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Comparisons of Real Output in Manufacturing

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International comparisons of real output and productivity should rely not on official exchange rates but on standardized valuations of the different elements of output.

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The most direct way of comparing output in different countries is to use the official exchange rate to convert GDP in one country's prices into the prices of another country — and in multi-country comparisons to convert it into a common currency, such as the U.S. dollar. But exchange rates mainly indicate the purchasing power of currencies over tradables, not the average purchasing power of currencies over all goods and services. And even for tradables, the use of exchange rates is problematic because of currency fluctuations and capital movements.

With the measurement of comparative real output across countries intertwined with assessments of purchasing power, the question becomes: what is the best way to make those assessments? Most purchasing power parities have been developed for the components of final demand — for consumption, investment, and so on. This expenditure approach is useful for looking at an entire economy, but it cannot be used directly for analyzing individual sectors because it does not show real product by industry.

The production approach used here looks at the industry of origin — and provides a basis for growth accounting, comparative structural anaylsis, studies of technological performance, and work on labor productivity and total factor productivity.

The method essentially takes the value of output in national prices and uses unit values from census data to standardize output uniformly and consistently. So, rather than use a common conversion factor (the exchange rate) it uses a standardized basis of valuation.

Applied to the manufacturing sectors of Brazil, Mexico, and the United States, the revaluation of output in national and U.S. prices provides a sounder basis for constructing relative indicators of productivity. It also reveals much about trade protection policies and their incidence on different sectors of the economy.

The approach shows, in addition, which data are anomalous and which analytically useful in industrial census. It thus provides important lessons for the development of the Bank's data base — on how to increase its reliability and improve its relevance to operations. It also shows how new insights might be gained by exploiting some official sources which, though rich in detail, often remain untapped by international agencies.

This paper is a product of the Socioeconomic Data Division, International Economics Department. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Estela Zamora, Room F7-136, ext. 33706.

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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 over three 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) 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 unstated 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), and D.J. Roy (1987) 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.

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 14 other international comparisons of levels of output or productivity in manufacturing which have appeared over the past four decades. They all use information derived from production censuses, and they are all restricted to two or three countries.

This type of study was given its initial impetus by Rostas (1948), and the studies of Maddison (1952), Galenson (1955), Frankel (1957) and Yukizawa (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), Kudrov (1969), West (1971), Smith, Hitchens and Davies (1982), Smith (1985)[1], 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 stuck 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] In fact Smith (1985) is derived from the same data set as Davies and Caves (1987).

TABLE 1.3
15 Studies of Real Output Levels in Manufacturing

Author	Number of Products Sampled	Size of Sample	Country Coverage	Reference Years
Rostas (1948)	108	22 percent of 1937 US employment	UK/USA	1935 to 1939
Maddison (1952)	34	15 percent of Canadian, 14 percent of UK, and 8 percent of US employment in 1935	Canada/UK/USA	1935
Galenson (1955)	23	17 per cent of US industrial gross output in 1939[a]	USSR/USA	1936 to 1939
Frankel (1957)	50[b]	18 percent of 1947 US employment, 16 per cent of UK 1948 employment	UK/USA	1948/7
Paige and Bombach (195[illegible])	380	51 percent of UK, and 48 percent of US manufacturing value added	UK/USA	[illegible]3
Mensink (196[illegible])	78	14 percent of UK 1958 employment	Netherlands/UK	1958
Kudrov (1969)	224[c]	substantial, but not stated	USSR/USA	1963
Czech Statistical Office/INSEE (1969)	113	substantial, but not stated	Czechslovakia/ France	1962 and 1967
West (1971)	150[b]	31 percent[d] of US shipments	Canada/USA	1963
Yukizawa (1978)	60	26 percent of Japanese and 24 percent of US value added in 1972	Japan/USA	1958/9, 1963 1967, 1972
Smith, Hitchens & Davies (1982)	487[cef]	66 percent of UK value added and 64 percent of US value added[f]	UK/USA	1968/7
	350[cef]	31 percent of German value added and 37 percent of UK value added[f]	Germany/UK	1967/8
Smith (1985)	386[cef]	55 percent of UK value added and 53 percent of US value added[f]	UK/USA	1977
Davies and Caves (1987)	398[cef]	60 percent of UK value added and 61 percent of US value added[f]	UK/USA	1977
Van Ark (1988)	167-197	38 percent of Brazilian value added, and 29 percent of UK value added	Brazil/UK	1975
Maddison and Van Ark (present study)	171-372 192-342 200-157	33 percent of value added in Brazil, 39 percent in Mexico, 20 percent in USA	Brazil/USA Mexico/USA Mexico/Brazil	1975 1975 1975

(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) Information supplied by the authors.
(d) West does not say how big his sample is, but we derived this figure by comparing the industry codes he uses (pp. 59-61) with 1963 information in the General Summary volume of the 1977 Census of Manufactures.
(e) Refers to number of 'matches' instead of number of matched products.
(f) These figures refer only to directly derived PPPs.

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.

The present study is part of a series of comparative industry of origin investigations in which we and our colleagues have been engaged. Other comparisons for the manufacturing sector for India/USA (Van Ark, 1987) and Brazil/UK (Van Ark, 1988) are available, and others are underway for Japan, Korea, France and the Netherlands. A fourteen country comparison is available for agriculture by Van Ooststroom and Maddison (1985), and for mining in Brazil, Mexico and the USA by Houben (1988).

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.

Originally it was intended to include India in the present study, but the complete Indian manufacturing census was not available to us in time. India is interesting because it is the country whose authorities seem most dissatisfied with the ICP results for 1975 which they think exaggerate India's real product. Futhermore, an earlier "industry of origin" study mentioned in table 1.2 (Maddison, 1970) showed a substantially lower real product in India than the ICP. Preliminary results of a separate India/USA comparison are now available (Van Ark, 1987), and a complete study will follow.

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 33 and 39 percent of total value added respectively. For the USA our sample was rather small for food products and electrical machinery, but our overall sample coverage was close to 20 percent.

Chapter II deals with the problem of reconciling the industrial census material with the national accounts. Chapter III presents PPPs and binary output comparisons for a sample of 17 industries for Brazil/USA and Mexico/USA both in national and US units. Chapter IV is a binary comparison of Brazil and Mexico using a more refined definition of value added. There were considerable problems in matching different data sources, making coverage adjustments for non-measurable items, defining the boundaries of manufacturing in a comparable way, and testing the validity of price and quantity indicators used to blow up sample results to cover branches as a whole. These methodological issues are covered in Chapters III and IV as they arise and the particular problems of matching and quality are treated in Chapters V and VI. Chapter VII deals with labour productivity. Chapter VIII presents our main findings and recommendations in summary form.

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	34,681	6,564	18.9	28,964	5,808	20.1	39,985	2,522	6.3
Beverages	5,494	2,022	36.8	12,994[a]	6,875[a]	52.9	8,110	2,130	26.3
Tobacco	3,212	3,212	100.0	1,817[a]	1,817[a]	100.0	3,722	3,722	100.0
Textiles & Wearing Apparel	27,247[b]	10,247	37.6	19,678	8,365	42.5	26,793	6,217	23.2
Footwear & Leather Products	4,798[b]	4,746	98.9	3,330	3,330	100.0	3,187	2,942	92.3
Wood and Paper Products	34,086	4,648	13.6	17,805	6,279	35.3	59,231	7,626	12.9
Chemicals	48,552	23,163	47.7	40,334[ac]	15,125[ac]	37.5	55,476	17,184	31.0
Rubber & Plastic Goods	12,028	3,159	26.3	8,276	2,954	35.7	13,599	3,463	25.5
Stone, Clay & Glass Products	19,161	7,516	39.2	11,930	4,317	36.2	14,849	2,049	13.8
Metal Products	38,782	18,080	46.6	31,280	13,535	43.3	64,570	15,783	24.4
Electrical Machinery	17,655	3,637	20.6	13,430	2,566	19.1	34,845	1,543	4.4
Machinery & Transport Equipment	51,192	14,411	28.1	26,743	14,542	54.4	96,381	21,466	22.3
Other	10,005	----	----	3,241	----	----	21,738	----	----
Total	306,893	101,404	33.0	219,820	85,511	38.9	442,485	86,645	19.6

a) indirect taxes and subsidies are deducted (see table 2.3).
b) the footwear industry (3,188 million cruzeiros) was reallocated from wearing apparel to footwear and leather.
c) 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 2.3 (Mexico) and table 2.5 (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 purchases of agricultural materials for food processing and 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 (see also chapter IV). 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 and switch to our preferred concept only at the level of manufacturing branches and manufacturing as a whole. In chapter IV which provides a direct bilateral comparison between Mexico and Brazil we were able to use our preferred "former national accounts" concept of value added throughout.

Input-Output Tables Potentially Useful for Double Deflation

We were not able to make much use at this stage of the input-output tables (Mexico table 2.5, USA table 2.8). This was partly because in the US they were not readily reconcilable with the census information, and in the Brazil case because the statistical office (IBGE) had not published its work on the 1975 table. However, these tables will be most useful for purposes of double deflation (see chapter III and VIII) at a later stage.

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 (Gusma 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 have 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.
   The 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 (cruzeiros)	Present National Accounts Concept of Gross Value Added per Person Employed (US $)[a]
	(million cruzeiros)					
	(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).

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 2.5 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 2.3 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 2.4). 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 2.3). 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);
   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).

TABLE 2.3
Comparison of Mexican National Accounts and Industrial Census Estimates for Manufacturing Gross Value Added 1975

	Census Estimate (US Census) Concept) of Gross Value Added (million pesos)	Census Estimate (Present National Accounts Concept) of Gross Value Added (million pesos)	National Accounts Estimate (present concept) of Contribution to GDP at factor cost (million pesos)	Ratio of Value Added (Present National Accounts Concept) National Accounts/ Census Values
	(1)	(2)	(3)	(4)
Food Products	28,963.6	22,111.8	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 2.4
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 2.3

TABLE 2.5

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 2.6 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 2.6 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 2.7 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 2.8 presents a consolidated version of the US input-output table for 1977. The input-output industry classification corresponds very closely with that used in the census, but there is some reclassification of secondary products, i.e. the "the secondary products and associated inputs are excluded from the industry that produced it and included in the industry in which it was primary" (US Dept. of Commerce, 1984a, p. 51). The inputs are for current use only, e.g. construction inputs are only those for repair and maintenance (not for new capital formation). Broadly speaking the inputs in the first five columns of table 2.8 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 2.8 total value added (US$ 487,203 million) is the national accounts definition, the US census definition would be more or less equivalent to 659,622 million US dollars (i.e. the national accounts value added - US$ 487,203 million - plus service inputs - US$ 172,419 million-). The ratio of the national accounts to the US census concept of value added would therefore be 73.9 per cent for 1977, i.e. not too different from the 1975 ratio of 76.6 in the bottom right of table 2.6.

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 2.6
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	}38,886	}1,193	}6,219	}31,474	}65.4
Beverages	8,110	}	}	}	}	}
Tobacco Products	3,722	5,071	- 87	2,432	2,726	73.2
Textile Mill Products	12,044	10,088	- 62	408	9,742	80.9
Apparel, Other Textile Products	14,749	11,204	- 47	168	11,083	75.1
Lumber and Wood Products	10,356	10,406	- 166	371	10,201	98.1
Furniture & Fixtures	6,290	4,933	- 63	124	4,872	77.5
Paper and Allied Products	17,944	14,286	- 214	708	13,792	76.9
Printing and Publishing	24,641	18,237	- 101	406	17,932	72.8
Chemical, Allied Products	44,976	28,982	- 473	1,376	28,079	62.4
Petroleum and Coal Products	10,500	10,882	- 42	4,700	6,224	59.3
Rubber, Miscellaneous Plastic Products	13,599	10,507	- 75	1,011	9,571	70.4
Leather, Leather Products	3,187	2,421	- 33	41	2,413	75.7
Stone, Clay, Glass Products	14,849	11,506	- 165	507	11,164	75.2
Primary Metals	30,367	28,439	- 178	1,424	27,193	89.5
Fabricated Metal Products	34,203	27,152	- 415	744	26,823	78.4
Machinery, except Electric	51,044	40,997	-1,422	948	41,471	81.2
Electric, Electronic Equipment	34,845	28,480	- 508	657	28,331	81.3
Motor Vehicles & Equipment	21,466	21,654	- 277	1,058	20,873	97.2
Other Transportation Equipment	23,871	18,415	-1,401	118	19,698	82.5
Instrument, Related Goods	14,158	9,548	- 177	214	9,511	67.2
Miscellaneous Manufacturing Goods	7,580	6,058	- 67	144	5,981	78.9
Total[a]	442,485	358,152	-4,780	23,778	339,154	76.6

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, and information supplied by Robert Parker, Associate Director of National Economic Accounts in July 1985.

TABLE 2.7
US Employment and Productivity in 1975 According to Annual Survey of Manufactures and National Accounts

	ASM Employment (1000)	Nat. Accounts Employment (1000)	ASM Gross Value Added Per Person Employed	National Accounts Adjusted GDP per Person Employed
Food & Kindred Products	1,321	}1,687	}31,538	}18,657
Beverages	204	}	}	}
Tobacco Products	66	73	56,388	37,342
Textile Mill Products	835	872	17,663	11,172
Apparel, Other Textile Products	1,214	1,258	12,149	8,810
Lumber & Wood Products	588	684	17,612	14,914
Furniture & Fixtures	396	425	15,884	11,464
Paper & Allied Products	589	643	30,465	21,449
Printing & Publishing	1,070	1,129	23,029	15,883
Chemicals, Allied Products	842	1,025	53,416	27,394
Petroleum & Coal Products	141	189	74,465	32,931
Rubber, Miscellaneous Plastic Products	585	603	23,247	15,372
Leather, Leather Products	240	247	13,280	9,769
Stone, Clay, Glass Products	589	641	25,210	17,417
Primary Metal Industries	1,089	1,144	27,885	23,770
Fabricated Metal Products	1,417	1,475	24,138	18,185
Machinery, Except Electric	1,967	2,096	25,950	19,786
Electric, Electronic Equipment	1,524	1,705	22,864	16,616
Motor Vehicles & Equipment	699	787	30,709	26,522
Other Transportation Equipment	906	918	26,348	21,458
Instruments, Related Goods	500	551	28,315	17,261
Miscellaneous Manufactured Goods	393	442	19,288	13,532
Total	17,174[a]	18,594	25,765	18,240

a) excludes 1,128,400 employees with a payroll of US$ 19,014.9 in administrative offices and auxiliaries located outside establishments.

Source: National Income and Product Accounts of the US 1929-76 and sources cited in table 2.6

TABLE 2.8
U.S. Input-Output Structure at Producers' Prices[a], 1977
(million US$)

	Manufac-turing	Utilities	Agriculture Forestry, Fishery	Mining	Mainte-nance Repair Construc-tion	Services	Total Inputs	Value Added	Total Gross Output
Food & Kindred Products	47,549	1,825	52,519	99	713	21,056	123,761	38,554	162,315
Beverages	10,225	242	726	11	152	3,203	14,559	12,326	26,885
Tobacco Products	3,400	41	2,446	7	18	1,074	6,986	5,867	12,853
Textile Mill Products	19,912	764	2,073	34	199	3,868	26,850	10,862	37,712
Apparel, Other Textile Products	25,134	382	262	6	155	5,207	31,146	18,379	49,525
Lumber and Wood Products	15,568	518	3,801	6	212	4,008	24,113	14,867	38,978
Furniture and Fixtures	6,661	183	0	5	109	2,699	9,657	7,035	16,693
Paper and Allied Products	22,984	1,728	21	335	504	7,101	32,673	18,886	51,560
Printing and Publishing	15,742	1,308	0	3	174	9,263	26,490	23,494	49,984
Chemical, Allied Products	45,076	4,544	399	4,138	876	18,839	73,872	38,610	112,483
Petroleum and Coal Products	12,943	2,378	0	60,278	818	8,191	84,608	14,287	98,895
Rubber, Miscellaneous Plastic Products	16,160	813	0	79	235	4,990	22,277	17,089	39,366
Leather, Leather Products	3,520	62	0	4	28	932	4,546	3,110	7,655
Stone, Clay, Glass Products	8,934	1,765	3	1,997	502	5,384	18,585	16,028	34,613
Primary Metal Industries	40,600	4,688	1	9,133	1,545	16,469	72,436	34,178	106,613
Fabricated Metal Products	35,638	1,067	1	48	820	9,077	46,651	35,121	81,773
Machinery, except Electric	47,624	1,141	0	31	536	13,938	63,270	55,397	118,667
Electric, Electronic Equipment	33,428	964	2	13	417	12,651	47,475	41,546	89,019
Motor Vehicles & Equipment	72,824	775	1	45	270	10,113	84,028	33,657	117,685
Other Transportation Equipment	20,603	439	0	6	175	5,904	27,127	20,889	48,016
Instrument, Related Goods	7,726	211	0	7	91	3,469	11,504	13,566	25,070
Miscellaneous Manufacturing Goods	6,839	188	26	28	106	4,151	11,338	8,407	19,745
Ordnance and Accessories	2,824	119	0	4	53	832	3,832	5,048	8,879
Total Manufacturing	521,914	26,145	62,281	76,317	8,708	172,419	867,784	487,203	1,354,984

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

Source: US Dept. of Commerce (1984a and 1984b).

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 17 industries representing 20 to 39 per cent of manufacturing output. 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. This problem does not arise in the binary Mexico/Brazil comparisons which are presented in chapter IV.

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. 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 tables 12 and 13 for individual industries in the Statistical Appendix we also present, pro memoria, results using the quantity indicator method.

Levels of Real Output in 17 Industries

Our detailed analysis covered 17 industries in Brazil, Mexico and the USA. We covered a sample of 171 Brazilian product items and 372 US product items for the Brazil/USA comparison, and 192 Mexican product items and 342 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 these 17 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 A3, A4 and A11 in the Statistical Appendix). Table 3.1 also shows total gross value of output of manufacturing to demonstrate the size of the sample.

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
Grain Mill Products	7,428.1	9,123.1	5,698.1
Sugar & Sugar Products	12,142.4	6,596.3	2,964.0
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	29,420.5	17,909.9	22,486.5
Footwear and Leather Products	10,291.8	6,447.3	6,874.7
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	7,261.2	3,460.2	6,629.7
Agricultural Fertilizers	12,096.1	4,865.7	7,151.7
Petroleum Refining and Products	58,024.6	28,463.4[ab]	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	51,525.3	32,836.9	50,582.0
Radio and TV Receivers	9,003.6	4,854.5	5,732.6
Motor Vehicles	57,791.5	39,425.6	117,746.5
Total in our sample	297,828.9	202,002.0	376,968.4
as % of Total Manufacturing Output	38.05	42.08	27.75

a) indirect taxes and subsidies are deducted (see table 2.3).
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.

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.

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
Grain Mill Products	913.7	729.9	6,469.3
Sugar & Sugar Products	1,493.5	527.7[a]	4,490.8
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	3,618.8	1,432.8	15,770.8
Footwear and Leather Products	1,265.9	515.8	5,730.9
Pulp and Paper	1,319.9	1,168.6	17,335.5
Soap and Detergents	446.1	506.8	5,006.0
Paints	893.1	276.8	5,149.9
Agricultural Fertilizers	1,487.8	389.3[ab]	6,971.0
Petroleum Refining and Products	7,137.1	2,277.1[ab]	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	1,229.8
Iron and Steel	6,337.7	2,626.9	42,211.7
Radio and TV Receivers	1,107.4	388.4	4,443.6
Motor Vehicles	7,108.4	3,154.1	70,031.8
Total in our sample	36,633.3	16,160.2	275,040.0
as % of Total Manufacturing Output	38.05	42.08	26.46

a) indirect taxes and subsidies are deducted (see table 2.3).
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.

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):

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

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

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

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 A17) 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 A3.6, A4.6 and A11.6 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 3.3
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 (%)
Grain Mill Products	6,177.9	32,712.2	18.89	682.7	3,308.4	20.64
Sugar & Sugar Products	11,514.8	10,036.5	114.73	2,854.5	2,146.2	133.00
Malt and Malt Beverages	3,019.0	53,864.2	5.60	393.4	6,699.0	5.87
Tobacco and Tobacco Products	5,516.0	35,729.9	15.44	1,485.0	8,525.0	17.42
Textiles	25,411.8	209,508.2	12.13	3,080.2	18,693.6	16.48
Footwear and Leather Products	5,792.7	17,393.2	33.30	1,409.8	3,595.1	39.21
Pulp and Paper	8,347.1	163,655.9	5.10	1,076.3	16,507.4	6.52
Soap and Detergents	3,437.9	22,365.3	15.37	880.6	2,972.9	29.62
Paints	3,290.8	11,072.5	29.72	818.6	2,972.2	27.54
Agricultural Fertilizers	10,001.5	82,677.1	12.10	740.2	6,000.6	12.34
Petroleum Refining & Products	22,160.7	985,464.8	2.25	1,839.8	80,826.2	2.28
Tires and Inner Tubes	5,729.5	60,102.4	9.53	562.2	5,212.7	10.79
Cement	4,928.6	16,560.1	29.76	588.6	1,977.6	29.76
Bricks	3,125.3	2,564.6	121.86	1,047.4	772.4	135.60
Iron and Steel	27,749.6	229,057.7	12.11	4,375.8	29,346.4	14.91
Radio and TV Receivers	5,597.6	30,533.5	18.33	687.4	3,714.8	18.50
Motor Vehicles	19,769.7	461,396.9	4.28	3,564.9	81,084.0	4.40

Source: See tables 5 for industries A1 to A17 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.	USA 1977 million)	Mexico/ USA (%)	Mexico 1975 (1977 US$	USA 1977 million)	Mexico/ USA (%)
Grain Mill Products	5,985.5	58,420.6	10.25	371.8	3,412.7	10.90
Sugar & Sugar Products	5,651.7	15,102.0	37.42	829.2	2,146.2	38.64
Malt and Malt Beverages	9,775.6	117,396.2	8.33	557.7	6,699.0	8.33
Tobacco and Tobacco Products	3,772.3	64,377.6	5.86	582.5	8,123.6	7.17
Textiles	7,542.3	290,469.4	2.60	514.0	18,478.6	2.78
Footwear and Leather Products	3,463.5	46,379.9	7.47	355.4	4,194.2	8.47
Pulp and Paper	9,674.3	382,689.0	2.53	518.3	17,853.2	2.90
Soap and Detergents	5,167.7	38,474.8	13.43	640.1	3,744.4	17.10
Paints	2,397.8	41,926.4	5.72	177.5	2,972.2	5.97
Agricultural Fertilizers	3,254.0	57,848.3	5.63	372.5	6,000.6	6.21
Petroleum Refining & Products	21,467.6	706,447.4	3.04	2,383.8	76,541.8	3.11
Tires and Inner Tubes	2,421.1	137,548.3	1.76	94.4	4,806.5	1.96
Cement	3,345.3	20,706.9	16.16	326.6	2,009.2	16.26
Bricks	1,147.0	5,956.5	19.26	102.4	738.2	13.87
Iron and Steel	23,808.3	356,414.2	6.68	2,426.1	28,988.7	8.37
Radio and TV Receivers	3,337.3	34,423.8	9.69	275.0	3,624.9	7.59
Motor Vehicles	23,598.5	946,475.6	2.49	1,986.1	78,512.6	2.53

Source: See tables 6 for industries A1 to A17 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 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].

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
Grain Mill Products	83.17	58.06	65.51	59.89
Sugar & Sugar Products	94.83	72.41	85.68	72.41
Malt and Malt Beverages	88.05	93.67	89.08	93.67
Tobacco and Tobacco Products	90.15	94.19	98.05	89.76
Textiles	86.37	83.13	42.11	82.18
Footwear and Leather Products	56.28	52.29	53.72	61.01
Pulp and Paper	77.78	75.62	66.23	81.79
Soap and Detergents	94.79	48.84	81.57	61.51
Paints	45.32	44.83	69.30	44.83
Agricultural Fertilizers	82.68	83.90	66.88	83.90
Petroleum Refining and Products	38.19	86.60	75.42	82.01
Tires and Inner Tubes	79.48	58.11	48.72	53.58
Cement	86.64	65.00	59.22	66.04
Bricks	51.73	47.17	70.07	45.08
Iron and Steel	53.86	58.02	72.50	57.31
Radio and TV Receivers	62.17	64.80	68.75	63.23
Motor Vehicles	34.21	68.86	59.86	66.68
Weighted Average 17 industries	57.61	72.78	67.23	71.32

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.

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"
Grain Mill Products	87.06	130.41
Sugar & Sugar Products	80.48	188.25
Malt and Malt Beverages	87.82	99.22
Tobacco and Tobacco Products	105.01	84.80
Textiles	83.39	84.10
Footwear and Leather Products	96.83	86.09
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
Petroleum Refining and Products	85.02	83.72
Tires and Inner Tubes	90.94	87.56
Cement	90.70	84.59
Bricks	91.16	82.39
Iron and Steel	95.67	87.23
Radio and TV Receivers	72.77	106.52
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.

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).

TABLE 3.7
Quantities (Gross Output), 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 (%)
Grain Mill Products	7,428.1	49,048.4	15.14	1,070.5	6,469.3	16.55
Sugar & Sugar Products	12,142.4	11,155.8	108.84	5,666.4	4,490.8	126.18
Malt and Malt Beverages	3,429.0	50,503.2	6.79	443.4	6,232.2	7.11
Tobacco & Tobacco Products	6,118.4	39,834.7	15.36	1,396.8	8,059.9	17.33
Textiles	29,420.5	210,164.1	14.00	2,999.1	15,770.8	19.02
Footwear & Leather Products	10,291.8	32,206.6	31.96	2,156.3	5,730.9	37.63
Pulp and Paper	10,731.1	182,596.8	5.88	1,302.4	17,335.5	7.51
Soap and Detergents	3,626.9	42,420.8	8.55	826.8	5,006.0	16.52
Paints	7,261.2	20,961.3	34.64	1,653.1	5,149.9	32.10
Agricultural Fertilizers	12,096.1	83,701.3	14.45	1,027.3	6,971.0	14.74
Petroleum Refining & Products	58,024.6	967,454.9	6.00	4,032.9	66,429.4	6.07
Tires and Inner Tubes	7,209.0	94,064.8	7.66	619.3	7,143.1	8.67
Cement	5,688.3	23,107.4	24.62	574.6	2,334.3	24.62
Bricks	6,041.1	4,956.0	121.89	1,668.0	1,229.8	135.63
Iron and Steel	51,525.3	377,695.4	13.64	7,087.7	42,211.7	16.79
Radio and TV Receivers	9,003.6	34,287.7	26.26	1,177.8	4,443.6	26.50
Motor Vehicles	57,791.5	454,325.6	12.72	9,140.8	70,031.8	13.05
Total in our sample	297,828.9	2,678,484.8	11.12	42,843.3	275,040.0	15.58

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.	USA 1975 million)	Mexico/ USA (%)	Mexico 1975 (1975 US$	USA 1975 million)	Mexico/ USA (%)
Grain Mill Products	9,123.1	84,918.2	10.74	739.1	6,469.3	11.43
Sugar & Sugar Products	6,596.3	16,786.3	39.30	1,821.9	4,490.8	40.57
Malt and Malt Beverages	10,973.8	110,071.0	9.97	621.2	6,232.2	9.97
Tobacco & Tobacco Products	3,847.4	75,320.4	5.11	503.8	8,059.9	6.25
Textiles	17,909.9	294,769.0	6.08	1,026.4	15,770.8	6.51
Footwear & Leather Products	6,447.3	73,613.5	8.76	569.6	5,730.9	9.94
Pulp and Paper	14,607.1	394,793.5	3.70	736.6	17,335.5	4.25
Soap and Detergents	6,335.6	57,940.0	10.93	698.5	5,006.0	13.95
Paints	3,460.2	79,370.7	4.36	234.5	5,149.9	4.55
Agricultural Fertilizers	4,865.7	58,564.9	8.31	639.1	6,971.0	9.17
Petroleum Refining & Products	28,463.4	732,357.2	3.89	2,646.0	66,429.4	3.98
Tires and Inner Tubes	4,969.8	233,466.4	2.13	169.7	7,143.1	2.38
Cement	5,648.6	28,439.2	19.86	466.6	2,334.3	19.99
Bricks	1,639.9	12,044.1	13.59	120.4	1,229.8	9.79
Iron and Steel	32,836.9	594,946.0	5.52	2,918.9	42,211.7	6.92
Radio and TV Receivers	4,854.5	39,615.0	12.25	426.0	4,443.6	9.59
Motor Vehicles	39,425.6	962,493.3	4.10	2,910.5	70,031.8	4.16
Total in our sample	202,002.0	3,849,508.7	5.25	17,248.7	275,040.0	6.27

Source: derived from tables 3.4, 3.5 and 3.6

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, which we have used in chapter IV below (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 (which we do in chapter IV).

For the detailed value added comparisons in this chapter for our 17 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.

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.

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[1] Formulae (3.8) 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.

Levels of Value Added in 17 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 3.9
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
Grain Mill Products	236.0	207.3	1,587.8
Sugar & Sugar Products	571.4	257.3[a]	933.9
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	1,260.4	669.2	6,217.3
Footwear and Leather Products	583.8	266.4	2,941.6
Pulp and Paper	571.6	502.3	7.626.1
Soap and Detergents	169.7	216.3	2,419.7
Paints	350.8	127.8	2,126.3
Agricultural Fertilizers	445.5	180.9	3,306.1
Petroleum Refining and Products	1,883.0	684.9[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	715.7
Iron and Steel	2,223.8	1,082.8	15,783.2
Radio and TV Receivers	447.3	205.3	1,542.5
Motor Vehicles	1,772.6	1,163.3	21,465.9
Total in our sample	12,472.8	6,840.9	86,645.4
as % of Total Manufacturing	33.04	38.90	19.58

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 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.

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
Grain Mill Products	25.83	28.41	24.54
Sugar & Sugar Products	38.26	48.76	20.80
Malt and Malt Beverages	58.97	62.65	34.17
Tobacco and Tobacco Products	52.49	47.22	46.17
Textiles	34.83	46.70	39.42
Footwear and Leather Products	46.11	51.64	51.33
Pulp and Paper	43.31	42.98	43.99
Soap and Detergents	38.04	42.68	48.34
Paints	39.28	46.16	41.29
Agricultural Fertilizers	29.94	46.48	47.43
Petroleum Refining and Products	26.38	30.08	14.05
Tires and Inner Tubes	43.82	59.45	48.48
Cement	54.63	61.07	57.10
Bricks	72.97	52.98	58.20
Iron and Steel	35.09	41.22	37.39
Radio and TV Receivers	40.39	52.85	34.71
Motor Vehicles	24.94	36.88	30.65
Weighted average 17 industries	34.05	42.33	31.50

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. million)	USA 1975	Brazil/ USA (%)	Brazil 1975 (1975 US$ million)	USA 1975	Brazil/ USA (%)
Grain Mill Products	1,918.7	12,038.2	15.94	276.5	1,587.8	17.41
Sugar & Sugar Products	4,645.4	2,320.0	200.24	2,167.8	933.9	232.13
Malt and Malt Beverages	2,021.9	17,259.0	11.72	261.4	2,129.8	12.27
Tobacco & Tobacco Products	3,211.7	18,392.9	17.46	733.2	3,721.5	19.70
Textiles	10,246.9	82,852.7	12.37	1,044.6	6,217.3	16.80
Footwear & Leather Products	4,746.0	16,531.3	28.71	994.4	2,941.6	33.80
Pulp and Paper	4,647.5	80,326.6	5.79	564.1	7,626.1	7.40
Soap and Detergents	1,379.8	20,504.5	6.73	314.5	2,419.7	13.00
Paints	2,852.3	8,654.5	32.96	649.4	2,126.3	30.54
Agricultural Fertilizers	3,621.5	36,696.6	9.12	307.6	3,306.1	9.30
Petroleum Refining & Products	15,309.0	135,912.4	11.26	1,064.0	9,332.3	11.40
Tires and Inner Tubes	3,159.1	45,600.3	6.93	271.4	3,462.8	7.84
Cement	3,107.7	13,194.5	23.55	313.9	1,332.9	23.55
Bricks	4,408.5	2,884.2	152.85	1,217.2	715.7	170.07
Iron and Steel	18,079.7	141,222.5	12.80	2,487.0	15,783.2	15.76
Radio and TV Receivers	3,636.9	11,902.2	30.56	475.8	1,542.5	30.84
Motor Vehicles	14,411.4	139,258.3	10.35	2,279.4	21,465.9	10.62
Total in our sample	101,404.1	788,550.7	12.86	15,422.2	86,645.4	17.80

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 (%)
Grain Mill Products	2,591.8	20,842.0	12.44	210.0	1,587.8	13.22
Sugar & Sugar Products	3,216.1	3,490.8	92.13	888.3	933.9	95.12
Malt and Malt Beverages	6,874.8	37,615.8	18.28	389.2	2,129.8	18.28
Tobacco & Tobacco Products	1,816.8	34,777.7	5.22	237.9	3,721.5	6.39
Textiles	8,364.7	116,206.3	7.20	479.4	6,217.3	7.71
Footwear & Leather Products	3,329.5	37,784.9	8.81	294.1	2,941.6	10.00
Pulp and Paper	6,278.8	173,674.5	3.62	316.6	7,626.1	4.15
Soap and Detergents	2,704.2	28,005.9	9.66	298.1	2,419.7	12.32
Paints	1,597.0	32,770.7	4.87	108.2	2,126.3	5.09
Agricultural Fertilizers	2,261.7	27,775.3	8.14	297.1	3,306.1	8.99
Petroleum Refining & Products	8,561.7	102,884.8	8.32	795.9	9,332.3	8.53
Tires and Inner Tubes	2,954.4	113,178.8	2.61	100.9	3,462.8	2.91
Cement	3,449.5	16,239.0	21.24	284.9	1,332.9	21.38
Bricks	867.2	7,009.2	12.37	63.8	715.7	8.91
Iron and Steel	13,535.1	222,453.8	6.08	1,203.2	15,783.2	7.62
Radio and TV Receivers	2,565.7	13,751.5	18.66	225.2	1,542.5	14.60
Motor Vehicles	14,541.6	295,020.1	4.93	1,073.5	21,465.9	5.00
Total in our sample	85,510.9	1,283,481.2	6.66	7,266.2	86,645.4	8.39

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.

Complementarity of Price and Quantity Relatives

The previous sections showed the results for our sample of 17 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 17 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 17 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 31 of the 51 PPPs were below the exchange rate for the Brazil/USA comparison and 27 of the 51 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.

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)
Grain Mill Products	7.58	6.94	7.25	13.13	12.34	12.73
Sugar & Sugar Products	2.48	2.14	2.30	3.74	3.62	3.68
Malt and Malt Beverages	8.10	7.73	7.91	17.66	17.66	17.66
Tobacco and Tobacco Products	4.94	4.38	4.65	9.35	7.64	8.45
Textiles	13.33	9.81	11.44	18.69	17.45	18.06
Footwear and Leather Products	5.62	4.77	5.18	12.85	11.32	12.06
Pulp and Paper	10.53	8.24	9.31	22.77	19.83	21.25
Soap and Detergents	8.45	4.39	6.09	11.55	9.07	10.24
Paints	4.07	4.39	4.23	15.41	14.76	15.08
Agricultural Fertilizers	12.01	11.77	11.89	8.40	7.61	8.00
Petroleum Refining and Products	14.56	14.39	14.47	11.02	10.76	10.89
Tires and Inner Tubes	13.17	11.64	12.38	32.68	29.29	30.94
Cement	9.90	9.90	9.90	12.18	12.11	12.14
Bricks	4.03	3.62	3.82	9.79	13.60	11.54
Iron and Steel	8.95	7.27	8.07	14.09	11.25	12.59
Radio and TV Receivers	7.72	7.64	7.68	8.92	11.39	10.08
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)	9.10	6.58	7.74	14.81	11.71	13.20
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.

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

In this section we blow up our sample results for 17 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 Czech Statistical Office/INSEE (1969) 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 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. 34), 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 the price ratios for grain mill, sugar and sugar products. Table 3.14 shows our PPPs for 13 manufacturing branches. In some cases we combined divisions, because PPPs were not available for each division separately (for example for wood products and furniture). 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.

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	5.69	2.69	3.91	9.65	5.29	7.14
Beverage Products	8.10	7.73	7.92	17.66	17.66	17.66
Tobacco Products	4.94	4.38	4.65	9.35	7.64	8.45
Textiles and Wearing Apparel	13.33	9.81	11.43	18.69	17.45	18.06
Footwear and Leather Products	5.62	4.77	5.18	12.85	11.32	12.06
Wood and Paper Products	10.53	8.24	9.32	22.77	19.83	21.25
Chemical Products	11.92	9.92	10.87	11.14	10.09	10.60
Rubber and Plastic Products	13.17	11.64	12.38	32.68	29.28	30.94
Stone, Clay and Glass Products	7.85	4.91	6.21	11.35	12.38	11.85
Metal products	8.95	7.27	8.07	14.09	11.25	12.59
Electrical Machinery	7.72	7.64	7.68	8.92	11.39	10.07
Machinery and Transport Equipment	6.49	6.32	6.40	13.74	13.55	13.64
Other	8.79	6.26	7.42	14.92	10.94	12.77
Total	8.79	6.26	7.42	14.92	10.94	12.77

Source and note:
PPPs from table 3.13. The PPP for food products is the weighted average for grain mill and sugar and sugar products. The PPP for chemical products is a weighted average for soap and detergents, paints, agricultural fertilizers, petroleum refining and products. The PPP for stone, clay and glass products is a weighted average for cement and bricks. In all cases value added figures (US census concept) were used as weights. The cruzeiro/US$ PPPs and peso/US$ PPPs for "Other Manufacturing" and "Total Manufacturing" are derived from the sum of the values for all other branches from tables 3.15 and 3.16 respectively.

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	27,759	144,744	19.18	10,337	25,421	40.66
Beverages	4,565	41,774	10.93	590	5,155	11.45
Tobacco Products	2,987	12,203	24.48	682	2,469	27.62
Textiles and Wearing Apparel	22,940[a]	270,854	8.47	2,339	20,325	11.51
Footwear and Leather Products	3,977[a]	13,145	30.26	833	2,339	35.63
Wood and Paper Products	27,696	482,290	5.74	3,362	45,788	7.34
Chemical Products	42,511	388,781	10.93	4,286	32,627	13.14
Rubber and Plastic Products	10,260	121,560	8.44	881	9,231	9.55
Stone, Clay and Glass Products	15,365	84,899	18.10	3,130	10,817	28.93
Metal products	31,176	470,798	6.62	4,289	52,617	8.15
Electrical Machinery	15,437	211,184	7.31	2,020	27,369	7.38
Machinery and Transport Equipment	44,231	513,071	8.62	6,996	79,087	8.85
Other	8,109	132,811	6.11	1,295	15,099	8.58
Total	257,012	2,888,112	8.90	41,039	328,343	12.50

a) 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 Products Accounts of the United States: 1929-76 Statistica. Tables (1981c) after adjustment for inventories indirect taxes and subsidies an net intrest (see table 2.6). 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.	USA 1975 million)	Mexico/ USA (%)	Mexico 1975 (1975 US$	USA 1975 million)	Mexico/ USA (%)
Food Products	20,446[a]	245,296	8.34	3,866	25,421	15.21
Beverages	8,170[a]	91,046	8.97	462	5,155	8.97
Tobacco Products	1,177[a]	23,073	5.10	154	2,469	6.24
Textiles and Wearing Apparel	15,334	379,890	4.04	879	20,325	4.32
Footwear and Leather Products	2,472	30,044	8.23	218	2,339	9.34
Wood and Paper Products	13,121	1,042,762	1.26	662	45,788	1.44
Chemical Products	26,226[ab]	363,469	7.22	2,600	32,627	7.97
Rubber and Plastic Productss	6,264	301,708	2.08	214	9,231	2.32
Stone, Clay and Glass Products	8,857	122,755	7.21	715	10,817	6.61
Metal products	23,949	741,602	3.23	2,129	52,617	4.05
Electrical Machinery	9,557	243,997	3.92	839	27,369	3.06
Machinery and Transport Equipment	19,423	1,086,945	1.79	1,434	79,087	1.81
Other	2,494	225,228	1.11	228	15,099	1.51
Total	157,488	4,897,816	3.22	14,401	328,343	4.39

a) indirect taxes and subsidies are deducted (see table 2.3).
b) 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 2.3 which does not exclude bank costs). US value added in national currencies from National Income and Products Accounts of the United States: 1929-76 Statistical Tables (1981c) after adjustment for inventories indirect taxes and subsidies and net intrest (see table 2.6). PPPs from table 3.14.

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 3.17
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	9.10	6.58	7.74	14.81	11.77	13.20
Reweighted PPP (by major branch)	8.79	6.26	7.42	14.92	10.94	12.77
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

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

Introduction

This chapter supplements chapter III, which showed two binary comparisons between Brazil/USA and Mexico/USA, with a direct comparison between Mexico and Brazil.

The major conceptual difference between this and the previous chapter is that we are able here to make comparisons for our sample industries for our preferred "national accounts" concept of value added instead of the "US census concept", which we had to use for the detailed industry comparisons of chapter III because the necessary information was not available for the USA.

Another advantage of a direct Mexico/Brazil comparison is that we did not have to make an adjustment for different benchmark years, as was the case in the comparison with USA.

Levels of Real Gross Output in 17 Industries

This chapter covers the same sample of industries as in chapter III. We attempt to match products of Mexico (country M) with products of Brazil (country B), in one case in terms of the unit values of country B (cruzeiros) and in the other case in terms of the unit values of country M (pesos). We made two separate comparisons, namely the ratio of country M's quantity of output to that of country B, in unit values of country M and in unit values of country B:

$$\frac{\Sigma\,(Q_y^M * P_y^M)}{\Sigma\,(Q_y^B * P_y^M)} \qquad (4.1a)$$

and

$$\frac{\Sigma\,(Q_y^M * P_y^B)}{\Sigma\,(Q_y^B * P_y^B)} \qquad (4.1b)$$

Table 4.1 shows total gross value of output for these 17 industries as derived from the industrial censuses, expressed in both national currencies with conversion at the average official exchange rate of 1.5375 pesos to the cruzeiro in 1975. In the last column of the table, Mexico/Brazil gross output ratios are presented. In the case of Brazil, our sample covered 42 per cent of gross value of output, in Mexico 38 per cent.

Table 4.2 represents the first stage in the calculation procedure. It shows figures for that part of the 1975 gross value of output of Brazil and Mexico which is covered by our matching of individual product items. Figures are presented in terms of national currency and in prices of the other country. The corresponding gross output ratios are also presented in this table, as indicated by formulae (4.2a) and (4.2b):

$$\frac{\Sigma\,(Q^{M}_{y,75} * P^{M}_{y,75})_{c}}{\Sigma\,(Q^{B}_{y,75} * P^{M}_{y,75})_{c}} \qquad (4.2a)$$

and

$$\frac{\Sigma\,(Q^{M}_{y,75} * P^{B}_{y,75})_{c}}{\Sigma\,(Q^{B}_{y,75} * P^{B}_{y,75})_{c}} \qquad (4.2b)$$

We did not, as we did in chapter III, make a quality adjustment for passenger cars because quality differences between Mexico and Brazil are much smaller than those between these countries and the USA.

Table 4.3 shows the coverage ratios for the products matched in this direct comparison between Mexico and Brazil, and compares them with the coverage ratios for the Brazil/USA and Mexico/USA comparisons of chapter III. The greater homogeneity of Mexican and Brazilian output might be expected to make it possible to match more product items than in chapter III, but table 4.3 shows that in practice there was not much difference in the matching in the two chapters.

Chapter III discussed two methods of adjusting the covered part of output in terms of prices of the other country, $\Sigma(Q^{B}_{y} * P^{M}_{y})_{c}$ and $\Sigma(Q^{M}_{y} * P^{B}_{y})_{c}$ to total gross value of output. In practice we prefer the method which assumes the price relationships for the covered part of output to be representative for uncovered output as well (see chapter III).

Table 4.4 presents the gross output quantity comparison calculated both in terms of pesos and cruzeiros. The Brazilian figures at national prices are directly derived from the Censo Industrial, and for Mexico from the Resumen General (see also table 4.1). The figures in country B at prices of country M are derived by adjusting the matched figure by the inverse coverage ratio for country B; for country M at prices of country B by using the coverage ratio of country M (compare with formula 3.5a and 3.5b in chapter III). Table 4.4 also shows the corresponding ratios of Mexican to Brazilian output.

TABLE 4.1
Gross Value of Output in Brazil and Mexico in 1975,
in national currencies and at the official exchange rates

	Mexico (million pesos)	Mexico (million cruzeiros)	Brazil (million pesos)	Brazil (million cruzeiros)	Mexico/Brazil (%)
Total Manufacturing Output	480,048.2[ab]	312,226.5[ab]	1,203,398.9	782,698.5	39.89
Grain Mill Products	9,123.1	5,933.7	11,420.8	7,428.1	79.88
Sugar & Sugar Products	6,596.3	4,290.3	18,668.9	12,142.4	35.33
Malt and Malt Beverages	10,973.8[a]	7,137.4[a]	5,272.0	3,429.0	208.15
Tobacco and Tobacco Products	3,847.4[a]	2,502.4[a]	9,407.0	6,118.4	40.89
Textiles	17,909.9	11,648.7	45,234.0	29,420.5	39.59
Footwear and Leather Products	6,447.2	4,193.3	15,823.7	10,291.8	40.74
Pulp and Paper	14,607.1	9,500.6	16,499.0	10,731.1	88.53
Soap and Detergents	6,335.6	4,120.7	5,576.4	3,626.9	113.61
Paints	3,460.2	2,250.5	11,164.1	7,261.2	30.99
Agricultural Fertilizers	4,865.7[ab]	3,164.7[ab]	18,597.7	12,096.1	26.16
Petroleum Refining and Products	28,463.4[ab]	18,512.8[ab]	89,212.9	58,024.6	31.90
Tires and Inner Tubes	4,969.8	3,232.4	11,083.9	7,209.0	44.83
Cement	5,648.6	3,673.9	8,745.8	5,688.3	64.58
Bricks	1,636.9	1,064.6	9,288.2	6,041.1	17.62
Iron and Steel	32,836.9	21,357.3	79,220.1	51,525.3	41.45
Radio and TV Receivers	4,854.5	3,157.4	13,843.0	9,003.6	35.06
Motor Vehicles	39,425.6	25,642.7	88,854.4	57,791.5	44.37
Total in our sample	202,002.0	131,383.4	457,911.9	297,828.9	44.14
as % of Total Manufacturing Output		42.08		38.05	

a) indirect taxes and subsidies are deducted (see table 2.3).
b) includes 25,008.3 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: Figures are converted at the exchange rate of 1.5375 pesos to the cruzeiro.
Source: Figures for Brazil from Censo Industrial, and for Mexico from Resumen General (except figures mentioned under footnotes a) and b)).

TABLE 4.2
Quantities (Matched Output), Mexico/Brazil (1975)

	at Mexican "prices"			at Brazilian "prices"		
	Mexico (mill.	Brazil pesos)	Mexico/ Brazil (%)	Mexico (mill.	Brazil cruzeiros)	Mexico/ Brazil (%)
Grain Mill Products	5,960.1	11,319.4	52.65	3,047.3	6,087.0	50.06
Sugar & Sugar Products	5,651.7	17,372.0	32.53	3,796.0	11,514.8	32.96
Malt and Malt Beverages	9,775.6	6,889.8	141.89	4,554.1	3,019.0	150.85
Tobacco and Tobacco Products	3,772.3	9,085.9	41.51	2,296.9	5,507.0	41.70
Textiles	7,404.8	41,055.2	18.03	4,939.9	24,821.9	19.90
Footwear and Leather Products	3,148.2	15,541.3	19.99	1,405.9	6,910.0	20.34
Pulp and Paper	7,304.5	13,364.8	54.65	2,862.2	7,041.5	40.64
Soap and Detergents	5,108.5	6,209.1	82.27	3,803.2	3,439.0	110.59
Paints	2,610.7	12,413.3	21.03	921.4	3,838.0	24.00
Agricultural Fertilizers	3,254.0	8,030.2	40.52	4,016.6	10,001.5	40.15
Petroleum Refining & Products	25,834.4	20,880.2	123.73	34,151.9	28,136.7	121.38
Tires and Inner Tubes	2,531.3	15,572.0	16.25	861.9	5,282.3	16.31
Cement	3,524.9	6,452.1	54.63	2,843.9	5,212.6	54.55
Bricks	1,147.0	6,373.4	17.99	256.2	2,536.7	10.10
Iron and Steel	23,832.7	49,557.5	48.09	17,619.4	31,587.4	55.77
Radio and TV Receivers	2,235.4	7,737.2	28.89	1,373.7	5,541.8	24.78
Motor Vehicles	24,859.7	46,588.3	53.36	11,578.2	21,521.3	53.79

Source: See tables 7 for industries A1 to A17 in Statistical Appendix.

TABLE 4.3
Coverage Ratio: Gross Value of Matched Items as a percentage of Total Gross Value of Output (national currencies)

	Direct Mexico/Brazil Comparison		Mexico/USA and Brazil/USA comparison	
	Mexico	Brazil	Mexico	Brazil
Grain Mill Products	65.33	81.95	65.51	83.17
Sugar & Sugar Products	85.68	94.83	85.68	94.83
Malt and Malt Beverages	89.08	88.05	89.08	88.05
Tobacco and Tobacco Products	98.05	90.01	98.05	90.15
Textiles	41.34	84.37	42.11	86.38
Footwear and Leather Products	48.83	67.14	53.72	56.28
Pulp and Paper	50.01	65.62	66.23	77.78
Soap and Detergents	80.63	94.82	81.57	94.79
Paints	75.45	52.86	69.30	45.32
Agricultural Fertilizers	66.88	82.68	66.88	82.68
Petroleum Refining and Products	90.76	48.49	75.42	38.19
Tires and Inner Tubes	50.93	73.27	48.72	79.48
Cement	62.40	91.64	59.22	86.64
Bricks	70.07	41.99	70.07	51.73
Iron and Steel	72.58	61.30	72.50	53.86
Radio and TV Receivers	46.05	61.55	68.75	62.17
Motor Vehicles	63.05	37.24	59.86	34.21
Weighted Average 17 industries	68.29	61.11	67.23	57.61

Source: Coverage ratios for three country comparisons from table 3.5;

TABLE 4.4
Quantities (Gross Output), Mexico/Brazil (1975)

	at Mexican "prices"			at Brazilian "prices"		
	Mexico (mill.	Brazil pesos)	Mexico/ Brazil (%)	Mexico (mill.	Brazil cruzeiros)	Mexico/ Brazil (%)
Grain Mill Products	9,123.1	13,813.3	66.04	4,664.4	7,428.1	62.79
Sugar & Sugar Products	6,596.3	18,318.8	36.00	4,430.4	12,142.4	36.48
Malt and Malt Beverages	10,973.8	7,825.2	140.23	5,112.3	3,429.0	149.09
Tobacco & Tobacco Products	3,847.4	10,094.6	38.11	2,342.6	6,118.4	38.28
Textiles	17,909.9	48,661.2	36.80	11,948.1	29,420.5	40.61
Footwear & Leather Products	6,447.3	23,445.4	27.49	2,879.3	10,291.8	27.97
Pulp and Paper	14,607.1	20,367.7	71.71	5,723.7	10,731.1	53.33
Soap and Detergents	6,335.6	6,548.5	96.74	4,716.8	3,626.9	130.05
Paints	3,460.2	23,485.1	14.73	1,221.2	7,261.2	16.81
Agricultural Fertilizers	4,865.7	9,711.9	50.09	6,005.9	12,096.1	49.65
Petroleum Refining & Products	28,463.4	43,049.9	66.10	37,627.2	58,024.6	64.84
Tires and Inner Tubes	4,969.8	21,252.0	23.38	1,692.2	7,209.0	23.47
Cement	5,648.6	7,041.0	80.22	4,557.2	5,688.3	80.11
Bricks	1,636.9	15,178.0	10.78	365.7	6,041.1	6.05
Iron and Steel	32,836.9	80,838.0	40.62	24,276.1	51,525.3	47.11
Radio and TV Receivers	4,854.5	12,570.4	38.61	2,983.3	9,003.6	33.13
Motor Vehicles	39,425.6	125,104.0	31.51	18,362.1	57,791.5	31.77
Total in our sample	202,002.0	487,315.0	41.44	138,908.6	297,828.9	46.64

Source: Figures in prices of the other country derived from tables 4.2 and 4.3; figures in national currencies derived from table 4.1.

Levels of Value Added in 17 Industries

An important advantage of the direct binary comparison between Mexico and Brazil is the possibility of comparing levels of value added for sample industries at the "national accounts" concept. This concept is much netter than the "US census" concept used in the previous chapter, because it excludes substantial non-industrial inputs (see chapter II).

Our preference is for the former over the present "national accounts" concept. In the present (1968) System of National Accounts, value added of particular industries, and indeed for major sectors of the economy, such as manufacturing, is calculated before deduction of bank service charges. The latter are deducted only globally (without being allocated by industry or sector) to arrive at the total GDP figure for all industries combined. In the former national accounts system, bank service charges were deducted for each industry.

Table 4.5 shows value added (former national accounts concept), both in national currencies and converted at the official exchange rate. Table 4.6, which presents the value added - gross output ratios, shows that the difference between value added at the US census concept and value added at the national accounts concepts is bigger in Mexico than in Brazil (for the present national accounts concept of value added, see table 1 for each industry in the Statistical Appendix).

As explained in chapter III we are unable to apply the "double indicator" approach, i.e. separate comparisons for gross output and inputs. We applied the value added - gross output ratios in table 4.6 to the gross value of output figures in table 4.4 to arrive at the real value added comparisons at the former national accounts concept in table 4.7.

TABLE 4.5

Value Added (Former National Accounts Concept) in Brazil and Mexico in 1975 in national currencies and at the official exchange rate

	Mexico		Brazil		Mexico/ Brazil
	(million pesos)	(million cruzeiros)	(million pesos)	(million cruzeiros)	(%)
Total Manufacturing	157,487.7[ab]	102,431.0[ab]	395,155.5	257,011.7	39.85
Grain Mill Products	1,680.1	1,092.8	2,437.1	1,585.1	68.94
Sugar & Sugar Products	2,255.4[a]	1,466.9[a]	5,207.6	3,387.0	43.30
Malt and Malt Beverages	4,285.8[a]	2,787.5[a]	2,670.6	1,737.0	160.48
Tobacco and Tobacco Products	1,177.0[a]	765.5[a]	4,592.1	2,986.8	25.63
Textiles	6,623.0	4,307.6	13,059.5	8,494.0	50.71
Footwear and Leather Products	2,472.2	1,607.9	6,045.8	3,932.2	40.89
Pulp and Paper	4,470.6	2,907.7	5,851.6	3,805.9	76.40
Soap and Detergents	1,847.8	1,201.8	1,891.8	1,230.4	97.67
Paints	1,098.5	714.5	3,731.5	2,427.0	29.43
Agricultural Fertilizers	1,022.9	665.3	4,622.1	3,006.2	22.13
Petroleum Refining and Products	4,854.2[ab]	3,157.2[ab]	21,884.2	14,233.6	22.18
Tires and Inner Tubes	2,258.7	1,469.1	4,310.6	2,803.7	52.39
Cement	2,469.2	1,606.0	4,387.5	2,853.6	56.27
Bricks	718.8	467.5	5,322.5	3,461.8	13.50
Iron and Steel	10,444.9	6,793.4	22,784.5	14,819.2	45.84
Radio and TV Receivers	1,738.2	1,130.6	5,048.5	3,283.6	34.43
Motor Vehicles	10,112.9	6,577.5	19,023.8	12,373.2	53.15
Total in our sample	59,530.3	38,718.9	132,871.3	86,420.3	44.80
as % of Total Manufacturing Output	37.80		33.63		

a) indirect taxes and subsidies are deducted (see table 2.3).
b) 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, 1981.

Note: Figures are converted at the exchange rate of 1.5375 pesos to the cruzeiro.

Source: Figures for Brazil from Censo Industrial, and for Mexico from Resumen General (except figures mentioned under footnotes a) and b)).

TABLE 4.6

Value Added (US Census Concept, Present and Former National Accounts Concept) as a percentage of Gross Value of Output, 1975, in national currencies

	Mexico			Brazil		
	US census concept	present national accounts concept	former national accounts concept	US census concept	present national accounts concept	former national accounts concept
Total Manufacturing	45.79	35.02	32.81	39.20	33.63	32.83
Grain Mill Products	28.41	21.72	18.42	25.83	21.95	21.34
Sugar & Confectionery Products	48.76	40.67	34.19	38.26	29.34	27.89
Malt and Malt Beverages	62.65	41.12	39.06	58.97	51.39	50.66
Tobacco and Tobacco Products	47.22	34.39	30.59	52.49	49.32	48.82
Textiles	46.70	40.05	36.98	34.83	30.26	28.87
Footwear and Leather Products	51.64	39.68	38.34	46.11	39.98	38.21
Pulp and Paper	42.98	33.01	30.61	43.31	36.45	35.47
Soap and Detergents	42.68	30.01	29.17	38.04	34.30	33.90
Paints	46.16	32.69	31.75	39.28	34.22	33.42
Agricultural Fertilizers	46.48	23.10	21.02	29.94	25.55	24.85
Petroleum Refining and Products	30.08	19.86	17.05	26.38	24.78	24.53
Tires and Inner Tubes	59.45	45.98	45.45	43.82	39.39	38.89
Cement	61.07	47.40	43.71	54.63	50.53	50.17
Bricks	52.98	45.76	43.91	72.97	58.59	57.30
Iron and Steel	41.22	34.21	31.81	35.09	29.49	28.76
Radio and TV Receivers	52.85	39.11	35.81	40.39	37.04	36.47
Motor Vehicles	36.88	27.94	25.65	24.94	21.75	21.41
Weighted average 17 industries	42.33	32.04	29.74	34.05	29.70	29.02

Source: US census concept ratios derived from table 3.10; present national accounts ratios derived from tables 1 for industries A1 to A17 of the Statistical Appendix; former national accounts ratios derived from tables 4.1 and 4.5

TABLE 4.7

Quantities (Value Added, Former National Accounts Concept), Mexico/Brazil, 1975

	at Mexican "prices"			at Brazilian "prices"		
	Mexico (mill.	Brazil pesos)	Mexico/ Brazil (%)	Mexico (mill.	Brazil cruzeiros)	Mexico/ Brazil (%)
Grain Mill Products	1,680.1	2,947.6	56.99	859.0	1,585.1	54.19
Sugar & Sugar Products	2,255.4	5,109.9	44.13	1,514.8	3,387.0	44.72
Malt and Malt Beverages	4,285.8	3,964.0	108.12	1,996.6	1,737.0	114.94
Tobacco & Tobacco Products	1,177.0	4,927.8	23.88	716.6	2,986.8	23.99
Textiles	6,623.0	14,049.0	47.14	4,418.4	8,494.0	52.01
Footwear & Leather Products	2,472.2	8,957.8	27.59	1,104.0	3,932.2	28.07
Pulp and Paper	4,470.6	7,223.6	61.88	1,751.8	3,805.9	46.02
Soap and Detergents	1,847.8	2,221.6	83.17	1,375.7	1,230.4	111.81
Paints	1,098.5	7,849.7	13.99	387.7	2,427.0	15.97
Agricultural Fertilizers	1,022.9	2,413.7	42.37	1,262.2	3,006.2	41.99
Petroleum Refining & Products	4,854.2	10,562.7	45.95	6,417.0	14,233.6	45.08
Tires and Inner Tubes	2,258.7	8,265.2	27.32	769.1	2,803.7	27.43
Cement	2,469.2	3,532.2	69.90	1,992.1	2,853.6	69.81
Bricks	718.8	8,697.6	8.26	160.6	3,461.8	4.64
Iron and Steel	10,444.9	23,249.9	44.92	7,721.8	14,819.2	52.10
Radio and TV Receivers	1,738.2	4,584.4	37.91	1,068.2	3,283.6	32.53
Motor Vehicles	10,112.9	26,784.9	37.75	4,710.0	12,373.2	38.06
Total in our sample	59,530.3	145,341.5	40.96	38,226.1	86,420.3	44.23

Source: Derived from tables 4.4, 4.5 and 4.6. Includes adjustments for indirect taxes and subsidies for malt and malt beverages, tobacco and tobacco products, and for petroleum refining and products.

Purchasing Power Parities in 17 Industries

Table 4.8 shows the PPPs for the 17 industries at both Brazilian and Mexican quantity weights and also their geometric average (Fisher index). These PPP estimates are derived from table 4.7, i.e. they are based on the "former national accounts concept" of value added. The average for the sample as a whole is an average of the industry PPPs weighted at the value added according to the former national accounts concept.

In the last column of table 4.8 we show also the geometric average for the Mexico/Brazil price ratios, which were derived inferentially from the Mexico/USA and Brazil/USA comparison in chapter III (see table 3.13).

Table 4.8
Purchasing Power Parities, Mexico/Brazil (Pesos to the Cruzeiro), 1975

	PPP: Pesos/Cruzeiro			"Inferential" PPP:
	Brazil Quantity Weights	Mexico Quantity Weights	Geometric Average	Pesos/Cruzeiro Geometric Average
Grain Mill Products	1.8596	1.9559	1.9070	1.7548
Sugar & Sugar Products	1.5087	1.4889	1.4988	1.5944
Malt and Malt Beverages	2.2821	2.1466	2.2133	2.2310
Tobacco and Tobacco Products	1.6499	1.6423	1.6461	1.8156
Textiles	1.6540	1.4990	1.5746	1.5795
Footwear and Leather Products	2.2781	2.2392	2.2586	2.3284
Pulp and Paper	1.8980	2.5520	2.2008	2.2813
Soap and Detergents	1.8054	1.3432	2.4250	1.6805
Paints	3.2343	2.8333	3.0272	3.5671
Agricultural Fertilizers	0.8029	0.8108	0.8068	0.6726
Petroleum Refining & Products	0.7421	0.7565	0.7493	0.7523
Tires and Inner Tubes	2.9480	2.9369	2.9424	2.4987
Cement	1.2378	1.2395	1.2386	1.2268
Bricks	2.5125	4.4765	3.3537	3.0200
Iron and Steel	1.5689	1.3526	1.4567	1.5612
Radio and TV Receivers	1.3962	1.6273	1.5073	1.3123
Motor Vehicles	2.1647	2.1471	2.1559	2.1305
Weighted average PPP for sample (value added weights, former national accounts concept)	1.6818	1.5573	1.6184	---
Weighted average PPP for sample (value added weights, US census concept)	---	---	---	1.7068
Exchange Rates	1.5375	1.5375	1.5375	1.5375

Source: pesos/cruzeiro PPPs derived from table 4.7. Includes adjustments for indirect taxes and subsidies for malt and malt beverages, tobacco and tobacco products, and petroleum refining and products. Inferential peso/cruzeiro PPPs derived from table 3.13 (chapter III).

It appears from table 4.8 that 33 of the 51 PPPs for individual industries in the direct Mexico/Brazil comparison are above the exchange rate, and that the three average PPPs are also all slightly above the exchange rate.

The average weighted sample PPP for the direct Mexico/Brazil comparison turns out to be somewhat lower than the average "inferential" PPP for the sample derived from chapter III (see also below).

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

Tables 4.9 and 4.10 show the results of our blowing-up procedure of the sample to arrive at quantitative relatives and PPPs for total manufacturing in the direct Mexico/Brazil comparison. Table 4.9 shows the reweighted PPPs by manufacturing branch, and table 4.10 shows the quantity ratios for Mexico/Brazil for manufacturing branches and for manufacturing as a whole (for procedure see chapter III).

TABLE 4.9
Purchasing Power Parities by Major Branch of Manufacturing
Mexico/Brazil (Pesos to the Cruzeiro), 1975

	PPP: Pesos/Cruzeiro		
	Brazil Quantity Weights	Mexico Quantity Weights	Geometric Average
Food Products	1.6205	1.6579	1.6391
Beverage Products	2.2821	2.1465	2.2133
Tobacco Products	1.6499	1.6425	1.6462
Textiles and Wearing Apparel	1.6540	1.4990	1.5746
Footwear and Leather Products	2.2781	2.2393	2.2586
Wood and Paper Products	1.8980	2.5520	2.2008
Chemical Products	1.1029	0.9344	1.0152
Rubber and Plastic Products	2.9479	2.9368	2.9423
Stone, Clay and Glass Products	1.9365	1.4809	1.6934
Metal products	1.5689	1.3527	1.4568
Electrical Machinery	1.3962	1.6272	1.5073
Machinery and Transport Equipment	2.1648	2.1471	2.1559

Sources and notes:
PPPs from table 4.8. The PPP for food products is the weighted average for grain mill and sugar and sugar products. The PPP for chemical products is a weighted average for soap and detergents, paints, agricultural fertilizers, petroleum refining and products. The PPP for stone, clay and glass products is a weighted average for cement and bricks. In all cases value added figures (former national accounts concept) were used as weights. The peso/cruzeiro PPPs for "Other Manufacturing" and "Total Manufacturing" were derived from the sum of the values for all other branches from table 4.10.

TABLE 4.10

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

	at Mexican "prices"			at Brazilian "prices"		
	Mexico 1975 (1975 Ps.	Brazil 1975 million)	Mexico/ Brazil (%)	Mexico 1975 (1975 Cr.	Brazil 1975 million)	Mexico/ Brazil (%)
Food Products	20,446	44,984	45.45	12,323	27,759	44.43
Beverages	8,170[a]	10,418	78.42	3,806	4,565	83.37
Tobacco Products	1,177[a]	4,928	23.89	717	2,987	23.99
Textiles and Wearing Apparel	15,334	37,943	40.41	10,229	22,940[c]	44.59
Footwear and Leather Products	2,472	9,060	27.29	1,104	3,977[c]	27.76
Wood and Paper Products	13,121	52,566	24.96	5,142	27,696	18.56
Chemical Products	26,226[ab]	46,885	55.94	28,068	42,511	66.03
Rubber and Plastic Productss	6,264	30,245	20.71	2,133	10,260	20.79
Stone, Clay and Glass Products	8,857	29,754	29.77	5,980	15,365	38.92
Metal products	23,949	48,913	48.96	17,706	31,176	56.79
Electrical Machinery	9,557	21,552	44.34	5,873	15,437	38.04
Machinery and Transport Equipment	19,423	95,749	20.29	9,046	44,231	20.45
Other	2,494	14,107	17.68	1,643	8,109	20.27
Total	157,488	447,104	35.22	103,779	257,012	40.38

a) indirect taxes and subsidies are deducted (see table 2.3).
b) 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.
c) the footwear industry (2,675.9 million cruzeiros) was reallocated from wearing apparel to footwear and leather.

Source: Mexican gross value added in national currencies calculated from Resumen General (see table 2.3 which does not exclude bank costs). Brazilian gross value added in national currencies calculated from Censo Industrial (see table 2.1 which does not exclude bank costs). Bank costs derived from the same sources (for calculation see chapter II). PPPs from table 4.9.

Comparison of the Direct Binary Quantity Ratios with the Inferential Ratios

It is not possible to make an exact comparison between the quantity ratios for Mexico/Brazil in this chapter and those one can inferentially derive from the Brazil/USA and Mexico/USA comparisons in chapter III. The latter are what Kravis, Heston and Summers (1982) refer to as a "star system of binary comparisons". The United States, the country at the centre, was compared separately with each of the points of the star, Brazil and Mexico. A comparison between points of the star, i.e. between Mexico and Brazil, will show identical results with those of the direct Mexico/Brazil comparison in this chapter, only if there is "transitivity"[1]. In practice complete transitivity can not be expected.

Another reason for the incongruity between the present direct Mexico/Brazil results and the inferential results derived from chapter III, is that we were able to use the more refined national accounts concept of value added throughout the present chapter.

Table 4.11 compares the quantity relatives for manufacturing value added as a whole of the present chapter with the binary ratios and the inferential ratio that can be derived from chapter III. In fact our direct Mexico/Brazil ratio is very similar to the inferential comparison.

TABLE 4.11
Comparison of Direct and Inferential Quantity Relatives for Manufacturing as a Whole, Mexico/Brazil, 1975

	Brazil/USA Geometric Average	Mexico/USA Geometric Average	Mexico/Brazil Geometric Average
Inferential Relatives Implicit in the Binary Comparisons of Chapter III)	(10.55)	(3.76)	35.64
Direct Binary Comparison	---	---	37.71

Note: The figures show the numerator country as a percent of the denominator country's value added at the former national accounts concept.

Source: First line from tables 3.15 and 3.16; second line derived from table 4.10.

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[1] "Transitivity" requires that the Mexico/Brazil quantity ratio equals the product of the Mexico/US and US/Brazil quantity ratios i.e.:

$$\Sigma Q_y^M / \Sigma Q_y^B = \frac{\Sigma (Q_y^M * P_y^U) / \Sigma (Q_y^U * P_y^U)}{\Sigma (Q_y^B * P_y^U) / \Sigma (Q_y^U * P_y^U)}$$

with Q_y = quantity of product y
P_y = price of product y
M = Mexico
B = Brazil
U = United States

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.

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[1].
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

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[1] For all industries A1 to A17 (see Statistical Appendix) we show summary tables for each matching procedure, which ranks the items according to their value of output, and which shows if they are matched are not and how much they contribute to the cumulative matching percentage.

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 9.3 - Matching of Product Items, US-Brazil, Motor Vehicles and Equipment.
Hamonized and A-D-R 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 HAR	PPP Cr./US$ US Quantity Weights ADR approach
1.	1 37111 11	Complete Vehicles	) thousand						
	1 37111 51	Chassis for sale separately	) thousand	9.192.3	47.796.3	5.199.66	109.034.1	3.97	3.97
		Adjustment for quality differences	(a)		47.796.3		237.776.4	4.97	4.97
2.	37112	-- Trucks, truck tractors, and truck chassis by gross vehicle weight							
	3 37112 11	6.000 pounds and less	thousand	1.343.0	6.380.4	4.678.60			
	2 37112 13	6.001 to 10.000 pounds	)	1.775.7	8.231.6	4.691.90			
	37112 15	10.001 to 14.000 pounds	)	90.1	275.0	5.089.02			
	37112 17	14.001 to 16.000 pounds	)						
	37112 21	16.001 to 19.500 pounds		41.3	260.6	6.582.63			
	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		32.5	760.0	23.529.41			
	5 37112 29	Over 44.000 pounds	thousand	96.2	3.045.7	31.660.06			
				3.560.1	21.562.9	6.071.67	166.605.7	6.71	6.71
3.		Complete trailer units:							
	37151 10	Truck trailers:							
		Van:							
		Closed top:							
	37151 02.-14.-60	Insulated	thousand	15.9	209.1	13.000.05			
	37151 04.-16.-40	Semi-insulated		2.6	21.2	8.119.38			
	37151 05.-15.-44	Drop frame type.		4.0	90.5	19.530.03			
	37151 07.-17	Livestock	thousand	1.4	24.0	17.142.86			
		All other closed top vans:							
	37151 09	Steel	thousand	0.0	5.2	6.500.00			
	37151 19	Aluminum		62.2	483.8	7.770.14			
	37151 60	FRP (fiberglass)	thousand	7.3	57.0	7.000.22			
		Open top, incl. low side grain, fruit etc.:							
	37151 12	Steel	thousand	1.4	11.4	8.142.86			
	37151 21.-70	Aluminum and FRP	thousand	2.8	20.0	10.305.71			
		Tank:							
	37151 30	Flammable liquids	thousand	3.1	60.9	19.645.16			
	37151 38	Asphalt		0.6	10.8	18.000.00			
	37151 39	Chemicals and acids		0.8	19.5	23.125.00			
	37151 32	Other		3.3	60.8	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	30.0	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, semi. detachable	thousand	9.9	78.0	9.219.53			
	37151 90	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 65	Rollies or converter gear	thousand	5.2	14.2	2.117.38			
				194.1	1.676.3	8.635.97	7.343.2	4.51	4.51

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 HAR	PPP Cr./US$ Brazilian Quantity Weights ADR approach
3	4502	Cars, assembled, less than 75 hp	) single	132.234	2.944.434	22.418.82			
1	4505	Other passenger cars	) single	317.442	6.322.129	19.915.86			
				449.676	9.266.563	20.611.65	2.338.163	3.97	3.97
					9.266.553		1.983.900	4.66	4.66
6	4533	Trucks, heavy duty, complete	) single	12.253	1.255.286	102.460.71			
13	4534	Trucks with tanks,pumps,ladders,other	)	3.798	402.132	105.539.23			
4	4535	Trucks, 100-220 hp, autobus	)	63.168	1.825.411	28.976.87			
	4550	Truck chassis without engine	)	4.668	66.730	11.565.95			
	4674	Complete truck	) single	16.883	318.707	19.021.36			
				99.330	4.068.276	40.755.88	683.099	6.71	6.71
8	4704	Trailers and semi-trailers	) single	20.805	813.684	39.100.41			
	4777	Trailers	) single	242	4.699	18.425.62			
				21.047	817.943	38.862.69	181.951	4.51	4.51

TABLE 9.2 - Matching of Product Items, US-Brazil, Motor Vehicles and Equipment.
Minimalist and A-S-H approach. (US 1977) (Brazil 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Seller Value (mill. US$)	US Seller Unit Value	US Quantity valued at Brazilian Unit Values (mill.Cr.)	PPP Cr./US$ US Quantity Weights MMR	PPP Cr./US$ US Quantity Weights AHH 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 MMR	PPP Cr./US$ Brazilian Quantity Weights AHH approach
4.	4 37161 11	Gasoline engines,new	millions	10.0	9.520.6	952.06	37.970.6	6.07	6.07	2	4620	Internal combustion engines,gasoline	single	1.186.290	6.200.652	5.227.06	611.601	6.07	6.07
5.		Wheels:																	
	37161 35	Passenger car type	millions	66.0	626.6	9.49													
	37161 37	Truck and bus type	millions	20.6	356.9	17.90													
				86.6	983.5	11.36	8.290.8	8.43	8.43	12	4636	Wheels	single	6.998.905	671.689	98.96	79.669	8.43	8.43
6.		Transmissions:																	
		Manual:																	
	37161 61	Passenger car type	millions	0.6	66.7	166.75													
	37161 65	Truck and bus type	millions	1.5	990.3	990.07													
		Automatic:																	
6	37161 63	Passenger car type	millions	9.8	2.001.3	212.38													
	37161 67	Truck and bus type	millions	3.5	913.3	232.09													
				15.2	3.990.6	234.12	25.210.2	7.00	7.00	9	4530	Gear boxes	thousand	669	762.007	1.698.57	108.119	7.00	7.00
7.	37131 25	Truck bodies: Pickup (all types)	thousand	5.3	15.0	2.901.13	48.6	3.00	----		4719	Fiber-glass bodies	single	3.706	29.941	9.176.22	9.299	3.00	----
8.	37131 33	Truck bodies: Dump	thousand	22.8	46.0	2.052.63	210.9	6.62	----		4712	Dump truck bodies (metal)	single	21.168	287.706	13.597.17	63.666	6.62	----
9.	37131 33	Refuse and garbage: Rear loading	thousand	5.7	52.0	9.263.16	587.6	11.13	----		4753	Garbage truck bodies	single	106	20.721	183.986.86	963	11.13	----
10.	37131 53	Other vehicle bodies	thousand	360.9	990.5	1.725.28	9.005.7	9.03	----		4726	Other special bodies for trucks	single	8.613	168.115	16.966.66	16.090	9.03	----
11.	37161 17	Hub and drum assemblies	millions	31.9	479.5	15.03	2.682.6	5.59	----		4665	Brake-drum	thousand	2.363	190.702	86.09	35.519	5.99	----
12.	37161 21	Fuel pump assemblies	millions	19.3	98.10	6.56	1.077.2	12.23	----		4517	Gasoline fuel pumps	thousand	1.396	77.916	98.81	6.372	12.23	----
13.	37161 23	Water pump assemblies	millions	10.6	112.6	10.01	88.1	8.78	----		4516	Water pumps	thousand	4.976	62.176	8.68	53.779	8.78	----
14.	37161 26	Filters: Fuel	millions	57.8	66.9	8.78	367.1	7.73	----		4593	Fuel filters	thousand	3.216	13.296	6.68	1.728	7.73	----
15.	37161 25	Filters: Oil	millions	360.9	626.6	1.25	6.276.9	16.78	----		4596	Oil filters	thousand	9.177	168.910	18.61	11.438	16.78	----
16.	37161 26	Filters: Air	millions	131.7	190.0	1.66	3.719.3	19.58	----		4591	Air filters	thousand	1.811	81.166	28.36	2.613	19.58	----
17.	37161 27	Exhaust system components: Mufflers	millions	66.6	619.6	9.45	1.009.7	6.55	----		4661	Mufflers for discharge pipes	single	2.619.119	112.630	43.01	26.752	6.58	----
18.	37161 31	Radiators,complete	millions	17.9	719.3	60.16	7.599.5	10.59	----		4654	Complete radiators	single	601.223	169.391	422.06	16.127	10.59	----
19.	37161 33	Brake cylinders: Wheel	millions	26.5	69.8	1.97	972.5	13.93	----		4551	Wheel cylinders	single	2.376.113	63.990	27.39	6.672	13.93	----
20.	37161 36	Brake cylinders: Master	millions	21.6	275.8	12.09	1.530.1	9.98	----		4662	Main cylinder brakes	single	16.993	1.949	71.67	188	9.98	----
21.	37161 33	Brake valves	millions	20.7	98.5	1.76	107.6	3.71	----		4686	Check-valve for brake master cylinder	single	367.566	2.270	6.53	612	3.71	----
22.	37161 61	Shock absorbers	millions	100.9	602.9	6.78	3.988.1	9.27	----		4699	Shock absorbers	thousand	7.986	312.663	39.52	37.006	9.27	----
23.	37161 67	Tie rod ends	millions	11.9	98.7	6.26													
	37161 69	Steering idler arms,drag links,control arms	millions	56.7	361.3	6.02					4509	Steering system bars	thousand	2.750	169.312	56.37			
											4522	Steering system arms	thousand	22	523	23.77			
				68.60	393.0	5.71	3.713.0	9.67	----					2.772	190.935	56.13	15.668	9.67	----
24.	37161 12	Crankshafts, engine	millions	1.0	29.0	29.00	385.1	13.28	----		4668	Crankshafts	thousand	389	119.886	305.13	8.961	13.28	----

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

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value	US Quantity valued at Brazilian Unit Value (mill.Cr.)	PPP Cr./US$ US Quantity Weights MAT	PPP Cr./US$ US Quantity Weights ABH approach	Rank Code of Item	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 MAT	PPP Cr./US$ Brazilian Quantity Weights ABH approach
25.										4566	Clutch discs	thousand	906	39.991	30.62			
										4581	Clutches		88	24.912	311.40			
										4599	Parts in clutches		671	10.165	15.12			
	37141	01 Clutch disc and facing assemblies	millions	30.5	173.6	5.69	2,168.3	12.69	----	4647	Clutch discs	thousand	3.094	275.549	90.23			
													4.791	360.997	71.09	27.269	12.69	----
26.	37143	21 Rebuilt gasoline engines	millions	0.7	117.4	167.71	1,498.9	12.73	----	4622	Rebuilt engines	single	66.739	130.232	2,139.85	10.096	12.73	----
TOTAL MATCHED ITEMS. MANUALIST APPROACH					95,066.9		498,287.5	5.34	----					22,282.831		4,265.282	5.23	----
TOTAL MATCHED ITEMS. MANUALIST APPROACH, incl. quality adjustment for passenger cars (a)					95,066.9		906,329.8	5.90	----					22,282.831		3,891.629	5.71	----
in % of total specified output					74.02									70.62				
in % of total specified and unspecified output					72.93									36.43				
TOTAL MATCHED ITEMS. ABH APPROACH					81,084.0		413,456.7	----	5.19					19,769.719		3,919.261	----	5.04
TOTAL MATCHED ITEMS. ABH APPROACH, incl. quality adjustment for passenger cars (a)					81,084.0		461,298.9	----	5.69					19,769.719		3,564.968	----	5.55
in % of total specified output					69.90									62.36				
in % of total specified and unspecified output					68.86									34.21				

Source: US figures from table A17.3; Brazilian figures from table A17.3;
Note: (a) Passenger car valuation was adjusted for quality differences between the USA and Brazil, see note in the Statistical Appendix.

TABLE 5.3 - Matching of Product Items. US-Mexico. Motor Vehicles and Equipment.
Numerical and A-B-H 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 A&H approach	PPP Ps./US$ US Quantity Weights B&H approach
1.									
1	37111 11	Complete Vehicles	thousand						
1	37111 51	Chassis for sale separately	thousand	9.192.2	67.796.3	5.199.66	636.562.1	9.13	9.13
		Adjustment for quality difference	US		67.794.3		522.643.7	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	1.363.0	6.380.4	4.670.60			
2	37112 13	6.001 to 10.000 pounds	thousand	1.775.7	8.331.6	4.691.90			
	37112 15	10.001 to 14.000 pounds		58.1	275.8	5.489.02			
	37112 17	14.001 to 16.000 pounds							
	37112 21	16.001 to 19.500 pounds		61.3	288.6	6.303.63			
7	37112 23	19.001 to 26.000 pounds		163.4	2.913.9	13.326.97			
	37112 25	26.001 to 33.000 pounds		25.3	667.9	18.496.07			
	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	3.865.7	31.660.08			
				3.948.1	23.562.9	6.871.67	329.180.5	14.06	14.06
3.		Truck bodies:							
	37131 36	Utility	thousand	66.0	86.6	1.963.64	2.870.4	33.22	33.22
4.									
4	37141 11	Gasoline engines.new	millions	10.0	9.520.6	952.06	71.700.3	12.97	12.97
5.		Transmissions:							
		Manual:							
	37141 61	Passenger car type	millions	0	66.7	166.75			
	37141 65	Truck and bus type	millions	1.6	906.9	398.67			
		Automatic:							
6	37141 63	Passenger car type	millions	9.8	2.901.3	212.38			
	37141 67	Truck and bus type	millions	3.5	812.3	252.09			
				19.2	3.950.6	236.12	28.066.0	8.11	8.11
6.									
	37131 21	Truck bodies: Van	thousand	36.1	90.6	2.651.03	912.5	10.09	----
7.	37131 23	Truck bodies: Multistop	thousand	26.7	69.2	3.007.69			
	37131 25	Truck bodies: Pickup (all types)	thousand	5.3	19.8	2.981.13			
				32.0	96.1	3.003.13	892.0	9.28	----
8.	37131 27	Truck bodies: Panel	thousand	0.6	0.5	1.250.00	7.2	16.61	----
9.	37131 33	Truck bodies: Dump	thousand	22.0	66.8	2.952.63	500.1	10.86	----
10.	37131 36	Truck bodies: Stake and platform	thousand	35.6	35.9	1.016.12	155.6	6.33	----
11.	37131 99	Other vehicle bodies	thousand	306.9	900.9	1.725.26	2.582.9	6.32	----

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 A&H approach	PPP Ps./US$ Mexican Quantity Weights B&H approach
2	4 cylinder cars	single	152.062	6.027.980	39.712.30			
3	6 cylinder cars		60.271	3.183.166	52.813.89			
4	8 cylinder cars	single	45.060	3.002.204	66.636.81			
			257.373	12.223.330	47.492.67	1.130.252	9.13	9.13
				12.223.330		1.172.231	10.43	10.43
1	Trucks	single	70.946	6.053.766	88.329.49			
1	Truck cab chassis		9.496	1.298.764	139.925.01			
	Light trucks		6.963	328.399	66.610.31			
	Tractor trucks		396	236.751	696.560.66			
	Tractors		506	270.432	661.000.95			
	Truck chassis		7.963	260.364	33.726.48			
	Tractors for trailers	single	67	30.180	450.000.00			
			96.599	8.536.836	98.263.36	574.376	10.86	10.86
12	Passenger truck bodies	single	7.295	479.096	65.228.92	14.325	33.22	33.22
9	Car engines	single	99.927	760.937	7.570.68			
	6 & 8 cylinder car & truck engines		61.958	341.988	5.512.19			
	4 cylinder car engines		31.714	276.519	8.719.15			
	6 cylinder car engines	single	6.779	62.699	9.253.16			
			199.371	1.639.654	7.170.82	110.220	12.97	12.97
6	Transmissions	single	491.198	933.769	1.899.60	116.997	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			
	Conveyors for freight transport	single	42	1.381	32.880.95			
			866	23.173	26.758.66	2.296	10.09	----
	Bodies,light trucks	single	987	25.282	27.876.31	2.726	9.28	----
	Panels	single	136	2.669	18.897.35	170	16.61	----
	Metallic bodies (dump trucks)	single	6.116	91.726	22.288.23	8.669	10.86	----
	Truck bodies: stake and platform	single	4.481	19.367	6.356.05	6.663	6.33	----
	Other bodies	single	13.241	98.367	7.665.99	22.864	6.32	----

TABLE 9.3 - Matching of Product Items. US-Russian, Motor Vehicles and Equipment. Minimalist and A-D-H approach. (US 1977) (Russian 1975)

Rank of Item	Code	United States Product Item	Unit	US Quantity	US Dollar Value (mill. USD)	US Dollar Unit Value	US Quantity valued at Russian Unit Values (mill.Ps.)	PPP Ps./USD US Quantity Weights RMS	PPP Ps./USD US Quantity Weights AGH approach
12.		Complete trailer units:							
	37151 10	Truck trailers:							
		Van:							
		Closed top:							
	37151 02.-14.-60	Insulated	thousand	19.9	380.1	13.000.05			
	37151 04.-14.-60	Semi-insulated	thousand	2.6	21.1	8.115.38			
	37151 05.-15.-64	Drop frame type.	thousand	4.8	50.3	10.520.83			
	37151 07.-17	Livestock	thousand	1.4	24.0	17.142.84			
		All other closed top vans:							
	37151 09	Steel	thousand	0.8	5.2	6.500.00			
	37151 19	Aluminum	thousand	42.2	403.8	7.770.14			
	37151 ?0	FRP (fiberglass)	thousand	7.3	57.0	7.800.22			
		Open top, incl. low side grain, front etc.:							
	37151 12	Steel	thousand	1.4	11.4	8.142.86			
	37151 21 -70	Aluminum and FRP	thousand	2.0	20.0	10.305.71			
		Tank:							
	37151 29	Flammable liquids	thousand	3.1	60.9	19.645.16			
	37151 28	Asphalt	thousand	0.6	10.0	18.000.00			
	37151 30	Chemicals and acids	thousand	0.8	18.5	23.125.00			
	37151 32	Other	thousand	3.3	68.0	20.606.06			
	37151 33	Bulk commodity & dry materia	thousand	1.7	31.9	18.764.71			
	37151 35	Pole, logging, and pipe	thousand	1.6	13.1	8.187.50			
	37151 37	Platform	thousand	26.3	157.4	6.677.37			
		Low-bed heavy haulers > 20 ton:							
	37151 38	20 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	8.5	83.9	9.639.53			
	37151 42	for Other	thousand	0.8	10.0	12.500.00			
	37151 44	Automobile transport trailer	thousand	2.8	43.4	17.600.00			
	37151 49	Other trailers, excl. detachable	thousand	9.5	78.0	8.210.53			
	37151 20	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	thousand	20.7	95.0	4.106.28			
	37151 45	Bolsten or converter gear	thousand	5.2	16.2	3.115.38			
				194.1	1.670.3	8.625.97	27.679.2	16.53	----
13.	37141 21	Fuel pump assemblies	millions	19.3	88.1	4.56	1.101.9	13.41	----
14.									
	37141 31	Radiators.complete	millions	17.9	719.3	40.18	13.969.8	18.86	----
15.									
	37141 32	Brake cylinders: Wheel	millions	23.8	69.0	1.97			
	37141 34	Brake cylinders: Master	millions	21.4	275.8	12.89			
	37141 33	Brake valves "	millions	28.7	50.5	1.76			
	37141 36	Brake shoe assemblies	millions	30.3	221.3	7.30			
	37141 38	Brake caliper assemblies	millions	27.8	246.1	9.14			
	37141 14	Brake discs	millions	30.9	109.9	3.56			
				186.6	1.973.0	5.81	16.996.7	15.66	----
16.	37141 61	Shock absorbers	millions	180.9	482.5	4.78	8.990.0	18.63	----

Rank of Item	Russian Product Item	Unit	Russian Quantity	Russian Pure Value (1000 Ps.)	Russian Pure Unit Value	Russian Quantity valued at US Unit Values (1000 USD)	PPP Ps./USD Russian Quantity Weights RMS	PPP Ps./USD Russian Quantity Weights AGH approach
	Trailers	single	432	98.100	196.221.92			
	Semi-trailers for trailers		531	92.905	175.112.99			
	Semi-trailers		576	92.980	161.298.61			
	Semi-trailers		182	22.540	123.890.11			
	Trailers	single	909	39.904	78.554.03			
			2.630	346.525	262.682.00	20.961	16.53	----
	Gasoline pumps	single	320.000	38.129	61.22	1.901	13.61	----
	Radiators	single	5.006	15.000	3.093.09			
	Radiators	single	189.021	131.305	695.08			
			194.027	146.073	736.97	7.797	18.86	----
	Brake systems	single	368.905	286.187	604.82			
	Rubber for brakes	thousand	3.623	120.096	33.37			
	Brake drums	thousand	1.163	91.936	79.06			
	Rotors for automobile brakes	single	417.884	70.573	168.91			
	Air brake parts		3.209	20.215	6.299.47			
	Drum pile drivers		20.294	20.000	980.99			
	Brake cylinders		630.367	10.900	43.93			
	Brake diaphragms		110.000	2.930	25.00			
	Disc brakes	single	36.617	2.185	88.76			
			6.160.076	953.630	89.91	35.819	15.66	----
	Shock absorbers	thousand	1.767	195.695	89.19	8.354	18.63	----

TABLE 9.3 - Matching of Product Items, US-Mexico, Motor Vehicles and Equipment, Maximalist and A-D-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 ADM approach	Rank of Item	Mex'can Product Item	Unit	Mexican Quantity	Mexican Peso Value (1000 Ps.)	Mexican Peso Unit Value	Mexican Quantity valued at US Unit Values (1000 US$)	PPP Ps./US$ Mexican Quantity Weights MAX	PPP Ps./US$ Mexican Quantity Weights ADM approach
17.	37161 12	Crankshafts, engine	millions	1.0	29.0	29.00	276.5	9.66	----		Reconstructed crankshafts	single	20.605	5.677	276.63	600	9.46	----
18.	37161 01	Clutch disc and facing assemblies	millions	39.5	173.6	5.69	4.471.6	25.76	----		Clutch discs	single	187.172	27.660	166.60	1.869	25.76	----
19.	37163 23	Rebuilt water pumps	millions	7.5	63.5	8.47	981.5	15.46	----		Water pumps	single	24.300	3.180	130.86	306	15.46	----
TOTAL MATCHED ITEMS, MAXIMALIST APPROACH					83,686.5		930,976.0	11.22	----					25.110.306		2.269.416	11.07	----
TOTAL MATCHED ITEMS, MAXIMALIST APPROACH, incl. quality adjustment for passenger cars (a)					83,686.5		1.025.254.4	12.25	----					25.110.306		2.103.393	11.96	----
in % of total specified output					72.16									70.76				
in % of total specified and unspecified output					71.07									63.71				
TOTAL MATCHED ITEMS, ADM APPROACH					78,512.6		860,194.0	----	10.95					23.990.675		2.152.167	----	10.96
TOTAL MATCHED ITEMS, ADM APPROACH, incl. quality adjustment for passenger cars (a)					78,512.6		966,475.6	----	12.06					23.990.675		1.986.166	----	11.08
in % of total specified output					67.68									66.60				
in % of total specified and unspecified output					66.68									59.06				

Source: US figures from table A17.2; Mexican figures from table A17.4:
Note: (a) Passenger car valuation was adjusted for quality difference between the USA and Mexico, see text to the Statistical Appendix.

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.

TABLE 6.1
Number of Unit Values Available and Matched in Our 17 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
Grain Mill Products	21	6	55	10	37	19	18
Sugar & Confectionery Products	10	5	7	3	13	9	9
Malt and Malt Beverages	3	2	7	2	20	17	17
Tobacco and Tobacco Products	6	4	4	3	21	21	16
Textiles	49	21	209	37	54	51	49
Footwear and Leather Products	65	19	163	23	48	18	22
Pulp and Paper	24	12	133	16	68	47	53
Soap and Detergents	13	7	43	9	38	20	23
Paints	26	6	63	10	54	31	30
Agricultural Fertilizers	9	6	32	6	22	22	22
Petroleum Refining and Products	59	19	56	11	44	17	13
Tires and Inner Tubes	14	7	22	4	16	8	6
Cement	5	1	10	4	7	1	2
Bricks	23	4	31	5	24	4	2
Iron and Steel	94	27	114	21	76	29	27
Radio and TV Receivers	22	13	92	12	21	17	18
Motor Vehicles	100	12	393	16	101	41	15
Total 17 Industries	543	171	1,434	192	674	372	342

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

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 17 industry sample yielded 1,434 Mexican unit values from which 192 were chosen to match with the USA, and 543 unit values for Brazil of which 171 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).

CHAPTER VII

LABOUR PRODUCTIVITY

One of the major purposes of our approach to measurement of real product and purchasing power is to provide information on comparative levels of labour productivity. The estimates of real value added for manufacturing branches in chapter III and IV make it possible to construct reasonable estimates of labour productivity levels.

Labour productivity is here expressed as output per person engaged in production, as the definition of the denominator is the same in the industrial censuses of all three countries. Figures on working hours are generally not available for Brazil, and there are only rough figures for Mexico. In 1975, average working hours in Mexico were 44.05 per week compared with 39.50 for production and non-supervisory workers in US manufacturing[1]. Reliable comparative information on time off for holidays and sickness is not available, so output per man hour cannot be calculated with any accuracy, but it seems probable that aggregate hours per person engaged were longer in Brazil and Mexico than in the USA.

The labour productivity ratios presented here do not account for activities in head offices and auxiliaries in any of the three countries. We do not believe that the ratios would change very much by including head office and auxiliary employment. The head office share of total manufacturing employment was 4 per cent in both Brazil and Mexico and 6 per cent in the USA (see table 7.5).

Table 7.1 presents ratios of value added per person engaged in manufacturing branches for the Brazil/USA and the Mexico/USA comparison. 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 which are shown in table 7.5. The productivity ratios show a very clear US productivity advantage over both the other countries.

In the Brazil/USA comparison, the geometric ("Fisher") index of labour productivity varied between 33 per cent of the USA for wood and paper products to 76 per cent for food products, with a weighted average of 49 per cent for manufacturing as a whole. The average Mexico/USA productivity ratio is below that for Brazil/USA, namely 39 per cent, with a minimum of 22 per cent of the US level for wood and paper products and a high of 48 per cent for food products.

We were also able to make a direct binary comparison of the Mexico/-Brazil productivity relationship. The corresponding labour productivity ratios are presented in table 7.2. From this it appears that Mexican productivity is on average 83 per cent of the Brazilian level, with a range from 47 per cent for rubber and plastic products to 110 per cent for metal products.

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[1] For Mexico, see INEGI (1985), vol. 1, p. 60; for the USA, see Employment and Earnings, December 1978, p. 85.

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

	Brazil/USA			Mexico/USA		
	Brazil Unit Value Weights	USA Unit Value Weights	Geometric Average	Mexico Unit Value Weights	USA Unit Value Weights	Geometric Average
Food Products	52.53	111.37	76.49	35.57	64.90	48.05
Beverages	42.76	44.80	43.77	26.35	26.35	26.35
Tobacco Products	67.61	76.28	71.82	39.06	47.80	43.21
Textiles and Wearing Apparel	34.19	46.45	39.85	36.12	38.69	37.38
Footwear and Leather Products	56.12	66.08	60.90	41.00	46.52	43.68
Wood and Paper Products	28.94	37.00	32.72	20.20	23.20	21.65
Chemical Products	60.42	72.59	66.23	45.13	49.84	47.43
Rubber and Plastic Products	40.85	46.22	43.45	22.76	25.40	24.05
Stone, Clay and Glass Products	34.22	54.72	43.27	42.18	38.67	40.39
Metal products	38.63	47.55	42.86	39.19	49.10	43.86
Electrical Machinery	65.35	65.97	65.66	52.17	40.82	46.15
Machinery and Transport Equipment	51.69	53.04	52.36	35.71	36.24	35.97
Other	37.29	52.37	44.19	28.99	39.55	33.86
Total Manufacturing	41.62	58.64	49.33	32.98	44.99	38.52

Source: Value added per person engaged Brazil/USA from table 7.6;
Value added per person engaged Mexico/USA from table 7.7;

TABLE 7.2

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

	Mexico/Brazil		
	Brazil Unit Value Weights	Mexico Unit Value Weights	Geometric Average
Food Products	70.81	69.22	70.01
Beverages	58.85	62.57	60.68
Tobacco Products	66.21	66.51	66.36
Textiles and Wearing Apparel	89.57	98.83	94.08
Footwear and Leather Products	73.31	74.58	73.94
Wood and Paper Products	79.53	59.15	68.59
Chemical Products	63.32	74.74	68.80
Rubber and Plastic Products	46.91	47.08	46.99
Stone, Clay and Glass Products	92.02	120.33	105.23
Metal products	101.84	118.13	109.68
Electrical Machinery	66.07	56.69	61.20
Machinery and Transport Equipment	67.62	68.17	67.89
Other	75.80	86.90	81.16
Total Manufacturing	77.24	88.55	82.70

Source: Value added per person engaged Mexico/Brazil from table 7.8;

Table 7.3 compares our labour productivity results for Brazil, Mexico and the USA with those of analogous studies for other countries. The studies of Paige and Bombach for 1950, and Smith, Hitchens and Davies for 1967/8, and Smith for 1977 all found the UK/US productivity ratio (value added per person employed) to be rather similar to what we found for Mexico/USA in 1975. However, the overall averages in some of the studies were not always derived in exactly the same way. For example, Paige and Bombach used blow-up procedures relying predominantly on quantitative parallelism for their covered and uncovered sectors, and there is a negligible difference between their sample result and their overall result for manufacturing.

TABLE 7.3
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
		UK/USA (1950)	
Paige and Bombach (1959)	34.2	39.1	36.6
		UK (1968)/US (1967)	
Smith, Hitchens and Davies (1982)	36.2	39.7	37.9
		UK/USA (1977)	
Smith (1985)	38.3	41.5	39.9
		USSR/USA (1963)	
Kudrov (1969)	33.6	36.8	35.3
		Japan/USA (1972)	
Yukizawa (1978)	78.2	62.1	69.9
		Canada/USA (1963)	
West (1971)	64.4	68.5	66.4
		Brazil/USA (1975)	
Present study	41.6	58.5	49.3
		Mexico/USA (1975)	
Present study	33.0	45.0	38.6
		Brazil/UK (1975)	
Van Ark (1988)	82.1	104.1[a]	92.5

a) at UK prices
Sources: see our bibliographic references.

It is at first sight surprising that real productivity levels in Brazilian and Mexican manufacturing are as high as they appear by international standards. 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 7.4 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, with a productivity level in manufacturing a quarter above that in the rest of the economy, but the Japanese situation is closer to the OECD norm than it is to the two Latin American countries.

TABLE 7.4
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
Mexico	22.8	199.9
France	27.8[a]	119.8
Germany	33.9[a]	97.1
Japan	28.2	124.6
UK	26.0	91.2
USA	21.3	102.0

a) 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. 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.

There are several reasons for this relatively high level of labour productivity in the manufacturing sectors of Brazil and Mexico. One is that in many sectors of manufacturing, the nature of technology is such that it is often rational to use processes which are labour saving and capital intensive, even in countries with low wages. Low income countries do have

some leeway in adapting technology to a situation of low labour costs, but a large part of industrial technology was developed in countries where labour is more expensive, and there are problems in adapting it to different factor cost situations.

A second reason for relatively high labour productivity in Brazilian and Mexican manufacturing is the importance of policies which subsidise capital inputs. As a result, scarce capital is funnelled by priority towards industry. These policies are probably operative to a greater degree than in the OECD countries.

The third reason for relatively high manufacturing labour productivity in Latin America is the backward character of an important part of non-manufacturing. In the two Latin American countries, the continued existence of a large low productivity agricultural sector explains a good deal of the backwardness of non-manufacturing productivity.

TABLE 7.5
Persons Engaged in Manufacturing and Total Population in 1975

	Brazil	Mexico	USA
Food Products	482,434	309,651	1,321,400
Beverages	52,080	69,392	203,800
Tobacco Products	23,965	8,645	66,200
Textiles and Wearing Apparel	507,593[a]	229,027	2,049,300
Footwear and Leather Products	129,231[a]	48,101	239,700
Wood and Paper Products	524,402	164,595	2,642,700
Chemical Products	177,920	157,170[b]	983,100
Rubber and Plastic Products	120,866	53,363	585,000
Stone, Clay and Glass Products	311,361	100,714	588,800
Metal products	429,539	206,509	2,505,800
Electrical Machinery	170,425	114,382	1,523,600
Machinery and Transport Equipment	595,580	178,678	3,571,200
Other	146,260	34,113	893,200
Total Manufacturing	3,671,656[c]	1,674,340[d]	17,173,800[e]
Total Population	104,851,000	60,153,000	215,973,000
Ratio of Total Engaged in Manufacturing to Population (percent)	3.50	2.78	7.95

(a) employment in the footwear industry (95,358 employees) was reallocated from wearing apparel to footwear and leather.
(b) includes 25,989 employees in petroleum refining which are not covered by the industrial census Resumen General, but taken from SPP, 1981.
(c) excludes 152,682 employees in head offices and auxiliary activities.
(d) excludes 69,448 employees in head offices and auxiliary units.
(e) excludes 1,128,400 employees in administrative offices and auxiliaries.

Source: Persons engaged: Brazil from IBGE, Censo Industrial (1981a) (see also table 2.1), Mexico from SPP, Resumen General (1979a) (see also table 2.4), USA from US Dept. of Commerce, Annual Survey of Manufactures 1975-76 (1979) (see also table 2.7); Population: Brazil from IBGE, Censo Demografico (1983), Mexico from Bank of Mexico, Indicadores Economicos (1986), USA from OECD, Labour Force Statistic (1987).

TABLE 7.6

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	57,539	109,538	52.53	21,426	19,238	111.37
Beverages	87,654	204,975	42.76	11,332	25,294	44.80
Tobacco Products	124,628	184,330	67.61	28,451	37,296	76.28
Textiles and Wearing Apparel	45,194	132,169	34.19	4,607	9,918	46.45
Footwear and Leather Products	30,776	54,839	56.12	6,448	9,758	66.08
Wood and Paper Products	52,814	182,499	28.94	6,410	17,326	37.00
Chemical Products	238,931	395,464	60.42	24,092	33,188	72.59
Rubber and Plastic Products	84,887	207,794	40.85	7,293	15,780	46.22
Stone, Clay and Glass Products	49,347	144,189	34.22	10,052	18,371	54.72
Metal products	72,581	187,883	38.63	9,984	20,998	47.55
Electrical Machinery	90,579	138,609	65.35	11,850	17,963	65.97
Machinery and Transport Equipment	74,265	143,669	51.69	11,746	22,146	53.04
Other	55,442	148,691	37.29	8,853	16,904	52.37
Total Manufacturing	69,999	168,170	41.62	11,177	19,119	58.46

Source: Value added (former national accounts concept) from table 3.15; employment from table 7.5.

TABLE 7.7

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 pesos)	USA 1975	Mexico/ USA (%)	Mexico 1975 (1975 US$)	USA 1975	Mexico/ USA (%)
Food Products	66,029	185,634	35.57	12,486	19,238	64.90
Beverages	117,730	446,741	26.35	6,665	25,294	26.35
Tobacco Products	136,148	348,535	39.06	17,828	37,296	47.80
Textiles and Wearing Apparel	66,951	185,376	36.12	3,837	9,918	38.69
Footwear and Leather Products	51,396	125,342	41.00	4,540	9,758	46.52
Wood and Paper Products	79,719	394,582	20.20	4,020	17,326	23.20
Chemical Products	166,865	369,718	45.13	16,541	33,188	49.84
Rubber and Plastic Products	117,375	515,740	22.76	4,009	15,780	25.40
Stone, Clay and Glass Products	87,938	203,483	42.18	7,104	18,371	38.67
Metal products	115,973	295,954	39.19	10,309	20,998	49.10
Electrical Machinery	83,550	160,145	52.17	7,333	17,963	40.82
Machinery and Transport Equipment	108,703	304,364	35.71	8,025	22,146	36.24
Other	73,110	252,158	28.99	6,685	16,904	39.55
Total Manufacturing	94,060	285,191	32.98	8,601	19,119	44.99

Source: Value added (former national accounts concept) from table 3.16; employment from table 7.5.

TABLE 7.8

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

	at Mexican "prices"			at Brazilian "prices"		
	Mexico 1975 (1975	Brazil 1975 pesos)	Mexico/ Brazil (%)	Mexico 1975 (1975	Brazil 1975 cruzeiros)	Mexico/ Brazil (%)
Food Products	66,029	93,245	70.81	39,827	57,539	69.22
Beverages	117,730	200,034	58.85	54,846	87,654	62.57
Tobacco Products	136,148	205,618	66.21	82,892	124,628	66.51
Textiles and Wearing Apparel	66,951	74,750	89.57	44,665	45,194	98.83
Footwear and Leather Products	51,396	70,109	73.31	22,952	30,776	74.58
Wood and Paper Products	79,719	100,240	79.53	31,238	52,814	59.15
Chemical Products	166,865	263,519	63.32	178,583	238,931	74.74
Rubber and Plastic Products	117,375	250,239	46.91	39,967	84,887	47.08
Stone, Clay and Glass Products	87,938	95,560	92.02	59,380	49,347	120.33
Metal products	115,973	113,873	101.84	85,737	72,581	118.13
Electrical Machinery	83,550	126,462	66.07	51,345	90,579	56.69
Machinery and Transport Equipment	108,703	160,766	67.62	50,627	74,265	68.17
Other	73,110	96,449	75.80	48,177	55,442	86.90
Average for Total Manufacturing	94,060	121,772	77.24	61,982	69,999	88.55

Source: Value added (former national accounts concept) from table 4.10; employment from table 7.5.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

This study had a twofold objective:

a) a substantive analysis of real output levels, PPPs and labour productivity outcomes in Brazilian, Mexican and US manufacturing in 1975;
b) 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.

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

The most interesting feature of our results is perhaps the PPPs and the extent to which they deviate from the results of previous studies. The striking fact about our PPP results (table 8.1) is that they are not very different from the exchange rates for these countries for 1975. In fact, this would not be too surprising in a year of reasonable payments equilibrium as the manufacturing sector's output consists largely of "tradeables" which one might expect to be more in tune with the exchange rate than a non-tradeable sector like services.

It should be stressed that the PPPs presented in table 8.1 are our preferred summary measures, and are not unique in character. 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, our 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.

The results in table 8.1 show 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.

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$)	Mexico/USA (Ps./US$)	Mexico/Brazil (Ps./Cr.)
Our PPPs for Manufacturing (weighted by major branch)	7.42	12.77	1.62
ICP (Augmented Binary) PPPs for GDP	5.40	7.17	1.48
Exchange Rate	8.13	12.50	1.54
Our Exchange Rate Deviation Index for Manufacturing	0.91	1.02	1.05
ICP Exchange Rate Deviation Index for GDP (Augmented Binaries)	0.66	0.57	0.96

Source: Our PPPs for Brazil/USA and Mexico/USA from table 3.17 and for Mexico/Brazil from table 4.10; 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 PPP to the exchange rate.

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$)	Mexico/USA (Ps./US$)	Mexico/Brazil (Ps./Cr.)
Our PPPs for Manufacturing (weighted by major branch)	7.42	12.77	1.62
Proxy PPPs for Manufacturing Derived from ICP Augmented Binaries	7.42	10.66	1.56
Ratio of Our PPP/Proxy ICP PPP	1.00	1.20	1.04

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".

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

One can use the ICP PPPs in order to derive a crude proxy PPP estimate for the manufacturing sector. The authors of the ICP have not themselves ever 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 identical with the proxy PPP, and not very different for Mexico/Brazil, but for the Mexico/USA comparison they are substantially different. It should be noted that the preliminary results of Van Ark's binary comparisons for India/USA and Brazil/UK also show differences from similarly derived ICP proxies, with the "industry of origin" PPPs being nearer to the exchange rate.

Apart from the possible shortcomings of the proxy PPPs, there is also the substantial problem that they are 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 (output per person engaged) 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 Western European countries for some earlier years (for example Paige and Bombach for 1950, and Smith, Hitchens and Davies for 1967/8, see table 7.3). A few additional remarks should be added to this surprising conclusion. Firstly, the Latin American standing in terms of output per man hour, which could not be measured accurately, is probably lower than the productivity ratio in terms of output per person engaged, because working hours appear to be 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.

Substantive Results for Output and Productivity Mexico/Brazil

Table 8.4 is a binary comparison of Mexico/Brazil which is statistically somewhat better grounded than table 8.3, because of the availability of census data on all inputs and a bigger industry sample for the two Latin American countries than for the USA. Table 8.4 shows that Brazil had a better performance than Mexico both in terms of labour productivity and output per head of population. From the results shown in table 8.3 one can also make the inferential comparisons for Mexico/Brazil shown on the right hand side of table 8.4.

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

	Brazil/USA	Mexico/USA
Value Added (Former National Accounts Concept) as a percentage of the USA	10.55	3.76
Value Added (Former National Accounts Concept) per Person Engaged as a percentage of the USA	49.33	38.52
Value Added (Former National Accounts Concept) per Head of Population as a percentage of the USA	21.72	13.48
Persons Engaged in Manufacturing as a percentage of the USA	21.38	9.75
Population as a percentage of the USA	48.55	27.85

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

Source: Value added from table 3.15 and 3.16; value added per person employed from table 7.1; value added per head of population derived from tables 7.5, 7.6 and 7.7; persons engaged and population from table 7.5.

TABLE 8.4
Summary Results for Manufacturing Output and Productivity Mexico/Brazil (1975)

	Direct Mexico/Brazil	Inferential Mexico/Brazil
Value Added (former national accounts concept) as a percentage of Brazil	37.71	35.64
Value Added (former national accounts concept) per Person Engaged as a percentage of Brazil	82.70	78.09
Value Added (former national accounts concept) per Head of Population as a percentage of Brazil	65.74	62.06
Persons Engaged in Manufacturing as a percentage of Brazil	45.60	45.60
Population as a percentage of Brazil	57.36	57.36

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

Source: Direct Mexico/Brazil comparison: Value added from table 4.10; value added per person engaged from table 7.2; value added per head of population derived from tables 7.5 and 7.8; persons engaged and population from table 7.5; Inferential Mexico/Brazil comparison from table 8.3.

Results of Our Methodological Endeavours

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.

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 Czech/INSEE 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 unable 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 17 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 matched with a similar product in the other country where it is important, or in case 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 17 industry sample yielded 1,434 Mexican unit values from which 192 were chosen to match with the USA, and 543 Brazilian unit values of which 171 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 of motor vehicles was based largely on Japanese and European models which were 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. From the point of view of our other objective of comparing output, productivity and PPP outcomes for the three countries, the results can always be improved by increasing the sample size, but we felt that there was already reasonable coverage of major industry branches in Brazil and Mexico, and weaknesses only for food products and electrical machinery for the USA (see table 1.4 in chapter I). Having already spent 5 man years on the project and obtained a big enough sample to fulfil our methodological objective reasonably well, we felt that the priorities in such research now lie elsewhere, as mentioned below.

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 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.

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. 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.

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. In the case of Mexico and the USA, input-output tables are available for the census years we covered, and the 1975 table for Brazil is due rather soon, so for these three countries, this work should be feasible.

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 plan to extend our present three country comparison to cover India, Japan and Korea. The NIESR in London intends to extend its previous comparisons for Germany, the UK and USA (Smith, Hitchens and Davies, 1982) to cover also France and the Netherlands. 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 would like 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. Some work has already been done in this direction for agriculture and mining so the main task here would be to analyse 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

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).

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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 A1 to A17. 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	A1	Grain Mill Products
		A2	Sugar and Sugar Products
313	Beverages	A3	Malt and Malt Beverages
314	Tobacco	A4	Tobacco and Tobacco Products
321/2	Textiles, Wearing Apparel	A5	Textiles
323/4	Leather Products, Footwear	A6	Footwear and Leather Products
331	Wood Products	--	not represented
332	Furniture	--	not represented
341	Paper and Paper Products	A7	Pulp and Paper
342	Printing and Publishing	--	not represented
351/2	Chemicals	A8	Soap and Detergents
		A9	Paints
		A10	Agricultural Fertilizers
353/4	Petroleum Refining, Petroleum and Coal Products	A11	Petroleum Refining and Products
355/6	Rubber and Plastic Products	A12	Tires and Inner Tubes
361/2/9	Stone Clay and Glass Products	A13	Hydraulic Cement
		A14	Bricks, Tiles and Clay Refractories
371/2	Iron and Steel, Non Ferrous Metals	A15	Iron and Steel
381/2/3	Metal Products, Machinery, Electrical Machinery	A16	Radio and TV Receivers
384	Transport Equipment	A17	Motor Vehicles and Equipment
385/90	Miscellaneous	---	not represented

For each industry there are 13 tables, e.g. for industry A1, Grain Mill Products, the detailed tables are numbered from A1.1 to A1.13. 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. English translations are provided for all specifications in Brazil and Mexico, which were originally in Portuguese and Spanish respectively. In the very small number of cases in which we were unable to find proper translations, the original specifications are shown between inverted commas. The total census values for some industries are sometimes different from the total we obtained by summing the values of specified items. In these cases we show both the "Census Total" and "Our Total" in tables 2, 3 and 4. 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 in table 2 are not entirely congruent in coverage with those for the USA in table 1. Table 1 includes primary products and secondary products of all establishments within the particular industry class; table 2 includes all products which are primary to the industry class, wherever they are produced. In our sample, the totals in table 2 were always smaller than in table 1, 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 Producăc 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, 6 and 7

The binary matchings which we made to derive PPPs for gross output are presented in tables 5 (US/Brazil), 6 (US/Mexico) and 7 (Mexico/Brazil). 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.

Tables 8, 9, 10

These tables give the reader a summary picture of the matching procedure. In making the matching for simple industries, i.e. sugar and sugar products, malt and malt beverages, tobacco and tobacco products, tires and inner tubes, cement and bricks we used the maximalist approach (see chapter V), where we matched as many as items as possible. For the other, more complex, industries, we had to be more selective in matching and used the ABM approach (see also chapter V). For this reason we show in tables 8, 9 and 10 the proportion of the value of an industry we were able to match in each of the binary comparisons.

Table 11

For Brazil and Mexico the detailed information is all for 1975, the basic year of comparison. But for the US there was no census for 1975, so the detailed information is all for 1977. The conversion from 1977 to 1975 quantities and prices is shown in table 11.

Table 12 and 13

Table 12 summarizes the final results for each industry as shown in chapter III, and table 13 summarizes the results as shown in chapter IV. 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

A4 - Tobacco and Tobacco Products

- 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 A4.5 and A4.6).

A5 - Textiles

- Only part of the US industry 2824 "Organic Fibers, Noncellulosic" is included in the sample, i.e. category 29246 "Producer Textured Manmade Fibers" (see also footnote table A5.1).
- 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.

A8 - 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 A8.1).
- 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 A8.5) concernes only "dry" detergents, because liquid detergents could not be converted from US gallons to kilograms.

A9 - Paints

- Brazilian quantities are converted from kilograms to litres using the following conversion factors provided by Nelf Lakfabrieken B.V., Groningen, The Netherlands (see also table A9.5 and A9.7):
  paints, solvent type: 1 liter = 1.1 kilogram
  paints, water type: 1 liter = 1.35 kilogram
  paints and lacquers, industrial type: 1 liter = 1.5 kilogram

A11 - Petroleum Refining and Products

- Shell Oil's Technical Information Dept. in The Hague provided the following conversion factors which we used to convert US output in barrels to metric tons (see also table A11.5 and A11.6):
  light fuel oil: 1000 barrel = 135.945 ton
  heavy fuel oil: 1000 barrel = 144.690 ton
  paving grade asphalt: 1000 barrel = 163.8 ton
  roofing grade asphalt: 1000 barrel = 168.5 ton
  miscellaneous asphalt: 1000 barrel = 166.2 ton
  lubricating and similar oils: 1000 barrel = 141.5 ton
- The following conversion factors were used to convert Brazilian output in kilograms to liters or from tons to cubic metres. They were derived from Kirk and Othmer's Chemical Encyclopedia (1968) (see also table A11.5):
  benzene: 1 liter = 0.88 kilogram
  toluene: 1 liter = 0.87 kilogram
  xylene: 1 liter = 0.86 kilogram
- Shell Oil's Technical Information Dept. in The Hague provided the following additional conversion factors for Brazil (see also table A11.5 and A11.7).
  propane: 1 liter = 0.51 kilogram
  propylene (propene): 1 liter = 0.52 kilogram
  diesel oil: 1 liter = 0.89 kilogram
  lubricating oils: 1 ton = 1.1236 cubic metres
  liquid petroleum gas (LPG): 1 ton = 1.835 cubic metres
  combustible fuel oil: 1 ton = 1.053 cubic metres
- The following conversion factor was used to convert Mexican output in cubic metres to tons (as provided by Shell Oil's Technical Information Dept. in The Hague, see also table A11.6 and A11.7):
  asphalt: 1 cubic metre = 1.045 ton

A14 - Bricks

- Brazilian quantities are converted from square metres to single units using the following conversion factors provided by Vereniging De Nederlandse Baksteenindustrie, De Steeg, Netherlands (see also table A14.7):
  ceramic bricks: 1 square metre = 65 single units
- 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 A14.6 and A14.7).

A15 - 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.
- The commodity items "sponge iron" and "pig iron" in the Brazilian industry 178 "Iron and Steel Making and Manufacture of Iron and Steel Products" are excluded from the sample because it was classified elsewhere (in other industries) in Brazil and the USA.

A17 - 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 A17.2, A17.3 and A17.4.

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	1,245,642	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	532,686	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 separately and available on special request

Tables for Industry A.1, Grain Mill Products, are appended here by way of example

Table A1.1 - Summary Basic Figures for Total Grain Mill Products, United States (1977 and 1975) Brazil and Mexico (1975), in national currency

	Gross Value of Output	Value Added US Census Concept	Value Added National Accounts Concept	Value Added Former National Accounts Concept	Number of Employees
UNITED STATES, 1977		(million US dollars)			
2041 Flour and Other Grain Mill Products	3,683.3	824.5	---	---	15,600
2046 Wet Corn Milling	2,014.8	666.7	---	---	10,900
TOTAL	5,698.1	1,491.2	---	---	26,500
UNITED STATES, 1975		(million US dollars)			
2041 Flour and Other Grain Mill Products	4,327.6	714.9	---	---	17,700
2046 Wet Corn Milling	2,141.7	872.9	---	---	10,900
TOTAL	6,469.3	1,587.8	---	---	28,600
BRAZIL		(thousand cruzeiros)			
1023 Wheat mill products	5,510,563	1,251,741	1,051,883	1,019,496	9,271
1029 Manufacture of maize products, excl. oils	1,546,288	505,876	443,920	433,880	7,444
1035 Manufacture of various flour products and by-products	371,291	161,060	134,951	130,720	2,367
TOTAL	7,428,142	1,918,677	1,630,755	1,584,096	19,082
MEXICO		(thousand pesos)			
2021 Wheat flour manufacturing	5,944,296	1,532,561	1,215,666	965,606	7,522
2022 Corn flour manufacturing	2,299,211	641,220	529,702	488,202	2,884
2029 Manufacturing of other flour and mill products based on grain and leguminous plants	879,618	418,003	235,899	226,339	2,096
TOTAL	9,123,125	2,591,784	1,981,267	1,680,147	12,502

Sources: United States (1977) and (1975) from US Census of Manufactures, Industry Series, table 1a.
United States (1975) originally 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; additional information for calculation of value added at present and former national accounts concept derived from tables 15 and 35 (see also chapter II).
Mexico (gross value of output and employment) from Resumen General, table 5; additional information for calculation of value added derived from tables 19 and 20 (see also chapter II).

Table A1.2 - Basic US Census Listing for Grain Mill Products, 1977

Rank of Item	Code	Product Item	Unit	Quantity	Product Value (mill.)	Dollar Unit Value
		FLOUR AND OTHER GRAIN MILL PRODUCTS				
	2041- --	Total			3,678.6	per cwt/ sh. ton
	20411 --	Wheat flour, except flour mixes			2,208.9	
		White flour:				
10	20411 05+07	Shipped for export	1000 cwt.	19,545	142.2	7.28
		Domestic shipments:				
1	20411 11+13	Bakers & institutional white bread type		145,782	1,111.2	7.62
4	20411 15+17	Bakers & institutional soft wheat flour		43,598	294.1	6.75
		Family white flour:				
7	20411 21+23	All family flour, excl. self-rising		19,746	194.0	9.82
15	20411 24+25	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	1000 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			455.4	
2	20412 13	Wheat mill feed	1000 s.t.	4,952	433.5	87.54
	20412 17	Wheat germ		74	18.4	248.65
	20412 00	Wheat mill products other than flour n.s.k.	1000 s.t.	39	3.5	89.74
	20413 --	Corn mill products			413.3	
		Corn products for human consumption:				
	20413 11	Whole cornmeal	1000 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	1000 cwt.	9,269	58.9	6.35
14	20413 65	Hominy feed, cornmeal and other byproducts of drycorn milling (for animal feed)	1000 s.t.	1,402	110.8	79.03
	20413 93	Corn flour	1000 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	1000 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	1000 cwt.	1,710	12.0	7.02
	20416 23	Other flour, excl. wheat, corn, rye	1000 cwt.	3,210	29.8	9.28
	20416 27	Other mill feed (oats, rye, buckwheat etc.)	1000 s.t.	593	56.5	95.28
	20416 00	Other grain mill products, n.s.k.				
	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)	mill. 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+09	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)		138.0	25.2	182.61
	20460 61+63) +67)	Corn oil	mill. lb.		311.5	

Table A1.2 - Basic US Census Listing for Grain Mill Products, 1977

Rank of Item	Code	Product Item	Unit	Quantity	Product Value (mill.)	Dollar Unit Value
		Wet process corn byproducts:	mill. lb.			
	20460 71	Steepwater concentrate (50% solids basis)		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	mill. 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 2041,2046			5,624.7	

Source: US 1977 Census of Manufactures;
Note: (a) Figure included under the figure for the total category 20411 --;

Table A1.3 - Basic Brazilian Census Listing for Grain Mill Products, 1975

Rank of Item	Code	Product Item	Unit	Quantity	Cruzeiro Value (1000)	Cruzeiro Unit Value
		WHEAT MILL PRODUCTS MANUFACTURE OF CORN PRODUCTS, EXCL. OILS MANUFACTURE OF VARIOUS FLOUR PRODUCTS AND BY-PRODUCTS				
		Total			7,001,996	per ton/ 1000 liter
5	10848	Corn starch and "pecula"	ton	213,771	409,822	1,917.11
	10852	Arrowroot starch, flour and "pecula"	|	286	2,205	7,709.79
	10853	Starch and "pecula", n.e.s.	ton	3,651	9,557	2,617.64
	10938	Corn porridge	kg.	31,816,895	51,754	1,626.62
9	10957	Coconut flour	ton	9,168	133,192	14,527.92
7	10981	Corn bran	ton	276,230	212,256	768.40
6	10997	Wheat bran	kg.	809,795,848	283,955	350.65
	11005	Rice flour	ton	5,685	24,483	4,306.60
	11013	Rye flour	kg.	426,150	1,778	4,172.24
	11016	Barley flour	kg.	885,215	2,049	2,314.69
3	11037	Corn flour	ton	446,012	525,335	1,177.85
1	11064	Wheat flour	|	3,048,093	4,420,735	1,450.33
4	11072	Oat flour and meal	ton	11,383	41,111	3,611.61
	11073	Composite flours and "pecula" products	kg.	3,282,208	23,373	7,121.12
8	11080	Corn glucose (dextrose)	ton	105,044	191,745	1,825.38
	11082	Improved grainsorts (rice, corn etc.)	ton	2,383	9,927	4,165.76
	11083	Coconut milk	liter	1,826,100	27,521	15,070.92
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.	|	355	82	230.99
2	11114	Wheat semolina	ton	355,516	539,400	1,517.23
		TOTAL SPECIFIED			7,001,996	

Source: 1975 Censo Industrial do Brasil, Producao Fisica;

Table A1.4 - Basic Mexican Census Listing for Grain Mill Products, 1975

Rank of Item	Code	Product Item	Unit	Quantity	Peso Value (1000)	Peso Unit Value
		WHEAT FLOUR MANUFACTURING				
	2021	Total			5,776,219	per ton/ 1000 liter
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
6		Crackers	|	19,483	178,339	9,153.57
7		Premixed rice and wheat flour	|	23,758	155,092	6,527.99
8		Flour mixed with bran	|	70,802	120,519	1,702.20
11		Semiton (?)	|	63,642	106,448	1,672.61
12		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	1000 liter	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	
		CORN FLOUR MANUFACTURING				
	2022	Total			1,406,301	
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	
		MANUFACTURING OF OTHER FLOUR AND MILL PRODUCTS BASED ON GRAIN AND LEGUMINOUS PLANTS				
	2029	Total			850,851	
9		Corn products	ton	6,309	112,350	17,807.89
10		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	|	3	2,850	950,000.00
		Cooked-over beans	|	602	2,809	4,666.11
		Soybean oil	|	289	2,049	7,089.97
		Corn flour for gruel	|	133	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	
		TOTAL SPECIFIED, excl. "other"			7,854,883	

Source: X Censo Industrial 1976, Desglose.

Table A1.5 - Matching of Product Items. US-Brazil. Grain Mill Products.
A-B-M Approach. (US 1977) (Brazil 1975)

Rank of Item	Code	United States Product Item	Unit (a)	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value per ton	US Quantity valued at Brazilian Unit Values (mill.Cr.)	PPP Cr/US$ US Quantity Weights	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
1.		Wheat flour, white flour:															
10	20411 05+07	Shipped for export	ton	992.886	142.2	143.22											
		Domestic shipments:															
1	20411 11+13	Bakers & institutional white bread type		7.405.726	1.111.2	150.05											
4	20411 15+17	Bakers & institutional soft wheat flour		2.214.778	294.1	132.79											
		Family white flour:															
7	20411 21+23	All family flour, excl. self-rising		1.003.097	194.0	193.40											
15	20411 24+25	Self-rising flour		324.409	74.1	228.42											
		Flour shipped to blenders etc.:															
	20411 28	For use in nonfood products	ton	190.703	20.8	109.07											
				12.131.59v	1.036.4	151.37	17.596.8	9.58	1	11064	Wheat flour	ton	3.048.093	4.420.735	1.450.33	461.400	9.58
2.	9 20411 51	Durum flour and semolina	ton	932.688	165.2	155.68	1.415.1	9.75	2	11114	Wheat semolina	ton	355.516	539.400	1.517.23	55.346	9.75
3.	20413 11	Whole cornmeal	ton	123.190	31.8	258.14											
18	20413 15	Degermed cornmeal		222.301	59.7	268.56											
	20413 93	Corn flour	ton	195.732	32.2	164.51											
				541.223	123.7	228.56	637.5	5.15	3	11037	Corn flour	ton	446.012	525.335	1.177.85	101.939	5.15
4.	3 20460 35	Corn starch, incl. milo	ton	2.488.631	408.2	164.03	4.771.0	11.69	5	10848	Corn starch and "pecula"	ton	213.771	409.822	1.917.11	35.064	11.69
5.		Glucose syrup, unmixed:															
	20460 03	Type I (20-37 dextrose)	ton	90.476.1	12.7	140.37											
8	20460 04	Type II (38-57 dextrose)		1.298.305.8	160.5	123.62											
16	20460 05	Type III (58-72 dextrose)		512.047.8	72.4	141.39											
5	20460 06+09	Type IV (73 dextrose and above)		1.485.744.5	262.8	176.88											
	20460 18	Glucose syrup solids		67.300.2	25.6	380.39											
11	20460 19	Dextrose monohydrate and dextrose anhydrous	ton	551.774.5	138.6	251.19											
				4.005.646.9	672.6	167.91	7.311.8	10.87	8	11080	Corn glucose (dextrose)	ton	185.044	191.745	1.825.38	17.638	10.87
6.17	20413 21	Corn grits & hominy,excl. brewer's use	ton	382.219	63.4	165.87											
19	20413 23	Corn grits & flakes for brewer's use	ton	470.865	58.9	125.09											
				853.084	122.3	143.36	982.0	8.03	10	11092	Cracked corn	ton	78.964	90.899	1.151.14	11.320	8.03
MATCHED ITEMS					3.308.4		32.712.2	9.89						6.177.936		682.708	9.05
in % of total specific output					58.82									88.23			
in % of total specified and unspecified output					58.06									83.17			

Source: US figures from table A1.2; Brazilian figures from table A1.3;
Note: (a) Quantities are converted to metric units.

Table A1.6 - Matching of Product Items, US-Mexico, Grain Mill Products,
A-B-M Approach, (US 1977) (Mexico 1975)

Rank of Item	Code	United States Product Item	Unit (a)	US Quantity	US Dollar Value (mill. US$)	US Dollar Unit Value (per ton)	US Quantity valued at Mexican Unit Values (mill.Ps.)	PPP Ps/US$ US Quantity Weights	Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Peso Value (1000 Ps.)	Mexico Peso Unit Value (per ton)	Mexico Quantity valued at US Unit Values (1000 US$)	PPP Ps/US$ Mexican Quantity Weights
1		Wheat flour, white flour:														
10	20411 05-07	Shipped for export	ton	992.886	142.2	143.22										
		Domestic shipments:														
1	20411 11-13	Bakers & institutional white bread type		7.405.726	1.111.2	150.05										
4	20411 15-17	Bakers & institutional soft wheat flour		2.214.778	294.1	132 79										
		Family white flour:														
7	20411 21-23	All family flour, excl. self-rising		1.003.097	196.0	193.40										
15	20411 24-25	Self-rising flour		324.409	74.1	228.42			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	190.703	20.8	109.07				Wheat flour	ton	12.509	44.907	3.589.98		
				12.131.599	1.836.4	151.37	32.857.3	17.89				1.598.870	4.330.396	2.708.41	242.026	17.89
2. 9	20411 51	Durum flour and semolina	ton	932.688	145.2	155.68	2.541.6	17.50		Semoline	ton	21.104	57.509	2.725.03	3.285	17.50
3	20413 11	Whole cornmeal	ton	123.190	31.8	258.14				Corn honey	ton	3.020	27.897	9.237.62		
10	20413 15	Degermed cornmeal		222.301	59.7	268.56			3	Corn flour		497.128	1.305.486	2.626.06		
	20413 93	Corn flour	ton	195.732	32.2	164.51			10	Maizena	ton	12.415	109.671	8.833.75		
				541.223	123.7	228.56	1.523.7	12.32				512.563	1.443.054	2.815.37	117.150	12.32
4. 3	20460 35	Corn starch, incl. milo	ton	2.488.631	408.2	164.03	6.686.5	16.38		Starch for industrial use	ton	29.675	79.731	2.686.81	6.867	16 38
5.		Glucose syrup, unmixed:														
	20460 03	Type I (20-37 dextrose)	ton	90.474.1	12.7	140.37										
8	20460 04	Type II (38-57 dextrose)		1.298.305.8	160.5	123.62										
16	20460 05	Type III (58-72 dextrose)		512.047.8	72.4	141.39										
5	20460 06-09	Type IV (73 dextrose and above)		1.485.744.5	262.8	176.88										
	20460 18	Glucose syrup solids		67.300.2	25.6	380.39										
11	20460 19	Dextrose monohydrate and dextrose anhydrous	ton	551.774.5	138.6	251.19										
				4.005.646.9	672.6	167.91	10.107.9	15.03		Glucose honey	ton	19.577	49.401	2.523.42	3.287	15.03
6. 6	20460 75	Corn gluten feed	ton	1.829.432.9	226.6	123.86	4.703.5	20.76		Corn gluten	ton	9.865	25.363	2.571.01	1.222	20 76
MATCHED ITEMS					3.412.7		58.420.6	17.12					5.985.454		371.838	16.10
in % of total specified output					60.67								76.20			
in % of total specified and unspecified output					59.89								65.61			

Source: US figures from table A1.2; Mexican figures from table A1.4;
Note. (a) Quantities are converted to metric units.

Table A1.7 - Matching of Product Items, Brazil-Mexico, Grain Mill Products, A-B-M Approach, (1975)

Rank of Item	Code	Brazil Product Item	Unit	Brazil Quantity	Brazil Cruzeiro Value (mill. Cr.)	Brazil Cruzeiro Unit Value (per ton)	Brazil Quantity valued at Mexican Unit Values (1000 Ps.)	PPP Ps./Cr. Brazil Quantity Weights	Rank of Item	Mexico Product Item	Unit	Mexico Quantity	Mexico Peso Value (1000 Ps.)	Mexico Peso Unit Value (per ton)	Mexico Quantity valued at Brazil Unit Values (1000 US$)	PPP Ps./Cr. Mexican Quantity Weights
1.									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		
										Wheat flour	ton	12.509	44.907	3.589.98		
1	11364	Wheat flour	ton	3.048.093	4.420.735	1.450.33	8.255.487	1.87				1.598.870	4.330.396	2.708.41	2.318.806	1.87
2. 2	11114	Wheat semolina	ton	355.516	539.400	1.517.23	968.791	1.80		Semolina	ton	21.104	57.509	2.725.03	32.020	1.80
										Corn honey	ton	3.020	27.897	9.237.42		
3.									3	Corn flour	"	497.128	1.305.486	2.626.06		
									10	Maizena	ton	12.415	109.671	8.833.75		
3	11037	Corn flour	ton	446.012	525.335	1.177 85	1.255.688	2.39				512.563	1.443.054	2.815.37	603.722	2.39
4. 5	10848	Corn starch and "pecule"	ton	213.771	409.823	1.917.11	574.361	1.40		Starch for industrial use	ton	29.675	79.731	2.686.81	56.890	1.40
5. 8	11000	Corn glucose (dextrose)	ton	105.044	191.765	1.825.30	265.070	1.38		Glucose honey	ton	19.577	49.401	2.523.42	35.735	1.38
MATCHED ITEMS					6.087.037		11.319.398	1.86					5.960.091		3.047.253	1.96
in % of total specified output					86.93								75.88			
in % of total specified and unspecified output					81.95								65.33			

Source: Brazil figures from table A1.3; Mexican figures from table A1 4;

Table A1.8 - Ranking of Items, United States-Brazil, Grain Mill Products, (US 1977) (Brazil 1975)

UNITED STATES				BRAZIL			
rank of item	value as % of total value of output	cumulative % of total value of output	matched with BRAZIL	rank of item	value as % of total value of output	cumulative % of total value of output	matched with USA
a) Items Specified by Quantity and Value, contributing more than 1 per cent to Output:				a) Items Specified by Quantity and Value, contributing more than 1 per cent to Output:			
1	19.50	19.50	Yes	1	59.51	59.51	Yes
2	7.61	27.11	No	2	7.26	66.77	Yes
3	7.16	34.27	Yes	3	7.07	73.85	Yes
4	5.16	39.43	Yes	4	0.55	74.40	No
5	4.61	44.05	Yes	5	5.52	79.92	Yes
6	3.98	48.02	No	6	3.82	83.74	No
7	3.40	51.43	Yes	7	2.86	86.60	No
8	2.82	54.24	Yes	8	2.58	89.18	Yes
9	2.55	56.79	Yes	9	1.79	90.97	No
10	2.50	59.29	Yes	10	1.22	92.20	Yes
11	2.43	61.72	Yes				
12	2.14	63.87	No				
13	2.07	65.93	No				
14	1.94	67.88	No				
15	1.30	69.18	Yes				
16	1.27	70.45	Yes				
17	1.11	71.56	Yes				
18	1.05	72.61	Yes				
19	1.03	73.64	Yes				
Percentage matched:			55.90	Percentage matched:			83.17
b) Items Specified by Quantity and Value, contributing less than 1 per cent to Output:				b) Items Specified by Quantity and Value, contributing less than 1 per cent to Output:			
20-37	8.16	81.80		11-21	2.07	94.26	
Percentage matched:			2.16	Percentage matched:			0.00
c) Output not Specified by Quantity:				c) Output not Specified by Quantity:			
	18.20	100.00			5.74	100.00	
Percentage matched:			0.00	Percentage matched:			0.00
Total percentage matched:			58.06	Total percentage matched:			83.17

Source: US figures derived from tables A1.2 and A1.5; Brazilian figures derived from tables A1.3 and A1.5;

Table A1.9 - Ranking of Items, United States-Mexico, Grain Mill Products, (US 1977) (Mexico 1975)

UNITED STATES				MEXICO			
rank of item	value as % of total value of output	cumulative % of total value of output	matched with MEXICO	rank of item	value as % of total value of output	cumulative % of total value of output	matched with USA
a) Items Specified by Quantity and Value, contributing more than 1 per cent to Output:				a) Items Specified by Quantity and Value, contributing more than 1 per cent to Output:			
1	19.50	19.50	Yes	1	26.89	26.89	Yes
2	7.61	27.11	No	2	20.08	46.97	Yes
3	7.16	34.27	Yes	3	14.31	61.28	Yes
4	5.16	39.43	Yes	4	3.49	64.77	No
5	4.61	44.05	Yes	5	2.94	67.71	No
6	3.98	48.02	Yes	6	1.95	69.67	No
7	3.40	51.43	Yes	7	1.70	71.37	No
8	2.82	54.24	Yes	8	1.32	72.69	No
9	2.55	56.79	Yes	9	1.23	73.92	No
10	2.50	59.29	Yes	10	1.20	75.12	Yes
11	2.43	61.72	Yes	11	1.17	76.29	No
12	2.14	63.87	No	12	1.08	77.37	No
13	2.07	65.93	No				
14	1.94	67.88	No				
15	1.30	69.18	Yes				
16	1.27	70.45	Yes				
17	1.11	71.56	No				
18	1.05	72.61	Yes				
19	1.03	73.64	No				
Percentage matched:			57.73	Percentage matched:			62.49
b) Items Specified by Quantity and Value, contributing less than 1 per cent to Output:				b) Items Specified by Quantity and Value, contributing less than 1 per cent to Output:			
20-37	8.16	81.80		13-55	8.73	86.10	
Percentage matched:			2.16	Percentage matched:			3.12
c) Output not Specified by Quantity:				c) Output not Specified by Quantity:			
	18.20	100.00			13.90	100.00	
Percentage matched:			0.00	Percentage matched:			0.00
Total percentage matched:			59.89	Total percentage matched:			65.61

Source: US figures derived from tables A1.2 and A1.6; Mexican figures derived from tables A1.4 and A1.6;

Table A1.10 - Ranking of Items, Brazil-Mexico, Grain Mill Products, (1975)

BRAZIL				MEXICO			
rank of item	value as % of total value of output	cumulative % of total value of output	matched with MEXICO	rank of item	value as % of total value of output	cumulative % of total value of output	matched with BRAZIL
a) Items Specified by Quantity and Value, contributing more than 1 per cent to Output:				a) Items Specified by Quantity and Value, contributing more than 1 per cent to Output:			
1	59.51	59.51	Yes	1	26.89	26.89	Yes
2	7.26	66.77	Yes	2	20.08	46.97	Yes
3	7.07	73.85	Yes	3	14.31	61.28	Yes
4	0.55	74.40	No	4	3.49	64.77	No
5	5.52	79.92	Yes	5	2.94	67.71	No
6	3.82	83.74	No	6	1.95	69.67	No
7	2.86	86.60	No	7	1.70	71.37	No
8	2.58	89.18	Yes	8	1.32	72.69	No
9	1.79	90.97	No	9	1.23	73.92	No
10	1.22	92.20	No	10	1.20	75.12	Yes
				11	1.17	76.29	No
				12	1.08	77.37	No
Percentage matched:			81.95	Percentage matched:			62.49
b) Items Specified by Quantity and Value, contributing less than 1 per cent to Output:				b) Items Specified by quantity and Value, contributing less than 1 per cent to Output:			
11-21	2.07	94.26		13-55	8.73	86.10	
Percentage matched:			0.00	Percentage matched:			2.84
c) Output not Specified by Quantity:	5.74	100.00		c) Output not Specified by Quantity:	13.90	100.00	
Percentage matched:			0.00	Percentage matched:			0.00
Total percentage matched:			81.95	Total percentage matched:			65.33

Source: Brazil figures derived from tables A1.3 and A1.7; Mexican figures derived from tables A1.4 and A1.7;

Table A1.11a - Volume Movements in the United States, Grain Mill Products, 1975-1977

	Gross Value of Output (million 1972 US$) according to Industrial Outlook 1977	1975	Ratio of 1975 to 1977 Quantity for Gross Output	Gross Value of Output (million 1977 US$) according to Census Valuation 1977	Our Estimate 1975	Ratio of 1975 to 1977 Quantity for Gross Output
2041 Flour and Other Grain Mill Products	2,968.0	2,749.4	92.6348	3,683.3	3,412.0	
2046 Wet Corn Milling	1,052.7	809.1	76.8595	2,014.8	1,548.6	
TOTAL				5,698.1	4,960.6	87.0568

Source: Gross Value of Output at 1972 US$ from US Dept. of Commerce, 1982 US Industrial Outlook, Washington D.C:
Census Valuation of Output at 1977 US$ from 1977 US Census of Manufactures, see table A1.1;

Table A1.11b - Price Movements in the United States, Grain Mill Products, 1975-1977

	Gross Value of Output in 1975 according to ASM (1975 US$)	Our Estimate (1977 US$)	Ratio of 1975 to 1977 Prices for Gross Output
2041 Flour and Other Grain Mill Products	4,327.6	3,412.0	126.8341
2046 Wet Corn Milling	2,141.7	1,548.6	138.3022
TOTAL	6,469.3	4,960.6	130.4141

Source: Gross Value of Output at 1975 US$ from US Dept. of Commerce, Annual Survey of Manufactures.

Table A1.12 - Basic Data and Principal Results for Grain Mill Products, US, Brazil and Mexico

		Brazil	Mexico	United States	
				Brazil Comparison	Mexico Comparison
Part I - Basic data used in Calculations					
I.1	Total Gross Value of Output, 1975 in 1975 million national currency units	7,428.1	9,123.1	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	---	5,985.5	---	---
	c) in 1977 million US dollars	682.7	371.8	---	---
I.4	Matched Gross Value of Output, 1977				
	a) in 1975 million Cruzeiros	---	---	32,712.2	---
	b) in 1975 million Pesos	---	---	---	58,420.6
	c) in 1977 million US dollars	---	---	3,308.4	3,412.7
I.5	Coverage Ratio Matched Output to Total Gross Value of Output, (%)	83.17	65.61	58.06	59.89
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	---	28,478.2	---
	b) in 1975 million Pesos	---	5,985.5	---	50,859.1
	c) in 1975 million US dollars	890.3	484.9	3,756.2	3,874.6
I.9	Value Added (US Census Concept), 1975 in 1975 million national currency units	1,918.7	2,591.8	1,587.8	1,587.8
I.10	1975 Ratio of Value Added (US Census Concept) to Gross Value of Output	25.83	28.41	24.54	24.54
I.11	Employment in 1975	19,082	12,502	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	6.94	---	1.00	---
	b) Mexico quantity weights	---	12.34	---	1.00
	c) US quantity weights	7.58	13.13	1.00	1.00
II.2	Total Gross Value of Output				
	a) Brazil unit value weights, (mill. Cr.)	7,428.1	---	49,048.4	---
	b) Mexico unit value weights, (mill. Ps.)	---	9,123.1	---	84,918.2
	c) US unit value weights, (mill. US$)	1,070.5	739.1	6,469.3	6,469.3
II.3	Value Added (US Census Concept)				
	a) Brazil unit value weights, (mill. Cr.)	1,918.7	---	12,038.2	---
	b) Mexico unit value weights, (mill. Ps.)	---	2,591.8	---	20,842.0
	c) US unit value weights, (mill. US$)	276.5	210.0	1,587.8	1,587.8
II.4	Gross Output per Employee,				
	a) Brazil unit value weights, (Cr.)	389,275	---	1,714,978	---
	b) Mexico unit value weights, (Ps.)	---	729,733	---	2,969,167
	c) US unit value weights, (US$)	56,101	59,121	226,199	226,199
II.5	Value Added (US Census Concept) per Employee				
	a) Brazil unit value weights, (Cr.)	100,549	---	420,917	---
	b) Mexico unit value weights, (Ps.)	---	207,310	---	728,741
	c) US unit value weights, (US$)	14,491	16,796	55,517	55,517
Part III - Pro Memoria					
III.1	Alternate Purchasing Power Parity for Gross Value of Output (national currency/US$)				
	a) Brazil quantity weights	4.84	---	1.00	---
	b) Mexico quantity weights	---	11.27	---	1.00
	c) US quantity weights	5.29	11.98	1.00	1.00

Note: lines I.1, I.2 and I.9 to I.11 derived from table A1.1; lines 1.3 to 1.5 from tables A1.4 and A1.5; line I.6 and line I.7 from table A1.11. The other figures are all derived from the basic data in part I.

Table A1.13 - Basic Data and Principal Results for Grain Mill Products, Brazil and Mexico

	Brazil	Mexico
Part I - Basic data used in Calculations		
I.1 Total Gross Value of Output, 1975 in 1975 million national currency units	7,428.1	9,123.1
I.2 Matched Gross Value of Output, 1975		
a) in 1975 million Cruzeiros	6,087.0	3,047.3
b) in 1975 million Pesos	11,319.4	5,960.1
I.3 Coverage Ratio Matched Output to Total Gross Value of Output, (%)	81.95	65.33
I.4 Value Added, 1975 in 1975 million national units:		
- present national accounts concept	1,630.8	1,981.3
- former national accounts concept	1,585.1	1 680.1
I.5 1975 Ratio of Value Added to Gross Value of Output:		
- present national accounts concept	21.95	21.72
- former national accounts concept	21.34	18.42
I.6 Employment in 1975	19,082	12,502
I.7 1975 Exchange Rate (pesos/cruzeiro)	1.5375	1.5375
Part II - Principal Results, 1975 in all cases		
II.1 Purchasing Power Parity for (Matched-Total) Gross Value of Output (pesos/cruzeiro)		
a) Brazil quantity weights	1.8596	---
b) Mexico quantity weights	---	1.9559
II.2 Total Gross Value of Output		
a) Brazil unit value weights, (mill. Cr.)	7,428.1	4,664.4
b) Mexico unit value weights, (mill. Ps.)	13,813.3	9,123.1
II.3 Value Added (present national accounts concept)		
a) Brazil unit value weights, (mill. Cr.)	1,630.8	1,013.0
b) Mexico unit value weights, (mill. Ps.)	3,032.5	1,981.3
II.4 Value Added (former national accounts concept)		
a) Brazil unit value weights, (mill. Cr.)	1,585.1	859.0
b) Mexico unit value weights, (mill. Ps.)	2,947.6	1,680.1
II.5 Value Added (present national accounts concept) per Employee		
a) Brazil unit value weights, (Cr.)	85,460	81,025
b) Mexico unit value weights, (Ps.)	158,921	158,476
II.6 Value Added (former national accounts concept) per Employee		
a) Brazil unit value weights, (Cr.)	83,068	68,711
b) Mexico unit value weights, (Ps.)	154,472	134,390
Part III - Pro Memoria		
III.1 Alternate Purchasing Power Parity for Gross Value of Output (pesos/cruzeiro)		
a) Brazil quantity weights	2.3326	---
b) Mexico quantity weights	---	2.4534

Note: lines I.1, and I.4 to I.6 derived from table A1.1; lines 1.2 and 1.3 from tables A1.7; The other figures are all derived from the basic data in part I.

	Title	Author	Date
WPS1	Imports Under a Foreign Exchange Constraint	Cristian Moran	March 1988
WPS2	Issues in Adjustment Lending	Vinod Thomas	March 1988
WPS3	CGE Models for the Analysis of Trade Policy in Developing Countries	Jaime de Melo	March 1988
WPS4	Inflationary Rigidities and Stabilization Policies	Miguel A. Kiguel Nissan Liviatan	April 1988
WPS5	Comparisons of Real Output in Manufacturing	Angus Maddison Bart van Ark	April 1988
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