounts Concept) by Major Branch of Manufacturing, Brazil/USA, 1975

	at Brazilian "prices"			at US "prices"		
	Brazil 1975 (1975 Cr. million)	USA 1975	Brazil/ USA (%)	Brazil 1975 (1975 US$ million)	USA 1975	Brazil/ USA (%)
Food Products	30,254[a]	173,292	17.46	6,757	25,892	26.10
Beverages	4,565	32,738	13.94	799	5,251	15.21
Tobacco Products	2,987	12,412	24.06	682	2,519	27.06
Textiles	15,723	103,620	15.17	2,157	9,546	22.60
Wearing Apparel	7,217[b]	91,839	7.86	879	11,181	7.86
Wood Products	12,035	193,978	6.20	1,044	14,766	7.07
Paper Products, Printing and Publishing	15,661	330,872	4.73	1,787	31,475	5.68
Chemical Products	40,015[a]	404,654	9.89	3,899	33,572	11.61
Footwear, Leather, Rubber and Plastic Products	14,237[b]	114,632	12.42	2,144	11,706	18.31
Stone, Clay and Glass Products	15,365	84,887	18.10	2,971	11,036	26.92
Basic Metals and Metal Products	31,176	437,931	7.12	4,530	53,774	8.42
Machinery and Transport Equipment	44,231	515,166	8.59	6,767	77,480	8.73
Electric Engineering	15,437	272,536	5.66	1,587	27,581	5.75
Other	8,109	143,128	5.67	1,173	16,325	7.18
Total Manufacturing	257,012	2,911,686	8.83	37,173	332,104	11.19

a) vegetable and animal fats and oils (2,495.5 million cruzeiros) were reallocated from chemicals to food products.
b) the footwear industry (2,675.9 million cruzeiros) was reallocated from wearing apparel to footwear and leather.

Note: The breakdown between food products and beverages for the US on a national accounts basis was assumed to be proportionately the same as on a US Census basis (1975 figures derived from Annual Survey of Manufactures).

Source: Brazil value added in national currencies from Censo Industrial (see table 2.1 which does not exclude bank costs). US value added in national currencies from National Income and Product Accounts of the United States: 1929-82 Statistical Tables (1986) after adjustment for inventories, indirect taxes and subsidies (see table 2.7) and net interest. PPPs from table 3.14.

TABLE 3.16
Quantities (Value Added, Former National Accounts Concept) by Major Branch of Manufacturing, Mexico/USA, 1975

	at Mexican "prices"			*at US "prices"*		
	Mexico 1975 (1975 Ps. million)	USA 1975	Mexico/ USA (%)	Mexico 1975 (1975 US$ million)	USA 1975	Mexico/ USA (%)
Food Products	20,582[a]	330,263	6.23	2,940	25,892	11.35
Beverages	8,170[b]	70,055	11.66	613	5,251	11.67
Tobacco Products	1,177[b]	23,540	5.00	154	2,519	6.12
Textiles	11,024	148,385	7.43	720	9,546	7.55
Wearing Apparel	4,309	176,178	2.45	274	11,181	2.45
Wood Products	3,641	325,512	1.12	155	14,766	1.05
Paper Products, Printing and Publishing	9,481[abc]	723,478	1.31	559	31,475	1.78
Chemical Products	26,091[abc]	439,346	5.94	2,208	33,572	6.58
Footwear, Leather, Rubber and Plastic Products	8,736	272,555	3.21	563	11,706	4.81
Stone, Clay and Glass Products	8,857	124,607	7.11	724	11,036	6.56
Basic Metals and Metal Products	23,949	675,974	3.54	2,128	53,774	3.96
Machinery and Transport Equipment	19,423	1,176,883	1.65	1,455	77,480	1.88
Electric Engineering	9,557	444,275	2.15	455	27,581	1.65
Other	2,494	254,923	0.98	208	16,325	1.28
Total	157,489	5,185,975	3.04	13,156	332,104	3.96

a) vegetable and animal fats and oils (135.7 million pesos) were reallocated from chemicals to food products.
b) indirect taxes and subsidies are deducted (see table 2.4).
c) includes 3,831.7 million pesos (excl.indirect taxes and subsidies) for petroleum refining, which are not shown in the census Resumen General but taken from Sistema de Cuentas Nacionales de Mexico.

Note: The breakdown between food products and beverages for the US on a national accounts basis was assumed to be proportionately the same as on a US Census basis (1975 figures derived from Annual Survey of Manufactures).

Source: Mexican value added in national currencies from Resumen General (see table 2.4 which does not exclude bank costs). US value added in national currencies from National Income and Product Accounts of the United States: 1929-82 Statistical Tables (1986) after adjustment for inventories, indirect taxes and subsidies (see table 2.6) and net interest. PPPs from table 3.14.

TABLE 3.17
Comparison of Our Weighted Average PPPs for Manufacturing as a Whole and the Augmented Binaries of the ICP Expenditure Items with a Manufacturing Content

	Brazil/USA			Mexico/USA		
	US Quantity Weights	Brazil Quantity Weights	Geometric Average	US Quantity Weights	Mexican Quantity Weights	Geometric Average
Sample PPP	8.80	6.75	7.71	15.12	11.83	13.37
Reweighted PPP (by major branch)	8.77	6.91	7.79	15.62	11.97	13.67
ICP III Augmented PPP	8.93	6.17	7.42	12.58	9.04	10.66

Note: All our PPPs are adjusted for quality differences in passenger cars.

Source: Top line from table 3.13. Second line derived from tables 3.15 and 3.16 for Brazil/USA and Mexico/USA respectively. Third line derived from Kravis, Heston and Summers (1982) p. 255 and 272, as follows: the ICP III augmented binary PPPs for expenditure on the consumer items food, beverages, tobacco, clothing, footwear, furniture, appliances and transport equipment, and for producers durables were used to make the weighted average. These are the ICP PPPs which are conceptually closest to our type of comparison. The preferred PPPs of the ICP itself are in "international dollars".

CHAPTER IV

EXTRAPOLATION OF THE BINARY COMPARISONS OF REAL OUTPUT AND PURCHASING POWER PARITIES, BRAZIL/USA AND MEXICO/USA FROM 1975 TO 1985

In the previous chapter we presented the results of the benchmark comparison for a single year, i.e. 1975. For the three countries considered here this type of comparison can be repeated every five years, as they hold censuses on a quinquennial basis. It would be desirable to repeat the present comparison for 1975 for a more recent year, but this requires a large amount of new work which we were not able to undertake.

As an alternative one can extrapolate the benchmark year comparison of value added from 1975 using national time series. There are two different ways to do this. The first approach is to merge two types of information by applying the growth rates of real output for each country (at national weights) to our 1975 benchmark figure for each country. The second method is to extrapolate the PPP on the basis of manufacturing producer price indices for each country. The extrapolated PPPs can then be used to convert the value added for a later year to a common currency. Below we show the details of the adjustment using the first method, and we also discuss the conditions under which the second method will lead to the same results.
Here we have made the extrapolation for the period 1975-85. For a longer period covering almost four decades from 1950 to 1987, see Van Ark (1993).

Method (i)

Table 4.1 shows US gross value added (former national accounts concept) for our 14 manufacturing branches for 1975 and 1985 in 1975 prices. The extrapolation was based on the time series for the volume of manufacturing GDP (i.e. "gross product originating") at 1982 prices contained in US national accounts. Corresponding figures for gross value added at constant prices in manufacturing from the Brazilian and Mexican national accounts are shown in tables 4.2 and 4.3 respectively.

The change in real gross value added at constant prices is applied to our 1975 benchmark estimates of manufacturing value added (former national accounts concept) shown in tables 3.15 and 3.16 above for Brazil/USA and Mexico/USA respectively. Table 4.4 shows value added by manufacturing branch in Brazil and the USA in cruzeiros and in US dollars in 1985. The relative level of manufacturing value added in the two countries in 1985 was virtually the same as in 1975 (see table 3.15). At branch level there were some changes, i.e. a substantial rise in the relative value added in tobacco products, wood and paper products and basic metals and metal products and a fall in footwear, leather and rubber and plastic products and also in machinery and transport equipment. Table 4.5 compares manufacturing value added for 1985 in Mexico and the USA. Comparing table 3.16 and table 4.5 shows a slight rise in relative value added between 1975 and 1985 for all manufacturing branches in Mexico compared to the USA.

Method (ii)

The extrapolation procedure on the basis of real output can be replicated for the purchasing power parities, which can be extrapolated to 1985

using manufacturing producer price indices. The latter are the deflators for manufacturing GDP in the national accounts. The Brazilian deflator for manufacturing rose 936 fold between 1975 and 1985 compared to a 60 per cent rise in the USA. As a result the manufacturing PPP in 1985 was 4,568 cruzeiros to the US dollar. The manufacturing deflator for Mexico rose 29 fold between 1975 and 1985 so we arrive at an estimate of manufacturing PPP of 245 pesos to the US dollar. It appeared that the extrapolated cruzeiro/US dollar PPP for 1985 of 4,568 cruzeiros was well below the 1985 exchange rate of 6,200 cruzeiros. For Mexico/USA the 1985 PPP of 245 pesos was close to the exchange rate of 257 pesos.

If the quantity and price indices are compatible, i.e. when multiplied they yield a correct estimate of the change in value added in current prices between two years, both methods described above will yield the same result. However, if the value added in current prices in 1985 is derived from an independent source (for example, from the manufacturing census for 1985) the alternative methods will not necessarily lead to the same result.

It should be emphasised that neither of the above procedures for extrapolating our 1975 benchmark to 1985 would necessarily yield the same result obtained from a new "independent" benchmark comparison. Firstly, there can be differences between countries in the way their time series are constructed. Secondly, the methods and procedures used to make comparisons for different benchmark years can differ. Finally, there are typical index number problems related to differences in weights used for the benchmarks and the time series which prevent one from arriving at an identical result between an independent benchmark result and a comparative estimate which is updated from another year. In the Penn World Tables, which aim to link the PPPs from various ICP rounds, Summers and Heston (1991) approached this problem by smoothing out differences between benchmarks and time series by way of a consistentisation technique (originally developed by Stone, Champernowne and Meade, 1942). In our view, as there is no unique or straightforward solution to this problem, it is desirable to replicate benchmark comparison at regular intervals and to carefully scrutinise the reasons for differences between extrapolated results and new benchmarks.

TABLE 4.1
Gross Value Added (Former National Accounts Concept)
in US Manufacturing, 1975 and 1985, in 1975 prices

	Gross Value Added in 1975 at 1975 Factor Cost mln. US$	1985 as a % 1975	Gross Value Added in 1985 at 1985 Factor Cost mln. US$
Food Products	25,892	131.9[a]	34,150
Beverages	5,251	139.6[a]	7,331
Tobacco Products	2,519	62.6	1,576
Textiles	9,546	131.5	12,556
Wearing Apparel	11,181	107.6	12,035
Wood Products and Furniture	14,766	128.7	19,003
Paper Products, Printing and Publishing	31,475	134.8	42,417
Chemicals	33,572	159.9	53,688
Footwear, Leather, Rubber and Plastic Products	11,706	154.3	18,058
Stone, Clay and Glass Products	11,036	110.9	12,235
Basic Metals and Metal Products	53,774	100.5	54,037
Machinery and Transport Equipment	77,480	156.2	120,999
Electric Engineering	27,581	195.4	53,894
Other Manufacturing	16,325	128.4	20,967
Total Manufacturing	332,104	138.4[b]	459,496

a) The estimate for beverages was derived on the basis of the rise in census value added at current prices from the Annual Survey of Manufactures for 1975 and 1985 deflated by the producer price index for beverages. The estimate for food products was derived from this index and the index for total food and kindred products from the national accounts.
b) The index of total value added for manufacturing is slightly different from what can be implicitly obtained by adding branch figures. This is due to the fact that the national accounts index in based on 1982 price weights instead of 1975 weights. By adding the branch figures the index for total manufacturing is 139.4.

Source: Value added in 1975 from table 2.7; GDP index at 1982 prices from US Dept. of Commerce, The National Income and Product Accounts of the United States 1929-1982, Statistical Tables, and Survey of Current Business, January 1991.

TABLE 4.2

Gross Value Added (Former National Accounts Concept) by Major Branch in Manufacturing in Brazil, 1975 and 1985, in 1975 prices

	Gross Value Added in 1975 at 1975 Factor Cost mln. Cruzeiros	1985 as a % 1975	Gross Value Added in 1985 at 1985 Factor Cost mln. Cruzeiros
Food Products	30,254	137.2	41,523
Beverages	4,565	138.3	6,315
Tobacco Products	2,987	159.0	4,748
Textiles	15,723	116.7	18,353
Wearing Apparel	7,217	133.1	9,604
Wood Products and Furniture	12,035	137.4[a]	16,540
Paper Products, Printing and Publishing	15,661	200.3	31,374
Chemicals	40,015	175.4	70,197
Footwear, Leather, Rubber and Plastic Products	14,237	136.5	19,431
Stone, Clay and Glass Products	15,365	120.5	18,516
Basic Metals and Metal Products	31,176	142.6	44,471
Electric Engineering	15,437	161.5	24,926
Machinery and Transport Equipment	44,231	101.1	44,725
Other Manufacturing	8,109	137.4[a]	11,145
Total Manufacturing	257,012	137.4[b]	353,221

a) Estimates for wood products and other manufacturing were derived from the index for total manufacturing.

b) The index of total gross value added for manufacturing is slightly different from what can be implicitly obtained by adding branch figures. This is due to the fact that the national accounts index is based on 1980 price weights instead of 1975 weights. By adding the branch figures the index is 140.8.

Source: Gross value added in 1975 from table 3.15; index of gross value added is based on the revised national accounts estimates by Maria Alice Gusmao Veloso, "Brazilian National Accounts, 1947-1985", IBGE, Rio de Janeiro, 1987.

TABLE 4.3
Gross Value Added (Former National Accounts Concept) by Major Branch in Manufacturing in Mexico, 1975 and 1985, in 1975 prices

	Gross Value Added in 1975 at 1975 Factor Cost mln. Pesos	1985 as a % 1975	Gross Value Added in 1985 at 1985 Factor Cost mln. Pesos
Food Products, Beverages and Tobacco Products	29,929	150.3	44,971
Textiles and Wearing Apparel	15,333	128.7	19,736
Wood Products	3,641	137.0	4,986
Paper Products, Printing and Publishing	9,481	166.7	15,801
Chemicals, Footwear, Leather, Rubber and Plastic Products	34,827	187.8	65,417
Stone, Clay and Glass Products	8,857	144.8	12,827
Basic Metals and Metal Products	23,949	141.5	33,880
Machinery, Transport Equipment and Electric Engineering	28,980	135.3	39,196
Other Manufacturing	2,494	139.1	3,470
Total Manufacturing	157,489	151.2[a]	238,094

a) The index of total gross value added for manufacturing is slightly different from what can be implicitly obtained by adding branch figures. This is due to the fact that the national accounts index is based on 1980 price weights instead of 1975 weights. By adding the branch figures the index is 152.6.

Source: Gross value added in 1975 from table 3.16; index of gross value added is based on the revised national accounts estimates from Wharton-CIMIEX, Perspectivas Economicas de Mexico, July 1985 and March 1988.

TABLE 4.4

Quantities (Value Added, Former National Accounts Concept) by Major Branch of Manufacturing, Brazil/USA, 1985, updated from 1975

	at Brazilian "prices"			at US "prices"		
	Brazil 1985 (1975 Cr. million)	USA 1985	Brazil/ USA (%)	Brazil 1985 (1975 US$ million)	USA 1985	Brazil/ USA (%)
Food Products	41,523	228,569	18.17	9,273	34,150	27.15
Beverages	6,315	45,703	13.82	1,105	7,331	15.07
Tobacco Products	4,748	7,766	61.14	1,083	1,576	68.74
Textiles	18,353	136,291	13.47	2,518	12,556	20.05
Wearing Apparel	9,604	98,855	9.72	1,169	12,035	9.72
Wood Products	16,540	249,641	6.63	1,434	19,003	7.55
Paper Products, Printing and Publishing	31,374	445,901	7.04	3,579	42,417	8.44
Chemicals	70,197	647,116	10.85	6,840	53,688	12.74
Footwear, Leather, Rubber and Plastic Products	19,431	176,830	10.99	2,926	18,058	16.20
Stone, Clay and Glass Products	18,516	94,109	19.68	3,580	12,235	29.26
Basic Metals and Metal Products	44,471	440 070	10.11	6,461	54,037	11.96
Electric Engineering	24,926	532,545	4.68	2,563	53,894	4.75
Machinery and Transport Equipment	44,725	804,526	5.56	6,842	120,999	5.65
Other Manufacturing	11,145	183,824	6.06	1,612	20,967	7.69
Total Manufacturing	353,221	4,028,585	8.77	51,088	459,496	11.12

Source: tables 3.15, 4.1 and 4.2.

TABLE 4.5

Quantities (Value Added, Former National Accounts Concept) by Major Branch of Manufacturing, Mexico/USA, 1985, updated from 1975

	at Mexican "prices"			at US "prices"		
	Mexico 1985	USA 1985	Mexico/ USA	Mexico 1985	USA 1985	Mexico/ USA
	(1975 Ps. million)		(%)	(1975 US$ million)		(%)
Food Products, Beverages and Tobacco Products	44,971	542,166	8.29	5,570	43,058	12.49
Textiles and Wearing Apparel	19,736	385,068	5.13	1.279	24,591	5.20
Wood Products	4,986	418,917	1.19	213	19,003	1.12
Paper Products, Printing and Publishing	15,801	974,998	1.62	932	42,417	2.20
Chemicals, Footwear, Leather, Rubber and Plastic Products	65,417	1,128,043	5.80	5,204	71,745	7.25
Stone, Clay and Glass Products	12,827	138,143	9.29	1,048	12,235	8.57
Basic Metals and Metal Products	33,880	679,276	4.99	3,010	54,037	5.57
Electric Engineering, Machinery and Transport Equipment	39,196	2,698,716	1.45	2,583	174,893	1.48
Other Manufacturing	3,470	327,406	1.06	290	20,967	1.38
Total Manufacturing	238,094	7,175,273	3.32	19,889	459,496	4.33

Source: tables 3.16, 4.1 and 4.3.

CHAPTER V

METHODOLOGY OF MATCHING PROCEDURES: THE PROBLEM AND A PROPOSED SHORT CUT

The criteria for selection of the particular "representative" commodity items on which quantity and price comparisons are ultimately based is a central issue in this kind of study. This chapter describes alternative methods and the matching procedure we adopted.

Earlier contributions

Many of the methodological problems of intercountry comparisons using the "industry of origin" approach were adumbrated by Rostas (1948), and more fully elaborated by Paige and Bombach (1959). Their contributions to solving problems of measurement have already been discussed in chapters I and III. They added large appendices to their studies, in which the actual calculations are presented industry by industry, and are more fully transparent than most other studies of this kind. However, with regard to the matching problem even Rostas and Paige and Bombach do not present a systematic procedure. Their presentation has an ad hoc quality, with no general presentation of the matching issue and feasible options for tackling it. In other studies dealing with international comparisons from the product side hardly any relevant information is given on how the matching problem was dealt with.

Below we develop a number of criteria for a systematic matching procedure which is also economical in terms of time and effort. It may also be helpful to national census statisticians in considering whether their existing product specifications and aggregations can be improved (within the limits of confidentiality, which in some cases is the origin of the comparability problem).

Product Comparability

Before discussing three possible approaches to matching, we consider the general problem of "product comparability". Time series collected for index purposes (e.g. consumer price indices) for a particular country are, for the most part, based on exact matching. The statistics record, at regular intervals, the price of an identical product, sold in the same condition at the same point in the production chain. For example, food prices generally relate to particular brands of processed food, sold in specified quantities in particular stores (a 10 ounce can of a name brand of baked beans sold in such and such a supermarket at a specified location). Of course it will not always be possible to make exact matches if, for example, the selected outlet closes down or the manufacturer discontinues the particular brand or modifies it in some crucial way, but in general it is probable that exact matching is the rule rather than the exception for price comparisons within a country.

In comparison between countries exact matching is difficult to realise, because strictly identical products are only rarely available in two or more countries at the same date. In consequence, lower degrees of product comparability have to be accepted for international comparisons than for inter-temporal comparisons within a single country. This is true not only for the present product-based study, but also for expenditure-based studies such as the ICP project carried under the direction of the United Nations.

The following paragraphs describe the problems faced in this study with regard to product matching. We discuss the alternative procedures, and show their different outcomes for the comparison of the motor vehicle industries in the three countries. This industry presents particular difficulties for product matching because of the large number of items produced and the wide range of quality differences within product groups.

Maximalist Approach

The industrial censuses we used give value and quantity information for 100 automobile products for Brazil, 393 items in Mexico and 101 in the USA. In our first round of comparison we tried to match as many products as possible from the Brazilian and Mexican census reports with those listed in the US census.

At our first attempt we found 36 products from the Brazilian census that appeared to match 62 products as reported by the United States, and 45 products for Mexico matching 59 products for the United States. These product matches are given in tables 5.2 and 5.3 which are shown at the end of the chapter.

At this stage, products were considered "matched" provided that the product descriptions were the same or very similar, and provided also that price and quantity figures were available for both countries. This approach requires the matched products to have a more or less "homogeneous" character as well (to this issue reference will be made later on). This matching procedure is described as "maximalist" because the aim was to obtain the maximum number of matches without regard to the plausibility of the PPPs we derived from them.

It can be seen from tables 5.2 and 5.3 that some matches can only be achieved for rather aggregated "products", obtained by combining several specific items in one or both of the countries being compared. Therefore, out of the 36 Brazilian matched motor vehicle products, only 26 PPPs could be calculated, and out of the 49 matched Mexican products only 19 PPPs could be calculated.

The PPPs for matched products following the maximalist procedure are given in the penultimate columns of both the left and right hand side of tables 5.2 and 5.3. For the Brazil/US comparison they range from 0.78 to 19.58 cruzeiros to the US dollar, and for Mexico from 4.32 to 33.22 pesos to the US dollar. These widely divergent PPPs for different products were a signal that some of the matches were false. In spite of having similar (or even identical) descriptions, we inferred that some of these "outlier" products were, in reality, different from each other.

If it is assumed that the matching errors are random (i.e. better and worse quality products are just as likely to be matched as worse and better ones) then the following solutions might seem appropriate.

Rejection of Outliers

First, extreme PPP values ("outliers") could be defined as those lying outside some arbitrarily selected number of standard deviations on either side of the mean (for example, 1.5 or 2.0 standard deviations). This idea was rejected for two reasons: first, a boundary definition for outliers is necessarily arbitrary; why pick 1.5 rather than 1.4 or 1.6? Secondly, a procedure of this kind assumes that observations are distributed symmetrically around the mean, but this is clearly not the case with the PPPs as measured here. Purchasing power parities subject to measurement errors cannot form a symmetrical distribution because they are constrained to exceed zero, but can take any large positive value. They thus form a right-skewed distribution, and a rule that observations lying outside "n" standard deviations about the mean would inevitably result in discarding more observations above the mean than observations below it. Such a rule would not be even-handed.

Mode or Median

An alternative solution which appears to overcome this problem would be to take either the modal or the median PPP value as representing the true average PPP for the industry. On the assumption of random incompetence -- assuming, that is, that the matcher is as likely to mismatch in either direction -- either measure could be expected to provide an unbiassed estimate of the true average PPP for the industry. The objections to this approach are, first, that for most industry groups it is not possible to match enough items to obtain accurate estimates of either the mode of the median. Thus the maximalist approach provided only 26 PPPs for the motor vehicle industry in Brazil, and 19 in Mexico. The mode or median derived from such a small number of observations is unstable in the sense that the addition of one or two more observations might drastically alter the modal or median values.

The second objection is that if, as seems certain, PPPs differ from one product to another, they should be weighted by the relative importance of each product in arriving at the PPP for the industry as a whole. The mode or the median may provide an unbiassed estimate of the arithmetic average PPP for a given industry, but what is needed is a weighted average PPP, where the weights are each product's relative importance in the total output of that industry.

Prices of Components

Another possibility that was considered was to use only data for vehicle components on the grounds that these are likely to be more similar between countries than complete vehicles. This approach is often used in compiling price indices for building and construction work: in most countries price comparisons are not based on complete buildings, bridges, roads, etc., because no two complete structures are sufficiently similar to yield valid price comparisons. Instead price indices are based on the costs of standard components, such as steel structural work, concrete foundations, elevator shafts, etc.

In practice, however, the PPPs obtained for motor vehicle components in the maximalist approach turned out to be just as variable as those for completed or semi-completed vehicles. In the case of Brazil, for example, the lowest and highest PPPs given in table 5.2 refer to vehicle components -- water pumps and air filters, respectively.

Minimalist Approach

The next matching procedure that was tried is more systematic and is here termed the "minimalist" approach. In this approach the product items for the motor vehicle industry are ranked according to their gross value of output. Next an average unit value can be calculated for all items which contribute more than 1 per cent to the total value of output of the industry in either country. The output ratios and PPPs can be calculated on base of these average unit values for each country. This method was seen as a quick and simple way of obtaining quantity ratios and PPPs which would be based on significant shares of the vehicle industry's output in the three countries. Virtually no element of ad hoc judgment is required of the minimalist "matcher".

The objections to this method, however, are also obvious. It abandons some of the essential elements of acceptable matching. The product items matched are not chosen in virtue of their function, appearance or method of production, but by reference to their relative importance in gross output. This may lead to very strange results, in particular when a product item with an extreme low or high unit value is included in the matched output basket of one country and not in that of the other country. It is clear that this method is too crude for proper matching.

A-B-M Approach

To eliminate the crude aspects of the minimalist approach, we developed an "in-between" method, the essential feature of which is that a minimum of items are matched with a maximum of coverage. The matching is confined to the most important products, but each item in one country is now individually matched with a corresponding item in the other country. In this way the positive features of the two other approaches are combined:

- The more careful matching of the maximalist approach;
- The more systematic and time-saving element of the minimalist approach;

This method we called the A-B-M approach. The acronym derives from the surnames of the two principal researchers involved in this project, and Derek Blades with whom we had extensive discussions on this point.

The criteria for carrying out the A-B-M approach are as follows:

1) Matching starts with the commodities which are relatively most important with regard to their value of output.
2) A product will be matched only if the description of the commodity in both censuses is more or less consistent.
3) It is preferable to match "homogeneous" products such as passenger vehicles of a specific weight and engine size rather than a "heterogeneous" product such as "passenger vehicles". However, if the item specified in the census of one country is rather heterogeneous, while it is divided up into separate homogeneous products in the census of the other country, we may be forced to combine the latter country's homogeneous items into a single heterogeneous product in order to achieve a match.
4) Although we only attempted to find a match for items which account for more than 1 per cent of the total value of output of the industry in either country, in some cases small items are included in the matching procedure. Two cases exist when this may occur:
   - When carrying out a match between two important items in both countries, it may be necessary to include some smaller items, in order to get a proper match. For example, it can be seen from table 5.3 that matching Mexican "Trucks" and "Truck Cab Chassis" (contributing respectively 15.36 and 3.27 per cent to the total value of output) with US trucks, implies inclusion of five small Mexican product items which also refer to trucks;
   - An important product item which contributes more than 1 per cent to the total value of output of the industry in one country may be matched with a less important item in the other country. An example derived from table 5.3 is Mexican "Passenger Truck Bodies" (contributing 1.21 per cent to the total value of output) which are matched with US "Utility Trucks", which contribute only 0.07 per cent to the total value of output in the US.
5) The matching procedure is continued until we come to deal with items which contribute less than 1 per cent to the total value of output in both countries. This 1 per cent "cut off" level was determined by empirical testing for some of the sample industries. Higher cut-off levels, for example 5 per cent, would bring down sample coverage too much, and therefore lead to an unacceptable loss of product information.

The advantage of using a systematic matching procedure is important, when one has to deal with:

- a large industry with many product items, for example, textiles or footwear and leatherware, and/or
- a technically complicated industry producing items difficult for an inexperienced researcher to characterize, for example, motor vehicles and equipment and iron and steel.

Systematic application of the A-B-M method provides researchers, who are not experienced in this field, with a reliable technique for making relevant international price comparisons which involves a minimum element of ad hoc judgment. Moreover, the method is time-saving. The execution of a matching procedure for the three countries according to the A-B-M method for a medium-sized industry like the radio and TV receivers industry took about 20 man-hours of work.

For smaller, simpler industries the maximalist approach remains the most appropriate method.

Tables 5.2 and 5.3 show that the number of matches decreases significantly when we move from the maximalist to the A-B-M approach in the case of motor vehicles, from 26 to 6 for the Brazil/USA comparison and from 19 to 5 for the Mexico/USA comparison.

Table 5.1 summarizes the range of PPPs for both approaches. These PPPs are ratios of 1975 unit values in Brazil and Mexico to 1977 US unit values. For both the Brazil/US and the Mexico/US comparison, the A-B-M approach yields a distinctly smaller range of PPPs than the maximalist approach, and average PPPs which are not too different.

TABLE 5.1

Range of PPPs and Weighted Average PPP in the Motor Vehicle Industry (adjusted for quality differences), Brazil/US and Mexico/US

	Brazil (1975) - US (1977)			Mexico (1975) - US (1977)		
	Range of PPPs	Average PPP weighted at quantity weights		Range of PPPs	Average PPP weighted at quantity weights	
		USA	Brazil		USA	Mexico
Maximalist Approach	0.78-19.57	5.90	5.71	4.32-33.22	12.25	11.94
ABM Approach	3.65- 8.43	5.69	5.55	8.11-33.22	12.06	11.88

Source: tables 5.2 and 5.3.

TABLE 5.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Mexico 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Mexican Unit Values (mill.Ps.)	PPP Ps./US$ US Quantity Weights MAX	PPP Ps./US$ US Quantity Weights ABM approach	Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Peso Value (1000 Ps.)	Mexico Peso Unit Value	Mexico Quantity valued at US Unit Values (1000 US$)	PPP Ps./US$ Mexican Quantity Weights MAX	PPP Ps./US$ Mexican Quantity Weights ABM approach
16.	37141 61	Shock absorbers	millions	100.9	482.5	4.78	8,990.0	18.63	----		Shock absorbers	thousand	1,747	155,655	89.10	8,354	18.63	----
17.	37141 12	Crankshafts, engine	millions	1.0	29.0	29.00	274.5	9.46	----		Reconstructed crankshafts	single	20,685	5,677	274.45	600	9.46	----
18.	37141 81	Clutch disc and facing assemblies	millions	30.5	173.6	5.69	4,471.4	25.76	----		Clutch discs	single	187,172	27,440	146.60	1,065	25.76	----
19.	37143 23	Rebuilt Water pumps	millions	7.5	63.5	8.47	981.5	15.46	----		Water pumps	single	24,300	3,180	130.86	206	15.46	----
TOTAL MATCHED ITEMS, MAXIMALIST APPROACH					83,684.5		938,976.8	11.22	----					25,118,346		2,269,416	11.07	----
TOTAL MATCHED ITEMS, MAXIMALIST APPROACH, incl. quality adjustment for passenger cars (a)					83,684.5		1,025,258.4	12.25	----					25,118,346		2,103,395	11.94	----
in % of total specified output					72.14									70.76				
in % of total specified and unspecified output					71.07									63.71				
TOTAL MATCHED ITEMS, ABM APPROACH					78,512.6		860,194.0	----	10.95					23,598,475		2,152,167	----	10.96
TOTAL MATCHED ITEMS, ABM APPROACH, incl. quality adjustment for passenger cars (a)					78,512.6		946,475.6	----	12.06					23,598,475		1,986,146	----	11.88
in % of total specified output					67.68									66.48				
in % of total specified and unspecified output					66.68									59.86				

Source: US figures from table A27.2; Mexican figures from table A27.4;
Note: (a) Passenger car valuation was adjusted for quality difference between the USA and Mexico, see text to the Statistical Appendix.

TABLE 5.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Mexico 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Mexican Unit Values (mill.Ps.)	PPP Ps./US$ US Quantity Weights MAX	PPP Ps./US$ US Quantity Weights ABM approach
1.									
1	37111 11	Complete Vehicles	†thousand						
1	37111 51	Chassis for sale separately	†thousand	9,192.2	47,796.3	5,199.66	436,562.1	9.13	9.13
		Adjustment for quality difference (a)			47,796.3		522,843.7	10.94	10.94
2.	37112	-- Trucks, truck tractors, and truck chassis by gross vehicle weight							
3	37112 11	6,000 pounds and less	thousand	1,363.8	6,380.4	4,678.40			
2	37112 13	6,001 to 10,000 pounds	¶	1,775.7	8,331.4	4,691.90			
	37112 15	10,001 to 14,000 pounds	† ¶	50.1	275.0	5,489.02			
	37112 17	14,001 to 16,000 pounds	† ¶						
	37112 21	16,001 to 19,500 pounds	¶	41.3	268.6	6,503.63			
7	37112 23	19,001 to 26,000 pounds	¶	163.4	2,013.9	12,324.97			
	37112 25	26,001 to 33,000 pounds	¶	25.3	467.9	18,494.07			
	37112 27	33,001 to 44,000 pounds	¶	32.3	760.0	23,529.41			
5	37112 28	Over 44,000 pounds	thousand	96.2	3,045.7	31,660.08			
				3,548.1	21,542.9	6,071.67	320,188.5	14.86	14.86
3.		Truck bodies:							
	37131 36	Utility	thousand	44.0	86.4	1,963.64	2,870.4	33.22	33.22
4.									
4	37141 11	Gasoline engines,new	millions	10.0	5,528.4	552.84	71,708.2	12.97	12.97
5.		Transmissions:							
		Manual:							
	37141 41	Passenger car type	millions	0.4	66.7	166.75			
	37141 45	Truck and bus type	millions	1.5	598.3	398.87			
		Automatic:							
6	37141 43	Passenger car type	millions	9.8	2,081.3	212.38			
	37141 47	Truck and bus type	millions	3.5	812.3	232.09			
				15.2	3,558.6	234.12	28,864.8	8.11	8.11
6.									
	37131 21	Truck bodies: Van	thousand	34.1	90.4	2,651.03	912.5	10.09	----
7.	37131 23	Truck bodies: Multistop	thousand	26.7	80.3	3,007.49			
	37131 25	Truck bodies: Pickup (all types)	thousand	5.3	15.8	2,981.13			
				32.0	96.1	3,003.13	892.0	9.28	----
8.	37131 27	Truck bodies: Panel	thousand	0.4	0.5	1,250.00	7.2	14.41	----
9.	37131 33	Truck bodies: Dump	thousand	22.8	46.8	2,052.63	508.1	10.86	----
10.	37131 34	Truck bodies: Stake and platform	thousand	35.4	35.9	1,014.12	155.6	4.33	----
11.	37131 55	Other vehicle bodies	thousand	346.9	598.5	1,725.28	2,582.9	4.32	----

Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Peso Value (1000 Ps.)	Mexico Peso Unit Value	Mexico Quantity valued at US Unit Values (1000 US$)	PPP Ps./US$ Mexican Quantity Weights MAX	PPP Ps./US$ Mexican Quantity Weights ABM approach
2	4 cylinder cars	single	152,042	6,037,980	39,712.58			
3	6 cylinder cars	¶	60,271	3,183,146	52,813.89			
4	8 cylinder cars	single	45,060	3,002,204	66,626.81			
			257,373	12,223,330	47,492.67	1,338,252	9.13	9.13
				12,223,330		1,172,231	10.43	10.43
1	Trucks	single	70,946	6,053,786	85,329.49			
5	Truck cab chassis	¶	9,496	1,290,744	135,925.02			
	Light trucks	¶	4,945	328,399	66,410.31			
	Tractor trucks	¶	596	294,751	494,548.66			
	Tractors	¶	586	270,432	461,488.05			
	Truck chassis	¶	7,963	268,564	33,726.48			
	Tractors for trailers	single	67	30,150	450,000.00			
			94,599	8,536,826	90,242.24	574,374	14.86	14.86
12	Passenger truck bodies	single	7,295	475,896	65,235.92	14,325	33.22	33.22
8	Car engines	single	98,927	748,937	7,570.60			
	6 & 8 cylinder car & truck engines	¶	61,955	341,508	5,512.19			
	6 cylinder car engines	¶	31,714	276,519	8,719.15			
	6 cylinder car engines	single	6,775	62,690	9,253.14			
			199,371	1,429,654	7,170.82	110,220	12.97	12.97
6	Transmissions	single	491,190	932,769	1,899.00	114,997	8.11	8.11
	Bodies, for small motor vans	single	773	19,956	25,816.30			
	Motor van bodies	¶	51	1,836	36,000.00			
	Eurovans for freight transport	single	42	1,381	32,880.95			
			866	23,173	26,758.66	2,296	10.09	----
	Bodies,light trucks	single	907	25,282	27,874.31	2,724	9.28	----
	Panels	single	136	2,449	18,007.35	170	14.41	----
	Metallic bodies (dump trucks)	single	4,116	91,726	22,285.23	8,449	10.86	----
	Truck bodies: stake and platform	single	4,401	19,347	4,396.05	4,463	4.33	----
	Other bodies	single	13,241	98,587	7,445.59	22,844	4.32	----

E 5.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment,

TABLE 5.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Mexico 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Mexican Unit Values (mill.Ps.)	PPP Ps./US$ US Quantity Weights MAX	PPP Ps./US$ US Quantity Weights ABM approach	Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Peso Value (1000 Ps.)	Mexico Peso Unit Value	Mexico Quantity valued at US Unit Values (1000 US$)	PPP Ps./US$ Mexican Quantity Weights MAX	PPP Ps./US$ Mexican Quantity Weights ABM approach
12.		Complete trailer units:																
	37151 10	Truck trailers:																
		Van:																
		Closed top:																
	37151 02,-14,-60	Insulated	thousand	15.9	208.1	13,088.05												
	37151 04,-16,-60	Semi-insulated	"	2.6	21.1	8,115.38												
	37151 05,-15,-64	Drop frame type,	"	4.8	50.5	10,520.83												
	37151 07,-17	Livestock	thousand	1.4	24.0	17,142.86												
		All other closed top vans:																
	37151 09	Steel	thousand	0.8	5.2	6,500.00												
	37151 19	Aluminum	"	62.2	483.8	7,778.14												
	37151 68	FRP (fiberglass)	thousand	7.3	57.0	7,808.22												
		Open top, incl. low side grain, fruit etc.:																
	37151 12	Steel	thousand	1.4	11.4	8,142.86												
	37151 21,-70	Aluminium and FRP	thousand	2.8	28.8	10,285.71												
		Tank:																
	37151 20	Flammable liquids	thousand	3.1	60.9	19,645.16												
	37151 28	Asphalt	"	0.6	10.8	18,000.00												
	37151 30	Chemicals and acids	"	0.8	18.5	23,125.00												
	37151 32	Other	"	3.3	68.0	20,606.06												
	37151 33	Bulk commodity & dry materia	"	1.7	31.9	18,764.71												
	37151 35	Pole, logging, and pipe	"	1.6	13.1	8,187.50												
	37151 37	Platform	thousand	24.3	157.4	6,477.37												
		Low-bed heavy haulers ¢ 10 ton:																
	37151 38	10 to 40 ton	thousand	3.2	30.8	9,625.00												
	37151 39	40 ton and over	thousand	1.4	29.1	20,785.71												
		Dump trailers:																
	37151 40	for Material	thousand	8.6	82.9	9,639.53												
	37151 42	for Other	"	0.8	10.0	12,500.00												
	37151 44	Automobile transport trailer	"	2.5	43.6	17,440.00												
	37151 49	Other trailers, excl. detachable	" thousand	9.5	78.0	8,210.53												
	37151 50	Detachable trailer bodies and chassis:																
		Truck Trailers:																
	37151 53	Detachable trailer bodies	thousand	7.6	48.2	6,342.11												
	37151 54	Detachable trailer chassis	"	20.7	85.0	4,106.28												
	37151 45	Dollies or converter gear	thousand	5.2	16.2	3,115.38												
				194.1	1,674.3	8,625.97	27,679.2	16.53	----		Trailers	single	632	98,100	155,221.52			
											Semi-trailers for trailers	"	531	92,985	175,112.99			
											Semi-trailers	"	576	92,908	161,298.61			
											Semi-trailers	"	182	22,548	123,890.11			
											Trailers	single	509	39,984	78,554.03			
													2,430	346,525	142,602.88	20,961	16.53	----
13.	37141 21	Fuel pump assemblies	millions	19.3	88.1	4.56	1,181.5	13.41	----		Gasoline pumps	single	328,805	20,129	61.22	1,501	13.41	----
14.											Radiators	single	5,006	15,488	3,093.89			
											Radiators	single	189,021	131,385	695.08			
	37141 31	Radiators,complete	millions	17.9	719.3	40.18	13,549.8	18.84	----				194,027	146,873	756.97	7,797	18.84	----
15.											Brake systems	single	340,905	206,187	604.82			
											Rubber for brakes	thousand	3,623	120,894	33.37			
											Brake drums	thousand	1,163	91,924	79.04			
	37141 32	Brake cylinders: Wheel	millions	35.5	69.8	1.97					Rotors for automobile brakes	single	417,804	70,573	168.91			
	37141 34	Brake cylinders: Master	"	21.4	275.8	12.89					Air brake parts	"	3,209	20,215	6,299.47			
	37141 33	Brake valves	"	28.7	50.5	1.76					Drum pile drivers	"	39,294	20,000	508.98			
	37141 36	Brake shoe assemblies	"	30.3	221.3	7.30					Brake cylinders	"	430,247	18,900	43.93			
	37141 38	Brake caliper assemblies	"	37.8	346.1	9.16					Brake diaphragms	"	118,000	2,950	25.00			
	37141 14	Brake discs	millions	30.9	109.9	3.56					Disc brakes	single	24,617	2,185	88.76			
				184.6	1,073.4	5.81	16,596.7	15.46	----				6,160,076	553,828	89.91	35,819	15.46	----

TABLE 5.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Mexico 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Mexican Unit Values (mill.Ps.)	PPP Ps./US$ US Quantity Weights MAX	PPP Ps./US$ US Quantity Weights ABM approach
1.									
1	37111 11	Complete Vehicles	†thousand						
1	37111 51	Chassis for sale separately	†thousand	9,192.2	47,796.3	5,199.66	436,562.1	9.13	9.13
		Adjustment for quality difference (a)			47,796.3		522,843.7	10.94	10.94
2.	37112 --	Trucks, truck tractors, and truck chassis by gross vehicle weight							
3	37112 11	6,000 pounds and less	thousand	1,363.8	6,380.4	4,678.40			
2	37112 13	6,001 to 10,000 pounds	¶	1,775.7	8,331.4	4,691.90			
	37112 15	10,001 to 14,000 pounds	† ¶	50.1	275.0	5,489.02			
	37112 17	14,001 to 16,000 pounds	† ¶						
	37112 21	16,001 to 19,500 pounds	¶	41.3	268.6	6,503.63			
7	37112 23	19,001 to 26,000 pounds	¶	163.4	2,013.9	12,324.97			
	37112 25	26,001 to 33,000 pounds	¶	25.3	467.9	18,494.07			
	37112 27	33,001 to 44,000 pounds	¶	32.3	760.0	23,529.41			
5	37112 28	Over 44,000 pounds	thousand	96.2	3,045.7	31,660.08			
				3,548.1	21,542.9	6,071.67	320,188.5	14.86	14.86
3.		Truck bodies:							
	37131 36	Utility	thousand	44.0	86.4	1,963.64	2,870.4	33.22	33.22
4.									
4	37141 11	Gasoline engines,new	millions	10.0	5,528.4	552.84	71,708.2	12.97	12.97
5.		Transmissions:							
		Manual:							
	37141 41	Passenger car type	millions	0.4	66.7	166.75			
	37141 45	Truck and bus type	millions	1.5	598.3	398.87			
		Automatic:							
6	37141 43	Passenger car type	millions	9.8	2,081.3	212.38			
	37141 47	Truck and bus type	millions	3.5	812.3	232.09			
				15.2	3,558.6	234.12	28,864.8	8.11	8.11
6.									
	37131 21	Truck bodies: Van	thousand	34.1	90.4	2,651.03	912.5	10.09	----
7.	37131 23	Truck bodies: Multistop	thousand	26.7	80.3	3,007.49			
	37131 25	Truck bodies: Pickup (all types)	thousand	5.3	15.8	2,981.13			
				32.0	96.1	3,003.13	892.0	9.28	----
8.	37131 27	Truck bodies: Panel	thousand	0.4	0.5	1,250.00	7.2	14.41	----
9.	37131 33	Truck bodies: Dump	thousand	22.8	46.8	2,052.63	508.1	10.86	----
10.	37131 34	Truck bodies: Stake and platform	thousand	35.4	35.9	1,014.12	155.6	4.33	----
11.	37131 55	Other vehicle bodies	thousand	346.9	598.5	1,725.28	2,582.9	4.32	----

Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Peso Value (1000 Ps.)	Mexico Peso Unit Value	Mexico Quantity valued at US Unit Values (1000 US$)	PPP Ps./US$ Mexican Quantity Weights MAX	PPP Ps./US$ Mexican Quantity Weights ABM approach
2	4 cylinder cars	single	152,042	6,037,980	39,712.58			
3	6 cylinder cars	¶	60,271	3,183,146	52,813.89			
4	8 cylinder cars	single	45,060	3,002,204	66,626.81			
			257,373	12,223,330	47,492.67	1,338,252	9.13	9.13
				12,223,330		1,172,231	10.43	10.43
1	Trucks	single	70,946	6,053,786	85,329.49			
5	Truck cab chassis	¶	9,496	1,290,744	135,925.02			
	Light trucks	¶	4,945	328,399	66,410.31			
	Tractor trucks	¶	596	294,751	494,548.66			
	Tractors	¶	586	270,432	461,488.05			
	Truck chassis	¶	7,963	268,564	33,726.48			
	Tractors for trailers	single	67	30,150	450,000.00			
			94,599	8,536,826	90,242.24	574,374	14.86	14.86
12	Passenger truck bodies	single	7,295	475,896	65,235.92	14,325	33.22	33.22
8	Car engines	single	98,927	748,937	7,570.60			
	6 & 8 cylinder car & truck engines	¶	61,955	341,508	5,512.19			
	6 cylinder car engines	¶	31,714	276,519	8,719.15			
	6 cylinder car engines	single	6,775	62,690	9,253.14			
			199,371	1,429,654	7,170.82	110,220	12.97	12.97
6	Transmissions	single	491,190	932,769	1,899.00	114,997	8.11	8.11
	Bodies, for small motor vans	single	773	19,956	25,816.30			
	Motor van bodies	¶	51	1,836	36,000.00			
	Eurovans for freight transport	single	42	1,381	32,880.95			
			866	23,173	26,758.66	2,296	10.09	----
	Bodies,light trucks	single	907	25,282	27,874.31	2,724	9.28	----
	Panels	single	136	2,449	18,007.35	170	14.41	----
	Metallic bodies (dump trucks)	single	4,116	91,726	22,285.23	8,449	10.86	----
	Truck bodies: stake and platform	single	4,401	19,347	4,396.05	4,463	4.33	----
	Other bodies	single	13,241	98,587	7,445.59	22,844	4.32	----

TABLE 5.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment,

TABLE 5.2 - Matching of Product Items, US-Brazil, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Brazil 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Brazilian Unit Values (mill.Cr.)	PPP Cr./US$ US Quantity Weights MAX	PPP Cr./US$ US Quantity Weights ABM approach
25.									
	37141 81	Clutch disc and facing assemblies	millions	30.5	173.6	5.69	2,168.3	12.49	----
26.	37143 31	Rebuilt gasoline engines	millions	0.7	117.4	167.71	1,494.9	12.73	----
TOTAL MATCHED ITEMS, MAXIMALIST APPROACH					85,866.9		458,387.5	5.34	----
TOTAL MATCHED ITEMS, MAXIMALIST APPROACH, incl. quality adjustment for passenger cars (a)					85,866.9		506,329.8	5.90	----
in % of total specified output					74.02				
in % of total specified and unspecified output					72.93				
TOTAL MATCHED ITEMS, ABM APPROACH					81,084.0		413,454.7	----	5.10
TOTAL MATCHED ITEMS, ABM APPROACH, incl. quality adjustment for passenger cars (a)					81,084.0		461,396.9	----	5.69
in % of total specified output					69.90				
in % of total specified and unspecified output					68.86				

Rank of Item	Code	Brazil Product Item	Unit	Brazil Quantity	Brazil Cruzeiro Value (1000 Cr.)	Brazil Cruzeiro Unit Value	Brazil Quantity valued at US Unit Values (1000 US$)	PPP Cr./US$ Brazilian Quantity Weights MAX	PPP Cr./US$ Brazilian Quantity Weights ABM approach
	4566	Clutch discs	thousand	986	29,991	30.42			
	4581	Clutches	¶	80	24,912	311.40			
	4599	Forks in clutches	¶	671	10,145	15.12			
	4647	Clutch discs	thousand	3,054	275,549	90.23			
				4,791	340,597	71.09	27,269	12.49	----
	4622	Rebuilt engines	single	64,729	138,232	2,135.55	10,856	12.73	----
					22,202,821		4,245,282	5.23	----
					22,202,821		3,891,029	5.71	----
					70.02				
					38.42				
					19,769,719		3,919,201	----	5.04
					19,769,719		3,564,948	----	5.55
					62.34				
					34.21				

Source: US figures from table A27.2; Brazilian figures from table A27.3;
Note: (a) Passenger car valuation was adjusted for quality difference between the USA and Brazil, see note in the Statistical Appendix.

TABLE 5.2 - Matching of Product Items, US-Brazil, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Brazil 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Brazilian Unit Values (mill.Cr.)	PPP Cr./US$ US Quantity Weights MAX	PPP Cr./US$ US Quantity Weights ABM approach	Rank of Item	Code	Brazil Product Item	Unit	Brazil Quantity	Brazil Cruzeiro Value (1000 Cr.)	Brazil Cruzeiro Unit Value	Brazil Quantity valued at US Unit Values (1000 US$)	PPP Cr./US$ Brazilian Quantity Weights MAX	PPP Cr./US$ Brazilian Quantity Weights ABM approach
4.	4 37141 11	Gasoline engines,new	millions	10.0	5,528.4	552.84	37,970.6	6.87	6.87	2	4620	Internal combustion engines,gasoline	single	1,106,290	4,200,652	3,797.06	611,601	6.87	6.8
5.		Wheels:																	
	37141 35	Passenger car type	millions	66.0	626.6	9.49													
	37141 37	Truck and bus type	millions	20.4	356.9	17.50													
				86.4	983.5	11.38	8,290.8	8.43	8.43	12	4656	Wheels	single	6,998,905	671,600	95.96	79,669	8.43	8.4
6.		Transmissions:																	
		Manual:																	
	37141 41	Passenger car type	millions	0.4	66.7	166.75													
	37141 45	Truck and bus type	millions	1.5	598.3	398.87													
		Automatic:																	
6	37141 43	Passenger car type	millions	9.8	2,081.3	212.38													
	37141 47	Truck and bus type	millions	3.5	812.3	232.09													
				15.2	3,558.6	234.12	25,210.2	7.08	7.08	9	4530	Gear boxes	thousand	449	744,697	1,658.57	105,119	7.08	7.0
7.	37131 25	Truck bodies: Pickup (all types)	thousand	5.3	15.8	2,981.13	48.6	3.08	----		4719	Fiber-glass bodies	single	2,784	25,541	9,174.21	8,299	3.08	---
8.	37131 33	Truck bodies: Dump	thousand	22.8	46.8	2,052.63	310.0	6.62	----		4712	Dump truck bodies (metal)	single	21,165	287,784	13,597.17	43,444	6.62	---
9.	37131 32	Refuse and garbage: Rear loading	thousand	5.7	52.8	9,263.16	587.6	11.13	----		4753	Garbage truck bodies	single	104	10,721	103,086.54	963	11.13	---
10.	37131 55	Other vehicle bodies	thousand	346.9	598.5	1,725.28	5,885.7	9.83	----		4724	Other special bodies for trucks	single	8,612	146,115	16,966.44	14,858	9.83	---
11.	37141 17	Hub and drum assemblies	millions	31.9	479.5	15.03	2,682.4	5.59	----		4665	Brake-drum	thousand	2,363	198,702	84.09	35,519	5.59	---
12.	37141 21	Fuel pump assemblies	millions	19.3	88.10	4.56	1,077.2	12.23	----		4517	Gasoline fuel pumps	thousand	1,396	77,914	55.81	6,372	12.23	---
13.	37141 23	Water pump assemblies	millions	10.4	112.4	10.81	88.1	0.78	----		4516	Water pumps	thousand	4,976	42,174	8.48	53,779	0.78	---
14.	37141 24	Filters: Fuel	millions	57.8	44.9	0.78	347.1	7.73	----		4593	Fuel filters	thousand	2,214	13,294	6.00	1,720	7.73	---
15.	37141 25	Filters: Oil	millions	340.9	424.6	1.25	6,274.5	14.78	----		4594	Oil filters	thousand	9,177	168,910	18.41	11,430	14.78	---
16.	37141 26	Filters: Air	millions	131.7	190.0	1.44	3,719.3	19.58	----		4591	Air filters	thousand	1,811	51,144	28.24	2,613	19.58	---
17.	37141 27	Exhaust system components: Mufflers	millions	44.4	419.6	9.45	1,909.7	4.55	----		4661	Mufflers for discharge pipes	single	2,619,119	112,650	43.01	24,752	4.55	---
18.	37141 31	Radiators,complete	millions	17.9	719.3	40.18	7,555.3	10.50	----		4654	Complete radiators	single	401,323	169,391	422.08	16,127	10.50	---
19.	37141 32	Brake cylinders: Wheel	millions	35.5	69.8	1.97	972.5	13.93	----		4551	Wheel cylinders	single	2,376,112	65,090	27.39	4,672	13.93	---
20.	37141 34	Brake cylinders: Master	millions	21.4	275.8	12.89	1,538.1	5.58	----		4642	Main cylinder brakes	single	14,595	1,049	71.87	188	5.58	---
21.	37141 33	Brake valves	millions	28.7	50.5	1.76	187.4	3.71	----		4686	Check-valve for brake master cylinder	single	347,564	2,270	6.53	612	3.71	---
22.	37141 61	Shock absorbers	millions	100.9	482.5	4.78	3,988.1	8.27	----		4499	Shock absorbers	thousand	7,906	312,483	39.52	37,806	8.27	---
23.	37141 67	Tie rod ends	millions	11.9	50.7	4.26					4509	Steering system bars	thousand	2,750	149,512	54.37			
	37141 68	Steering idler arms,drag links,control arms	millions	56.7	341.3	6.02					4522	Steering system arms	thousand	22	523	23.77			
				68.60	392.0	5.71	3,713.0	9.47	----					2,772	150,035	54.13	15,840	9.47	---
24.	37141 12	Crankshafts, engine	millions	1.0	29.0	29.00	385.1	13.28	----		4688	Crankshafts	thousand	309	119,006	385.13	8,961	13.28	---

BLE 5.2 - Matching of Product Items, US-Brazil, Motor Vehicles and Equipment, Maximalist and A-B-M approach, (US 1977) (Brazil 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Brazilian Unit Values (mill.Cr.)	PPP Cr./US$ US Quantity Weights MAX	PPP Cr./US$ US Quantity Weights ABM approach	Rank of Item	Code	Brazil Product Item	Unit	Brazil Quantity	Brazil Cruzeiro Value (1000 Cr.)	Brazil Cruzeiro Unit Value	Brazil Quantity valued at US Unit Values (1000 US$)	PPP Cr./US$ Brazilian Quantity Weights MAX	PPP Cr./US$ Brazilian Quantity Weights ABM approach
1	37111 11	Complete Vehicles	† thousand							3	4503	Cars, assembled, less than 75 hp	† single	132,234	2,964,424	22,418.02			
1	37111 51	Chassis for sale separately	† thousand	9,192.2	47,796.3	5,199.66	189,834.1	3.97	3.97	1	4505	Other passenger cars	† single	317,442	6,322,129	19,915.86			
		Adjustment for quality difference (a)			47,796.3		237,776.4	4.97	4.97					449,676	9,286,553	20,651.65	2,338,162	3.97	3.97
															9,286,553		1,983,908	4.68	4.68
	37112	-- Trucks, truck tractors, and truck chassis by gross vehicle weight																	
3	37112 11	6,000 pounds and less	thousand	1,363.8	6,380.4	4,678.40													
2	37112 13	6,001 to 10,000 pounds	"	1,775.7	8,331.4	4,691.90													
	37112 15	10,001 to 14,000 pounds	† "	50.1	275.0	5,489.02													
	37112 17	14,001 to 16,000 pounds	† "																
	37112 21	16,001 to 19,500 pounds	"	41.3	268.6	6,503.63													
7	37112 23	19,001 to 26,000 pounds	"	163.4	2,013.9	12,324.97													
	37112 25	26,001 to 33,000 pounds	"	25.3	467.9	18,494.07													
	37112 27	33,001 to 44,000 pounds	"	32.3	760.0	23,529.41													
5	37112 28	Over 44,000 pounds	thousand	96.2	3,045.7	31,660.08													
				3,548.1	21,542.9	6,071.67	144,605.7	6.71	6.71	6	4533	Trucks, heavy duty, complete	† single	12,253	1,255,206	102,440.71			
										13	4534	Trucks with tanks,pumps,ladders,other	† "	3,798	602,132	158,539.23			
										4	4535	Trucks, 100-220 hp, autobus	† "	63,148	1,825,411	28,906.87			
											4550	Truck chassis without engine	† "	4,048	46,738	11,545.95			
											4674	Complete truck	† single	16,083	318,787	19,821.36			
														99,330	4,048,274	40,755.80	603,099	6.71	6.71
		Complete trailer units:																	
	37151 10	Truck trailers:																	
		Van:																	
		Closed top:																	
	37151 02,-14,-60	Insulated	thousand	15.9	208.1	13,088.05													
	37151 04,-16,-60	Semi-insulated	"	2.6	21.1	8,115.38													
	37151 05,-15,-64	Drop frame type,	"	4.8	50.5	10,520.83													
	37151 07,-17	Livestock	thousand	1.4	24.0	17,142.86													
		All other closed top vans:																	
	37151 09	Steel	thousand	0.8	5.2	6,500.00													
	37151 19	Aluminum	"	62.2	483.8	7,778.14													
	37151 68	FRP (fiberglass)	thousand	7.3	57.0	7,808.22													
		Open top, incl. low side grain, fruit etc.:																	
	37151 12	Steel	thousand	1.4	11.4	8,142.86													
	37151 21,-70	Aluminium and FRP	thousand	2.8	28.8	10,285.71													
		Tank:																	
	37151 20	Flammable liquids	thousand	3.1	60.9	19,645.16													
	37151 28	Asphalt	"	0.6	10.8	18,000.00													
	37151 30	Chemicals and acids	"	0.8	18.5	23,125.00													
	37151 32	Other	"	3.3	68.0	20,606.06													
	37151 33	Bulk commodity & dry materials	"	1.7	31.9	18,764.71													
	37151 35	Pole, logging, and pipe	"	1.6	13.1	8,187.50													
	37151 37	Platform	thousand	24.3	157.4	6,477.37													
		Low-bed heavy haulers ¢ 10 ton:																	
	37151 38	10 to 40 ton	thousand	3.2	30.8	9,625.00													
	37151 39	40 ton and over	thousand	1.4	29.1	20,785.71													
		Dump trailers:																	
	37151 40	for Material	thousand	8.6	82.9	9,639.53													
	37151 42	for Other	"	0.8	10.0	12,500.00													
	37151 44	Automobile transport trailers	"	2.5	43.6	17,440.00													
	37151 49	Other trailers, excl. detachable	" thousand	9.5	78.0	8,210.53													
	37151 50	Detachable trailer bodies and -chassis:																	
		Truck Trailers:																	
	37151 53	Detachable trailer bodies	thousand	7.6	48.2	6,342.11													
	37151 54	Detachable trailer chassis	"	20.7	85.0	4,106.28													
	37151 45	Dollies or converter gear	thousand	5.2	16.2	3,115.38													
				194.1	1,674.3	8,625.97	7,543.2	4.51	4.51	8	4784	Trailers and semi-trailers	† single	20,805	813,484	39,100.41			
											4777	Trailers	† single	242	4,459	18,425.62			
														21,047	817,943	38,862.69	181,551	4.51	4.51

CHAPTER VI

THE COMPARATIVE MERITS OF CENSUS UNIT VALUES AND SPECIFICATION PRICING

It is sometimes suggested that unit values derived from census information in the industry of origin approach are inherently inferior to specification pricing as practiced by the ICP expenditure approach, but we do not believe this to be the case.

The Unit Value Problem

Specification pricing involves meticulous characterisation of the representative products. For consumer goods items, the ICP III exercise for 1975 provided a 462 page manual for the guidance of national statistical offices which was designed to ensure that the prices submitted should be for comparable products. This was supplemented by extensive research by the international secretariat on prices of capital goods. In our approach, by contrast, we do not solicit new information by questionnaire but use existing national censuses whose classification of products sometimes varies significantly. In some important cases the census breakdown of production is not disaggregated finely enough. A "product" for which we derive a unit value, may in practice be a mix of items, rather than a single item. This would not matter if the degree of disaggregation were uniform across countries, and if the mix and quality variaton for a "product" were similarly structured, but we know that such variations do exist.

The practical importance of the "unit value" problem in industry of origin comparisons, which is in fact a problem of matching heterogeneous items of different qualities, varies between industries. In the case of cement we come closest to the optimal situation of comparing more or less identical products across countries. Sugar, beer, tobacco products, tyres and grain mill products also pose no great problems. However, with textiles, radio and TV receivers and motor vehicles we clearly enter a different domain. To use the terminology of Gilbert and Kravis (1954, p. 79) we are dealing here with "common" products which have a similar function across the countries, but which vary in quality.

Our unit value specification was particularly poor in the case of motor vehicles, largely because of census confidentiality rules. The census information was therefore supplemented in this case by using information on output and consumer price structures from trade sources. Automotive News provides figures furnished by trade associations from trade sources which are rather reliable. The procedures are described in a note in the Statistical Appendix. Producer prices would have been preferable to consumer prices, but the US producer price index is based on information for only a limited number of models, and is as confidential as the census itself. Our method of handling the problem produced a reasonable though not an optimal adjustment for quality. In any case we would stress that our approach is not inferior to that of ICP for this particular industry. As the ICP approach is a multilateral one, its products have to be 'representative' in a global sense. ICP III used passenger car models which were characteristic across its 34 countries, and its comparison for Brazil/USA and Mexico/USA was based largely on Japanese and European models which were quite unrepresentative of the situation in these three markets.

For the other industries in our sample we made no adjustment for this problem because we did not think it was too serious. There is obviously still some unit value error in our results but its size is likely to be smaller than with cars and its direction is not clear.

Strengths of the Industry of Origin Approach

The disadvantage we suffer in our approach from potential unit value error is offset by certain strong advantages of the census material, as follows:

1) The census is not a sample, but covers the vast bulk of activity in manufacturing in the year specified. This means that the problem of representativity is much milder for us than it is in the expenditure approach. With the census one can judge the representativity of the "unit values" to be matched from a much wider range of information than ICP had at its disposal. Table 6.1 shows that our 27 industry sample yielded 1,909 Mexican unit values from which 309 were chosen to match with the USA, and 707 unit values for Brazil of which 221 were matched with the USA. The ICP, by contrast, had to live with what it got from national statistical offices (at least for consumption goods). For Mexico, it received only 284 of the much larger number of consumer prices it requested, as compared with 354 for Brazil and 571 for the USA (Kravis, Heston and Summers, 1982, p. 45).
2) Although our "price" information is implicit, the unit values we derive refer to actual transactions, and they cover all such transactions throughout the year and for all parts of the country. Specification prices, by contrast, are quotes, shelf, list or monitored market prices for one point in the year in a limited number of locations. For example, for Mexico, in order "to obtain national average prices it was necessary to obtain an average of the various urban prices and to take account of rural prices. The adjustment for rural prices was done roughly on the basis of a sample survey of forty common items in rural areas linked to several of the major provincial cities. From these rural and urban prices, adjustment factors were obtained to move from urban to national average prices" (Kravis, Heston and Summers, 1982, p. 43). Quite clearly, the ICP pricing technique involves an elaborate process of collection, adjustment, and data merge, and what comes out of in the wash is not always as clean as was specified.

Conclusion

The industry of origin and the expenditure approaches are complementary techniques. Each approach had its weaknesses and its strengths. A detailed reconciliation is not feasible by comparison of unit values and specification prices because the one approach deals with producer prices and the other with final expenditure. The nature of the reconciliation problem also depends on whether the basic comparisons are of a binary kind, such as we have attempted here and which was also the case in the early expenditure comparisons of OEEC; or multilateral, as was the case in ICP III, and in the recent studies of EUROSTAT and OECD. In multilateral studies where "international" prices are used, the problem of representativity becomes much more complex, as items have to be selected which are "representative" across a very wide range of countries (see Krijnse Locker, 1984; Ghosh, 1984; and our remark above relating to motor vehicles).

TABLE 6.1

Number of Unit Values Available and Matched in Our 27 Industry Sample, Brazil and Mexico (1975) and USA (1977)

	Brazil		Mexico		United States		
	total	matched (a)	total	matched (b)	total	matched Brazil/ USA	matched Mexico/ USA
Dairy Products	20	13	93	26	24	22	15
Fats and Oils	44	7	88	11	47	12	14
Grain Mill Products	21	6	55	8	37	17	16
Cane Sugar and Products	10	7	7	2	13	9	7
Cocoa, Chocolate and Confectionery Products	9	5	79	13	27	9	12
Malt and Malt Beverages	3	2	7	2	20	17	17
Tobacco and Tobacco Products	6	5	4	3	21	16	16
Textiles	49	21	209	43	54	48	46
Men's Clothing	9	2	83	12	30	6	6
Leather Products	25	4	42	8	14	5	4
Footwear	30	11	48	16	31	15	15
Sawmill Products	32	6	49	19	37	19	21
Pulp and Paper	24	10	133	21	68	25	30
Soap and Detergents	13	7	43	10	38	14	29
Paints	26	5	63	17	54	30	31
Agricultural Fertilizers	9	5	32	7	22	16	16
Synthetic Fibres	7	5	32	16	26	9	11
Petroleum Refining and Products	59	9	56	5	44	10	8
Tires and Inner Tubes	14	7	22	4	16	8	6
Cement	5	1	10	1	7	1	1
Bricks	23	8	31	5	24	9	6
Iron and Steel	94	33	114	21	76	28	24
Bolts, Nuts, Rivets and Washers	13	6	50	5	11	7	7
Agricultural Machinery	32	7	62	4	197	30	16
Radio and TV Receivers	22	12	92	11	21	13	15
Electric Lamps and Bulbs	8	5	12	3	39	14	14
Motor Vehicles	100	12	393	16	101	41	15
Total 27 Industries	707	221	1,909	309	1,099	450	418

(a) in the Brazil/USA comparison;
(b) in the Mexico/USA comparison;
Source: see industry tables in Statistical Appendix.

CHAPTER VII

LABOUR PRODUCTIVITY

Table 7.1 presents ratios of value added per person engaged in manufacturing branches in Brazil, Mexico and the USA in 1975. These are derived from our estimates of value added levels (former national accounts concept) which are presented in tables 3.15 and 3.16 and the employment figures by branch from tables 7.7 to 7.9.

Table 7.1 shows that the comparative level of labour productivity in manufacturing in Brazil and Mexico was much lower than in the United States in all manufacturing branches. For the Brazil/USA comparison, no branch in Brazil showed a productivity level of more than 75 per cent of the USA, and the average productivity for total manufacturing was only 46 per cent. In the Mexico/USA comparison no branch in Mexico showed a higher comparative level than 50 per cent and the (geometric) average for total manufacturing was only 36 per cent.

The productivity estimates for the individual branches in table 7.1 are shown as value added per person engaged, excluding persons who work in auxiliary units such as head offices, laboratories and sales offices. However, we made an adjustment for this for total manufacturing. This led to an increase in the comparative productivity ratios of Brazil and Mexico implying a larger number of auxiliary unit employees in the United States than in the other two countries.

As workers in different countries do not work the same number of annual hours, it is useful to adjust our productivity figures for differences in working hours. Table 7.2 shows the number of annual hours actually worked in Brazilian, Mexican and US manufacturing in 1975, and the effects of differences between these countries on their relative productivity performance.

It appears that manufacturing employees in Brazil and Mexico worked over 150 hours per year more than US employees in 1975. As a result the productivity gap between Brazil and the USA and Mexico and the USA is bigger after allowing for these differences in working hours.

The estimates for hours refer to actual working time rather than hours paid, i.e. we exclude hours paid but not worked such as time off for holidays and vacations, sickness and strikes, short-time working and absence for personal reasons. Our estimates of US annual working hours take detailed account of such absences. For Brazil and Mexico we had to use the crude assumption that 6 out of the 52 weeks in a year for which pay is received are not worked.

Tables 7.3 and 7.4 show the estimates of comparative value added per person employed and per hour worked in 1985, which were updated from the estimates for 1975 with national time series on manufacturing output and employment. Between 1975 and 1985 the comparative productivity of Brazilian manufacturing deteriorated significantly, and the average productivity level (value added per person engaged) fell from 49 to 40 per cent of the level of US manufacturing. Mexico also showed some worsening of its comparative productivity performance, but it was only very slight compared to Brazil. In

1985 the difference in annual working time between Brazil and Mexico on the one hand and the USA on the other hand widened to about 200 hours.

Table 7.5 compares our labour productivity results for Brazil, Mexico and the USA with those of analogous comparisons with the USA for approximately the same date as our benchmark. Most of these studies use a similar methodology with the exception of Yukizawa (1978) which covers a relatively small sample of product quantities at Japanese and US prices, and Frank (1977) who makes a separate deflation for part of the material inputs.

It is surprising that real productivity levels in Brazilian and Mexican manufacturing are so near to those in the UK, and so much higher than in Korea. However, evidence from estimates at national prices appears to confirm that Brazil and Mexico have much higher productivity levels in manufacturing compared with the rest of the economy than is the case in the more advanced countries. This is clear from table 7.6 which shows Brazilian productivity in manufacturing to be two and threequarters times as high as in the rest of the economy, and Mexican productivity twice as high. In five OECD countries, the differences between manufacturing and non-manufacturing productivity levels are very modest, and, in Germany and the UK, manufacturing levels are actually lower than the average for the rest of the economy. In this OECD group, Japan is the extreme case, but nevertheless its productivity level in manufacturing is only a quarter above that in the rest of the economy.

TABLE 7.1

Productivity Ratios (Value Added, Former National Accounts Concept per Person Engaged) by Major Branch of Manufacturing, Brazil/USA and Mexico/USA, 1975

	1975 Brazil Unit Value Weights	1975 US Unit Value Weights	1975 Geometric Average	1975 Mexico Unit Value Weights	1975 US Unit Value Weights	1975 Geometric Average
Food Products	45.94	68.67	56.17	26.53	48.33	35.81
Beverages	54.57	59.52	56.99	34.25	34.29	34.27
Tobacco Products	66.47	74.74	70.48	38.29	46.85	42.35
Textiles	39.02	58.11	47.62	44.82	45.52	45.17
Wearing Apparel	52.16	52.16	52.16	32.77	32.80	32.78
Wood Products	19.09	21.74	20.37	14.65	13.79	14.21
Paper Products	38.39	46.04	42.04	24.30	32.94	28.29
Chemical Products	61.46	72.18	66.60	37.32	41.34	39.28
Footwear, Leather, Rubber and Plastic Products	40.95	60.39	49.73	26.05	39.07	31.90
Stone, Clay and Glass Products	34.23	50.91	41.74	41.55	38.34	39.91
Basic Metals and Metal Products	41.53	49.14	45.18	42.99	48.02	45.44
Electric Engineering	50.64	51.44	51.04	28.65	21.96	25.08
Machinery and Transport Equipment	51.48	52.37	51.92	32.99	37.52	35.18
Other Manufacturing	34.60	43.87	38.96	25.62	33.41	29.26
Total Manufacturing	41.29	52.35	46.49	31.15	40.63	35.58
Adjusted to include employment in auxiliary units	43.13	54.69	48.56	32.54	42.45	37.16

Source: Tables 7.10 and 7.11.

TABLE 7.2

Productivity Ratios and Number of Hours Worked per Person Engaged by Major Branch of Manufacturing, Brazil/USA and Mexico/USA, 1975

	1975 Brazil/ USA Value Added per Person Engaged	Annual Hours per Person Engaged 1975 Brazil	USA	1975 Brazil/ USA Value Added per Hour Worked	1975 Mexico/ USA Value Added per Person Engaged	Annual Hours per Person Engaged 1975 Mexico	USA	1975 Mexico/ USA Value Added per Hour Worked
Food Products, Beverages and Tobacco Products	56.64	2,325	1,873	45.63	36.13	2,046	1,873	33.06
Textiles and Wearing Apparel	52.92	2,134	1,741	43.18	42.59	2,088	1,741	35.52
Wood Products and Furniture	20.37	2,166	1,808	17.01	14.22	2,055	1,808	12.51
Paper Products	42.04	2,548	1,804	29.77	28.29	2,138	1,804	23.88
Chemical Products	66.60	2,250	1,908	56.47				
Footwear, Leather, Rubber and Plastic Products	49.73	2,176	1,837	41.98	} 38.35	2,042	1,876	35.22
Stone, Clay and Glass Products	41.74	2,102	1,891	37.55	39.92	2,171	1,891	34.77
Basic Metals and Metal Products	45.18	2,081	1,875	40.71	45.43	2,070	1,875	41.15
Electric Engineering	51.04	2,006	1,852	47.11				
Machinery and Transport Equipment	51.92	1,853	1,890	52.95	} 31.33	2,107	1,879	27.94
Other	38.96	2,017	1,830	35.35	29.26	2,236	1,830	23.95
Total Manufacturing	46.49	2,017	1,848	42.60	35.58	2,082	1,848	31.58
Adjusted to include employment in auxiliary units	48.56	2,017	1,848	44.50	37.16	2,082	1,848	32.99

Source: Value added per person engaged from table 7.1; Brazil hours supplied by Regis Bonelli derived from Federacao das Industrias do Estado de Sao Paulo (October 1989), which were monthly hours paid which we adjusted by assuming that actual annual working time consists of 46 out of 52 weeks. Mexico hours are actual hours from ILO, Yearbook of Labour Statistics which were weekly hours paid, which we adjusted by assuming that actual annual working time consists of 46 weeks. The figure for total manufacturing was derived by weighting the hours by branch by the corresponding employment. This implies a figure for weekly working hours of 45.6 hours which is relatively close to an estimate of 44.1 hours for the total industrial sector (i.e. including mining and construction) from INEGI, Estadisticas Historicas de Mexico, 1985.
US paid hours for 1975 from BLS, Monthly Labor Review, October 1977, with adjustment for overtime hours of non-production employees by half of that of production workers; estimates of holidays and sickness from BLS, Employee Compensation in the Private Non-Farm Economy, 1977, April 1980. Work stoppages from US Dept. of Commerce, Statistical Abstract of the United States, 1979, tables 681 and 710.

TABLE 7.3

Productivity Ratios (Value Added, Former National Accounts Concept per Person Engaged) by Major Branch of Manufacturing, Brazil/USA and Mexico/USA, 1985

	1985 Brazil Unit Value Weights	1985 US Unit Value Weights	1985 Geometric Average	1985 Mexico Unit Value Weights	1985 US Unit Value Weights	1985 Geometric Average
Food Products	36.90	55.16	45.11			
Beverages	36.80	40.15	38.44	} 26.10	40.71	32.60
Tobacco Products	181.09	203.62	192.03			
Textiles	29.77	44.33	36.33			
Wearing Apparel	28.98	28.98	28.98	} 35.73	36.27	36.00
Wood Products	20.84	23.74	22.25	13.51	12.72	13.11
Paper Products	60.89	73.03	66.68	30.20	40.95	35.17
Chemical Products	46.39	54.48	50.28			
Footwear, Leather, Rubber				} 31.37	39.23	35.08
and Plastic Products	27.63	40.75	33.55			
Stone, Clay and Glass Products	31.41	46.72	38.31	41.84	38.61	40.19
Basic Metals and Metal Products	48.16	56.99	52.39	43.44	48.52	45.91
Electric Engineering	36.96	37.55	37.25			
Machinery and and Transport				} 29.76	33.93	31.78
Equipment	29.35	29.85	29.60			
Other Manufacturing	33.21	42.11	37.39	25.95	33.85	29.64
Total Manufacturing	33.97	43.08	38.26	29.98	39.10	34.24
Adjusted to include employment in auxiliary units	35.49	45.00	39.96	31.32	40.85	35.77

Source: Tables 7.12 and 7.13.

TABLE 7.4

Productivity Ratios and Number of Hours Worked per Person Engaged by Major Branch of Manufacturing, Brazil/USA and Mexico/USA, 1985

	1985 Brazil/ USA Value Added per Person Engaged	Annual Hours per Person Engaged 1985 Brazil	USA	1985 Brazil/ USA Value Added per Hour Worked	1985 Mexico/ USA Value Added per Person Engaged	Annual Hours per Person Engaged 1985 Mexico	USA	1985 Mexico/ USA Value Added per Hour Worked
Food Products, Beverages and Tobacco Products	46.93	2,346	1,876	37.53	32.60	2,072	1,876	29.51
Textiles and Wearing Apparel	35.13	2,187	1,823	29.29	36.00	1,919	1,823	34.20
Wood Products and Furniture	22.25	2,250	1,930	19.03	13.11	2,165	1,930	11.69
Paper Products	66.68	2,452	1,852	50.37	35.17	2,186	1,852	29.80
Chemical Products	50.28	2,166	1,929	44.78				
Footwear, Leather, Rubber and Plastic Products	33.55	2,282	1,950	18.67	}35.08	2,087	1,941	32.62
Stone, Clay and Glass Products	38.31	2,102	1,991	36.29	40.19	2,024	1,991	39.54
Basic Metals and Metal Products	52.39	2,070	1,950	49.36	45.91	1,948	1,950	45.95
Electric Engineering	37.25	2,197	1,873	31.75				
Machinery and Transport Equipment	29.60	1,985	1,957	29.19	} 31.78	2,414	1,932	25.42
Other Manufacturing	37.39	2,102	1,906	33.91	29.64	1,941	1,906	29.10
Total	38.26	2,102	1,904	34.66	34.24	2,087	1,904	31.23
Adjusted to include employment in auxiliary units	39.96	2,102	1,904	36.20	35.77	2,087	1,904	32.62

Source: Value added per person engaged from table 7.3. Annual hours in Brazil and Mexico, see sources table 7.2. US paid hours for 1985 from Monthly Labor Review with overtime adjustment as described above. Ratio of hours worked to hours paid from Jablonski, Kunze and Otto (1990), 'Hours at Work: A New Base for BLS Productivity Statistics', Monthly Labor Review, February, Washington DC.
US sources see table 7.3.

TABLE 7.5
Results of Analogous Studies and Our Study of Output per Person Engaged in Manufacturing as a Whole, as a % of the USA

	at local prices	at US prices	geometric average
		India/USA (1975)	
Van Ark (1991)	4.5	8.5	6.2
		Korea/USA (1975)	
Pilat (1993)[a]	9.8	12.5	11.1
		Argentina/USA (1975)	
Pilat and Hofman (1990)	23.0	29.1	25.8
		Mexico/USA (1975)	
Present study	32.5	42.5	37.2
		UK/USA (1977)	
Smith (1985)	38.3	41.5	39.9
		UK/USA (1975)	
Van Ark (1990)	43.1	54.7	48.6
		Brazil/USA (1975)	
Present study	41.6	58.5	49.3
		Japan/USA (1975)	
Pilat (1993)[a]	59.5	81.6	69.7
		Japan/USA (1972)	
Yukizawa (1978)	78.2	62.1	69.9
		Canada/USA (1977)	
Frank (1977)	76.1	73.2	74.6

a) revised figures, originally from Szirmai and Pilat (1990).
Sources: see our bibliographic references.

TABLE 7.6
Comparative Characteristics of Manufacturing Activity in 1980
Brazil and Mexico compared with Five OECD Countries

	Manufacturing Share of GDP at Factor Cost (percentages)	Labour Productivity Level in Manufacturing Relative to Non-Manufacturing (percentages)
Brazil	27.1	278.8
India	17.6[a]	214.1
Korea	26.6	151.8
Mexico	22.8	199.9
France	27.8	119.8
Germany	33.9[b]	97.1
Japan	28.2	124.6
UK	26.0	91.2
USA	21.3	102.0

a) including small scale (unregistered) manufacturing.
b) The German definition of manufacturing is somewhat broader than in the other countries with respect to repair services and quarrying.

Source: Brazil: output from Contas Nacionais do Brasil: Metodologia e Tabelas Estatisticas, Vargas Foundation, Rio, 1984; employment in manufacturing from IBGE, Censo Industrial, Dados Gerais, 1980, Rio, 1984; non-manufacturing employment from Anuario Estatistico do Brasil, IBGE, Rio, 1985. India: GDP from CSO, National Accounts Statistics 1991. Employment from 1981 Population Census. Korea: GDP from Bank of Korea, National Accounts, 1990 and employment from Economic Planning Board, Economically Active Population Survey. Mexico: INEGI, Sistema de Cuentas Nacionales de Mexico: Principales Variables Macroeconomicas, Periodo 1970-1982, Mexico, 1983. OECD countries (except USA) from OECD, National Accounts 1972-1984, Paris, 1986. USA from US Dept. of Commerce, Survey of Current Business.

TABLE 7.7
Persons Engaged in Manufacturing and Total Population, Brazil, 1975 and 1985

	Persons Employed according to Censo Industrial 1975	1985 Employment as a % of 1975 Employment	Persons Employed in 1985 extrapolated from 1975
Food Products	502,200	121.2	632,544
Beverages	52,100	107.8	56,888
Tobacco Products	24,000	55.8	19,009
Textiles	324,700	95.9	308,955
Wearing Apparel	182,900	203.3	370,028
Wood Products and Furniture	319,900	112.5	358,874
Paper Products	204,500	117.3	237,446
Chemicals	158,200	147.0	232,160
Footwear, Leather, Rubber and Plastic Products	250,100	151.9	371,298
Stone, Clay and Glass Products	311,400	111.7	349,903
Basic Metals and Metal Products	429,500	107.2	454,325
Electric Engineering	170,400	148.3	249,682
Machinery and Transport Equipment	595,600	127.3	751,201
Other Manufacturing	146,300	127.7	186,007
Total Manufacturing	3,671,700	127.2	4,679,726
including employment in auxiliary units	3,824,382	127.2	4,874,325
Total Population	104,851,000	127.8	133,966,000
Ratio of total Engaged in Manufacturing to Total Population (%)	3.65		3.63

Sources: 1975 from IBGE, Censo Industrial 1975 (1981a) (see also table 2.1); 1975-1980 and 1980-1985 trend from Censo Industrial 1980 (1984) and Censo Industrial 1985 (1990). Population from Maddison and Associates (1992).

TABLE 7.8

Persons Engaged in Manufacturing and Total Population, Mexico, 1975 and 1985

	Persons Employed according to Resumen General	1985 Employment as a % of 1975 Employment	Persons Employed in 1985 extrapolated from 1975
Food Products	310,400 }		
Beverages	69,400 }	122.1	474,209
Tobacco Products	8,600 }		
Textiles	138,400 }		
Wearing Apparel	90,600 }	111.9	256,242
Wood Products and Furniture	75,100	132.4	99,418
Paper Products	89,500	123.2	110,293
Chemicals	156,400 }		
Footwear, Leather, Rubber and	}	138.1	356,220
Plastic Products	101,500 }		
Stone, Clay and Glass Products	100,700	123.1	123,938
Basic Metals and Metal Products	206,500	120.4	248,643
Electric Engineering	114,400 }		
Machinery and Transport	}	98.9	289,788
Equipment	178,700 }		
Other Manufacturing	34,100	122.0	41,585
Total Manufacturing including employment in auxiliary units	1,674,300	119.9	2,007,153
	1,743,748	119.9	2,090,407
Total Population	60,153,000	129.6	77,938,000
Ratio of total Engaged in Manufacturing to Total Population (%)	2.90		2.68

Sources: 1975 from SPP (1979a), Resumen General (see also table 2.5). Mexican 1975-85 trend from SPP, Sistema de Cuentas Nacionales de Mexico. Population from Maddison and Associates (1992).

TABLE 7.9
Persons Engaged in Manufacturing and Total Population, United States, 1975 and 1985

	Persons Employed according to Annual Survey of Manufactures 1975	1985 Employment as a % of 1975 Employment	Persons Employed in 1985 extrapolated from 1975
Food Products	1,321,400	97.2	1,284,744
Beverages	203,800	74.3	151,465
Tobacco Products	66,200	84.9	56,225
Textiles	835,000	81.8	682,921
Wearing Apparel	1,214,000	90.9	1,103,724
Wood Products and Furniture	984,000	114.7	1,128,835
Paper Products	1,659,000	123.9	2,055,151
Chemicals	983,100	101.0	992,810
Footwear, Leather, Rubber and Plastic Products	824,700	113.2	933,695
Stone, Clay and Glass Products	588,800	94.9	558,535
Basic Metals and Metal Products	2,505,800	86.4	2,165,447
Electric Engineering	1,523,600	129.4	1,971,928
Machinery and Transport Equipment	3,571,200	111.0	3,965,289
Other Manufacturing	893,200	114.0	1,018,515
Total Manufacturing including employment in auxiliary units	17,173,800	105.6	18,132,911
	18,658,000	105.6	19,700,000
Total Population	215,973,000	110.8	239,279,000
Ratio of total Engaged in Manufacturing to Total Population (%)	8.64		8.23

Sources: 1975 from US Dept. of Commerce (1979), Annual Survey of Manufactures 1975-76 (see also table 2.8); total manufacturing including auxiliary units is directly taken from the National Income and Product Accounts (see also table 2.8); 1975-1985 from US Dept. of Commerce (1986), National Income and Product Accounts, 1929-1982 and Survey of Current Business, July issues. National Accounts estimates include self-employed which is derived as the difference between total persons engaged and full-time equivalent employees. Population from OECD, Labour Force Statistics (1992).

TABLE 7.10

Productivity (Value Added, Former National Accounts Concept) per Person Engaged by Major Branch of Manufacturing, Brazil/USA, 1975

	at Brazilian "prices"			at US "prices"		
	Brazil 1975 (1975 cruzeiros)	USA 1975	Brazil/ USA (%)	Brazil 1975 (1975 US$)	USA 1975	Brazil/ USA (%)
Food Products	60,247	131,143	45.94	13,455	19,594	68.67
Beverages	87,654	160,636	54.57	15,338	25,768	59.52
Tobacco Products	124,628	187,493	66.47	28,440	38,051	74.74
Textiles	48,426	124,096	39.02	6,644	11,432	58.11
Wearing Apparel	39,457	75,650	52.16	4,804	9,210	52.16
Wood Products	37,624	197,132	19.09	3,263	15,006	21.74
Paper Products	76,569	199,441	38.39	8,736	18,972	46.04
Chemical Products	252,964	411,611	61.46	24,647	34,149	72.18
Footwear, Leather, Rubber and Plastic Products	56,926	138,999	40.95	8,572	14,194	60.39
Stone, Clay and Glass Products	49,347	144,170	34.23	9,541	18,743	50.91
Basic Metals and Metal Products	72,581	174,767	41.53	10,545	21,460	49.14
Electric Engineering	90,579	178,877	50.64	9,312	18,103	51.44
Machinery and Transport Equipment	74,265	144,256	51.48	11,362	21,696	52.37
Other	55,442	160,241	34.60	8,019	18,277	43.87
Total Manufacturing	69,999	169,542	41.29	10,124	19,338	52.35
Adjusted to include employment in auxiliary units	67,204	155,830	43.13	9,720	17,774	54.69

Source: Value added (former national accounts concept) from table 3.15; employment from tables 7.7 and 7.9.

TABLE 7.11

Productivity (Value Added, Former National Accounts Concept) per Person Engaged by Major Branch of Manufacturing, Mexico/USA, 1975

	at Mexican "prices"			at US "prices"		
	Mexico 1975 (1975	USA 1975 pesos)	Mexico/ USA (%)	Mexico 1975 (1975	USA 1975 US$)	Mexico/ USA (%)
Food Products	66,305	249,935	26.53	9,470	19,594	48.33
Beverages	117,730	343,745	34.25	8,835	25,768	34.29
Tobacco Products	136,148	355,591	38.29	17,827	38,051	46.85
Textiles	79,643	177,707	44.82	5,204	11,432	45.52
Wearing Apparel	47,561	145,122	32.77	3,021	9,210	32.80
Wood Products	48,470	330,804	14.65	2,070	15,006	13.79
Paper Products	105,952	436,093	24.30	6,250	18,972	32.94
Chemical Products	166,804	446,898	37.32	14,116	34,149	41.34
Footwear, Leather, Rubber and Plastic Products	86,097	330,490	26.05	5,546	14,194	39.07
Stone, Clay and Glass Products	87,938	211,629	41.55	7,187	18,743	38.34
Basic Metals and Metal Products	115,973	269,764	42.99	10,305	21,460	48.02
Electric Engineering	83,550	291,596	28.65	3,976	18,103	21.96
Machinery and Transport Equipment	108,703	329,548	32.99	8,141	21,696	37.52
Other	73,110	285,405	25.62	6,107	18,277	33.41
Total Manufacturing	94,060	301,970	31.15	7,857	19,338	40.63
Adjusted to include employment in auxiliary units	90,314	277,548	32.54	7,544	17,774	42.45

Source: Value added (former national accounts concept) from table 3.16; employment from tables 7.8 and 7.9.

TABLE 7.12

Productivity (Value Added, Former National Accounts Concept) per Person Engaged by Major Branch of Manufacturing, Brazil/USA, 1985 (updated from 1975)

	at Brazilian "prices"			at US "prices"		
	Brazil 1985 (1975 cruzeiros)	USA 1985	Brazil/ USA (%)	Brazil 1985 (1975 US$)	USA 1985	Brazil/ USA (%)
Food Products	65,648	177,910	36.90	14,661	26,582	55.16
Beverages	111,048	301,739	36.80	19,432	48,402	40.15
Tobacco Products	250,124	138,118	181.09	57,077	28,031	203.62
Textiles	59,407	199,570	29.77	8,150	18,385	44.33
Wearing Apparel	25,954	89,565	28.98	3,160	10,904	28.98
Wood Products	46,092	221,149	20.84	3,997	16,834	23.74
Paper Products	132,111	216,968	60.89	15,072	20,640	73.03
Chemical Products	302,393	651,803	46.39	29,463	54,077	54.48
Footwear, Leather, Rubber and Plastic Products	52,332	189,388	27.63	7,880	19,340	40.75
Stone, Clay and Glass Products	52,925	168,492	31.41	10,233	21,905	46.72
Basic Metals and Metal Products	97,875	203,224	48.16	14,221	24,954	56.99
Electric Engineering	99,816	270,063	36.96	10,262	27,331	37.55
Machinery and Transport Equipment	59,540	202,892	29.35	9,109	30,515	29.85
Other Manufacturing	59,931	180,482	33.21	8,668	20,586	42.11
Total Manufacturing	75,480	222,170	33.97	10,917	25,340	43.08
Adjusted to include employment in auxiliary units	72,466	204,201	35.49	10,481	23,291	45.00

Sources: Tables 4.4, 7.7, 7.9 and 7.10.

TABLE 7.13

Productivity (Value Added, Former National Accounts Concept) per Person Engaged by Major Branch of Manufacturing, Mexico/USA, 1985 (updated from 1975)

	at Mexican "prices"			at US "prices"		
	Mexico 1985 (1975 pesos)	USA 1985	Mexico/ USA (%)	Mexico 1985 (1975 US$)	USA 1985	Mexico/ USA (%)
Food Products, Beverages and Tobacco Products	94,824	363,277	26.10	11,745	28,851	40.71
Textiles and Wearing Apparel	77,013	215,526	35.73	4,993	13,764	36.27
Wood Products	50,145	371,106	13.51	2,141	16,834	12.72
Paper Products	143,296	474,417	30.20	8,453	20,640	40.95
Chemicals, Footwear, Leather, Rubber and Plastic Products	183,657	585,539	31.37	14,611	37,241	39.23
Stone, Clay and Glass Products	103,479	247,332	41.84	8,457	21,905	38.61
Basic Metals and Metal Products	136,252	313,688	43.44	12,107	24,954	48.52
Electric Engineering, Machinery and Transport Equipment	135,275	454,542	29.76	8,913	26,016	34.26
Other Manufacturing	83,409	321,455	25.95	6,968	20,586	33.85
Total Manufacturing	118,620	395,704	29.98	9,909	25,340	39.10
Adjusted to include employment in auxiliary units	113,896	363,701	31.32	9,514	23,291	40.85

Sources: Tables 4.5, 7.8, 7.9 and 7.11.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

This study has a twofold objective:

a) a systematic methodological survey of the analytical problems inherent in the industry of origin approach, with whatever pragmatic contribution or recommendations we could make to mitigate or solve those which characteristically emerge.
b) a substantive analysis of real output levels, PPPs and labour productivity outcomes in Brazilian, Mexican and US manufacturing in 1975;

Confrontation of Our PPP Results with the Exchange Rate and the ICP PPPs

Perhaps the most interesting feature of our results is the PPPs and the extent to which they deviate from the results of previous studies. The striking fact about our PPPs (table 8.1) is that they are not very different from the exchange rates for these countries for 1975. This should not be too surprising in a year of reasonable payments equilibrium, because manufacturing output consists of products most of which are eminently tradeable whereas this is much less true of services.

It should be stressed that the PPPs presented in table 8.1 are our preferred summary measures. As in all such studies the final outcomes can be stated in alternative ways, i.e. the price relations can be measured with the "quantity" weights of either one of the two countries involved in each binary comparison. In complementary fashion, quantity relations (see table 8.3) can be measured using "price" weights of either one of the countries involved in each binary comparison. Our preferred measure is a geometric (Fisher) average of these alternatives.

Table 8.1 shows that the purchasing power of the Brazilian currency for manufactured products was somewhat greater than suggested by the exchange rate, and in Mexico the reverse situation prevailed. These conclusions seem quite plausible. After the first OPEC shock Brazil took steps to make its effective exchange rate more competitive in 1974 and 1975, whereas the Mexican currency is generally held to have been overvalued in 1975, as the exchange rate had been unchanged since 1954, and was substantially devalued in 1976. The trade policy literature also supports these conclusions. Several studies have suggested that Brazil's apparently high tariffs were substantially redundant (Bergsman, 1970; Tyler, 1985), whereas Balassa (1983) stresses the significance of both quantitative restrictions and tariffs in Mexico's rather more protectionist situation.

Our PPP results and our exchange rate deviation indices (table 8.1) are quite different from those of the ICP for GDP. This in itself does not mean that they are incompatible, as the ICP figures are strongly affected by services, where their exchange rate deviation index is particularly extreme.

Confrontation of Our Results with Proxy PPPs Derived from ICP for Manufacturing

One can use ICP PPPs in order to derive a crude proxy PPP estimate for the manufacturing sector. The authors of the ICP have never tried to do

this, but several other investigators have done so (see table 1.2 in chapter I). Using the same technique as such analysts, we derived the proxy PPPs for manufacturing presented in table 8.2.

In fact our average PPP result in the Brazil/USA comparison is slightly higher than the proxy PPP, but for the Mexico/USA comparison the difference is more substantial. It should be noted that the results of other binary comparisons by ICOP researchers for India/USA (Van Ark, 1991) and Korea/USA (Pilat, 1993) also show differences from similarly derived ICP proxies, with the "industry of origin" PPPs being nearer to the exchange rate.

In our view expenditure PPPs are unsuitable for output and productivity comparisons by sector. These PPPs include prices of imported goods, but exclude those of items produced for export. Expenditure prices include trade and transport margins and indirect taxes which may be different between countries. Finally, expenditure PPPs exclude price measures of intermediate products, such as paper, steel, cement, etc., which make up a substantial share of manufacturing output.

Apart from the possible shortcomings of the proxy PPPs, there is also a danger that they may be applied (see D.J. Roy, 1987) to the respective national accounts at national prices, without adjustment for differences in the coverage of such accounts. As we found in chapter II, the Mexican national accounts make a very large imputation for manufacturing activity in the informal sector, whereas the Brazilian accounts make virtually no adjustment for this. As there is no reason to expect the relative size of the informal sector to be much different in the two countries, use of inconsistent national accounts can have serious results. The typical shortcut proxy procedure would overstate Mexico's output position relative to Brazil's for two reasons:
a) by overstating the relative PPP of the peso, and
b) overstating Mexico's output in national currency terms vis-à-vis Brazil.

Substantive Results for Output and Productivity, Brazil/USA and Mexico/USA

The most striking feature of our quantitative results (table 8.3) is the relatively high levels of productivity in the manufacturing sectors of the two Latin American countries. Though well below the US level, they are not far from those which comparable studies have revealed for the UK and much higher than the estimates for Korea (see table 7.5). A few additional remarks should be added to this surprising conclusion. Firstly, the Brazilian and Mexican standing in terms of output per man hour is lower than the productivity ratio in terms of output per person engaged, because working hours are higher than in the USA. Secondly, in comparison with the USA there is probably a greater amount of informal manufacturing activity outside the scope of the census in Latin America where productivity is lower. Thirdly, Latin American performance per head of population is much lower than their productivity standing, because manufacturing employment is relatively much smaller than it is in the USA.

Our Methodological Innovations

a) Transparency of Procedures

With modern computer facilities, it was possible to lay out our procedures and assumptions in transparent fashion (with meticulous detail in the statistical appendix) so that they can be criticised, checked, replicated, augmented or truncated by other researchers in this field. In general the tables are laid out in similar fashion to the binary comparisons of Kravis, Heston and Summers (1982). In cases where there were alternative measures or concepts to those which we preferred, we generally provide enough information for use by others whose judgment differs from ours. Such transparency is an advance on most earlier "industry of origin" research whose detailed substructure was usually not published (Paige and Bombach being an honourable exception) and whose procedures were of a more ad hoc character. It has helped others since our first edition to replicate our methods (see Maddison and Van Ark, 1994).

b) An Integrated Three-Dimensional Approach

We tried to give full attention to each of the three main dimensions of international comparisons - real output, PPPs and productivity, and to set out their interrelations and complementary character clearly. Here our exposure to ICP methodology was very useful, as its rigour in this respect is exemplary. We feel that a good deal of previous work on industry-of-origin lines has suffered from concentrating only on the productivity aspects (this is true of all studies listed in table 1.3 of chapter I except Paige and Bombach, the Czechoslovakia/France study and that of West).

c) Reconciliation with the National Accounts Framework

There are obvious advantages in making sectoral output and productivity studies of this kind in a conceptual framework compatible with the national accounts. Chapter II therefore makes a careful confrontation between the census and the national accounts. From this one can see that the Mexican national accounts make extensive (and perhaps excessive) allowance for informal activity not recorded in the manufacturing censuses. It is also clear that census definitions of value added vary between countries, and need adjustment to bring the comparisons for the three countries to a common conceptual basis as is used in national accounting. Unfortunately, we were not able to adjust the detailed US census data to a national accounts concept of value added. This is a shortcoming of our chapter III, which uses a standardised but inferior notion of value added in neglecting to deduct service inputs (i.e. the US census concept) for our 27 industries. However, at the level of manufacturing branches and for manufacturing as a whole, all our comparisons employ the national accounts concept of value added.

d) Adjustment to a Common Benchmark Year

Chapter III presents a method for dealing with the problem of comparing countries whose census dates fall in different years. The procedures have general applicability, and they were applied here to the USA, whose performance is often a yardstick for comparison in such studies. In fact, using our approach, US data can be adjusted to any intercensal year needed for purposes of international comparison.

e) A Systematic Shortcut Procedure for Matching

Chapter V presents a systematic short-cut procedure, the ABM method, for matching products in complex multiproduct industries. This method confines matching to products which account for more than 1 per cent of the gross value of output of an industry. Smaller items were only included in case they could be matched with a similar product in the other country where it is important, or in cases where they were required to complete a "match" with an important product. The advantage of our short-cut method over the alternative maximalist procedure, is that it improves the quality of the results by eliminating "outlier" PPPs, and that it offers considerable savings in research time.

f) The Unit Value Approach is not Inferior to Specification Pricing

It is sometimes suggested that unit values such as we derived from census information are inherently inferior to specification pricing as practiced by ICP. In fact we do not believe this to be true and have explained why in chapter VI.

Specification pricing as practiced by ICP involves meticulous characterisation of the items chosen as representative, whereas our "prices" are unit values derived by confrontation of census information on values and quantities of product. In practice the "products" may be a mix of items and qualities and be very far from the ideal of specification pricing. But there are compensatory advantages in the industry of origin approach:

1) the unit values are average transaction values for the whole year for all producing locations of the countries compared, whereas ICP prices are quotes, shelf, list or monitored prices for one point in the year in a limited number of locations.
2) with the census one can judge the representativity of the "unit values" which are selected from a much wider range of information than ICP had at its disposal. For instance, our 27 industry sample yielded 1,909 Mexican unit values from which 309 were chosen to match with the USA, and 707 Brazilian unit values of which 221 were matched with the USA. ICP, by contrast, had to live with what it got from national statistical offices (at least for consumption goods). For Mexico it received only 284 of the much larger number of consumer prices it requested, as compared with 359 for Brazil and 571 for the USA (Kravis, Heston and Summers, 1982, p. 45).

The unit value specification was particularly poor in the case of motor vehicles, largely because of census confidentiality rules. The census information was therefore supplemented in this case by information on output and consumer price structures furnished by trade associations. This adjustment produced a reasonable though not an optimal adjustment for quality. In any case we would stress that our method of handling the problem does not lead to results which are inferior to those of ICP for this particular industry. The ICP multilateral comparison for expenditure on motor vehicles was based largely on Japanese and European models which were quite unrepresentative of the situation in Brazil, Mexico and the USA.

g) The Adequacy of the Sample

Our sample size (39 per cent of Mexican, 33 per cent of Brazilian and 20 per cent of US value added) was certainly big enough to illustrate most

of the methodological problems one is likely to meet in this kind of study and to help elaborate pragmatic solutions to them. Except as noted under h) below, the only failure in this respect was the problem of unique products, such as atomic weaponry, guided missiles and space vehicles, which are produced in the USA but not in the other two countries, and for which it would be difficult to derive dummy Brazilian and Mexican prices. There are also industries which are not unique, but near enough to impede comparison (such as aircraft, computers, oil drilling and other specialised machinery). These unique and quasi-unique industries were about 7 per cent of total US manufacturing output in 1975. Otherwise, there are very few industries which are truly comparison resistant, particularly if one makes supplementary inquiries with trade associations (which we did for motor vehicles, paints, petroleum products and bricks) where there were national idiosyncracies in measurement units or gaps in the census due to confidentiality rules.

h) Approaches to the Problem of Double Deflation

The important unsolved problem in this study is that of double deflation. Virtually all analysts who have used the industry of origin approach have been unable to find separate PPPs for inputs. The double deflation approach is feasible for agriculture (Van Ooststroom and Maddison, 1985), but not for manufacturing in these three countries, because the Brazilian and Mexican censuses give only rather global value figures on inputs with no detailed quantitative information, and the US census gives detailed figures only for energy consumption, contract work, and inputs directly related to the production process.

In agriculture the difference between the gross output PPPs and the double deflated PPPs was rather small. For Brazil the 1975 PPP (Brazil quantity weights) was 7.35 cruzeiros to the US dollar, 6.63 for inputs and 7.57 for value added. For Mexico the 1975 PPP (Mexican weights) was 13.46 pesos to the US dollar, 13.68 for inputs and 13.36 for value added.

In manufacturing, inputs are much bigger in relation to gross output than in agriculture, but in the USA 60 per cent of these are from manufacturing itself, in Brazil 65 per cent and in Mexico 48 per cent (see input/output tables in chapter II). For manufacturing as a whole therefore, it does not seem a priori likely that the PPPs resulting from "double deflation" would be very different from those in our study, but for particular branches they might vary a good deal more (see also Szirmai and Pilat, 1990).

Previous investigators who have discussed this problem, have been able to make only very partial adjustments for inputs. Paige and Bombach did this for fuel inputs on a rather aggregative basis, and Smith, Hitchens and Davies made some illustrative calculations (whose basis is not clear) for fuels and raw materials. Only Frank (1977) made a full comparison for fuel and raw materials in a comparison between Canada and the United States. However, tables 2.5 and 2.8 on input/output structures show clearly that fuel and raw material inputs are only a small part of the problem in most industries. In a study of manufacturing productivity for Japan, Korea and the United States following our first edition, Szirmai and Pilat (1990) experimented with a double deflation technique using input-output tables. They found that double deflation easily leads to volatile and improbable results, particularly when intermediate inputs make up a large part of gross

output or when the input-output structure is very different between countries (see also Van Ark, 1993).

Our analysis of the relation of census to GDP concepts of value added helps to clarify the nature of double deflation because it demonstrates the need to deal with all inputs. Further progress can best be made, when industry of origin studies such as the present one are available for all the major sectors of the economy, i.e. for agriculture, mining, manufacturing, utilities, construction and services. With this information and input-output tables for each of the countries under comparison, one can return to the problem of double deflation much better equipped to do a thorough job (see Pilat, 1993, for a Japan/USA and a Korea/USA comparison). In the case of Brazil, Mexico and the USA, input-output tables are available for 1975, so for these three countries, this work should be feasible.

i) Updating Methodology

In chapter III we presented two different techniques to update the benchmark comparison for 1975 to 1985. Both techniques, i.e. applying the growth rates of manufacturing real output for each country to the 1975 benchmark and extrapolating the 1975 PPP on the basis of manufacturing producer price indexes, yield the same result in case the multiplication of the quantity and price indices result in the original index of value added in current prices.

However, an estimate which is updated from an earlier benchmark needs not be identical to a new independent benchmark comparison. In our view it is desirable to replicate benchmark comparisons at regular intervals and to carefully scrutinise the reasons for differences between extrapolated results and new benchmarks.

Research Priorities

1) Research using the industry of origin approach can obviously throw new light on comparative performance across countries and its variation between branches. Such information is of major interest for growth analysis. For this reason, it is desirable to extend the present type of comparison to the leading manufacturing economies. Within our team in Groningen we now covered about 20 countries for manufacturing, and we are presently working on studies including China and the former Soviet Union. Work of this type can be self reinforcing, can be extended to incorporate capital productivity, more refined measures of labour inputs (adjusted for differences in working time and education per head) and total factor productivity.
2) For the three countries we covered, we need to extend the comparison to cover the other main sectors of the economy, so that we can arrive at estimates for GDP, strengthen the methodological foundation of the industry of origin approach, and make a more careful comparison with the results of the ICP (see Maddison and Van Ark, 1994). Some work has already been done in this direction for agriculture (Maddison and Van Ooststroom, 1993), mining (Houben, 1990) and transport and distribution (Mulder and Maddison, 1993) so the main task here would be to analyse the rest of the service sector. Coverage of the whole economy would make it possible to look afresh at the problem of double deflation, and to make better tests of the reliability of short-cut approaches.

Recommendations on Official Statistics

a) Censuses of Manufacturing

At present, the definitions of value added in manufacturing censuses are often anachronistic as they ignore inputs of services which are large and growing proportionately. They reflect the statistical practice of yesteryear, before the introduction of the more rigorous concepts of national accounts. Furthermore, these census concepts differ across countries in a way which is not adequately stressed in standard UN publications such as the Yearbook of Industrial Statistics, and this leads to use of non-commensurate valuations in construction of world indices of industrial production. There is therefore need for both improvement and standardisation in this field. Of course, it is not easy to modify the scope of detailed data collection in censuses, but at least some better guidelines on the problems of reconciliation with the national accounts should be provided in the summary volumes of the census reports. The US General Summary volume has made a start on this, but its analysis could be greatly improved given the wealth of input-output material available in that country.

b) Scope of National Accounts

Our investigation revealed a major difference between Mexican and Brazilian national accounting practice in estimating activity in the informal manufacturing sector. The Mexican estimates for such activity add 38 per cent to census definition of value added, whereas the Brazilian national accounts make virtually no such imputation, in spite of evidence from employment statistics that such informal activity is probably as large proportionately as in Mexico. This means that comparative real product estimates must be particularly wary of such differences in national accounts coverage. In the long run, improvements will require increased manpower resources in national statistical offices (in this case, particularly in Brazil) and increased scrutiny by international agencies with the vocation and the funds to carry out such a task (which in practice means the World Bank).

TABLE 8.1
Confrontation of Our PPPs for Manufacturing with the Exchange Rate and with the PPPs of ICP for 1975

	Brazil/USA (Cr./US$)	Mexico/USA (Ps./US$)
Our PPPs for Manufacturing (weighted by major branch)	7.79	13.67
ICP (Augmented Binary) PPPs for GDP	5.40	7.17
Exchange Rate	8.13	12.50
Our Exchange Rate Deviation Index for Manufacturing	1.04	0.91
ICP Exchange Rate Deviation Index for GDP (Augmented Binaries)	1.59	1.74

Source: Our geometric average PPPs for Brazil/USA and Mexico/USA from table 3.17; ICP augmented binaries from Kravis, Heston and Summers (1982), pp. 225, 272 and 313. In fact the preferred ICP PPPs are multilaterally weighted, but we have shown their augmented binaries here because they are conceptually closer to ours. The multilaterally weighted PPPs of ICP were not very different, i.e. 5.20, 7.40 and 1.43 respectively for 1975 (see Kravis, Heston and Summers, 1982, p.177); Exchange rates from IMF; The exchange rate deviation index is the ratio of the exchange rate to the PPP.

TABLE 8.2
Confrontation of Our PPPs for Manufacturing with the Proxy PPPs Derived from the ICP 1975 Augmented Binary Results

	Brazil/USA (Cr./US$)	Mexico/USA (Ps./US$)
Our PPPs for Manufacturing (weighted by major branch)	7.79	13.67
Proxy PPPs for Manufacturing Derived from ICP Augmented Binaries	7.42	10.66
Ratio of Our PPP/Proxy ICP PPP	1.05	1.28

Source: Top line from table 8.1; Second line derived from Kravis, Heston and Summers (1982), pp. 255, 272 and 313 as follows: the ICP III augmented binary PPPs for expenditure on the consumer items food, beverages, tobacco, clothing, footwear, furniture, appliances and transport equipment, and for producer durables were used to make the weighted average. These are the ICP PPPs which are conceptually closest to our type of comparison. The preferred PPPs of the ICP itself are in "international dollars".

TABLE 8.3
Summary Results for Manufacturing Output and Productivity Brazil/USA and Mexico/US, (1975)

	Brazil/USA		Mexico/USA	
	1975	1985	1975	1985
Value Added (Former National Accounts Concept) as a percentage of the USA	9.94	9.88	3.47	3.79
Value Added (Former National Accounts Concept) per Person Engaged as a percentage of the USA	48.56	39.96	37.16	35.77
Value Added (Former National Accounts Concept(per Hour Worked as a percentage of the USA	44.50	36.20	32.99	32.62
Value Added (Former National Accounts Concept) per Head of Population as a percentage of the USA	20.48	17.65	12.46	11.64
Persons Engaged in Manufacturing as a percentage of the USA	20.50	24.74	9.35	10.61
Population as a percentage of the USA	48.55	55.99	27.85	32.57

Note: figures in the three upper lines are geometric averages.

Source: Value added from tables 3.15, 3.16, 4.4 and 4.5; value added per person employed from tables 7.1 and 7.3; value added per hour worked from table 7.2 and 7.4: value added per head of population, persons engaged and population derived from tables 7.1, 7.3 and 7.7 to 7.9.

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STATISTICAL APPENDIX
(NOTES)

Introduction

This appendix presents the basic census material we have used and the detailed procedure for matching products. It is intended to be fully transparent in the sense that it gives enough detail for other scholars to replicate or modify our procedures. The tables are arranged by industry, and numbered 1 to 27. Their order follows their sequence within the ISIC major division "manufacturing".

The industries covered are:

ISIC Code	ISIC Three Digit Major Industry Groups	Our Code	Our Sample Industries
311/2	Food Products	1	Dairy Products
		2	Fats and Oils
		3	Grain Mill Products
		4	Sugar and Sugar Products
		5	Cocoa, Chocolate and Confectionary Products
313	Beverages	6	Malt and Malt Beverages
314	Tobacco	7	Tobacco and Tobacco Products
321	Textiles	8	Textiles
322	Wearing Apparel	9	Men's Clothing
323/4	Leather Products, Footwear	10	Leather Products
		11	Footwear
331	Wood Products	12	Sawmill Products
332	Furniture	--	not represented
341	Paper and Paper Products	13	Pulp and Paper
342	Printing and Publishing	--	not represented
351/2	Chemicals	14	Soap and Detergents
		15	Paints
		16	Agricultural Fertilizers
		17	Synthetic Fibres
353/4	Petroleum Refining, Petroleum and Coal Products	18	Petroleum Refining and Products
355/6	Rubber and Plastic Products	19	Tires and Inner Tubes
361/2/9	Stone Clay and Glass Products	20	Hydraulic Cement
		21	Bricks, Tiles and Clay Refractories
371/2	Iron and Steel, Non Ferrous Metals	22	Iron and Steel
381	Metal Products	23	Bolts, Nuts, Rivets and Washers
382	Machinery	24	Agricultural Machinery
383	Electrical Machinery	25	Radio and TV Receivers
		26	Electric Lamps and Bulbs
384	Transport Equipment	27	Motor Vehicles and Equipment
385/90	Miscellaneous	--	not represented

For each industry there are 7 tables, e.g. for industry 1, Dairy Products, the detailed tables are numbered from 1.1 to 1.7. At the end of this introduction we present some specific notes on industries.

Table 1

This table gives a summary English language presentation of basic data on output, value added and employment levels for the three countries. For the USA the 1977 figures were derived from the General Summary of the 1977 Census of Manufactures (US Dept. of Commerce, 1981a), and the 1975 figures from the Annual Survey of Manufactures 1975-1976 (US Dept. of Commerce, 1979), for Brazil from the Censo Industrial: Brasil (IBGE, 1981a), and for Mexico from the X Censo Industrial 1976, Datos de 1975 (SPP, 1979a). None of these countries follows the internationally standardised ISIC classification. Gross value of output in the USA refers to value of shipments of all products which are produced by the establishments classified in that industry (including interplant transfers within the company to which the establishment belongs). Brazilian and Mexican gross value of output refer to production plus net inventory change. Chapter II explains the different concepts of value added. The employment figures refer to average number of employees for the year.

Tables 2, 3, 4

The basic census information on production in physical terms and gross value of shipments (in national currencies) is given in tables 2 (USA), 3 (Brazil) and 4 (Mexico). The tables also show unit values derived from the census listings. The total census values for some industries are sometimes different from the total we obtained by summing the values of specified items. Virtually all of these differences are very small. The only big discrepancies are for the Brazilian motor vehicle and petroleum refining industries, where information was probably withheld because of confidentiality requirements (all three countries require suppression of information when there are only three firms or less in an industry).

Table 2 (USA)

The USA has its own Standard Industrial Classification (SIC) with four digit industries, e.g. "2111, Cigarettes" and the product detail within these is shown with seven digits. The detailed information can be derived from the Industry Statistics in the 1977 Census of Manufactures, Final Report Volumes (US Dept. of Commerce, 1981b). In fact the totals of specified items are not entirely congruent in coverage with those for total industry shipments. The latter includes primary products and secondary products of all establishments within the particular industry class; the total of specified items includes all products which are primary to the industry class, wherever they are produced. In our sample, the totals of the specified items were always smaller than total industry shipments, so differences in the ratio of the two values are taken into account by means of our coverage adjustment (see Fabricant, 1940, p. 350-1 for a discussion of the matter). In most cases the differences are small.

Table 3 (Brazil)

In Brazil there is no analytic coding in the census. The detailed information on quantities and values by product in the volume Producão Fisica of the Censo Industrial: Brasil (IBGE, 1981b) is listed with a sequence of numbers of 1 to 13,678. Some of these numbered items refer to production in Brazil as a whole and others to production by state. The summary volume Censo Industrial (IBGE, 1981a) gives an analytic breakdown of gross value of output, census value added, employment and inputs for 24 branches of industry, of which 23 are manufacturing branches. The numbering

system is this summary volume is different from that in Producão Fisica, though the same sequence of branches is used in the two volumes.

Table 4 (Mexico)

The Mexican census is issued in two main volumes for Mexico as a whole, the Desglose (SPP, 1979b) which only gives output quantities and values, and the analytic summary volume Resumen General (SPP, 1979a) which gives information on employment and inputs as well. Mexico has its own four digit code (Catalogo Mexicano de Actividades Economicas) for 239 industries, but the items within each branch are not numbered. They are arranged instead in descending order of the gross value of shipments. The degree of product detail in the Mexican census is generally bigger than in the US and much bigger than in Brazil. Sometimes a product with the same name is listed in more than one branch. In rarer cases one may find the same product mentioned twice within a branch.

Tables 5 and 6

The binary matchings which we made to derive PPPs for gross output are presented in tables 5 (US/Brazil) and 6 (US/Mexico). Before matching all quantities of measurement were expressed in metric units, e.g. US short tons were converted to metric tons and US gallons to litres.

Table 7

Table 7 summarizes the final results for each industry as shown in chapter III. The upper part of the table shows the basic data and matching results. The lower part shows the major calculations. The bottom of the table presents, pro memoria, alternate PPPs which assume that the quantity relations of the sample are representative for the non-sampled part of the industry (see chapter III).

Conversion factors

The following conversion factors were used to convert US measures to metric units:

1 short ton = 0.907 metric ton
1 US gallon = 3.785 litres
1 square feet = 0.930 square metre
1 linear yard = 0.914 metre

Specific Notes on Industries

1 - Dairy Products

- US quantities are converted from weight to litres using the following conversion factors:
  fluid milk, bulk sales: 1 lb. = 0.4674 litre
  fluid milk, packaged: 1 lb. = 1.0571 litre
- The unit value for the US item 20231 31 "nonfat dry milk" was derived from the price relationship between "dry skim milk, shipped in bulk" and "nonfat dry milk, shipped in consumer packages" from the 1972 US Census of Manufactures.
- The unit value for the US item 20262 32 "cream, heavy (whipping cream containing 30% or more fat" was derived from the price relationship between "cream light (coffee cream)" and "cream heavy (whipping cream)" from the 1972 US Census of Manufactures.

2 - Fats and Oils
- For Brazil and Mexico, vegetable and animal oils and fats for industrial use were transferred from the chemicals branch to the food products branch in order to obtain a correct match of industries with the United States.

5. - Cocoa, Chocolate and Confectionery Products
- The gross value of output, value added and employment for US industry 2099 "food preparations" was partly included on the basis of the share of the value of shipments of chocolate and cocoa products in this branch in total shipments of industry 2099.

6. - Malt and Malt Beverages
- Gross value of output and value added in Mexico were adjusted for indirect taxes and subsidies (i.e. 1,908 million pesos) which were derived from SPP, Sistema de Cuentas Nacionales de Mexico, Tomo III.

7. Tobacco and Tobacco Products
- Gross value of output and value added in Mexico were adjusted for indirect taxes and subsidies (i.e. 2,598 million pesos) which were derived from SPP, Sistema de Cuentas Nacionales de Mexico, Tomo III.
- The US commodity items 21110 53 and 21110 57 "Cigarettes, Non-filter tips" are included in the matching procedure, despite the lack of separate quantity specifications. However, their quantities are included in the total quantity specification (see "match 1" in table 7.5 and 7.6).

8 - Textiles
- The figures for 30 items in the Mexican industry 2316 "Manufacture of Velvet Cloths and Weaving of Bedspreads and Towels", and 105 items of industry 2317 "Spinning and Weaving of Other Soft Fibre Cloths" are presented in a consolidated form.
- US quantities are converted from linear metres to square metres using conversion factors from the UN Industrial Statistics Yearbook 1984:
  cotton fabrics: 1 linear metre = 1.189 square metre.
  woollen fabrics: 1 linear metre = 1.555 square metre.
  For man-made fibres and synthetic fibres it was assumed that the US linear metre was similar to the Brazilian metre.
- Brazilian quantities are converted using conversion factors from the UN Industrial Statistics Yearbook 1984:
  unbleached cotton fabrics: 1 ton = 11.7 thousand square metres.
  treated and finished cotton fabric: 1 linear metre - 1.195 square metre.
  silk fabric: 1 ton = 13.348 linear metres.
  woollen fabrics: 1 linear metre = 1.643 square metre.

11 - Footwear
- Rubber and plastic footwear were combined with leather footwear in order to obtain a correct match of industries between each country and the United States.

12 - Sawmill Products
- US quantities are converted using conversion factors from The Economist Measurement Guide and Reckoner, pp. 88-89:
  1 cubic metre = 2.36 broad feet
  1 square metre = 0.0929 square feet
  1 ton = 2.44 cord

14 - Soap and Detergents

- Only part of the US industry 2842 "Polishes and Sanitation Goods" is included in the sample, i.e. category 28422 'Household Bleaches" (see also footnote table 14.1).
- The commodity item "toothpaste" in the Mexican industry 3061 "Manufacture of Soap, Detergents and Other Washing and Cleaning Products" is excluded from the sample because it was classified elsewhere (in other industries) in Brazil and the USA.
- The matching procedure of detergents in the Brazil/USA comparison (see table 14.5) concerns only "dry" detergents, because liquid detergents could not be converted from US gallons to kilograms.

15 - Paints

- Brazilian quantities are converted from kilograms to litres assuming 1 kg = 1.25 liter.

18 - Petroleum Refining and Products

- The gross value of output, value added and employment for the refining of crude petroleum and derivatives for Mexico is derived from SPP, Sistema de Cuentas Nacionales de Mexico, Tomo III, Cuentas de Produccion Actividades Secundarias, volume 1. Gross value of output and value added in Mexico were adjusted for indirect taxes and subsides (i.e. 4,836.2 million pesos).
- US quantities are converted from barrels to tons using conversion factors from The Economist Measurement Guide and Reckoner, p. 102:
  light fuel oil: 1 ton = 7.6 barrels
  heavy fuel oil: 1 ton = 6.7 barrels
  lubricating oils: 1 ton = 7.2 barrels
  propane: 1 ton = 12.6 barrels

21 - Bricks, Tiles and Clay Refractories

- US quantities of refractory bricks are converted from tons to units using conversion factors from The Economist Measurement Guide and Reckoner, p. 96: 1 brick = 2.75 kilogram.
- US quantities in terms of inch equivalents were assumed to be identical to one unit.
- Mexican quantities are converted from tons to single units using the peso unit value for "Other Bricks" of which the quantity was given in single units (see also table 21.6).

22 - Iron and Steel

- US figures on quantity and value of shipments are derived from table 6a-2 in the Industry Series, Blast Furnaces, Steel Works, and Rolling and Finishing Mills (MC77-I-33A, Change Sheet, October 1980). This table was originally derived from the Current Industrial Reports, MA-33B, Steel Mill Products of the 1977 Census of Manufactures.

27 - Motor Vehicles and Equipment

- The figures for 134 items in the Mexican industry 3819 "Manufacture of Other Parts and Acessories for Motor Vehicles" are presented in a consolidated form.
- See separate note on the unit value adjustment for passenger cars.

Note on the Adjustment for Unit Value Basis for Passenger Cars

The 1977 Census of Manufactures for the USA gives only a single entry for passenger cars, while Brazil and Mexico both provide simple, but different, breakdowns; the former according to horsepower and the latter according to engine type.

With limited census information (see table A.1) we would have to value passenger cars produced in Brazil and Mexico by the single average price for all passenger cars produced in the United States, i.e. US$ 5,200. But the USA produces more large (and expensive) cars than the other two countries, so the average US price is too high for revaluing car output in Brazil and Mexico.

TABLE A.1
Industrial Census Information on Passenger Car Output in the United States (1977), Brazil and Mexico (1975)

	Quantity (1000 units)	Value (mill. national currencies)	Unit value (in national currencies)
United States (1977)			
Complete passenger vehicles	9,192.2	47,796.3	5,199.66
Brazil (1975)			
Cars, assembled, less than 75 hp.	132.2	2,964.4	22,418.02
Cars n.e.s.	317.4	6,322.1	19,915.86
Total	449.7	9,286.6	20,651.65
Mexico (1975)			
4 cylinder cars	152.0	6,038.0	39,712.58
6 cylinder cars	60.3	3,183.1	52,813.89
8 cylinder cars	45.1	3,002.2	66,626.81
Total	257.4	12,223.3	47,492.67

Source: Appendix Tables 27.2, 27.3 and 27.4.

Car output in the three countries was therefore divided into two groups: cars with 4 cylinders or less and those with more than 4 cylinders. Although, at first sight, this may seem a rather crude way of assessing passenger car quality, it appears to be appropriate for the purpose at hand. In the mid-1970s car output in the United States consisted largely of 6 and 8 cylinder models while in Brazil and Mexico it consisted mainly of 4 cylinder models.

The first step was to estimate quantities for all the three countries distinguishing between 4 cylinder cars and those with 6 or 8 cylinders. For Mexico we get this information directly from the census material (see table A.1). For the USA we used information from Automotive News, 1975 Almanac Issue, which is the most important trade journal of the automobile industry in the USA. It shows US production classified by model, together with technical specifications of each model. The figures show that 4 cylinder cars accounted for only 9.7 per cent of total car output in the USA in 1975 (table A.2). For Brazil some indirect information on quantities is also available from Automotive News which shows that car production by Volkswagen accounted for 63.5% of total car production. The entire output of Volkswagen

consisted of 4 cylinder cars, and as the other major car manufacturers in Brazil - Ford and General Motors - produced at least some 4 cylinder models - it seems reasonable to put 4 cylinder car output at about 70% of the total for Brazil. our estimated "census" quantities of 4 cylinder and 6/8 cylinder passenger car output are presented in the first column of table A.4.

TABLE A.2
Production of Passenger Cars in the United States in 1975
Classified by Engine Size

Model	Units produced (thousands)
Vega	194
Pinto	164
Bobcat	61
Astre	56
Monza	83
Mustang	94[a]
Total 4 cylinder vehicles	652
Total 4, 6, and 8 cylinder vehicles	6,741[b]

a) In 1975 Mustangs were produced with 4, 6 and 8 cylinder engines. For the purpose of the table it is assumed that 50% of Mustangs were produced with 4 cylinder engines.
b) This compares with 9,192,000 units given in the US Annual Survey of Manufacturers for 1975. The reasons for the understatement of total output by Automotive News are not known.

Source: Automotive News, 1975 Almanac Issue.

Next we calculated unit values for the two major types of passenger car. For Mexico this information was available in the census. For Brazil we could not find any price quotation by model. We assumed therefore that the Mexican price differential was also representative for Brazil. The price ratio for the USA was derived from information on retail prices in Automotive News. The average 1975 retail price for 4 cylinder cars was US$ 3,079, and an average of US$ 4,079 for the sample of 6 and 8 cylinder cars (see table A.3).

TABLE A.3
U.S. Retail Prices in 1975 for 4 Cylinder and 6/8 Cylinder Cars

Model	Retail value (1000 US$)	Number produced	Retail price (US$)
a) 4 cylinder cars			
Vega	193,882	540,155	2,786
Pinto	163,506	477,274	2,919
Bobcat	60,706	193,591	3,189
Astra	55,805	158,542	2,841
Monza	82,960	302,638	3,648
Mustang	93,727	330,763	3,529
	650,586	2,002,963	
Average retail price: 2,002,963 ÷ 650,586 = $ 3,079			
b) 6/8 cylinder cars			
Cutlass	363,814	1,361,756	3,743
Granada	336,842	1,245,542	3,698
Nova	274,521	850,741	3,099
Chevelle	269,967	919,777	3,407
Monte Carlo	266,541	1,132,533	4,249
Century	212,948	812,397	3,815
Cadillac	193,444	1,583,146	8,184
Ford	191,400	909,724	4,753
Dart	161,567	532,586	3,297
Camaro	156,406	553,677	3,540
		2,427,450	9,902,079
Average retail price: 9,902,079 ÷ 2,427,450 = $ 4,079			

Source: All 4 cylinder cars produced in 1975 are listed in part a) of the table, whereas part b) refers only to a sample. The 10 models listed in part b) are the 10 best-selling models in 1975 as shown in Automotive News, 1975 Almanac Issue for which retail prices could be identified from the same source. Some of the "models" listed in Automotive News are generic names such as Buick or Oldsmobile for which no single or representative retail price is available. These models had to be excluded from the "best-selling" list. All prices shown are those for the cheapest model-type available. This is usually a 2-door Sedan-Coupe.

The ratio of "small car" prices to "large car" prices as derived above was used to derive shadow prices for 4 cylinder and 6/8 cylinder cars. For this purpose we used the quantity weights for the two types of passenger car, according to the following equation:

$$(PS * w) + (PL * (1-w)) = PA \qquad (1)$$

with PS = unit value of small cars
PL = unit value of large cars
PA = average unit value of all cars produced
w = number of small cars as percentage of all cars produced

We can rewrite PL as (PS * PL/PS), which gives us the following equation:

$$(PS * w) + ((PS * PL/PS) * (1-w)) = PA \qquad (2)$$

The value of w can be calculated from the first column in table A.4 and that of PA from table A.1. PL/PS for the USA is 4,079/3,079 = 1.325, and for Brazil as 58,723/39,713 = 1.479 (see table A.3, for Mexico see table A.1). The second column of table A.4 shows the unit value estimates for 4 and 6/8 cylinder models.

TABLE A.4
Estimated Quantities and Unit Values for 4 and 6/8 Cylinder Passenger Cars in the United States (1977), Brazil and Mexico (1975)

	Quantity (1000 units)	Unit value (in national currencies)
United States (1977)		
4 Cylinder Cars	891.6	4,019.92
6/8 Cylinder Cars	8,300.6	5,326.39
Total	9,192.2	5,199.66
Brazil (1975)		
4 Cylinder Cars	314.8	18,056.88
6/8 Cylinder Cars	134.9	26,706.13
Total	449.7	20,651.65
Mexico (1975)		
4 Cylinder Cars	152.0	39,712.58
6/8 Cylinder Cars	105.4	58,722.98
Total	257.4	47,492.67

Source: see text.

We are now able to match 4 and 6/8 cylinder cars separately. Table A.5 and A.6 compare the results of the single match using census data only with the differentiated matches for 4 and 6/8 cylinder cars for the Brazil/US and Mexico/US comparison respectively. It appears that the PPPs of the differentiated matches are higher than the PPPs of the single match, which implies that the original comparison using census data only showed an overvalued output in Brazil and Mexico.

TABLE A.5

Gross Value of Output and PPPs for Passenger Cars, Brazil (1975)/USA (1977)

	Brazil (1975)			USA (1977)		
	million 1975 cruzeiros	million 1977 US $	PPP Cr./US$	million 1975 cruzeiros	million 1977 US $	PPP Cr./US$
Match using Census Data only (without model differentiation)						
Passenger cars	9,286.5	2,338.2	3.97	189,834.1	47,796.3	3.97
Match using Augmented Information						
4 cylinder cars	5,683.8	1,265.4	4.49	16,099.5	3,584.2	4.49
6 & 8 cylinder cars	3,602.7	718.5	5.01	221,676.9	44,212.1	5.01
Passenger cars	9,286.5	1,983.9	4.68	223,776.4	47,796.3	4.97

Source: see text.

TABLE A.6

Gross Value of Output and PPPs for Passenger Cars, Mexico (1975)/USA (1977)

	Mexico (1975)			USA (1977)		
	million 1975 pesos	million 1977 US $	PPP Ps./US$	million 1975 pesos	million 1977 US $	PPP Ps./US$
Match using Census Data only (without model differentiation)						
Passenger cars	12,223.3	1,338.3	9.13	436,562.1	47,796.3	9.13
Match using Augmented Information						
4 cylinder cars	6,038.0	611.2	9.88	35,407.7	3,584.2	9.88
6 & 8 cylinder cars	6,185.3	561.0	11.02	487,436.0	44,212.1	11.02
Passenger cars	12,223.3	1,172.2	10.43	522,843.7	47,796.3	10.94

Source: see text.

By using the differentiated pricing approach with augmented information we reduce "unit value error", i.e. the overstatement of the dollar value of Brazil and Mexico output due to the fact that they produce relatively more small-engined passenger cars than the United States. The unit value error for passenger cars in the Brazil/US comparison was 18 per cent at Brazilian weights and 25 per cent at US weights, and for the Mexico/US comparison 14 per cent at Mexican weights and 20 per cent at US weights. The lower bias for Mexico compared to Brazil may well reflect the fact that in 1975 gasoline was substantially cheaper in Mexico. This influenced Mexicans to purchase (and produce) a relatively higher proportion of 6/8 cylinder vehicles.

It should be noted that we did try to differentiate car prices in the USA by using producer price information instead of retail prices from trade sources. The highly sophisticated US producer price index collects monthly price quotes for 75,000 items and constructs price indices for 3,100 products (see US Bureau of Labor Statistics, 1982). However, for passenger cars the BLS collected only 15 prices for 1977, and for reason of confidentiality could supply us with only one average price for passenger cars. Hence we had no alternative but to use the sales price relatives we derived from trade sources, and we have no real reason to doubt that the percentage price differential at the retail level was much different from that at the producer level.

TABLES

OF

STATISTICAL APPENDIX

Bound separatey and available on special request

Tables for Grain Mill Products are appended here by way of example

Table 3.1 - Summary Basic Figures for Grain Mill Products, United States (1977 and 1975) Brazil and Mexico (1975), in national currency

	Gross Value of Output	Value Added US Census Concept	Number of Employees
UNITED STATES, 1977	(million US dollars)		
2041 Flour, Other Grain Mill Products	3,683.3	824.5	15,600
2046 Wet Corn Milling	2,014.8	666.7	10,900
	5,698.1	1,491.2	26,500
UNITED STATES, 1975	(million US dollars)		
2041 Flour, Other Grain Mill Products	4,327.6	714.9	17,700
2046 Wet Corn Milling	2,141.7	872.9	10,900
	6,469.3	1,587.8	28,600
BRAZIL, 1975	(thousand cruzeiros)		
1024 Fabricacao de farinha de trigo e de outros derivados do trigo em grao	5,510,563	1,251,741.0	9,271
1029 Fabricacao de produtos do milho - exclusive oleos	1,546,288	505,876.0	7,444
1032 Fabricacao de produtos da mandioca	489,457	207,444.0	7,910
	7,546,308	1,965,061	24,625
MEXICO, 1975	(thousand pesos)		
2021 Wheat flour manufacturing	5,944,296	1,532,561	7,522
2022 Corn flour manufacturing	2,299,211	641,220	2,884
2029 Manufacturing of other flour and mill products based on grain and leguminous plants	879,618	418,003	2,096
2092 Manufacture of starches, yeast and similar products	1,214,303	463,010	1,797
TOTAL	10,337,428	3,054,794	14,299

Sources: United States (1977) and (1975) from US Census of Manufactures, Industry Series, table 1a.
United States (1975) orinally from 1975 Annual Survey of Manufactures.
Brazil (gross value of output, value added US census concept and employment) from 1975 Censo Industrial Brasil, tables 3 and 26; Mexico (gross value of output and employment) from Resumen General, table 5; additional information for calculation of value added from tables 19 and 20 (see also chapter II).

Table 3.2 - Basic US Census Listing for Grain Mill Products, 1977

Rank of Item	Code	Product Item	Unit	Quantity	Value of Shipments (mln. US$)	Dollar Unit Value of Shipments
		FLOUR AND OTHER GRAIN MILL PRODUCTS				¶per cwt/¶ ¶ short ¶ ¶ ton ¶
	2041-	-- Total			3,678.6	
	20411	-- Wheat flour, except flour mixes			2,208.9	
		White flour:				
10	20411 05+	Shipped for export	000s cwt	19,545	142.2	7.28
		Domestic shipments:	¶			
1	20411 11+	Bakers & institutional white bread type	¶	145,782	1,111.2	7.62
4	20411 15+	Bakers & institutional soft wheat flour	¶	43,598	294.1	6.75
		Family white flour:	¶			
7	20411 21+	All family flour, excl. self-rising	¶	19,746	194.0	9.82
15	20411 24+	Self-rising flour	¶	6,386	74.1	11.60
		Flour shipped to blenders etc.:	¶			
	20411 26	For blending etc.	¶		(a)	
	20411 27	For processing into other food products	¶		(a)	
	20411 28	For use in nonfood products	¶	3,754	20.8	5.54
		Other than white flour:	¶			
	20411 31	Whole wheat	¶	2,809	24.5	8.72
9	20411 51	Durum flour and semolina	¶	18,360	145.2	7.91
	20411 61	Bulgur	¶	6,892	50.8	7.37
	20411 98	Other, incl. farina	000s cwt	3,262	24.3	7.45
	20411 00	Wheat flour, except flour mixes, n.s.k.			40.8	
	20412	-- Wheat mill products, other than flour	000s		455.4	
2	20412 13	Wheat mill feed	short ton	4,952	433.5	87.54
	20412 17	Wheat germ	000s	74	18.4	248.65
	20412 00	Wheat mill products other than flour n.s.k.	short ton	39	3.5	89.74
	20413	-- Corn mill products			413.3	
		Corn products for human consumption:				
	20413 11	Whole cornmeal	000s cwt	2,425	31.8	13.11
18	20413 15	Degermed cornmeal	¶	4,376	59.7	13.64
17	20413 21	Corn grits and hominy, excl. brewer's use	¶	7,524	63.4	8.43
19	20413 23	Corn grits and flakes for brewer's use	000s cwt	9,269	58.9	6.35
14	20413 65	Hominy feed, cornmeal and other byproducts of drycorn milling (for animal feed)	000s short ton	1,402	110.8	79.03
	20413 93	Corn flour	000s cwt	3,853	32.2	8.36
		Other corn mill products:	¶			
	20413 95	For human consumption	¶	3,919	35.5	9.06
	20413 97	Not for human consumption	000s cwt	2,206	13.7	6.21
	20413 00	Corn mill products, n.s.k.			7.3	
	20416	-- Other grain mill products			98.3	
	20416 11	Rye flour	000s cwt	1,710	12.0	7.02
	20416 23	Other flour, excl. wheat, corn, rye	000s cwt	3,210	29.8	9.28
	20416 27	Other mill feed (oats, rye, buckwheat etc.)	000s short ton	593	56.5	95.28
	20416 00	Other grain mill products, n.s.k.				

Table 3.2 - Basic US Census Listing for Grain Mill Products, 1977

Rank of Item	Code	Product Item	Unit	Quantity	Value of Shipments (mln. US$)	Dollar Unit Value of Shipments
	20410 00	Flour and other grain mill products, n.s.k. ¢= 5 empl.			109.7	
	20410 02	Flour and other grain mill products, n.s.k. ≥ 5 empl.			105.8	
	20415 --	Blended and prepared flour, made chiefly from flour milled in the same establishment			287.2	
		WET CORN MILLING				
	2046- --	Total			1,946.1	
		Glucose syrup, unmixed:				
	20460 03	Type I (20-37 dextrose)	mln. lb.	207.7	12.7	61.15
8	20460 04	Type II (38-57 dextrose)	¶	2,980.5	160.5	53.85
16	20460 05	Type III (58-72 dextrose)	¶	1,175.5	72.4	61.59
5	20460 06+	Type IV (73 dextrose and above)	¶	3,410.8	262.8	77.05
	20460 18	Glucose syrup solids	¶	154.5	25.6	165.70
11	20460 19	Dextrose monohydrate and dextrose anhydrous	¶	1,266.7	138.6	109.42
		Manufactured starch:	¶			
3	20460 35	Corn starch, incl. milo	¶	5,486.4	408.2	74.40
	20460 45	Other starch, incl. potato, wheat, rice etc.	¶	251.4	43.6	173.43
	20460 51	Dextrin (corn, tapioca and other)	mln. lb.	138.0	25.2	182.61
	20460 61+63†	+Corn oil			311.5	
		Wet process corn byproducts:				
	20460 71	Steepwater concentrate (50% solids basis)	mln. lb.	135.5	4.1	30.26
6	20460 75	Corn gluten feed	¶	4,199.8	226.6	53.95
12	20460 77	Corn gluten meal	¶	1,000.7	122.2	122.11
13	20460 79	Other wet process corn byproducts	mln. lb.	1,564.0	117.9	75.38
	20460 00	Other wet corn mill products, nsk, ¢=15 empl.			7.8	
	20460 02	Other wet corn mill products, nsk, ≥15 empl.			6.4	
		TOTAL SPECIFIED, products with quantity specification			4,748.2	
		TOTAL SPECIFIED, primary products			5,624.7	
		INDUSTRY SHIPMENTS 2041, 2046			5,698.1	

Table 3.3 - Basic Brazilian Census Listing for Grain Mill Products, 1975

Rank of Item	Code	Product Item	Unit	Quantity	Sales Value of Output (000s Cr.)	Cruzeiro Unit Value of Sales
						¶ per ton ¶
		WHEAT MILL PRODUCTS				
		MANUFACTURE OF CORN PRODUCTS, EXCL. OILS				
		MANUFACTURE OF TAPIOCA PRODUCTS				
9	10834	Tapioca starch and fecula	ton	82,886	146,159	1,763.37
4	10848	Corn starch and fecula	ton	213,771	409,822	1,917.11
	10938	Corn porridge	kg.	31,816,895	51,754	1,626.62
7	10981	Corn bran	ton	276,230	212,256	768.40
6	10997	Wheat bran	kg.	809,795,848	283,955	350.65
	11013	Rye flour	kg.	426,150	1,778	4,172.24
	11016	Barley flour	kg.	885,215	2,049	2,314.69
5	11017	Tapioca flour, incl. for 'panificacao	ton	183,618	304,974	1,660.92
3	11037	Corn flour	¶	446,012	525,335	1,177.85
	11058	Tapioca flour from manioc scrap	¶	13,839	15,339	1,108.39
1	11064	Wheat flour	¶	3,048,093	4,420,735	1,450.33
	11072	Oat flour and meal	ton	11,383	41,111	3,611.61
	11073	Composite flours and fecula products	kg.	3,282,208	23,373	7,121.12
8	11080	Corn glucose (dextrose)	ton	105,044	191,745	1,825.38
10	11092	Cracked corn	ton	78,964	90,899	1,151.14
	11106	Corn stalks	¶	1,150	817	710.43
	11108	Stalks, n.e.s.	ton	355	82	230.99
	11109	Manioc scrap	kg.	2,426,000	1,848	761.75
2	11114	Wheat semolina	ton	355,516	539,400	1,517.23
		TOTAL SPECIFIED			7,263,431	
		TOTAL GROSS VALUE OF OUTPUT			7,546,308	

Source: IBGE (1981b).

Table 3.4 - Basic Mexican Census Listing for Grain Mill Products, 1975

Rank of Item	Code	Product Item	Unit	Quantity	Sales Value of Output (000s Ps.)	Peso Unit Value of Sales
	2021	WHEAT FLOUR MANUFACTURING				¶ per ton/¶ ¶000s ltr.¶
1		Grade A wheat flour	ton	889,156	2,453,285	2,759.12
2		Wheat flour, n.e.s.	¶	697,205	1,832,204	2,627.93
4		Salvadillo (?)	¶	201,109	317,955	1,581.01
5		Bran	¶	181,224	268,563	1,481.94
7		Crackers	¶	19,483	178,339	9,153.57
8		Premixed rice and wheat flour	¶	23,758	155,092	6,527.99
11		Flour mixed with bran	¶	70,802	120,519	1,702.20
14		Semiton (?)	¶	63,642	106,448	1,672.61
		Grade B wheat flour	¶	37,909	98,648	2,602.23
		Alimentary pastes (noodles, spaghetti, etc.)	¶ ¶	17,377	89,703	5,162.17
		Semolina	¶	21,104	57,509	2,725.03
		Whole wheat flour	¶	13,910	26,772	1,924.66
		Small wheat grain	¶	9,315	16,236	1,743.00
		Wheat grain	¶	5,546	10,717	1,932.38
		Very fine bran	¶	4,187	6,549	1,564.13
		By-products	ton	2,792	4,124	1,477.08
		Refined sesame oil	000s ltr.	223	3,422	15,345.29
		Cream of wheat	ton	303	1,552	5,122.11
		Madder	¶	1,012	1,446	1,428.85
		Bleached rice	ton	209	1,127	5,392.34
		Other			26,009	
	2022	CORN FLOUR MANUFACTURING				
3		Corn flour	ton	497,128	1,305,486	2,626.06
		Wheat flour	¶	12,509	44,907	3,589.98
		Balanced food for animals	¶	3,426	9,250	2,699.94
		Bean flour	ton	317	4,612	14,548.90
		Other			42,046	
	2029	MANUFACTURING OF OTHER FLOUR AND MILL PRODUCTS BASED ON GRAIN AND LEGUMINOUS PLANTS				
12		Corn products	ton	6,309	112,350	17,807.89
13		Maizean corn starch	¶	12,415	109,671	8,833.75
		Starch for industrial use	¶	29,675	79,731	2,686.81
		Oatmeal	¶	6,798	68,205	10,033.10
		Glucose honey	¶	19,577	49,401	2,523.42
		Corn oil	¶	2,821	45,148	16,004.25
		Soybean flour	¶	11,215	38,664	3,447.53
		Corn husks	¶	3,463	38,387	11,084.90
		Corn honey	¶	3,020	27,897	9,237.42
		Corn gluten	¶	9,865	25,363	2,571.01
		Cotton flour	¶	13,159	24,449	1,857.97
		Bean flour	¶	1,811	21,020	11,606.85
		Corn bran	¶	11,296	17,970	1,590.83
		Rice flour	¶	2,119	15,857	7,483.25
		Puffed rice	¶	236	14,756	62,525.42
		Corn germ	¶	4,767	10,153	2,129.85
		Texturized soybean	¶	314	5,367	17,092.36
		Alfafa flour	¶	2,318	4,612	1,989.65
		Tamarind and apricot sweet	¶	180	4,500	25,000.00
		"Mole" (paste made of various hot peppers, spices, and sesame seed)	¶ ¶	262	3,940	15,038.17
		Soybean drink	¶	528	3,883	7,354.17
		Cotton husks	¶	6,565	3,000	456.97
		Pepper	ton	3	2,850	950,000.00

Table 3.4 - Basic Mexican Census Listing for Grain Mill Products, 1975

Rank of Item	Code	Product Item	Unit	Quantity	Sales Value of Output (000s Ps.)	Peso Unit Value of Sales
		Cooked-over beans	ton	602	2,809	4,666.11
		Soybean oil	¶	289	2,049	7,089.97
		Corn flour for gruel	¶	138	1,815	13,152.17
		Fruit powder	¶	126	1,800	14,285.71
		Inoculants	¶	254	1,580	6,220.47
		Spices	¶	62	1,281	20,661.29
		Wheat strips	¶	129	1,109	8,596.90
		Barley flour	ton	260	801	3,080.77
		Other			110,433	
	2092	MANUFACTURE OF STARCHES, YEAST AND SIMILAR PRODUCTS				
6		Starch	ton	81,815	286,931	3,507.07
9		Maize starch	¶	54,463	139,255	2,556.87
10		Unspecified glucose	¶	38,139	121,961	3,197.80
		Unspecified yeast	¶	9,907	73,941	7,463.51
		Maize glucose	¶	25,546	70,136	2,745.48
		Maize germ	¶	15,203	55,308	3,637.97
		Maize oil	¶	2,820	52,983	18,788.30
		Forage	¶	24,215	49,201	2,031.84
		Unspecified starch	¶	14,913	44,142	2,959.97
		Unspecified gluten	¶	15,576	36,613	2,350.60
		Humid yeast	¶	4,077	34,034	8,347.80
		Maize nutriments	¶	14,674	28,127	1,916.79
		Maize gluten	¶	986	25,373	25,733.27
		Yeast powder	¶	2,730	20,963	7,678.75
		Maize bran	¶	11,295	18,010	1,594.51
		Wheat gluten	¶	907	13,543	14,931.64
		Oils	¶	676	9,062	13,405.33
		Baker's powder	¶	974	8,196	8,414.78
		Dextrine milk	¶	767	5,643	7,357.24
		Fermentation nutriments	¶	163	3,584	21,987.73
		Broken sugar	¶	947	3,248	3,429.78
		Low-calory sugar	¶	116	1,762	15,189.66
		"Gragea"	¶	299	1,496	5,003.34
		Grated coconut	¶	120	1,445	12,041.67
		Jelly	¶	220	1,102	5,009.09
		Vanille	ton	5	785	157,000.00
		Other			64,882	
		TOTAL SPECIFIED, products with quantity specification			8,961,727	
		TOTAL SPECIFIED, primary products			9,205,097	
		GROSS VALUE OF OUTPUT 2021,2022,2029,2092			10,337,428	

Source: X Censo Industrial 1976, Desglose

Table 3.5 - Matching of Product Items, USA(1977)/Brazil(1975), Grain Mill Products

Rank of Item	Code	United States Product Item	Unit (a)	US Quantity	US Value of Shipments (mln. US$)	US Dollar Unit Value of Shipments (per ton)	US Quantity valued at Brazilian Unit Values (mln .Cr.)	UVR Cr./US$ US Quantity Weights	Rank of Item	Brazil Product Item	Unit	Brazil Quantity	Brazil Sales Value of Output (000s Cr.)	Brazil Cruzeiro Unit Value	Brazil Quantity valued at US Unit Values (000 US$)	UVR Cr./US$ Brazil Quantity Weights
		Wheat flour, white flour:														
10	20411 05+	Shipped for export	ton	886,542	142.2	160.40										
		Domestic shipments:														
1	20411 11+	Bakers & institutional white bread type		6,612,526	1,111.2	168.04										
4	20411 15+	Bakers & institutional soft wheat flour		1,977,562	294.1	148.72										
		Family white flour:														
7	20411 21+	All family flour, excl. self-rising		895,659	194.0	216.60										
15	20411 24+	Self-rising flour		289,663	74.1	255.81										
		Flour shipped to blenders:														
	20411 28	For use in nonfood products	ton	170,278	20.8	122.15										
				10,832,228	1,836.4	169.53	15,710.3	8.55	1	Wheat flour	ton	3,048,093	4,420,735	1,450.33	516,747	8.55
9	20411 51	Durum flour and semolina	ton	832,791	145.2	174.35	1,263.5	8.70	2	Wheat semolina	ton	355,516	539,400	1,517.23	61,985	8.70
	20413 93	Corn flour	ton	174,768	32.2	184.24	205.9	6.39	3	Corn flour	ton	446,012	525,335	1,177.85	82,175	6.39
3	20460 35	Corn starch, incl. milo	ton	2,488,631	408.2	164.03	4,771.0	11.69	4	Corn starch and fecula	ton	213,771	409,822	1,917.11	35,064	11.69
		Glucose syrup, unmixed:														
	20460 03	Type I (20-37 dextrose)	ton	90,474	12.7	140.37										
8	20460 04	Type II (38-57 dextrose)		1,298,306	160.5	123.62										
16	20460 05	Type III (58-72 dextrose)		512,048	72.4	141.39										
5	20460 06+	Type IV (73 dextrose & above)		1,485,744	262.8	176.88										
	20460 18	Glucose syrup solids		67,300	25.6	380.39										
11	20460 19	Dextrose monohydrate and dextrose anhydrous	ton	551,775	138.6	251.19										
				4,005,647	672.6	167.91	7,311.8	10.87	8	Corn glucose (dextrose)	ton	105,044	191,745	1,825.38	17,638	10.87
17	20413 21	Corn grits and hominy, excl. brewer's use	ton	341,281	63.4	185.77										
19	20413 23	Corn grits and flakes for brewer's use	ton	420,433	58.9	140.09										
				761,714	122.3	160.56	876.8	7.17	10	Cracked corn	ton	78,964	90,899	1,151.14	12,678	7.17
MATCHED ITEMS					3,216.9		30,139.3	9.37					6,177,936		726,288	8.51
in % of total specified output					67.75%								85.06%			
in % of total gross value of output					56.46%								81.87%			

Source: US figures from table 3.2; Brazil figures from table 3.3;
Note: (a) Quantities are converted to metric units;

Table 3.6 - Matching of Product Items, Mexico(1975)/US(1977), Grain Mill Products

Rank of Item	Code	United States Product Item	Unit (a)	US Quantity	US Value of Shipments (mln. US$)	US Dollar Unit Value of Shipments	US Quantity valued at Mexican Unit Values (mln. Ps.)	UVR Ps./US$ US Quantity Weights	Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Sales Value of Output (000s Ps.)	Mexico Peso Unit Value	Mexico Quantity valued at US Unit Values (000 US$)	UVR Ps./US$ Mexican Quantity Weights
		Wheat flour, white flour:														
10	20411 05+	Shipped for export	ton	886,542	142.2	160.40										
		Domestic shipments:														
1	20411 11+	Bakers & institutional white bread type		6,612,526	1,111.2	168.04										
4	20411 15+	Bakers & institutional soft wheat flour		1,977,562	294.1	148.72										
		Family white flour:														
7	20411 21+	All family flour, excl. self-rising		895,659	194.0	216.60										
15	20411 24+	Self-rising flour		289,663	74.1	255.81			1	Grade A wheat flour	ton	889,156	2,453,285	2,759.12		
		Flour shipped to blenders etc.:							2	Wheat flour, n.e.s.		697,205	1,832,204	2,627.93		
	20411 28	For use in nonfood products	ton	170,278	20.8	122.15				Wheat flour	ton	12,509	44,907	3,589.98		
				10,832,228	1,836.4	169.53	29,338.1	15.98				1,598,870	4,330,396	2,708.41	271,058	15.98
9	20411 51	Durum flour and semolina	ton	832,791	145.2	174.35	2,269.4	15.63		Semolina	ton	21,104	57,509	2,725.03	3,680	15.63
	20413 93	Corn flour	ton	174,768	32.2	184.24	459.0	14.25	3	Corn flour	ton	497,128	1,305,486	2,626.06	91,593	14.25
3	20460 35	Corn starch, incl. milo	ton	2,488,631	408.2	164.03	6,363.1	15.59	9	Maize starch	ton	54,463	139,255	2,556.87	8,933	15.59
		Glucose syrup, unmixed:														
	20460 03	Type I (20-37 dextrose)	ton	90,474	12.7	140.37										
8	20460 04	Type II (38-57 dextrose)		1,298,306	160.5	123.62										
16	20460 05	Type III (58-72 dextrose)		512,048	72.4	141.39										
5	20460 06+	Type IV (73 dextrose and above)		1,485,744	262.8	176.88										
	20460 18	Glucose syrup solids		67,300	25.6	380.39										
11	20460 19	Dextrose monohydrate and dextrose anhydrous	ton	551,775	138.6	251.19										
				4,005,647	672.6	167.91	10,997.4	16.35		Maize glucose	ton	25,546	70,136	2,745.48	4,290	16.35
6	20460 75	Corn gluten feed	ton	1,829,433	226.6	123.86	4,703.5	20.76		Corn gluten	ton	9,865	25,363	2,571.01	1,222	20.76
		MATCHED PRODUCTS			3,321.2		54,130.5	16.30					5,928,145		380,775	15.57
		in % of total specified output			69.95								66.15			
		in % of total gross value of output			58.29								57.35			

Source: US figures from annex table 3.2; Mexican figures from annex table 3.4;
Note: (a) Quantities are converted to metric units;

Table 3.7 - Basic Data and Principal Results for Grain Mill Products, Brazil, Mexico and USA

	Brazil	Mexico	United States	United States
				US/Brazil	US/Mexico
Part I - Basic data used in Calculations					
I.1 Total Gross Value of Output, 1975 in 1975 million national currency units	7,546.3	10,337.4	6,469.3	6,469.3
I.2 Total Gross Value of Output, 1977 in 1977 million US dollars	---	---	5,698.1	5,698.1
I.3 Matched Gross Value of Output, 1975				
a) in 1975 million Cruzeiros	6,177.9	---	---	---
b) in 1975 million Pesos	---	5,928.1	---	---
c) in 1977 million US dollars	726.3	380.8	---	---
I.4 Matched Gross Value of Output, 1977				
a) in 1975 million Cruzeiros	---	---	30,139.3	---
b) in 1975 million Pesos	---	---	---	54,130.5
c) in 1977 million US dollars	---	---	3,216.9	3,321.2
I.5 Coverage Ratio Matched Output to Total Gross Value of Output, (%)	81.87	57.35	56.46	58.29
I.6 1975 US Output Volume as a % of 1977	---	---	87.06	87.06
I.7 1975 US Unit Values as a % of 1977	130.41	130.41	130.41	130.41
I.8 Matched Gross Value of Output in 1975				
a) in 1975 million Cruzeiros	6,177.9	---	26,238.4	---
b) in 1975 million Pesos	---	5,928.1	---	47,124.4
c) in 1975 million US dollars	947.2	496.6	3,652.3	3,770.7
I.9 Value Added (US Census Concept), 1975 in 1975 million national currency units	1,965.1	3,054.8	1,587.8	1,587.8
I.10 1975 Ratio of Value Added (US Census Concept) to Gross Value of Output	26.04	29.55	24.54	24.54
I.11 Employment in 1975	24,625	14,299	28,600	28,600
I.12 1975 Exchange Rate (national currency/US$)	8.13	12.50	1.00	1.00
Part II - Principal Results, 1975 in all cases				
II.1 Purchasing Power Parity for (Matched=Total) Gross Value of Output (national currency/US$)				
a) Brazil quantity weights	6.52	---	1.00	---
b) Mexico quantity weights	---	11.94	---	1.00
c) US quantity weights	7.18	12.50	1.00	1.00
II.2 Total Gross Value of Output				
a) Brazil unit value weights, (mill. Cr.)	7,546.3	---	46,476.1	---
b) Mexico unit value weights, (mill. Ps.)	---	10,337.4	---	80,850.2
c) US unit value weights, (mill. US$)	1,157.0	865.9	6,469.3	6,469.3
II.3 Value Added (US Census Concept)				
a) Brazil unit value weights, (mill. Cr.)	1,965.1	---	11,406.9	---
b) Mexico unit value weights, (mill. Ps.)	---	3,054.8	---	19,843.6
c) US unit value weights, (mill. US$)	301.3	255.9	1,587.8	1,587.8

Table 3.7 - Basic Data and Principal Results for Grain Mill Products, Brazil, Mexico and USA

	Brazil	Mexico	United States	United States
				US/Brazil	US/Mexico
II.4 Gross Output per Employee,					
a) Brazil unit value weights, (Cr.)	306,449	---	1,625,039	---
b) Mexico unit value weights, (Ps.)	---	722,948		2,826,929
c) US unit value weights, (US$)	46,984	60,559	226,199	226,199
II.5 Value Added (US Census Concept) per Employee					
a) Brazil unit value weights, (Cr.)	79,799	---	398,843	---
b) Mexico unit value weights, (Ps.)	---	213,637	---	693,831
c) US unit value weights, (US$)	12,235	17,896	55,517	55,517
Part III - Pro Memoria					
III.1Alternate Purchasing Power Parity for Gross Value of Output (national currency/US$)					
a) Brazil quantity weights		---		---
b) Mexico quantity weights		12.13		1.00
c) US quantity weights		12.70		1.00

Note: lines I.1, I.2, I.9 and I.11 derived from table 3.1; lines 1.3 and 1.4 from tables 3.4 and 3.5;
Line I.6 from U.S. Dept. of Commerce, 1982 Industrial Outlook, Washington D.C.
The other figures are all derived from the basic data in part I.

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