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## Labor costs and productivity trends in selected Brazilian manufacturing industries: An international comparison

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Kiel Working Paper No. 294

Labor Costs and Productivity Trends  
in Selected Brazilian Manufacturing Industries:  
An International Comparison

by

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July 1987

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## I. Introduction

In assessing the international competitiveness of manufacturing industries labor cost comparisons play an important role. Many Newly Industrializing Countries have achieved an outstanding export performance based on labor cost advantages. However, there are hardly any comprehensive international comparisons of unit labor costs for individual manufacturing industries. This study provides such an empirical analysis for selected Brazilian manufacturing industries and their major competitors in developing and industrialized countries. Brazilian manufactured exports have rapidly expanded over the last 20 years, and the country was successful in both labor- and capital-intensive exports. For this reason, manufacturing industries included in the analysis were chosen with respect to their factor intensities.

The analysis focuses on the iron and steel industry, the motor vehicle and the non-electrical machinery industry as well as the manufacture of wearing apparel and footwear. The iron and steel industry and the motor vehicle industry were chosen, because they are characterized by low to middle skill level, capital-intensive production processes (Wolter 1974, 66-67; Walter 1982, 1; Humphrey 1982, 101; Kageyama, 1984, 25)<sup>1</sup>. The non-electrical machinery industry was selected, because it depends traditionally more on skilled labor, and less on physical capital (Dick 1981, 30; UNIDO 1984, 5 and 60). Finally the wearing apparel and the footwear industries represent the case of labor-intensive production processes that draw mainly on unskilled labor (Pearson 1983, 65; ILO 1979, 30). Throughout the analysis all manufacturing is used as a common benchmark. Reference is made to major competing newly industrialized countries, i.e., South Korea, Taiwan, Hong Kong, and Mexico, as well as to industrialized countries such as the United States, Spain, Japan, and the Federal Republic of Germany.

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<sup>1</sup> Dicke (1978, 64) has drawn a more sophisticated picture for various subsectors of the transport equipment industry in the FRG, the U.S., and Sweden. See also The Economist (1985, 16-17).

Section II will clarify the most important conceptual and methodological issues and some shortcomings of previous labor cost analyses, and lay the ground for the empirical investigation pursued in this study. Partial findings of previous studies on Brazilian labor costs will be referred to as complementary information in the empirical part of the study (Section III). In Section IV the major results of the analysis will be summarized.

## II. Conceptual and Methodological Problems of Labor Cost Analyses

It has become practice in analyses of labor costs to focus on unit labor costs. There are two possibilities to calculate unit labor costs (Geiger 1983, 26). First, one can calculate the ratio of total labor costs to some measure of the production volume (Variant I). Second, one may calculate total labor costs per unit of time worked, say the costs per employee hour worked, and then divide this expression by some measure of the production volume per employee hour worked, which is a measure of the productivity per employee hour (Variant II). Most studies on unit labor costs refer to Variant II although, of course, the resulting unit labor costs are by definition equal as long as reference is made to the same unit of working, which is not always the case in empirical work.

The reason for this preference is obvious. Unit labor costs capture both levels or trends in the compensation per working time on the one hand, and levels or trends in productivity per working time on the other hand. However, one may be interested not only in an aggregate expression for the unit labor costs, but also in the magnitudes of the components that make up for unit labor costs. In order to illustrate the case, the same level of unit labor costs may be consistent with very low hourly labor costs and very low hourly productivity levels and, alternatively, extremely high labor compensation and productivity levels. While ultimately unit labor costs are an important element for decisions on industrial location, it certainly makes a difference for an investor to learn whether an industry is "heading" in terms of

labor costs, or whether it is lagging behind in terms of productivity. The empirical study presented here, thus, provides both information on unit labor costs and information on labor costs and labor productivity.

#### 1. Choices with Respect to Labor Costs, Working Time, and Output Volume

There are several options available for the calculation of unit labor costs. Labor costs can be defined more or less comprehensively. They may, first, refer to a specific category of employees, say, production workers, or to all employees, and they may include self-employed persons<sup>1</sup>. The labor cost definition used may, second, be very narrow in that it includes only the direct pay for the employee time worked, or it may also include estimates of a part or total indirect labor costs (fringe benefits) as they pertain to the employer, or else, to the society as a whole<sup>2</sup>. The choice mainly depends on the purpose of the study. In an industry comparison, one would choose the most encompassing level of persons employed, and one would use labor cost figures on an hourly basis so as to capture differences in the number of hours actually worked (seasonal variations, part-time and full-time employees, differences in the weekly and annual work time). In a macro-economic analysis one would certainly prefer the most encompassing labor cost level in order to cover labor costs components that may in part be matched by some public budgets. On the individual firm level, in contrast, only those indirect labor costs really matter that are borne by the firm<sup>3</sup>. In the present study use has been made of the most encompassing definitions of labor costs and persons employed in the comparison of absolute unit labor costs. The comparison of labor cost and unit labor cost trends is based on direct and indirect wage data for produc-

<sup>1</sup> See, for example, the definitions used in the UN Yearbook of Industrial Statistics.

<sup>2</sup> See, for example, the wage and labor cost data concepts used in the ILO Yearbook at Labour Statistics.

<sup>3</sup> For a discussion of the meaning of indirect labor costs see e.g. Walterskirchen (1977, 487-488), Kulp (1983, 116), Clemens and Wollrab (1981), and Hemmer (1981).



tion workers only. One may add that any comparison of aggregate figures on labor costs needs to be qualified in the light of differences in the skill levels of the labor force employed.

Another problem arises with respect to the scope of the output volume used in the Variant I definition of unit labor costs, or else, in the definition of labor productivity. What matters here is the value added, not the gross output, because only the former can directly be related to the working time actually spent in the production process (e.g. Klodt 1986, 5). Due to data shortages, empirical research is often pursued on the basis of gross output figures rather than the value added. The difference matters in particular if the share of intermediate inputs varies significantly over the sample, which may very well be the case in cross-sectional analyses. In the present analysis the absolute unit labor cost comparison is based on value added data to account for differences in the extent of vertical integration of production. The most preferable proxy for the labor input in an productivity calculation, as in the case of labor costs in the preceding paragraph, is again the number of hours actually worked. In the case of data shortages, the number of persons employed (engaged) has been used.

The problem that remains open even if the value added concept is used in a labor productivity calculation is that only labor is referred to as an input factor, i.e., the contribution of capital to the value added is not accounted for. In addition, what is actually measured are average productivities rather than marginal productivities which would certainly be more interesting. More sophisticated multi-factor productivity analyses are rare, however, in part certainly because the measurement of capital input introduces severe problems one may not be willing to accept (Foss 1985, 3-8; Adler 1982, 15-21). What has been said with respect to the skill levels of the labor force in the preceding paragraph applies here as well: aggregate numbers on employment of labor do not contain information about the actual skill profile of the labor force employed. Additional information on the human capi-

tal-intensity may be required to understand productivity data<sup>1</sup>. In the present case the skill level of the labor force employed has been decisive in the selection of the industries analyzed. The assessment was based only on previous studies (see Introduction).

## 2. Fluctuations over the Business Cycle and Particularities of Time Series Comparisons

An analyst might easily get caught in another trap: productivity measures vary substantially over the business cycle. It may be that in one year the industry of a country is producing at full capacity, whereas it may produce well below full capacity in another year (Bolle 1982; Capdevielle and Neef 1980, 33). The same may apply, for a given point of time, to different countries. One country may just be in a boom period, whereas another one may face a serious depression. In time series analyses the common practice followed here is, therefore, to look at average rates of change, or at general trends, rather than at single years. In cross-national comparisons one may try to collect data on capacity utilization, and then standardize unit labor cost and productivity figures on the basis of a uniform rate of capacity utilization. Unfortunately, it has not been possible to collect data on capacity utilization in the present study.

An additional difficulty arises if the proxies for the production volumes are derived from figures on production values: the choice of an appropriate deflator (Klodt 1986, 8-17). This problem matters in all time series analyses that draw implicitly on production values, e.g., in unit labor cost and productivity time series analyses on aggregate industry levels.

In general, however, time series comparisons within an industry are considered to be less problematic since they allow a proper assessment of unit labor costs, and their determinants, over time

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<sup>1</sup> The most commonly used measurement concepts are the "Lary Concept" and the "Stock Concept" (e.g. Weiss 1978, 21-24; Fels 1972, 77-90).

if the errors made by using crude proxies only remain unchanged. For example, the use of a less encompassing definition of labor costs excluding a major part of the fringe benefits, or else, the use of the gross production volume instead of the use of the value added, would not matter too much if we knew that the share of fringe benefits in total labor costs, or else, the share of intermediate inputs, did not change noticeable. In turn, differences in the scope of the definitions used would, of course, fully be reflected in absolute comparisons of unit labor costs (Walterskirchen 1977, 485; Guger 1983, 27).

### 3. Specific Problems of International Labor Cost Comparisons

The consistent use of definitions is most essential in international comparisons. This applies equally to labor cost data, production volumes, and employment data. It is, for example, often not clear whether or not the data are comparable due to insufficient information on the methods applied in assembling data. Absolute unit labor cost comparisons across countries like the one presented here should, thus, be read with caution, because the margin for errors is particularly large.

But there is another problem which is involved in international comparisons. All the data on labor costs, productivity, and hence unit labor costs are usually based on figures denominated in national currencies. In an international comparison it is indispensable to choose a common standard of denomination in order to get at meaningful proportions. In most studies the average annual exchange rate approach is used for this purpose<sup>1</sup>. While this procedure is still prevailing, a study done for the World Bank (Kravis, Kenessey, Heston, and Summers 1975) had shown that absolute GDP per capita comparisons (the GDP per capita can be interpreted as a general productivity measure), if based on conversions into US\$ at average annual exchange rates, yield largely distorted results. For the group of developing countries, which

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<sup>1</sup> Occasionally, the own labor cost position is assessed in terms of a trade weighted average, or else, an income weighted average of labor costs abroad (e.g. Walterskirchen 1977, 493-94; OECD Economic Outlook).

is of particular importance in the present context, it was found that the general Purchasing Power Parities (PPPs) were much lower than the average annual exchange rate vis à vis the US\$ (Kravis, Heston, and Summers 1982, 11); the national currencies of the developing countries were actually undervalued in market terms<sup>1</sup>. Low PPPs, however, mean that most products produced in those countries were sold cheaper than a conversion with the average annual exchange rate would have indicated. In turn this means that the outputs per capita (or productivities) in these countries, if assessed in PPPs, are actually higher than average annual exchange rate based conversions would have suggested. These results have been reiterated in more recent studies (e.g. Summers and Heston 1984; Kravis and Lipsey 1982). For the industries and countries analyzed in this study the deviations of output specific PPPs from average annual exchange rates are displayed in Table A1. Consequently, absolute international productivity comparisons should be based on adequate PPPs, rather than on average annual exchange rates (Heitger 1983, 66-67)<sup>2</sup>. Unfortunately, only for 1975 very detailed information on industry and product specific PPPs has been made available by Kravis et al. (1982, 176-183) for a number of countries. For the GDP aggregates the PPPs are already available for most countries up to 1980 (Summers and Heston 1984, 220-260). As a consequence, comprehensive international labor cost comparisons require that the PPPs used get updated.

In cross-national productivity trend comparisons, however, the problem of an adequate conversion is of minor importance, at least when the output volumes are calculated in constant prices of some base year for all countries compared. One only needs to recall that PPPs say how many national currency units buy the same quantity of a product with equal quality characteristics as one US\$ in the United States (U.S. chosen as a benchmark for illustrative

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<sup>1</sup> See also Bauer (1976, 55-60).

<sup>2</sup> It may be noted that in the literature sometimes the exchange rate of a particular year is used, rather than current exchange rates in order to eliminate the impact of exchange rate fluctuations (e.g. Belous 1984).

purpose). For all other years than the base year the PPPs are updated by multiplying the base year figure by some ratio of the national and the U.S. price indexes for the output in question. It follows, hence, by definition that the PPPs in a calculation at constant prices of a base year do not influence productivity trends. They do, nevertheless, matter as far as the calculation and comparison of productivity levels is concerned.

But not only the productivity measures need to be looked upon from the perspective of an international comparison. The very same applies to comparisons of labor costs. If one were to convert labor costs denominated in national currency into US\$ at average annual exchange rates, this would certainly reflect the costs for labor in US\$ to some fictitious outside observer. However, what is important in the present context is the decision on a production location, and this means that anyone who wants to produce in a particular country faces a particular price for the output produced. As just mentioned, it had been found as a matter of rule with exceptions that price levels are lower in most LDCs compared to the U.S. The observation of deviations from the law of one price for internationally tradeable goods reflects the size of negative or positive protection (apart from transportation costs). If one converts labor costs at industry specific PPPs, then one says no more than that a national producer may not only have a lower wage bill, but that he may also face lower prices in the market he produces for. As long as the deviations of the PPPs from the average annual exchange rates are significant and persistent, the use of annual average exchange rates would yield a wrong impression about the actual labor cost burden. Again, an international comparison of labor costs requires that appropriate PPPs get calculated and used. The PPPs calculated for this study are reproduced in Table A2. This view has not yet been reflected sufficiently in the literature.

In the case of an absolute unit labor cost comparisons across countries the problem does not exist, if both the nominator (labor costs) and the denominator (production volume = production value of a particular year) are either converted at PPPs, or at

average annual exchange rates, because then the currency dimension is cancelled out by forming the unit labor cost ratio (Variant I). The same applies, of course, if the ratio of labor costs and production volume is calculated in the national currency. An analyst interested in unit labor cost trends relative to the U.S., again choosing the U.S. as a benchmark, may choose to calculate labor costs per employee time worked relative to the U.S. by using industry specific PPPs as just indicated, and correct the labor cost trends by the productivity trend relative to the U.S., starting with the base year chosen (Variant II). The initial values for unit labor costs in the base year may then be set equal to 1 to facilitate the trend interpretation.

Finally, it is necessary to realize that the stage of development of a country is likely to matter in labor cost comparisons. In earlier studies it has been argued that a developing country will find it relatively easy to catch up to a leading country in terms of technology and productivity growth at an early stage of its development, while it becomes increasingly harder to catch up, or even to take the lead, as moves on in its development (e.g. Belous 1984, 52; Klodt 1987, 58-60; Norton 1986, 28). From this perspective one would expect that industries in developing countries generally do better in terms of productivity growth than those in mature economies. In other words, interpretations of labor cost and productivity trends need to go beyond the cardinal ranking of figures whenever countries at different stages of development are considered.

### III. Empirical Analysis of Major Trends of Unit Labor Costs in Selected Brazilian Manufacturing Industries

It has already been mentioned that there has so far been no comprehensive labor cost study covering the Brazilian industry as a whole. Moreover, also single Brazilian manufacturing industries have frequently been neglected in international labor cost comparisons. The few studies that include Brazil focus almost exclusively on the automobile and the iron and steel industry (e.g.

Belous 1984, Reddy and Doidge 1986). Even on the aggregate level of all manufacturing industry the inclusion of Brazil in an international comparison has so far remained an exception (Belous 1984, 33-35). In addition, these studies are mainly confined to a discussion of unpublished labor cost data made available by the U.S. Bureau of Labor Statistics. The same source has been used here, though, as should have become clear from the preceding section, labor cost data can only tell a part of the story. Numerous other national and international statistics on output, employment, and additional labor cost data have been consulted to get at a satisfactory characterization of the labor cost situation in Brazil in a comparative perspective in these industrial sectors.

Similarly, the wearing apparel, the footwear, and the non-electrical machinery industries have been dealt with in little more than in impressionistic ways in the Brazilian case. A notable exception are the surveys on labor cost data done on behalf of the Union Bank of Switzerland (Gutmann and Kruck 1980; Enz 1982; Enz and Mäder 1985). Throughout the world, and for selected years they have assembled (raw) earnings data for toolmakers/lather operators and electrical engineers - among others - that shed some light at least at the situation of the non-electrical machinery industry. Drawing again on unpublished data from the U.S. Bureau of Labor Statistics, and numerous other sources, a picture of the labor cost situation in these industries is drawn that meets the basic requirements of valid labor cost comparisons as set out in Section II.

The analyses proceeds as follows. First, the findings for absolute unit labor costs for all manufacturing sectors selected in 1979 are discussed. The analysis then proceeds with findings for the unit labor cost trends since 1975 for the iron and steel, the automobile, and all manufacturing industries. In both presentations the U.S. figures are taken as a benchmark, i.e., all other figures are calculated in per cent of the U.S. figures. In order to understand what is behind the findings, and to some extent due to lack of appropriate data as in the case of wearing apparel,

footwear, and non-electric machinery, a separate discussion of labor cost and productivity figures is added. Finally, the analysis is complemented by a part that deals specifically with the question of where the Brazilian economy stands with respect to labor skills which has been a key criterion for the selection of industries in this study.

### 1. Unit Labor Cost Comparison for 1979

Section II has shown that a comprehensive labor cost study needs to focus primarily on unit labor costs. So far, only the Brazilian automobile industry has been included in a comparative unit labor cost study. The results have been quoted in Reddy and Doidge (1986, Appendix). The major finding is that Brazilian unit labor costs range in the neighborhood of 25 per cent of the unit labor costs of the U.S., Mexico and Japan had about the same cost advantage. Korea was even better than that with unit labor costs in the magnitude of 10 per cent of the U.S. figures. The German motor vehicle industry was found to produce at about 60 per cent of the U.S. reference value.

The absolute unit labor cost comparison for all selected manufacturing industries is pursued for 1979<sup>1</sup>. It has not been possible to correct the data for differences in the level of capacity utilization. The findings are presented in Table 1. In all manufacturing industry Brazil is heading the country group. Its unit labor costs amount to 53 per cent of the U.S. value. In the iron and steel industry Brazil (35 per cent) has lower unit labor costs than Korea (40 per cent), and probably they are somewhat higher than in Taiwan (22 per cent) where wage supplements have not been included. In the motor vehicle industry Mexico (32 per cent) is holding the first rank, followed by Brazil (49 per cent) and Korea (63 per cent). For Taiwan appropriate figures were not available, but a look at the transport equipment industry shows that Taiwan's unit labor costs (49 per cent) are likely to be very low.

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<sup>1</sup> This is the year in the middle of the time period covered by our study.



Table 1 - Unit Labor Costs in Selected Manufacturing Industries: Brazil and Other Countries 1979 (1)  
[U.S. = 100]

	Manufac- turing Industries	Iron & Non-electrical Steel Industry	Machinery Industry	Transport Equipment Industry	Motor Vehicle Industry	Wearing Apparel Industry	Footwear Industry
Brazil	53	35	96	59	49	61	59
Hong Kong	96	NA	NA	NA	NA	116	123
Korea	76	40	89	79	63	91	88
Mexico	NA	NA	NA	NA	32	NA	NA
Taiwan (2)	98	22	53	49	NA	63	NA
Germany	118	95	138	105	135	107	116
Japan	86	48	91	75	68	102	86
Spain	92	78	96	89	80	82	86

(1) Labor cost-output ratio is calculated in national currency. Labor costs include wage supplements and output is measured as value added.

(2) No wage supplements included.

Sources: U.N. Yearbook of Industrial Statistics; U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data; various national and international statistics. Own calculations.

The direct comparison with the results quoted above for the motor vehicle industry shows, first, that our figures are generally higher. Without having had access to more detailed information on how those figures had been calculated, two reasons are most likely to have influenced this difference. On the one hand the most comprehensive measure for labor costs available was used here, on the other hand the value added rather than the gross output concept was applied, while in both cases the other study may have used other proxies<sup>1</sup>. It is, second, obvious from Table 1 that Korea was found to have much lower unit labor cost advantages than in the study quoted above. A look at the transport equipment industry (which includes the motor vehicle industry) figure for Korea (79 per cent) supports our assessment. In the wearing apparel and in the footwear industry Brazil, again, has the lowest

<sup>1</sup> In addition, the analysis followed Variant II rather than Variant I of the unit labor cost calculation. The results differ whenever different measures for the working time are applied.

unit labor costs in comparison to the U.S. (61 and 59 per cent, respectively). Only in the case of non-electrical machinery Taiwan has a clear advantage (53 per cent).

Table 1 says in essence that Brazil had clear advantages in terms of unit labor costs, not only with respect to the U.S. On unit labor cost grounds the situation is was certainly as favorable as in Korea and in Taiwan. If one were to assess where the largest advantage relative to the next best competitors is, one would certainly find it in the wearing apparel and the footwear industry<sup>1</sup>.

## 2. Unit Labor Cost Trends in Selected Manufacturing Industries

For the iron and steel industry, the motor vehicle industry and the all manufacturing industry it was possible to calculate the unit labor cost trends. A trend analysis of unit labor costs reveals whether a unit labor cost (dis-)advantage has increased, decreased, or remained stable. Table 2 displays the figures for 1975-84. Given that there are cyclical patterns in unit labor costs, it is suggested to interpret the figures over the entire period only.

In the iron and steel industry the decline of the Brazilian unit labor cost advantage needs to be seen in conjunction with improvements for Korea, Mexico, and Taiwan. Even the German and the Japanese iron and steel industries have managed to lower unit labor costs relative to the U.S. In the motor vehicle industry it was Mexico that has improved most impressively. Korea and Taiwan managed to keep the unit labor costs quite constant relative to the U.S. The relative performance of the Brazilian automobile industry surprises somewhat in the light of the result presented in Table 1, where it was found that the Brazilian unit labor costs in the automobile industry were quite low in absolute terms. It is interesting to note that Japan has had almost dramatical unit labor cost increases in the automobile industry.

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<sup>1</sup> It did not make sense to consider the all manufacturing category in this question.

Table 2 - Unit Labor Cost Trends for Selected Manufacturing Industries, Brazil and Other Countries, 1975-1984 (1)

[U.S. = 1.00, Base Year 1975 = 1.00]

a All Manufacturing Industry

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	1.00	1.06	1.06	1.12	1.06	1.00	1.71	1.82	1.35	NA
Hong Kong	1.00	1.13	1.07	1.13	0.93	0.93	0.93	0.93	NA	NA
Korea	1.00	0.69	0.81	0.81	0.81	0.75	0.69	0.75	NA	NA
Taiwan	1.00	0.87	1.00	1.00	1.00	1.27	1.13	1.20	0.93	1.00
Germany	1.00	1.01	0.99	1.00	0.95	0.99	1.03	1.03	1.00	1.00
Japan	1.00	1.00	0.98	0.94	0.88	0.88	0.88	0.86	0.86	0.84
Spain	1.00	1.07	1.05	1.07	1.20	1.20	1.20	NA	NA	NA

b Iron and Steel Industry

Brazil	1.00	1.12	1.06	1.06	1.24	1.00	1.29	0.94	1.71	1.35
Korea	1.00	1.15	1.46	1.77	1.46	1.00	0.92	0.62	NA	NA
Mexico	1.00	1.13	1.03	1.00	0.94	0.81	0.97	0.53	0.47	NA
Taiwan	1.00	1.00	0.75	0.75	0.67	0.67	1.08	0.67	NA	NA
Germany	1.00	0.98	1.02	1.04	1.00	0.94	1.00	0.66	0.70	NA
Japan	1.00	1.21	1.23	0.97	0.95	0.69	0.79	0.54	0.77	NA
Spain (2)	NA	NA	1.00	1.05	1.05	0.85	1.00	0.58	NA	NA

c Motor Vehicle Industry

Brazil	1.00	1.29	1.36	1.36	1.14	1.43	1.71	1.64	1.64	1.79
Korea	1.00	1.38	2.13	2.63	2.88	1.88	1.13	1.25	NA	NA
Mexico	1.00	1.20	0.95	0.84	0.89	0.73	0.86	0.61	NA	NA
Taiwan	1.00	1.15	1.00	1.08	1.38	1.00	1.31	1.15	1.08	1.38
Germany	1.00	1.04	1.21	1.19	1.34	1.14	1.23	1.20	1.41	NA
Japan	1.00	1.21	1.27	1.48	1.73	1.21	1.36	1.48	1.88	NA
Spain (2)	NA	NA	1.00	1.04	1.51	1.24	1.56	1.20	NA	NA

(1) Hourly labor cost for production workers computed at industry specific PPPs, and corrected for productivity trend differential (ratio).

(2) Base year 1977 = 1.00.

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data; International Monetary Fund, International Financial Statistics Yearbook 1986; Kravis et al (1982) World Product and Income; various national and international statistics. Own calculations.

The major finding that applies to the all manufacturing industry, the iron and steel industry, and motor vehicle industry is that Brazil seems to have lost unit labor cost advantages, while Hong Kong, Korea, and Japan have gained, or at least have held their position relative to the U.S.

The most interesting question that arises from these results is what may have driven these recent developments. In Section II it has become clear that one needs to look at the dynamics of both the labor costs per unit of time worked and the labor productivities.

### 3. Trends of Labor Costs and Labor Productivity

The labor cost levels and trends for all manufacturing, iron and steel, and motor vehicles are presented in Table 3. The U.S. figures have, again, been chosen as common benchmark. They have been calculated both at industry specific PPPs (a) and average annual exchange rates (b). In the discussion of the conversions problem in Section II it was argued that the first method is more appropriate because one gets information about the labor cost burden as it pertains to a domestic producer<sup>1</sup>.

The figures for all manufacturing industry show that the labor costs of most countries including Brazil have risen relative to the U.S. In contrast, the labor costs of quite a number of countries have gone down relative to the U.S. when average annual exchange rates are used instead.

In the iron and steel industry the labor cost increase has been substantial for Brazil (about 100 per cent); only for Korea and Taiwan there were similar trends. The cost increases have been relatively modest for Germany and Japan. Mexico seems to have gained additional advantages. This overall picture, again, would have been different, if one had focussed on data calculated at average annual exchange rates instead: Brazil would even have gained somewhat.

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<sup>1</sup> Appendix Table A2 displays the PPPs for the output categories referred to in this study.

Table 3 - Hourly Labor Costs for Production Workers in Selected Manufacturing Industries, Brazil and Other Countries, 1975-1985 (1)

[U.S. = 1.00]

a Manufacturing Industry

		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazil	(a)	0.17	0.18	0.18	0.19	0.19	0.18	0.30	0.33	0.24	NA	NA
	(b) (2)	0.18	0.19	0.19	0.20	0.19	0.17	0.20	0.21	0.12	0.10	0.10
Hong Kong	(a)	0.15	0.16	0.16	0.18	0.17	0.17	0.18	0.17	0.19	0.19	NA
	(b) (2)	0.11	0.12	0.13	0.14	0.14	0.15	0.14	0.13	0.13	0.13	0.14
Korea	(a)	0.16	0.12	0.14	0.16	0.18	0.17	0.17	0.18	0.19	0.20	NA
	(b) (2)	0.06	0.07	0.08	0.10	0.13	0.11	0.10	0.10	0.11	0.11	0.11
Mexico	(a)	0.37	0.37	0.36	0.36	0.34	0.35	0.34	0.35	0.25	0.22	NA
	(b) (2)	0.30	0.30	0.23	0.25	0.26	0.30	0.33	0.17	0.12	0.14	NA
Taiwan	(a)	0.15	0.15	0.17	0.20	0.20	0.25	0.24	0.25	0.21	0.23	NA
	(b) (3)	0.08	0.08	0.09	0.10	0.11	0.13	0.14	0.13	0.11	0.12	0.11
Germany	(a)	0.77	0.80	0.79	0.81	0.80	0.84	0.86	0.86	0.84	0.85	0.83
	(b) (2)	0.97	0.95	1.03	1.16	1.24	1.25	0.96	0.89	0.87	0.77	0.76
Japan	(a)	0.50	0.52	0.54	0.55	0.56	0.61	0.63	0.64	0.64	0.66	0.65
	(b) (2)	0.48	0.48	0.53	0.67	0.61	0.57	0.56	0.49	0.51	0.51	0.50
Spain	(a)	0.44	0.48	0.49	0.48	0.51	0.52	0.54	0.55	0.52	NA	NA
	(b) (2)	0.41	0.42	0.43	0.47	0.60	0.60	0.51	0.46	0.39	0.37	0.37

b Iron and Steel Industry

Brazil	(a)	0.17	0.18	0.19	0.20	0.24	0.26	0.28	0.29	0.39	0.37	NA
	(b) (4)	0.13	0.13	0.13	0.14	0.13	0.12	0.13	0.13	0.10	0.09	0.09
Korea	(a)	0.13	0.16	0.19	0.24	0.25	0.22	0.23	0.21	0.25	0.30	NA
	(b) (4)	0.05	0.06	0.08	0.10	0.11	0.09	0.09	0.08	0.09	0.10	0.10
Mexico	(a)	0.32	0.33	0.30	0.30	0.29	0.28	0.30	0.19	0.14	NA	NA
	(b) (4)	0.23	0.22	0.17	0.18	0.20	0.22	0.24	0.11	0.09	0.11	NA
Taiwan	(a)	0.12	0.13	0.13	0.14	0.14	0.14	0.19	0.19	0.18	0.22	NA
	(b) (3)	0.06	0.07	0.07	0.09	0.09	0.09	0.10	0.09	0.08	0.10	0.09
Germany	(a)	0.50	0.48	0.53	0.55	0.59	0.59	0.57	0.46	0.55	0.58	NA
	(b) (4)	0.70	0.67	0.71	0.79	0.84	0.79	0.61	0.51	0.54	0.52	0.52
Japan	(a)	0.39	0.46	0.53	0.41	0.47	0.39	0.39	0.35	0.42	0.44	NA
	(b) (4)	0.51	0.61	0.75	0.72	0.72	0.57	0.56	0.44	0.51	0.55	0.52
Spain	(a)	NA	NA	0.39	0.39	0.42	0.39	0.41	0.37	0.38	0.39	NA
	(b) (4)	NA	NA	0.33	0.35	0.45	0.43	0.38	0.31	0.28	0.28	0.28

Continued Table 3

## c Motor Vehicle Industry

		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazil	(a)	0.14	0.16	0.16	0.16	0.13	0.18	0.18	0.18	0.18	0.16	NA
	(b) (5)	0.16	0.17	0.17	0.18	0.17	0.14	0.17	0.18	0.12	0.09	0.09
Korea	(a)	0.08	0.09	0.12	0.15	0.14	0.09	0.08	0.11	0.12	0.12	NA
	(b) (5)	0.05	0.06	0.08	0.11	0.12	0.09	0.09	0.09	0.10	0.09	0.09
Mexico	(a)	0.44	0.51	0.45	0.40	0.40	0.35	0.37	0.26	0.18	NA	NA
	(b) (5)	0.31	0.33	0.26	0.25	0.28	0.27	0.31	0.15	0.11	0.12	NA
Taiwan	(a)	0.13	0.15	0.16	0.17	0.20	0.19	0.24	0.23	0.21	0.25	NA
	(b) (3)	0.07	0.07	0.08	0.08	0.10	0.11	0.12	0.10	0.09	0.11	0.10
Germany	(a)	0.70	0.72	0.79	0.75	0.84	0.74	0.82	0.81	0.89	0.85	NA
	(b) (5)	0.81	0.80	0.85	0.94	1.03	0.96	0.77	0.71	0.74	0.65	0.63
Japan	(a)	0.33	0.36	0.37	0.41	0.47	0.40	0.44	0.45	0.49	0.49	NA
	(b) (5)	0.38	0.39	0.42	0.54	0.50	0.42	0.44	0.39	0.43	0.42	0.40
Spain	(a)	NA	NA	0.45	0.45	0.46	0.41	0.44	0.42	0.42	0.41	NA
	(b) (5)	NA	NA	0.38	0.40	0.50	0.44	0.41	0.36	0.31	0.29	0.29

- (1) Labor costs include direct and indirect wages. They are computed (a) at industry specific PPPs, and (b) at average annual exchange rates.
- (2) The PPPs for tradables as a proxy for manufacturing PPPs (Kravis et al 1982) have been updated in own calculations by recourse to national data on manufacturing price indexes (Appendix Table A1).
- (3) In the case of Taiwan the 1975 PPP (Summers and Heston 1984) for the GDP has been updated in calculations by corresponding price index data (Appendix Table A1).
- (4) The PPPs for nonresidential housing as a proxy for iron and steel PPPs (Kravis et al 1982) have been updated in own calculations (Appendix Table A2) by national data on iron and steel price indexes.
- (5) The PPPs for transport equipment as a proxy for motor vehicle PPPs (Kravis et al 1982) have been updated in own calculations (Appendix Table A2) by national data on transport equipment price indexes.

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data; International Monetary Fund, International Financial Statistics Yearbook 1986; Kravis et al (1982) World Product and Income; various national and international statistics. Own calculations.

Turning to the automobile sector, the labor cost increase has been relatively low in Brazil, while the losses seem to have been substantial for Japan, Taiwan, and Germany. Korea has also lost somewhat in terms of labor costs relative to the U.S. The conclusions to be drawn from labor cost figures based on average annual exchange rates again differ drastically.

In essence, Table 3 says that Brazil has lost advantages at the labor cost front over the time period 1975-1985. It has lost most in the iron and steel industry, while the loss has been relatively minor in the motor vehicle industry. The picture for Brazil is reinforced by the findings presented for all manufacturing. Thus, generally speaking there has been a significant upward pressure on Brazilian unit labor cost resulting from labor cost increases.

Table 3 allows also an assessment of the absolute magnitudes of Brazilian labor costs. For transport equipment (including motor vehicles), footwear, wearing apparel, and non-electrical machinery only most recent figures were available; they are presented in Table 4. It needs to be stressed that, unlike earlier studies that had drawn upon the same sources (e.g. Belous 1984; Reddy and Doidge 1985), the labor cost figures in line (a) are based on industry specific PPPs. Similarly, the surveys done on behalf of the Union Bank of Switzerland (Gutmann and Kruck 1980; Enz 1982; Enz and Mäder 1985) need to be interpreted with considerable caution as there are based on nominal exchange rates (Swiss Francs).

It is an interesting question to ask further what has driven the labor cost increases in Brazil and other countries. Following U.S. Sources, the Brazilian labor force is not highly organized (U.S. Department of Labor 1982, 28). There have, however, been increased problems from the late 1970s on (Mericle 1984, 21; Humphrey 1984, 96). While it is beyond the scope of this paper to analyze wage policies in detail, it can be shown quite easily, and on a comparative basis, how the indirect labor costs have developed. Caution is required as it is not possible to compare absolute wage supplements across countries due to differences in

Table 4 - Hourly Labor Costs for Production Workers in Selected Manufacturing Industries,  
Brazil and Other Countries, 1983-1985 (1)  
[U.S. = 1.00]

		Transport Equipment Industry	Footwear Industry	Wearing Apparel Industry	Non-electrical Machinery
Brazil	1983 (a)	0.17	0.65	0.24	0.30
	(b)	0.12	0.13	0.13	0.17
Hong Kong (2)	1983 (a)	NA	0.52	0.38	NA
	(b)	NA	0.27	0.23	NA
	1984 (a)	NA	0.47	0.36	NA
	(b)	NA	0.26	0.24	NA
Korea	1983 (a)	0.15	0.52	0.25	0.21
	(b)	0.12	0.13	0.12	0.13
	1984 (a)	0.16	0.56	0.26	0.22
	(b)	0.12	0.14	0.13	0.13
Mexico	1983 (a)	NA	NA	NA	NA
	(b)	NA	NA	NA	0.13
	1984 (a)	NA	NA	NA	NA
	(b)	NA	NA	NA	0.14
Taiwan (2)	1983 (a)	0.23	0.26	0.28	0.29
	(b)	0.10	0.14	0.16	0.11
	1984 (a)	0.28	0.28	0.29	0.32
	(b)	0.12	0.16	0.18	0.12
Germany	1983 (a)	0.93	0.99	0.89	0.83
	(b)	0.78	1.11	1.04	0.83
	1984 (a)	0.89	0.95	0.83	0.85
	(b)	0.68	1.00	0.95	0.73
	1985 (a)	NA	NA	NA	NA
	(b)	0.67	0.99	0.92	0.74
Japan	1983 (a)	0.52	0.65	0.39	1.00
	(b)	0.46	0.61	0.47	0.54
	1984 (a)	0.51	0.62	0.36	1.02
	(b)	0.44	0.61	0.48	0.54
	1985 (a)	NA	NA	NA	NA
	(b)	0.44	NA	0.47	0.53
Spain	1983 (a)	NA	NA	NA	NA
	(b)	0.34	0.48	0.51	0.37

- (1) Labor Costs include direct and indirect wages. They are computed (a) at industry specific PPPs, and (b) at average annual exchange rates. The industry specific PPPs for transport equipment, footwear, wearing apparel, and nonelectrical machinery have been taken from Kravis et al (1982). The data for 1975 have been updated in own calculations by national information on corresponding price indexes (Appendix Table A2). For all manufacturing, iron and steel, and motor vehicles data see Table 3.
- (2) For Hong Kong and Taiwan only PPPs for the GDP were available. The PPPs for 1975 were taken from Summers and Heston (1984) and were updated in own calculations by national information on corresponding price indexes (Appendix Table A2).

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data; Kravis et al (1982) World Product and Income; various national and international statistics. Own calculations.



the social security system and data coverages. It is reasonable, however, to analyze the data sets for various countries over time<sup>1</sup>. For Brazil a slight increase of the indirect labor costs for all manufacturing can be observed (Table A3). The indirect labor costs have also increased modestly in Korea, Japan, and somewhat more in the U.S. For Hong Kong there is no increase, and for Taiwan the numbers are only crude estimates. The conclusion is that the relative unit labor cost increases for Brazilian manufacturing industries in general can hardly be traced to an increased pressure at the indirect labor cost front. The situation is quite similar for the Brazilian iron and steel industry, where the share of indirect labor costs has remained fairly constant. The same holds for the motor vehicle industry. The overall conclusion is that increases in indirect labor costs have posed no problem in Brazil. It is interesting to note that the indirect labor compensation costs have risen most dramatically in all industries selected in Germany<sup>2</sup>.

Attention is now turned to the productivity performance as the other driving force behind unit labor cost developments (Table 5). Brazil has gained substantially in iron and steel sector, and somewhat in all manufacturing industry, while it has lost in the motor vehicle (and transport equipment) industry, the wearing apparel, the footwear, and the non-electrical machinery industry. In the all manufacturing industry Brazil is, however, far behind Japan, Korea, and Taiwan. In the motor vehicle industry, and the more encompassing transport equipment industry, Taiwan is most

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<sup>1</sup> See, for example, Salowski (1980, 258-60) for a comparative study on indirect labor cost on developments in major industrialized countries.

<sup>2</sup> The data for all other sectors analyzed are presented in Appendix Table A4. The data series are too short to get information on trends. It is apparent, however, that the ratios vary substantially across countries. The message one can get out of this table is that labor cost comparisons should always be based on comprehensive measures of labor costs, because otherwise one may easily get at false assessments of the relation of labor costs across countries. The same conclusion, of course, could have been drawn already from Table A3.

Table 5 - Labor Productivity Trends in Selected Manufacturing Industries, Brazil and Other Countries, 1975-1984

[U.S. = 100.0, Base Year 1975 = 100.0]

a All Manufacturing Industry

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	100.0	102.6	98.5	101.7	103.4	103.1	102.8	107.2	104.1	109.0
Hong Kong	100.0	96.1	98.2	103.7	125.7	124.2	128.3	118.4	NA	NA
Korea	100.0	109.7	117.5	133.0	148.7	153.2	170.7	175.0	NA	NA
Taiwan	100.0	111.2	114.2	130.5	131.9	134.2	139.2	140.8	153.0	152.4
Germany	100.0	102.5	104.0	105.6	109.9	110.8	109.3	108.4	108.9	110.0
Japan	100.0	104.7	109.4	117.1	126.5	138.5	141.7	148.6	149.9	158.5
Spain	100.0	101.3	105.8	102.1	96.7	97.4	101.3	NA	NA	NA

b Motor Vehicle Industry (2)

Brazil	100.0	89.7	82.8	84.3	81.5	86.1	73.6	77.8	77.8	64.4
Korea	100.0	82.7	69.9	69.7	62.8	60.3	90.6	110.6	NA	NA
Mexico	100.0	95.3	107.5	107.3	103.6	108.5	98.8	96.5	NA	NA
Taiwan	100.0	96.1	121.1	118.7	115.6	141.7	141.4	149.9	145.0	140.4
Germany	100.0	98.6	92.7	90.0	89.1	92.8	95.1	96.5	89.6	NA
Japan	100.0	89.2	88.2	82.6	81.4	99.8	96.7	91.6	79.7	NA
Spain	100.0	84.2	99.7	95.8	67.3	72.6	62.3	78.5	NA	NA

c Transport Equipment Industry (3)

Brazil	100.0	94.6	87.2	87.5	86.6	90.5	90.7	99.1	88.6	88.8
Korea	100.0	71.3	70.8	85.7	94.3	120.9	120.4	111.5	NA	NA
Mexico	100.0	82.9	82.3	92.3	96.8	104.4	105.7	NA	NA	NA
Taiwan	100.0	97.5	123.8	121.0	122.3	147.5	156.1	165.0	159.4	154.4
Germany	100.0	100.8	96.0	92.8	96.0	99.2	107.5	109.7	101.2	NA
Japan	100.0	93.5	95.5	95.1	100.3	123.3	127.5	121.1	NA	NA
Spain	100.0	74.4	79.6	67.0	49.4	50.3	49.5	NA	NA	NA

Continued Table 5

## d Iron and Steel Industry (3)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	100.0	95.1	106.0	112.1	119.9	149.1	130.4	186.4	155.3	158.4
Korea	100.0	105.0	101.9	105.4	132.0	167.5	198.5	284.2	NA	NA
Mexico (4)	100.0	91.6	90.8	94.0	97.5	106.1	94.5	116.1	88.9	NA
Taiwan	100.0	112.6	143.9	154.8	168.9	176.1	151.4	219.9	229.0	224.9
Germany	100.0	99.6	104.1	106.2	120.1	126.3	114.3	140.1	157.0	NA
Japan	100.0	96.7	108.8	110.0	127.9	145.3	125.0	163.5	139.3	NA
Spain (4)	100.0	94.6	98.5	94.1	98.5	115.7	102.6	160.4	NA	NA

## e Non-electrical Machinery Industry (3)

Brazil	100.0	114.1	99.5	99.2	98.7	104.8	94.4	94.0	87.3	86.2
Korea	100.0	111.3	103.5	130.0	116.2	106.8	122.7	131.1	NA	NA
Mexico	100.0	92.8	106.6	114.1	130.3	134.0	135.3	126.8	103.3	NA
Taiwan	100.0	130.0	126.1	143.1	158.0	148.0	150.6	151.3	157.8	149.6
Germany	100.0	99.9	101.9	105.5	109.3	113.2	106.2	109.1	100.8	NA
Japan	100.0	105.4	115.9	126.7	141.9	152.1	149.6	150.0	129.6	NA
Spain	100.0	85.1	85.6	72.6	53.1	61.1	68.3	NA	NA	NA

## f Wearing Apparel Industry (3)

Brazil (5)	100.0	86.9	76.8	77.3	76.2	77.5	80.8	84.9	70.9	70.8
Hong Kong	100.0	105.3	108.3	114.8	155.6	188.9	195.0	175.6	NA	NA
Korea	100.0	94.1	100.3	122.2	128.0	144.2	160.2	NA	NA	NA
Taiwan	100.0	140.1	134.4	161.6	173.1	226.4	242.7	225.0	208.0	200.7
Germany	100.0	93.6	101.8	102.0	100.7	107.3	107.1	112.8	111.0	NA
Japan	100.0	95.0	94.0	92.3	93.0	99.4	102.9	106.6	106.3	NA
Spain	100.0	89.3	80.9	75.6	69.4	66.0	66.4	NA	NA	NA

Continued Table 5  
g Footwear Industry (3)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil (6)	100.0	102.4	102.0	95.9	91.8	82.7	90.2	96.3	80.8	84.0
Hong Kong	100.0	115.5	97.4	132.9	183.6	180.4	180.3	134.5	NA	NA
Korea	100.0	114.4	128.9	142.6	111.2	97.1	97.6	75.1	NA	NA
Germany	100.0	110.3	116.3	118.9	117.3	108.3	115.4	123.2	112.8	NA
Japan	100.0	104.4	114.1	110.7	113.4	100.9	120.2	128.8	NA	NA

- (1) In general productivity is measured as constant value output per employee hour. The figures are calculated from data published by the U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, January 1986, except for Brazil, Korea, and Spain. In these cases data on the industrial production volume and the number of persons engaged (UN Yearbook of Industrial Statistics) have been used in own calculations. Note that the national accounting methods for measuring real output differ considerably.
- (2) In general productivity is calculated as real output per employee.
- (3) In general productivity is calculated as real output per person engaged.
- (4) Including non-ferrous metals.
- (5) Including footwear industry.
- (6) Including wearing apparel industry.

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review January 1986; UN Yearbook of Industrial Statistics, various issues; various national statistics. Own calculations.

successful. In the iron and steel sector Korea is ranking first, followed by Taiwan. Although Brazil's performance in terms of productivity growth is impressive in this industry, it is not better than that of Germany, relative to the U.S. In non-electrical machinery industry, once more, Korea and Taiwan have had the largest increases, but Japan's performance is equally good. In the wearing apparel industry Hong Kong and Taiwan, and with some distance Korea, leave the rest (including Brazil) far behind. In the footwear sector the most striking (unexpected) feature is that Japan, the FRG, and Hong Kong are leading, while the productivity performance of Korea is as poor as that of Brazil. One may note, however, that data for Taiwan as well as Mexico and Spain were not available, i.e., the picture for the footwear industry is not as complete as the other ones.

In summary, only the productivity performance in the iron and steel industry has been impressive in the case of Brazil. In most other industrial sectors Brazil's productivity performance has

even been poorer than that of more mature economies like those of the U.S. and Germany, not to speak of Japan. Following the hypothesis that the largest productivity gains can be reaped at a relatively early stage of development (catching-up hypothesis), the performance of Brazilian industries has even been poorer than the mere cardinal ranking of numbers suggests.

Putting the results on labor cost trends calculated at industry specific PPPs and the findings on productivity trends together, the reduction in unit labor cost advantages for Brazil relative to major competitors can be traced to both relatively unfavorable development at the labor cost front and unsatisfactory productivity performances. In comparison, in the all manufacturing industry, Korea, Taiwan, and Japan had gained, or at least held their position because the productivity increases have been large enough to match increased wage bills. The same applies to the iron and steel industry. In the motor vehicle (and transport equipment) industry the labor cost burden for Brazilian producers has even become more severe as the productivity performance has been particularly poor. Taiwan and Korea were able reduce the labor cost burden by some productivity advances, while the Mexican unit labor cost situation has improved directly at the labor cost side.

The results presented earlier on absolute unit labor costs in Table 1 have suggested that Brazil has particular advantages in the employment of unskilled labor. This interpretation would also be consistent with the observation that the productivity performance has been modest in Brazil (except in the iron and steel industry) in comparison to its major competitors, because high productivity growth is certainly not only to be associated with a more capital-intensive production, but also with increased reliance on a skilled labor force<sup>1</sup>.

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<sup>1</sup> The meaning of process innovation rather than product innovation has well been recognized, for example, in the automobile industry and the clothing industry (e.g. The Economist 1985, 16-17; Habbel 1985, 22; Morawetz 1981, 85-86).

In order to shore up the assessment of relative costs advantages for different labor skill requirements an analysis done by Kravis et al. (1982, 208-215) on the civil service has been taken up. Basically, due to the well-known peculiarity of measuring public asector output by input costs, Kravis et al. had calculated the PPPs for unskilled blue collar labor, skilled blue collar labor, skilled white collar labor, and professionals. Except Hong Kong and Taiwan all countries of interest here were included. Their findings for 1975 have been updated for the present purpose and are presented in Table 6. Brazil has the largest advantage in the unskilled labor and the skilled blue collar segment of the labor market. Korea and Mexico follow with some distance. It is remarkable, however, that the advantage is, relatively speaking, much lower with skilled white collar and professionals. Given that the public sector labor cost structure for different skills reflects the relative labor costs of different skills in the total labor market, simply because of its relative size, the conjecture presented above, that Brazil has a relative advantage in low skill labor production is strongly supported. This result is backed by some unpublished material on the Brazilian labor market (Macedo 1986, 20). The survey data assembled on behalf of the Union Bank of Switzerland (Gutmann and Kruck 1980; Enz 1982; Enz and Mäder 1985) suggest a similar conclusion. A sector study on the Brazilian automobile industry indicates further that the supply of unskilled labor is highly elastic, which explains why unskilled labor is cheap in Brazil (Röhrlich 1982, 162).

The final conclusion, thus, is that there are relative cost advantages in low skilled labor production processes in Brazil. It seems to have relative labor cost advantages particularly in the footwear and wearing apparel industries because both rely on labor-intensive, low-skill production processes. At the same time, as labor is relative to capital the more abundant factor, the iron and steel industry and the automobile (transport equipment) industry seem to have less advantages. In turn, the non-electrical industry appears to have labor cost disadvantages in Brazil.

Table 6 - Labor Costs in the Public Sector, Brazil and Other Countries, 1975-1985  
[U.S. = 1.00]

a Unskilled Blue Collar

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazil	0.12	0.14	0.13	0.13	0.13	0.11	0.14	0.13	0.08	0.07	NA
Korea	0.18	0.24	0.30	0.34	0.40	0.36	0.36	0.34	0.34	NA	NA
Mexico	0.36	0.33	0.30	0.32	0.35	0.40	0.44	0.27	0.19	0.21	NA
Germany	1.22	1.12	1.25	1.39	1.48	1.40	1.03	0.97	0.90	0.80	0.78
Japan	0.75	0.75	0.85	1.03	0.96	0.87	0.85	0.70	0.73	0.73	0.73
Spain	0.53	0.52	0.54	0.60	0.77	0.71	0.56	0.56	0.48	0.46	0.46

b Skilled Blue Collar

Brazil	0.16	0.17	0.16	0.17	0.17	0.14	0.16	0.16	0.10	0.09	NA
Korea	0.19	0.26	0.33	0.37	0.43	0.39	0.38	0.37	0.37	NA	NA
Mexico	0.34	0.31	0.28	0.30	0.33	0.37	0.41	0.25	0.18	0.20	NA
Germany	1.10	1.02	1.13	1.25	1.33	1.26	0.94	0.87	0.81	0.72	0.70
Japan	0.65	0.65	0.73	0.89	0.83	0.75	0.73	0.60	0.63	0.63	0.63
Spain	0.62	0.61	0.63	0.70	0.89	0.83	0.65	0.65	0.56	0.53	0.53

c White Collar

Brazil	0.62	0.64	0.62	0.63	0.63	0.54	0.63	0.61	0.38	0.34	NA
Korea	0.23	0.38	0.40	0.45	0.52	0.48	0.46	0.45	0.45	NA	NA
Mexico	0.45	0.41	0.37	0.39	0.43	0.48	0.54	0.33	0.24	0.26	NA
Germany	1.42	1.32	1.46	1.61	1.72	1.63	1.21	1.12	1.04	0.93	0.90
Japan	0.68	0.68	0.77	0.93	0.87	0.79	0.77	0.63	0.66	0.66	0.66
Spain	1.09	1.07	1.11	1.23	1.57	1.46	1.14	1.14	0.99	0.93	NA

Continued Table 6  
d Professionals

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazil	0.60	0.65	0.63	0.64	0.65	0.55	0.64	0.62	0.39	0.35	NA
Korea	0.25	0.34	0.43	0.48	0.56	0.51	0.49	0.48	0.48	NA	NA
Mexico	0.59	0.54	0.48	0.52	0.57	0.64	0.71	0.43	0.31	0.35	NA
Germany	1.53	1.43	1.58	1.75	1.86	1.76	1.32	1.22	1.13	1.01	0.98
Japan	1.29	1.29	1.45	1.77	1.65	1.49	1.45	1.19	1.25	1.25	1.25
Spain	1.02	1.01	1.04	1.16	1.47	1.37	1.07	1.07	0.92	0.87	0.87

(1) The 1975 figures are directly calculated from data presented in Kravis et al (1982) as ratio of the specific PPP and the average annual exchange rate. The original PPPs for 1975 have been updated in own calculations by the use of the deflator for the government services (government purchases in U.S.).

Sources: Kravis et al (1982), World Product and Income; International Financial Statistics Yearbook 1986; various national and international statistics. Own calculations.

#### IV. Major Results

The purpose of this study was to assess Brazilian labor costs in an international perspective. In order to get at a comprehensive picture selected manufacturing industries which differ characteristically in the extent of both the skill level of the labor employed and the capital-intensity have been looked at. From the conceptual and methodological discussion on labor cost analyses in Section II it had become clear that a comprehensive assessment would necessarily have to center around unit labor costs.

The empirical analysis in Section III has shown that Brazil had significant unit labor cost advantages in comparison to most competitors. Such advantages existed especially in industries that rely heavily on the employment of low-skilled labor. The advantage was largest in comparison to the next best competitors in the footwear industry and the wearing apparel industry. In contrast to the iron and steel industry and the automobile (transport equipment) industry those industries do not only em-



ploy a low-skilled labor force, but they produce labor- rather than capital-intensive. In non-electrical machinery industry, which depends distinctly on a skilled labor force, Brazilian unit labor costs were found to be relatively high.

However, a closer look at the unit labor cost trends for selected manufacturing industries revealed that the unit labor cost had risen substantially between 1975 and 1984. A more detailed analysis of the components that make up for unit labor cost trends showed that Brazil did not only have strong labor cost increases but also a poor record in terms of productivity growth, with the iron and steel industry being an exception. In contrast, in the all manufacturing industry, Korea, Taiwan, and Japan had gained, or at least held their position, because the productivity increases have been large enough to match increased wage bills. The same applied to the iron and steel industry. In the motor vehicle industry the labor cost burden for Brazilian producers has even become more severe as the productivity performance has been particularly poor in this industry. In comparison, Taiwan and Korea were able to reduce the labor cost burden by some productivity advances, while the Mexican unit labor cost situation has improved directly at the labor cost side.

The study has also made clear that the strong labor cost increases in Brazil had not been driven by enhanced indirect wage claims: the relation of indirect and direct wages remained fairly constant. This result differs markedly with recent developments in industrial countries, notably in the Federal Republic of Germany. In a supplementary analysis the previous assessment with respect to labor skills presented above could be confirmed. It was found that the costs of unskilled and blue collar labor, in contrast to the costs of white collar and professional labor, were particularly low in Brazil. In turn, the relative scarcity of skilled labor in Brazil may explain why the productivity performance has generally been so poor in comparison to major competitors from Asia and industrialized countries.

## Appendix

Table A1 - National Price Levels for Selected Output Categories, Brazil and Other Countries, 1975-1984 (1)

[U.S. = 1.00]

## a Manufacturing Goods (Tradables)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	1.05	1.02	1.05	1.03	1.01	0.95	0.67	0.63	0.51	NA
Hong Kong	0.73	0.77	0.80	0.79	0.82	0.87	0.79	0.76	0.68	0.67
Korea	0.53	0.58	0.61	0.63	0.68	0.64	0.60	0.59	0.58	0.55
Mexico	0.82	0.75	0.65	0.69	0.49	0.85	0.98	0.62	0.62	0.73
Taiwan	0.55	0.54	0.52	0.50	0.54	0.51	0.56	0.52	0.51	0.51
Germany	1.26	1.20	1.30	1.43	1.56	1.48	1.11	1.03	1.04	0.90
Japan	0.95	0.91	0.99	1.19	1.07	0.92	0.90	0.76	0.80	0.78
Spain	0.92	0.87	0.87	0.98	1.18	1.15	0.94	0.84	0.74	NA

## b Transport Equipment

Brazil	1.11	1.05	1.06	1.10	0.88	0.79	0.95	1.04	0.70	0.58
Korea	0.70	0.69	0.66	0.76	0.81	0.95	1.02	0.83	0.78	0.76
Taiwan	0.55	0.51	0.49	0.51	0.50	0.56	0.49	0.45	0.44	0.43
Germany	1.16	1.10	1.08	1.28	1.22	1.29	0.94	0.88	0.84	0.76
Japan	1.15	1.10	1.13	1.33	1.08	1.07	1.00	0.86	0.88	0.86

## c Iron and Steel

Brazil	0.76	0.73	0.70	0.67	0.56	0.45	0.47	0.45	0.27	0.25
Korea	0.42	0.40	0.42	0.42	0.44	0.41	0.40	0.38	0.35	0.33
Taiwan	0.55	0.53	0.52	0.61	0.65	0.66	0.52	0.47	0.45	0.44
Germany	1.38	1.38	1.34	1.43	1.41	1.35	1.07	1.11	0.99	0.90
Japan	1.32	1.33	1.43	1.74	1.52	1.47	1.45	1.25	1.22	1.25

## d Non-electrical Machinery

Brazil	0.93	0.90	0.90	0.90	0.78	0.66	0.82	0.79	0.56	0.53
Korea	0.98	0.98	0.97	0.93	0.94	0.77	0.71	0.67	0.63	0.60
Taiwan	0.55	0.51	0.48	0.50	0.51	0.50	0.44	0.40	0.38	0.37
Germany	1.28	1.24	1.32	1.47	1.52	1.45	1.12	1.04	1.00	0.86
Japan	0.72	0.67	0.71	0.85	0.76	0.68	0.64	0.54	0.54	0.53

Continued Table A1  
e Footwear

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	0.76	0.79	0.74	0.69	0.60	0.38	0.35	0.35	0.20	0.21
Hong Kong	0.73	0.70	0.73	0.69	0.58	0.59	0.57	0.59	0.52	0.55
Korea	0.25	0.27	0.27	0.28	0.31	0.28	0.28	0.27	0.25	0.25
Taiwan	0.55	0.53	0.51	0.56	0.59	0.57	0.55	0.53	0.53	0.57
Germany	1.26	1.22	1.36	1.51	1.52	1.51	1.25	1.20	1.12	1.05
Japan	0.85	0.85	0.97	1.19	1.01	0.98	1.03	0.92	0.94	0.98

f Wearing Apparel

Brazil	1.03	1.07	0.95	0.92	0.87	0.75	0.88	0.91	0.55	0.51
Hong Kong	0.73	0.71	0.74	0.72	0.68	0.71	0.67	0.68	0.60	0.66
Korea	0.37	0.41	0.45	0.48	0.56	0.53	0.52	0.51	0.48	0.50
Taiwan	0.55	0.54	0.54	0.57	0.60	0.61	0.60	0.58	0.58	0.63
Germany	1.26	1.22	1.32	1.52	1.64	1.61	1.30	1.22	1.17	1.14
Japan	0.90	0.96	1.08	1.37	1.34	1.28	1.29	1.15	1.22	1.33

(1) Own calculation as ratio of industry specific PPP (Appendix Table A2) and the average annual exchange rate.

Sources: International Monetary Fund, International Financial Statistics Yearbook 1986; Appendix Table A2. Own calculations.

Table A2 - Purchasing Power Parities (PPPs) for Selected Output Categories, Brazil and Other Countries, 1975-1984 (1)

[U.S. = 1.00]

## a All Manufacturing (Tradables)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	8.49	11.04	14.77	18.68	27.25	50.18	61.72	113.94	294.18	NA
Hong Kong (2)	3.61	3.75	3.72	3.72	4.08	4.33	4.44	4.62	4.95	5.27
Korea	257.00	282.70	295.55	305.83	331.53	390.64	411.20	434.33	449.75	439.47
Mexico	10.28	11.51	14.60	15.73	17.17	19.53	24.12	34.95	74.32	122.33
Taiwan (2)	20.93	20.55	19.79	18.02	19.48	18.39	21.22	20.78	20.56	20.52
Germany	3.10	3.01	3.01	2.88	2.85	2.70	2.51	2.51	2.64	2.57
Japan	282.25	270.96	265.32	251.20	234.27	208.87	197.58	189.11	189.11	186.29
Spain	52.87	58.16	66.09	75.08	79.31	82.48	86.71	91.99	106.27	NA

## b Iron and Steel (3)

Brazil	6.22	7.80	9.91	12.08	15.06	23.47	43.69	80.63	155.72	453.51
Korea	204.00	198.23	204.00	202.33	212.74	250.36	270.74	277.84	272.82	268.80
Taiwan (2)	20.93	20.34	19.82	21.96	23.32	23.92	19.64	18.62	18.03	17.61
Germany	3.40	3.46	3.10	2.87	2.57	2.45	2.41	2.69	2.51	2.55
Japan	392.00	395.69	385.06	366.30	333.20	333.45	319.41	310.23	290.46	297.46

## c Non-electrical Machinery

Brazil	7.63	9.57	12.69	16.14	21.11	34.82	76.67	141.93	327.44	975.55
Korea	472.00	476.45	467.82	452.50	454.26	468.83	480.69	488.37	485.33	479.78
Taiwan (2)	20.93	19.55	18.34	17.99	18.25	17.98	16.82	15.97	15.49	15.06
Germany	3.14	3.11	3.06	2.96	2.79	2.63	2.52	2.52	2.55	2.54
Japan	214.00	199.87	191.27	178.63	165.73	153.68	141.79	134.83	129.37	125.81

## d Transport Equipment

Brazil	9.04	11.24	14.99	19.77	23.71	41.30	88.44	187.32	403.30	1074.06
Korea	338.00	334.84	320.21	368.23	391.25	574.14	592.52	606.86	606.91	608.76
Taiwan (2)	20.93	19.56	18.73	18.38	18.06	20.21	18.66	17.84	17.58	17.33
Germany	2.85	2.77	2.50	2.57	2.23	2.34	2.13	2.14	2.14	2.16
Japan	342.00	326.00	303.00	280.83	236.59	243.62	220.45	213.75	207.85	204.10

Continued Table A2

## e Wearing Apparel

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Brazil	8.35	11.40	13.53	16.63	23.41	39.55	81.46	164.28	317.72	959.68
Hong Kong (2)	3.61	3.47	3.44	3.38	3.42	3.52	3.74	4.12	4.39	5.13
Korea	180.00	200.77	218.33	233.04	269.23	319.68	351.76	370.67	375.65	403.97
Taiwan (2)	20.93	20.53	20.54	20.56	21.65	22.10	22.85	23.26	23.36	25.24
Germany	3.11	3.07	3.07	3.05	3.00	2.94	2.94	2.97	2.97	3.25
Japan	267.00	284.97	289.25	288.46	294.38	288.36	285.34	286.78	290.22	315.92

## f Footwear

Brazil	6.19	8.37	10.45	12.43	16.19	20.00	32.49	63.63	115.71	394.50
Hong Kong (2)	3.61	3.44	3.41	3.21	2.90	2.92	3.21	3.61	3.79	4.28
Korea	125.00	128.57	128.44	136.65	151.27	173.01	191.18	196.43	190.63	198.25
Taiwan (2)	20.93	20.13	19.59	20.22	21.23	20.38	20.66	21.07	21.45	23.06
Germany	3.09	3.06	3.15	3.04	2.78	2.74	2.83	2.90	2.86	2.99
Japan	251.00	251.01	260.21	251.00	221.90	221.08	228.03	229.81	224.33	231.81

## g Gross Domestic Product

Brazil	6.30	6.50	6.60	13.60	19.50	30.50	55.10	101.67	239.27	707.23
Hong Kong	3.61	3.71	3.59	3.51	3.65	3.74	3.76	3.87	3.75	4.11
Korea	188.76	217.80	232.32	251.68	271.04	321.94	339.86	341.80	338.95	339.81
Mexico	7.38	8.64	10.83	11.84	13.00	14.67	17.04	25.78	47.74	76.11
Taiwan	20.93	20.93	21.31	20.55	21.29	22.72	23.22	21.77	22.14	21.44
Germany	2.90	2.86	2.78	2.69	2.54	2.46	2.33	2.29	2.28	2.23
Japan	273.05	281.72	276.57	265.15	252.01	242.61	228.44	218.49	212.16	206.44
Spain	42.48	46.83	54.69	61.34	63.77	57.40	69.92	74.56	80.42	85.95

(1) Generally the industry specific PPPs of 1975 were taken from Kravis et al (1982). The data series were updated in own calculations by taking recourse to appropriate price indexes. While the original PPPs are based on prices at the final consumption level, wholesale price indexes seemed to be the appropriate basis for updating in the present context, because they reflect more properly the market situation as seen from the producers point of view. We have taken wholesale price indexes wherever they were available.

(2) In 1975 the PPPs for the GDP were used (Summers and Heston 1984). The data series were updated in own calculations by taking recourse to appropriate price indexes.

(3) The PPPs for nonresidential capital formation were used.

Sources: Kravis et al (1982), World Product and Income; various national statistics. Own calculations.

Table A3 - Indirect Labor Costs in Selected Manufacturing Industries, Brazil and Other Countries, 1975-85 (1)

## a All Manufacturing Industry

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Brazil	35.0	35.1	35.2	35.1	35.7	35.7	35.7	37.7	37.7	37.7	37.7
Hong Kong	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	11.0	11.0	11.0
Korea	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	20.0	20.0	20.0
Mexico	33.3	32.4	33.1	34.6	34.5	36.2	39.5	38.2	49.5	45.9	NA
Taiwan	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	5.0	5.0	5.0
Germany	56.1	60.2	61.8	64.5	66.8	68.7	70.6	72.7	74.4	75.9	77.3
Japan	14.3	15.0	16.0	17.5	16.7	15.8	16.9	17.1	16.8	16.8	16.8
Spain	50.5	50.0	45.0	39.9	40.2	40.0	39.9	40.0	39.9	39.9	40.1
USA	31.5	32.8	33.6	34.5	35.4	36.0	38.6	37.4	35.8	35.8	36.2

## b Iron and Steel Industry

Brazil	35.4	36.7	35.8	35.7	36.5	36.5	36.5	38.5	38.5	38.5	38.5
Korea	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	13.0	13.0	13.0
Mexico	38.9	33.1	33.0	36.7	36.5	39.4	42.8	49.5	51.7	48.8	NA
Taiwan	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	5.0	5.0	5.0
Germany	65.8	67.8	68.1	71.5	73.9	77.7	78.6	80.6	84.1	84.4	84.7
Japan	16.6	17.1	18.5	21.8	19.6	19.4	20.4	18.1	19.9	22.0	22.0
Spain	NA	NA	45.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
USA	47.5	47.9	47.3	44.4	45.5	53.3	51.1	70.2	64.0	56.1	60.8

## c Motor Vehicle Industry

Brazil	35.6	36.1	35.6	34.3	34.7	34.7	34.7	36.7	36.7	36.7	36.7
Korea	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	16.0	16.0	16.0
Mexico	47.8	56.4	52.3	54.9	49.3	47.4	48.7	47.5	70.2	70.4	NA
Taiwan	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	15 - 20	8.0	8.0	8.0
Germany	66.1	70.8	73.6	75.7	80.2	83.4	87.2	89.6	92.3	92.7	94.1
Japan	13.3	14.3	14.9	17.9	18.5	15.6	15.4	16.5	17.8	16.2	16.2
Spain	NA	NA	45.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
USA	46.6	44.8	45.9	49.0	51.0	65.4	56.8	60.6	49.4	48.9	48.7

(1) Ratio of indirect hourly wages to direct hourly wages.

Sources: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data. Own calculations.

Table A4 - Indirect Labor Costs in Selected Manufacturing Industries, Brazil and Other Countries, 1983-1985 (1)

		Transport Equipment Industry	Non- electrical Machinery Industry	Wearing Apparel Industry	Footwear Industry
Brazil	1983	36.7	38.0	34.9	34.9
Hong Kong	1983	NA	NA	10.0	9.0
	1984	NA	NA	10.0	9.0
Korea	1983	16.0	17.0	14.0	19.0
	1984	16.0	17.0	14.0	19.0
Mexico	1983	NA	45.2	NA	NA
	1984	NA	41.3	NA	NA
Taiwan	1983	8.0	5.0	3.0	3.0
	1984	8.0	5.0	3.0	3.0
Germany	1983	90.0	75.5	62.5	63.4
	1984	90.3	77.2	64.2	65.6
	1985	91.6	78.9	65.8	67.9
Japan	1983	17.8	16.7	13.2	14.1
	1984	16.2	16.5	12.9	14.9
	1985	16.2	16.5	12.6	14.9
Spain	1983	40.0	40.0	40.0	40.0
USA	1983	44.1	37.9	25.6	28.3
	1984	44.9	37.0	23.7	30.1
	1985	45.0	37.4	24.1	30.5

(1) Sources: Ratio of indirect hourly wages to direct hourly wages. U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data. Own calculations.

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