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This paper presents estimates of purchasing power parities, real output and labour productivity in a binary comparison of medium and large scale manufacturing between Indonesia and the USA in the benchmark year 1987. It applies an industry of origin approach to international comparisons, comparing products and their unit values from the censuses of both countries. The 1987 PPP for manufacturing as a whole was 1200 rupiahs to the US dollar. Gross value added per person employed in 1987 was 10% of that in the USA. Detailed productivity comparisons were made for fifteen branches of manufacturing. Using national time series, the 1987 benchmark was extrapolated backwards and forwards to derive productivity comparisons for the period 1975-1990. 1975-1980 was a period of catch-up with labour productivity increasing from 7.7 to 10.6 per cent of the US level. Between 1980 and 1990 catch-up stagnated. Relative productivity remained unchanged in spite of considerable productivity growth in Indonesia.

1. Introduction

Starting from a low level of industrialisation in 1966, Indonesia has experienced a very rapid and sustained process of industrialisation since then. The growth rates for manufacturing were among the highest in the East Asian region. Between 1965 and 1980 value added grew by 12.5 per cent per annum, between 1980 and 1990 by 12 per cent per annum (World Bank, 1992). In all but five years since 1970, Indonesia has had double digit manufacturing growth (Hill, 1992). Of the ASEAN countries Indonesia had the lowest industrial output in 1966. By 1984 it had the largest output, contributing 30 per cent of the region's manufacturing production. Nevertheless, in terms of manufacturing value added per capita and share of manufacturing in national income, Indonesia is still one of the least industrialised countries of South and East Asia (Poot, Kuyvenhoven and Jansen, 1990; Hill, 1987, 1992). In 1989, after more than two decades of rapid growth, the share of manufacturing (including the large petroleum refining and natural gas sector) was only 18.4 per cent of GDP at market prices (*National Income of Indonesia 1984-1989*).

The success story of Indonesian industrialisation has been analysed in several recent publications (Hill, 1988, 1990a, 1990b, 1992; McCawley 1981; Poot, Kuyvenhoven and Jansen, 1990; Roepstorff, 1985; Soehoed, 1988; Thee, 1989, 1990, 1992). A number of the most important characteristics will be briefly recapitulated here.

In the sixties growth of Indonesian manufacturing was concentrated in traditional light industries such as textiles and processing of agricultural products (food, beverages and tobacco products). The industrialisation strategy was heavily inward looking, relying on a plethora of tariff and non-tariff barriers. Under the post 1966 new order (*orde baru*), the economy was opened up to foreign investment, though investment, both foreign and domestic remained highly regulated. In addition to foreign investment there was a substantial inflow of foreign aid. The first phase of easy import substitution in consumer goods industries lasted till the mid seventies (Roepstorff, 1985).

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In the seventies soaring oil revenues created an oil boom, which provided the government with ample funds for large scale industrial investment. The government, alone and in joint ventures with foreign firms, invested heavily in resource based capital intensive activities such as steel, aluminum, fertilisers, oil refining, LNG, petrochemicals and cement. The share of intermediate and capital goods industries in total value added of medium and large scale manufacturing including oil and gas refining increased from 20 per cent in 1970 to 57 per cent at the end of the decade (Poot et. al, 1990; Hill, 1987, 1992). There was also rapid expansion of electronics (followed by stagnation in the eighties) and transport equipment, which benefitted from extreme protection. In spite of extensive government involvement in the economy, consumer goods industries were primarily left to private enterprise. Thee and Yoshihara (1987) speak of upstream socialism, down stream capitalism. Oil exports dominated exports, Dutch disease effects hampering non-oil exports.

The collapse of oil prices in 1982, however, gave rise to a policy switch. The government embarked on a policy of retrenchment, fiscal austerity, devaluation and gradual liberalisation. The approach became more outward looking. The rupiah was first devalued in April 1983. From May 1986 onwards there were a series of important reforms aimed at liberalising the economy, redressing the anti-export bias, reducing restrictions on imports, stimulating foreign investment and simplifying procedures for approvals of investment. The rupiah was devalued by 31 per cent in september 1986 and after that there was a managed gradual depreciation of the currency against the falling US dollar (Thee, 1992, table 1).

Before 1982 manufactured exports were almost non-existent. In 1982 manufactured exports accounted for 11 per cent of total exports. Since then, there has been very rapid growth in industrial exports, particularly in textiles, wood products and furniture. By 1989 manufactured exports accounted for 50 per cent of total exports (Thee, 1992). Nevertheless, the manufacturing sector is still highly protected and predominantly inward looking. In terms of exports per capita and shares of exports in manufactured output Indonesia was far behind Asian economies such as Korea, Thailand, Malaysia and the Philippines (Poot et. al, 1990). Liberalisation of the economy turns out to be a slow and painful process.

Most observers agree that Indonesia differs from resource poor Asian NICs, both old and new, in its resource richness. Besides having a comparative advantage in labour intensive industries due to very low wages, Indonesia has a comparative advantage in resource intensive production (Poot et. al., 1990). A final characteristic of Indonesian manufacturing is the existence of an enormous small scale and cottage industry, accounting for a modest part of output (14.9 per cent in 1986), but creating most of manufacturing employment (3.3 million workers or 56.8 per cent of the manufacturing employment in 1986, see table 3).

Summing up, Indonesia has a booming industrial sector, which has developed in a highly protective environment. In recent years the inefficiencies in this sector have become more manifest and Indonesia has been moving in the direction of a more outward looking pattern of industrialisation. Protection is still high but has declined significantly in many sectors.

Comparisons and references to other economies are continuously being made in the Indonesian industrialisation literature. In spite of the differences mentioned above, the models for Indonesia are Korea, Taiwan, Singapore and Hong Kong and the second generation of Asian industrialising countries, Thailand, Malaysia and to some extent the Philippines. It is difficult, however, to make an assessment of Indonesian economic performance in manufacturing in comparison with other countries, because so far few systematic comparisons of levels of real output and productivity have been made.

This paper presents results of a study on real output and labour productivity in Indonesian

manufacturing. It focuses on a binary comparison of real output and labour productivity between the Indonesia and the USA in establishments employing 20 or more persons for the benchmark year 1987. The study is part of a larger ongoing research project on international comparisons of output and productivity (ICOP) being carried out at the University of Groningen.[2] It applies a standardised industry of origin approach to international comparisons, developed within the ICOP project (see section 2). The main characteristic of this approach is that it does not take exchange rates as the appropriate conversion factor for international comparisons, but derives specific purchasing power parities (PPPs) for different industries, branches and sectors of the economy. The binary comparison with the USA subsequently enables one to make indirect comparisons with other countries, included in the ICOP project such as South Korea, India, Australia and Japan.

At this stage the study focuses on labour productivity, the oldest and most simple productivity measure. It measures the distance between labour productivity in Indonesia and labour productivity in the USA, the technologically most advanced industrial economy.[3] In 1987 gross value added per person engaged in Indonesian medium and large scale manufacturing was 10% of that in the USA. It should be stressed here that in itself low relative labour productivity implies no criticism of Indonesian economic performance. It is only to be expected that in a labour surplus low wage economy following lines of comparative advantage, labour productivity will tend to be low. Nevertheless the study of trends in comparative labour productivity is relevant to the study of economic development.

In the first place, the level of per capita income depends on the combination of the proportion of the population actively employed and the real output per person employed. In the short run it may well be advisable to choose for an increase in employment rather than the most rapid increase in labour productivity. In the longer run, however, an increase in per capita incomes is inconceivable without an increase in real labour productivity. A bridging of the gap between per capita incomes in rich and poor countries implies a convergence in real labour productivities. For this reason I will not only present results for the benchmark year 1987, but will also extrapolate the benchmark comparison forwards and backwards in time, using national time series. In the second place, comparisons of labour productivity are relevant for the study of competitiveness. Along with labour costs, labour productivity is one of the important determinants of competitiveness and comparative advantage.

Main results

This section provides an overview of the main results of this study.[4] They will be discussed in more detail in sections 4 to 7 of this article.

The Purchasing Power Parities (PPPs) derived in this study from the detailed comparisons of products and unit values from the industrial censuses, are generally quite a bit lower than the exchange rate. The PPP for manufacturing as a whole (geometric average) is 1200

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[2] The ICOP project now covers some nineteen economies including five Asian ones. Most comparisons have been made for the manufacturing sector, but there are also comparisons involving agriculture, mining, construction and services (see Maddison and Van Ark, 1993; van Ark, 1993).

[3] Contrary to what is sometimes thought, labour productivity in the USA in manufacturing as a whole is still well ahead of that of Japan (see Van Ark and Pilat, 1993; Szirmai and Pilat, 1990b).

[4] The present results differ from previous estimates (Szirmai, 1993) in several respects. Matches for several industries have been improved. Estimates for oil refining have been included. Use has been made of Indonesian real output series based on census data, rather than national accounts data. New adjustments have been made for effects of hours worked, size of establishments, small scale manufacturing and structure of output.

rupiahs to the US dollar, compared to an exchange rate of 1644 rupiahs to the dollar in 1987. Thus, application of PPPs as conversion factors will result in higher productivity ratios for Indonesia, than found in studies using the exchange rate as a conversion factor, such as e.g. Hill (1990a, table 8).

Gross value added per person employed in Indonesian medium and large sized manufacturing as a whole is 10 per cent of that in the USA. Lowest relative labour productivity is found in branches such as food manufacturing (4.5% of value added per person in the USA), beverages (4.9%), tobacco products (3.9%) and other manufacturing (4%). Highest labour productivity vis à vis the USA is found in leather products and footwear (30.5%), basic and fabricated metal products (25.2%) and electrical machinery and equipment (21%). Intermediate levels of relative productivity are found in branches such as textile mill products (12.7%), wearing apparel (17.1%), machinery and transport equipment (14%), wood products, furnitures and fixtures (13.9%) and chemical products (13.4%). If one includes small scale and cottage manufacturing in the comparison, productivity drops to 4 per cent of the US level.

Relative labour productivity for medium and large scale manufacturing as a whole increased from 7.7 to 10.6 per cent of the US level between 1975 and 1980. In the 1980s relative labour productivity remained by and large unchanged, thus providing an interesting example of rapid growth of production and productivity without catch-up. Productivity growth in separate branches of Indonesian manufacturing was higher than aggregate productivity growth, as there was a shift to more labour intensive lines of production in the eighties.

Comparisons between Indonesia and other Asian economies for which ICOP comparisons have been made, show that from 1975 to 1986 Indonesia had somewhat higher relative labour productivity in manufacturing than India, but substantially lower labour productivity than South Korea, a country which often stands model for industrialisation processes in Asia.

2. Methodology

The ICOP methodology has been described in detail in several publications (see van Ark, 1993, see also Maddison and van Ark, 1988; Szirmai and Pilat, 1990a). Here, I provide only a brief outline of the methods used.

The primary sources used in this study are the US 1987 *Census of Manufactures* and the Indonesian 1987 *Survey of Large and Medium Scale Manufacturing (Statistik Industri)*. These sources provide information on product quantities and corresponding gross output values, making it possible to derive unit values for large numbers of products.

The basic approach is to make matches of comparable products (e.g. Portland cement, coffee beans, Kraft paper) or product groups (e.g cotton yarns, alkaline detergents) from the two censuses and to calculate unit value ratios for each of the matches. The matches are made in sample industries, which are made up out of comparable industries selected from the two censuses. The sample industries consist of one or more four digit industries from the US census and one or more five digit industries from the Indonesian Survey. For example the sample industry 'textile yarn and woven fabrics' consists of 9 four digit industries on the US side and 3 five digit industries on the Indonesian side.

The unit value ratios are used to calculate PPPs in a number of steps. First all the unit value ratios are aggregated at sample industry level using output quantities of either countries as weights:

$$PPP_j^{XU(X)} = \frac{\sum_{i=1}^{s} (Q_{ij}^X * P_{ij}^X)}{\sum_{i=1}^{s} (Q_{ij}^X * P_{ij}^U)} \qquad PPP_j^{XU(U)} = \frac{\sum_{i=1}^{s} (Q_{ij}^U * P_{ij}^X)}{\sum_{i=1}^{s} (Q_{ij}^U * P_{ij}^U)}$$

where

$PPP_j^{XU(X)}$	is the purchasing power parity of the Rupiah against the US dollar in sample industry j, at quantity weights of Indonesia
$PPP_j^{UU(U)}$	is the purchasing power parity of the Rupiah against the US dollar in industry j, at quantity weights of the USA
i= 1...s	is the sample of matched items

Next, the sample industry PPPs are aggregated at branch level by taking the weighted average of sample industry PPPs using gross value added as weights:

$$PPP_k^{XU(U)} = \frac{\sum_{j=1}^{o} [GVA_j^{U(U)} * PPP_j^{XU(U)}]}{\sum_{j=1}^{o} GVA_j^{U(U)}} \qquad PPP_k^{XU(X)} = \frac{\sum_{j=1}^{o} GVA_j^{X(X)}}{\sum_{j=1}^{o} [GVA_j^{X(X)} / PPP_j^{XU(X)}]} \qquad (2)$$

where

$GVA_j^{X(U)}$	is gross value added in US sample industry j in dollars
$GVA_j^{X(X)}$	is gross value added in Indonesian sample industry j in Rupiahs
k	branch of industry
j=1..o	sample industries belonging to a branch k

Manufacturing branches in this study consist of one or more ISIC three digit major sectors. In three instances, wood products, paper products and non-metallic mineral products a branch coincides with a two digit ISIC division (see table 1).

Finally the branch PPPs can be aggregated into PPPs for total manufacturing, using branch value added weights according to equation 2. The rationale behind these weighting procedures is to ensure that unit value ratios in large sample industries and branches receive heavier weights than in small ones (see van Ark, 1993).[5]

At each level of aggregation - sample industry, branch and total manufacturing - the PPPs can be used to convert value added into the currency of the other country for purposes of real value added comparisons. In theory it would be preferable to calculate PPPs for both inputs and outputs, thus achieving double deflated comparisons. In practice there is insufficient

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[5] Sometimes it is possible to improve the coverage by making a few matches outside the sample industries. In those cases we use all matches within a branch of industry, including the few non-sample industry matches to calculate a PPP for the non-sampled part of a branch, which receives the value added weight of the non-sampled part of the branch in calculating the overall branch PPP.

information on quantities and values of inputs. Therefore ICOP studies have generally applied output PPPs to value added.

It should be stressed that in binary comparisons one gets two PPPs at every level of aggregation, one at quantity weights of country X, the other at quantity weights of country U. If, as is often the case when one compares a developing country with an advanced industrial economy, the production structure is very different, the PPPs may differ quite substantially. We use the Fisher average of the two PPPs as a summary measure.

In this study matches have been made for 32 sample industries representing 14 major branches of manufacturing. The coverage ratios by branch of manufacturing are reproduced in table 1. (For sample industry coverage ratios the reader is referred to Annex table A1.) In total 214 matches have been made representing 61 per cent of total value of manufacturing gross output in Indonesia and 20 per cent in the USA. Especially on the US side, coverage is still low in rubber and products, electrical machinery and equipment and non-metallic mineral products. This is not so much due to low coverage within sample industries, but rather to the fact that in these branches only a few sample industries could be found in which adequate matches could be made.

TABLE 1
Coverage Ratio: Gross Value of Matched Output as % of Total Gross Value of Output in Branches of Manufacturing

ISIC	Branch and Sample Industries within the Branch	Indonesia 1987	USA 1987	Number of Matches
311/12	Food manufacturing (a)	51.9	28.9	41
313	Beverages	32.7	27.5	1
314	Tobacco and tobacco products	94.8	91.5	4
321	Textile mill products	60.3	49.2	13
322	Wearing Apparel	85.9	36.1	20
323/4	Leather Products and Footwear	65.0	57.1	5
33	Wood products, furniture and fixtures	86.9	19.2	10
34	Paper products, printing & publishing	37.3	12.5	13
351-3	Chemicals, petroleum & coal products (a)	70.3	31.0	36
355/6	Rubber and plastic products	10.3	2.6	7
36	Non-metallic mineral products	50.6	6.5	4
37 & 381	Basic and fabricated metal products (a)	61.2	17.9	34
382 & 384	Machinery & transport equipment	29.8	16.0	15
383	Electrical machinery & equipment	25.2	4.6	11
	Total Manufacturing	60.7	19.6	214

Note: (a) including matches outside sample industries.

3. Data Sources and Problems

Data Sources and adjustments

The Indonesian Census of Manufacturing is part of the quinquennial *Economic Census*. The 1986 census for medium and large scale manufacturing actually refers to 1985, the census for small scale industry (establishments with 5 - 19 persons engaged) and for home industry (1 - 5 persons engaged) refers to 1986. The census for medium and large scale manufacturing contains a listing of quantities and output values of products. The census for small scale and home industries does not provide such information, so matches can only be made for medium and large scale manufacturing. Home industry statistics are only available by province and are not broken down by branch of manufacturing.

In intercensal years, there is an annual survey of medium and large scale manufacturing, aiming at complete coverage of all establishments. The primary source for this article was the *Statistik Industri, 1987* (Jakarta, 1989). Volume II of this issue of the survey lists about 4200 products, with some double counting involved, as certain products are listed more than once and in more than one industry. For the USA, my source was the *1987 Census of Manufactures*, which lists approximately 11000 products.

The basic data on value added and employment derived from the 1987 US census and the 1987 Indonesian survey of manufactures are summarised in table 2. The table also contains new estimates for Indonesia on annual hours worked by branch of manufacturing derived from labour force surveys (see Annex Table A2).

For the comparison between the Indonesian survey and the US census the following points are of relevance:

1. Value added in the US census is a rather gross concept, including the cost of purchased services from outside the manufacturing sector. Indonesian census value added has been readjusted to the US concept by adding the cost of 'non industrial services received'.
2. The gross value of output in the Indonesian product listings includes indirect taxes and subsidies, the gross value of output in the US census is at factor cost. This means that unit value ratios are biased upwards. At four digit industry level, however, indirect taxes are given separately in the Indonesian survey. Using sample industry proportions, one can thus readjust sample industry PPPs, so as to exclude the effects of indirect taxes and subsidies.
3. As the Indonesian survey data refer only to establishments with 20 or more persons engaged, the US data on gross value of output, value added and employment in sample industries and branches were readjusted to a similar basis.
   The output values in the US product listings are not broken down by size. This implies that the unit value ratios are based on output from all establishments in the US, and on output from medium and large sized establishments in Indonesia. As small scale manufacturing accounts for a modest proportion of output in the US (see Annex table A3), this discrepancy does not lead to serious biases in the calculation of the PPPs.
4. In the Indonesian survey, head offices and auxiliary establishments are explicitly included in the establishments covered by the census. Employment figures by industry in the US census exclude head office and auxiliary employment. US branch employment figures were adjusted to include head office and auxiliary employment, using information from the general summary volume of the census (Chapter 2, table 6). Head office and auxiliary

TABLE 2
Census Value Added, Employment and Hours Worked, Indonesia and the USA, 1987
(large and medium size manufacturing)

	Indonesia				USA			
	Gross Value Added at factor cost (mill. Rps.) (a)	Gross Value Added in Branch as % of Total	Employment (b) (persons)	Average Annual Hours Indonesia	Gross Value Added at factor cost (mill. US$)	Gross Value Added in Branch as % of Total	Employment (b) (persons)	Average Annual Hours USA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 Food Manufacturing (311/12)	1,224,844.9	9.1	325,684	2,039	95,348.5	8.7	1,319,572	1,893
2 Beverages (313)	130,675.9	1.0	11,660	2,039	21,960.5	2.0	165,928	1,866
3 Tobacco Products (314)	1,454,326.9	10.8	201,679	2,039	14,251.5	1.3	63,100	1,853
4 Textile Mill Products (321)	1,261,880.7	9.4	323,930	2,219	24,808.2	2.3	680,717	2,053
5 Wearing Apparel (322)	198,816.8	1.5	78,979	2,219	29,808.0	2.7	1,029,300	1,794
6 Leather Products and Footwear (323/324)	65,355.4	0.5	12,842	2,219	4,155.1	0.4	128,000	1,843
7 Wood Products, Furniture & Fixtures (331/2)	1,499,162.3	11.1	209,982	2,245	42,613.5	3.9	1,045,400	1,964
8 Paper Products, Printing & Publishing (341/2)	423,703.8	3.1	61,667	2,202	129,487.5	11.8	1,952,600	1,847
9 Chemicals Products (351-53) (a)	3,396,130.8	25.2	120,095	2,202	134,235.2	12.2	1,132,641	1,922
of which petroleum refining	2,049,293.1	15.2	14,801		18,518.3	1.7	153,6000	
10 Rubber and Plastic Products (355/6)	536,934.6	4.0	148,696	2,202	42,080.3	3.8	811,200	1,986
11 Non-metallic Mineral Products (361-69)	545,257.5	4.1	81,362	2,202	29,508.3	2.7	479,700	2,003
12 Basic & Fabricated Metal Products (371-81) (b) (d)	1,641,070.9	12.2	88,078	2,202	113,480.7	10.3	2,048,600	1,956
13 Machinery & Transport Equipment (382/4)	820,861.9	6.1	81,536	2,202	243,300.9	22.1	3,684,530	1,905
14 Electrical Machinery & Equipment (383) (d)	226,500.0	1.7	29,539	2,202	93,385.1	8.5	1,636,400	1,877
15 Other Manufacturing Industries (385-90)	52,074.8	0.4	16,118	2,202	82,727.3	7.5	1,321,012	1,885
Total Manufacturing (incl. oil)	13,477,597.1	100.0	1,791,847	2,178	1,101,150.7	100.0	17,498,700	1,909
Total Manufacturing, (excl. oil and gas)	11,428,304.1		1,777,046		1,082,632.4		17,345,100	

Source: Indonesia, col. 1 to 3 from Statistik Industri 1987, Vol. I, Biro Pusat Statistik, Jakarta, 1989, tables 9, 12 and 13. Figures for petroleum refining from BPS, Mining Statistics of Petroleum and Natural Gas of Indonesia, 1987/88. Col. 4 from Annex table A2. Original Source: BPS, Keadaan Buruh/Pekerja di Indonesia, 1987, Keadaan Angkatan Kerja di Indonesia, 1987, 1990. USA, Col. 5 to 7 from US Dept. of Commerce, US 1987 Census of Manufactures, General Summary, Washington DC, 1990, table I.3. Head office employment from table II.6. Col. 8: Hours paid from BLS, Bulletin 2370, adjusted to hours worked with ratios from BLS, Monthly Labor Review various issues.

Notes: (a) adjusted to US census concept, by adding cost of non-industrial services received.
(b) excluding non-paid family workers, including head office and auxiliary employment.

employment figures are not broken down by size. I have assumed that all head office and auxiliary employment in the USA can be allocated to medium and large sized manufacturing establishments.

5. The Indonesian manufacturing survey provides no data on oil refining and liquid natural gas. Data for oil refining have been taken from *Mining Statistics of Petroleum and Natural Gas of Indonesia, 1987/88* (BPS, 1988). This source does not distinguish small scale and large and medium size establishments. Therefore oil refining data refer to all establishments. The US figures have been adjusted accordingly.
6. In the USA as the production of liquid natural gas in the USA is included in the census of mineral industries, rather than the census of manufacturing. I have excluded the figures for liquid natural gas production on the Indonesian side.
7. US census employment figures exclude unpaid family workers. This category is listed separately in the employment figures in the Indonesian survey, so they can be excluded for reasons of comparability.
8. In the Indonesian sample industry lamps and bulbs (38330), considerable part of the products listed (58%) consisted of cables, wires and rods, which are usually categorised under basic metal products. Therefore, I have reallocated 58 per cent of the value added and employment in this industry to the metal products branch.
9. In Indonesia basic and fabricated metal products were listed together in the same industry, Therefore I combined basic and fabricated metals into a single sample industry called ferrous and non-ferrous metals.

Census and National Accounts

Once the PPPs have been estimated they can be applied to value added figures from different sources such as national accounts or industrial censuses. This raises the issue of the discrepancies between such different sources. For a discussion of the relationship of US census and US national accounts, the reader is referred to the ICOP publications quoted above. The following discussion focuses on Indonesian sources.

As in many developing countries, the Indonesian census is the primary source for the national accounts. Nevertheless, there are several discrepancies between published census and survey data and published national accounts for manufacturing. The relationships between census and national accounts have been discussed in some detail in Hal Hill's valuable 1990 articles in the *Bulletin of Indonesian Economic Studies* (Hill, 1990a, 1990b).

Prior to the census of 1986, the manufacturing data were characterised by substantial underenumeration of enterprises (see Korns, 1993). Backcasting from the more complete coverage of establishments in the 1986 census resulted in an upward adjustment of previous survey data on value added in large and medium sized establishments by 22 per cent. Employment data have been adjusted upward by 9 per cent. Boldly assuming that the same underenumeration characterises the 1986 census data themselves, national accountants have applied the same ratios to make upward adjustments for 1986 (and subsequent years). They have also made the assumption that the same degree of underenumeration holds for statistics on small scale and cottage industry, as for large and medium sized industry. Hill concludes that after such adjustment for underenumeration, census data and national accounts on gross value added are broadly consistent. For 1986, he estimated that value added in total manufacturing from the industrial census was 94.2 per cent of manufacturing value added in the national accounts. More serious problems arise with regard to the compatibility of census and national accounts employment figures, due to difficulties in estimating full time

equivalent employment in cottage industries.

In table 3, I present a reconciliation for 1986 based on published figures, applying the adjustment techniques discussed in Hill's article. This table confirms Hill's conclusion that adjusted survey data are by and large consistent with the national accounts. But my adjusted value added from the survey is higher than that found by Hill (103.4 per cent of the national accounts figure, against 94.2 per cent). Hill's figure for value added in large and medium sized establishments in the survey is 10,197 billion rupiah, against 11,405 billion rupiahs in table 3. His figure for small scale industry, 899.4 billion rupiah is also lower than the figure of 945.9 billion rupiah derived from *Statistik Industri Kecil*, 1986. These discrepancies require further examination. Both Hill's article and table 3 bring out the crucial importance of the upward adjustment of value added by a factor of 1.22. Soon it will be possible to check the accuracy of this upward adjustment, when the results of new backcasting exercises based on later survey data become available.

TABLE 3
Reconciliation of Manufacturing Census and National Accounts, Indonesia, 1986

	Gross Value of Output at market prices (mill. Rps.) (1)	Gross Value Added at market prices (2)	Employment (persons) (3)
A. National Accounts			
Total national accounts incl. oil/gas	50,864,700	17,184,700	5,699,530
Medium and large scale industry, excl. oil/gas	32,081,212	10,747,049	2,439,575
Oil refineries	7,866,200	1,915,400	
Liquid natural gas	3,391,000	1,968,500	24,000
Small and cottage industry	7,526,288	2,553,751	3,235,955
Total national accounts, excl. oil/gas	39,607,500	13,300,800	5,675,530
B. Survey (market prices)			
Survey, large and medium, excl. oil/gas	25,877,340	9,348,483	1,691,435
Survey, Small Industry	2,182,821	775,304	770,144
Survey Cottage Industry	3,317,487	1,169,371	2,727,250
Survey, Total Manufacturing, excl. oil/gas	31,377,647	11,293,158	5,188,829
Survey Total as Percentage of National Accounts Total	79.22%	84.91%	91.42%
C. Adjusted Survey Data (market prices) (a)			
Survey, large and medium, excl. oil/gas		11,405,149	1,843,664
Survey, Small Industry		945,870	839,457
Survey, Cottage Industry		1,426,633	2,972,703
Survey, Total Manufacturing, excl. oil/gas		13,777,652	5,655,824
Survey Total as Percentage of of National Accounts Total		103.59%	99.65%

Note (a): value added multiplied by 1.22, employment by 1.09 (Hill, 1990a, table A1).
Sources: National accounts: from *National Income of Indonesia, 1984-1989*, Jakarta, 1990. Employment figures and data on small and cottage industry supplied by Mr. M. Asta of Biro Pusat Statistik. Survey: data for large and medium sized establishments from *Statistik Industri, 1986*, Vol I; small industry statistics from *Statistik Industri Kecil, 1986*; cottage industry figures from *Home Industry Statistics, 1986*, table 16b. Employment figures for oil refining and liquid gas estimated by Hill (1990a).

TABLE 4
Reconciliation Industrial Survey - National Accounts, 1987
(large and medium sized industries)

Branch	Gross Value Added at market prices (mill. Rps.)		Employment (persons)	
	Nat. Acc. (1)	Survey (2)	Nat. Ac. (3)	Survey (a) (4)
Food Manufacturing	1,538,491	1,302,538	427,370	328,618
Beverages	218,462	162,657	14,586	11,766
Tobacco Products	2,236,437	1,927,380	261,371	202,745
Textile Mill Products	1,609,916	1,322,081	424,446	326,202
Wearing Apparel	272,557	203,424	98,762	79,677
Leather Products and Footwear	82,337	69,482	26,150	13,028
Wood Products, Furniture & Fixtures	1,579,998	1,524,726	299,440	210,858
Paper Products, Printing & Publishing	342,583	456,478	86,822	61,963
Chemical Products (b)	2,528,999	1,411,448	249,139	105,533
Rubber and Plastic Products	666,128	595,146	226,957	149,214
Non-metallic Mineral Products	777,870	581,623	132,268	82,492
Basic & Fabricated Metal Products (c)	1,322,182	1,735,525	126,846	88,415
Machinery & Transport Equipment	752,831	854,765	101,482	81,848
Electrical Machinery & Equipment (c)	357,169	262,489	79,464	29,599
Other Manufacturing Industries	52,102	58,831	32,289	16,367
Total, excl. oil/gas	14,338,062	12,468,592	2,587,392	1,788,325
Survey as percentage of national accounts		87.0%		69.1%
Adjusted survey data as percentage of national accounts (d)		106.1%		75.4%

Notes: (a) Employment including unpaid family workers.
(b) Excl. oil refining and liquid gas.
(c) Part of value added and employment in sample industry lamps and bulbs (electrical machinery) reallocated to metal products branch.
(d) Value added adjusted upward by a factor of 1.22, employment by 1.09 (see Hill (1990a).

Source: Breakdown of national accounts by branch for large and medium size manufacturing in 1983 rupiahs, supplied by Mr. Moh. Asta of BPS. Adjusted to current 1987 rupiahs using ratios of total 1987 value added in current rupiahs to value added in 1983 rupiahs from the published national accounts. Survey data from *Statistik Industri, 1987*, Vol. I, Jakarta, 1989.

Table 4 presents a detailed reconciliation at branch level for 1987 between the national accounts and the 1987 Survey for Medium and Large Scale Industry. Census value added at market prices in non-oil manufacturing is 87 per cent of national accounts value added, employment is 69.1 per cent. If we adjust the survey data, using the adjustment factors suggested by Hill, the percentages become 106.1 per cent and 75.4 per cent respectively. At branch level there are considerable differences in branch shares in total value added and employment between the two sources.

In principle national accounts provide the most complete information on an economy and should therefore be the preferred source for international comparisons. In practice, the censuses are more transparent in their methods of data collection and data aggregation. In the national accounts various adjustments are made which are not explicitly specified and data on employment and production derive from different sources. The Indonesian manufacturing survey provides data on both output and employment deriving from one and the same questionnaire. For the purposes of productivity comparisons I have therefore chosen for a

comparison based on census data.

Quality Problems

Hill (1990) concludes that "Indonesia's Industrial Statistics ... are now excellent". As regards the quality of the product listings (Volume II of the Survey), this conclusion is in need of some qualification. There is not yet a consistent product code for categorising products. Products have no identifying codes at all. The survey questionnaire simply includes a blank page on which establishments are asked to list their most important products.

In the survey products are listed per industry in order of gross value of output. The listings are not consistent from one year to another. One year products are lumped together. Another year they are not. The description of items in the survey is often vague and provides insufficient detail. The quantity information is often in terms of numbers of products, unspecified by size, weight or quality. Not infrequently, the largest product in a listing is a residual category. Translations of the same items differ from year to year.

This has consequences for the quality of matches with products from the US census. In the US census large numbers of precisely described products have to be lumped together to achieve matches with a few roughly described products in Indonesia. For instance 12 kinds of alkaline detergents, such as phosphate based, phosphate free, anionic base or hard surface cleaners were matched with one Indonesian item detergent powder.[6] There may be a serious quality problem involved. The Indonesian survey provides insufficient detail to enable us to make quality adjustments, as were made in the case of the automobile industry in previous ICOP Studies (see Maddison and Van Ark, 1988; Szirmai and Pilat, 1990b).

One would expect the average quality of manufacturing products produced in Indonesia to be lower than in the USA, particularly in branches oriented towards the domestic market. If this is the case, than our PPPs are biased downwards and productivity will be overestimated. It is safe to state that our productivity comparisons are an upper bound.

It is hard to assess the exact magnitude of quality differences. In some export oriented branches such as wearing apparel Indonesia also produces high quality products such as e.g. Arrow shirts. There may be some concentration on lower value items in the garments industry, but for the same products there are probably no great quality differences (Hill, 1991). The problem is caused by the quality mix of items lumped together in a single match. In a subsequent stage of this research project, it might therefore be necessary to go outside the framework of the industrial survey and to use industry specific information and studies to supplement the survey data on prices, quantities and qualities.

On other hand unit value comparisons based on matches from the census have the great advantage that the products included are characteristic of the countries being compared. Price comparisons for precisely specified items in expenditure comparisons may have less quality problems, but the items chosen may not represent the production structure of the countries involved.

4. Results at branch level

Table 5 contains PPPs per branch of manufacturing. The PPPs for other manufacturing are quantity weighted price ratios of all the matches in the other branches. No matches were achieved in the residual category itself. In most branches PPPs at US weights are much higher than those at Indonesian weights. This is only to be expected. Products which are

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[6] An annex with the complete matching tables is available on request.

cheap and common in the USA, will tend to be expensive and rare in Indonesia. Therefore the the high unit value ratios will receive a high weight in the US and a low one in Indonesia. The greater the difference in industrial structure, the greater the divergence in PPPs.

The geometric (Fisher) average of PPPs for manufacturing as a whole is 1200 rupiahs to the US dollar, compared to an exchange rate of 1644 rupiahs to the dollar in 1987. A PPP for manufacturing calculated at national accounts branch value added weights, rather than census value added weights, is only marginally different.

TABLE 5
Purchasing Power Parities and Price Levels by Major Manufacturing Branch
Indonesia/USA (Rp. to the US$)

	PPP (Rp./US$) at US Quantity Weights	PPP (Rp./US$) at Indonesian Quantity Weights	PPP (Rp./US$) Geometric Average	Relative Price Level Indonesia (USA = 100)
1 Food Manufacturing	1,438	934	1,159	70.5
2 Beverages	1,735	1,735	1,735	105.5
3 Tobacco Products	807	827	817	49.7
4 Textile Mill Products	913	776	842	51.2
5 Wearing Apparel	510	509	509	31.0
6 Leather Products & Footwear	547	483	514	31.3
7 Wood Products, Furniture & Fixtures	1,237	1286	1261	76.7
8 Paper Products, Printing & Publishing	1,515	873	1,150	69.9
9 Chemical Products (incl. oil)	2,104	1,507	1,781	108.3
10 Rubber & Plastic Products	1,087	606	812	49.4
11 Non-metallic Mineral Products	906	1,088	993	60.4
12 Basic & Fabricated Metal Products	1,511	1,175	1,333	81.1
13 Machinery & Transport Equipment	1,642	719	1,086	66.1
14 Electrical Machinery & Equipment	693	592	641	39.0
15 Other Manufacturing Industries	1,553	1,073	1,291	78.5
Total Manufacturing, Census Weights	1,448	994	1,200	73.0
Total Manufacturing, National Accounts Weights	1,407	1,032	1,205	73.3
Exchange Rate	1,644	1,644	1,644	

Note (a): The PPP for total manufacturing is the weighted average of the PPPs of all manufacturing branches, weighted with value added weights. It can be based either on census or on national accounts weights.
Source: The PPP for each branch is the weighted average of the PPPs of the sample industries belonging to that branch. Sample industry PPPs available on request. The PPP for other manufacturing is the weighted average of all product unit value ratios.

In the last column of table 5, the geometric average of the PPPs has been divided by the exchange rate to calculate relative price levels for each branch. Given the fact that several branches of manufacturing were still subject to protection in 1987 in Indonesia, it is rather surprising that so many branch PPPs are lower than the exchange rate. The relative price level of total manufacturing is 73. This may have something to do with quality problems discussed above. But

it is also possible that prices of products produced for the domestic markets are much lower than those of exported products, irrespective of quality differences, leading to lower average unit values in Indonesia and thus to low PPPs.

The PPPs of table 5 have been used to convert the branch value added data in national currencies from table 2 into the currency of the other country. Division by employment figures provides us with labour productivity comparisons in table 6. On average, Indonesian gross value added per person in large and medium scale manufacturing is 10 per cent of the US level (geometric average).

TABLE 6
Gross Value Added (Census Concept) per Person Employed
Indonesia and the USA, 1987

	|-- at Indonesian Prices --|			|--- at US Prices ---|		Geometric
	Indo-nesia	USA	Indo-nesia/	Indo-nesia	USA	Indo-nesia/	Indo-nesia/
	(in mill. Rp.)		USA(%)	(in 1000 US$)		USA(%)	USA(%)
1 Food Manufacturing	3.8	103.9	3.6	4.0	72.3	5.6	4.5
2 Beverages	11.2	229.7	4.9	6.5	132.3	4.9	4.9
3 Tobacco Products	7.2	182.3	4.0	8.7	225.9	3.9	3.9
4 Textile Mill Products	3.9	33.3	11.7	5.0	36.4	13.8	12.7
5 Wearing Apparel	2.5	14.8	17.0	5.0	29.0	17.1	17.1
6 Leather Products and Footwear	5.1	17.8	28.7	10.5	32.5	32.4	30.5
7 Wood Products, Furniture & Fixtures	7.1	50.4	14.2	5.6	40.8	13.6	13.9
8 Paper Products, Printing & Publishing	6.9	100.4	6.8	7.9	66.3	11.9	9.0
9 Chemical Products	28.3	249.4	11.3	18.8	118.5	15.8	13.4
10 Rubber & Plastic Products	3.6	56.4	6.4	6.0	51.9	11.5	8.6
11 Non-metallic Mineral Products	6.7	55.8	12.0	6.2	61.5	10.0	11.0
12 Basic & Fabricated Metal Products	18.6	83.7	22.3	15.9	55.4	28.6	25.2
13 Machinery & Transport Equipment	10.1	108.4	9.3	14.0	66.0	21.2	14.0
14 Electrical Machinery & Equipment	7.7	39.5	19.4	13.0	57.1	22.7	21.0
15 Other Manufacturing Industries	3.2	97.3	3.3	3.0	62.6	4.8	4.0
Total Manufacturing (L + M)	7.5	91.1	8.3	7.6	62.9	12.0	10.0
Total Manufacturing, all establishments (a)			3.3			4.8	4.0

Source: Gross value and employment from table 2, Purchasing Power Parities from table 5.
Note: (a) after adjustment for productivity differentials between total and medium plus large scale manufacturing in both countries, see Annex Table A3.

Low productivity is to be found in food manufacturing (4.5% of the US level), beverages (4.9%), tobacco products (3.9%) and other manufacturing (4.0%). The productivity differential in food manufacturing may in part be explained by different types of food production in the two countries. In Indonesia production in this sector is characterised by simple resource processing activities. In the US production centres on brand name consumer final products with higher value added content. Low relative productivity in tobacco can be explained by the high degree of mechanisation in the USA and the labour intensiveness of Indonesian production processes.

High productivity is found in leather products and footwear (30.5%), metal products (25.2%) and electrical machinery and equipment (21%). Two other branches with above

average productivity are wearing apparel (17.1%) and machinery and transport equipment (14%). In leather products, high relative productivity may in part be explained by the importance of the Bata shoe plant, which applies advanced production techniques. Machinery and transport equipment is a capital intensive branch where labour productivity differentials are liable to be smaller. Conversely, the production of wearing apparel is a relatively labour intensive production process in both countries, in which there are limits to the increase of labour productivity by the substitution of capital for labour.

Application of the PPP for manufacturing from table 5 to national accounts data results in higher relative labour productivity in Indonesia, than on a census basis, as output is adjusted upwards more than employment. On a national accounts basis labour productivity in medium and large scale Indonesian manufacturing is 14.4 per cent of the US level, against 10 per cent on a census basis. For reasons set out above, the census comparison is for the time being preferred over the national accounts comparison.

TABLE 7
Gross Value Added (Census Concept) per Hour Worked
Indonesia and the USA, 1987

	|– at Indonesian Prices –|			|— at US Prices —|			Geometric
	Indo-nesia (rp)	USA (rp)	Indo-nesia/ USA(%)	Indo-nesia	USA (in US$)	Indo-nesia/ USA(%)	Indo-nesia/ USA(%)
1/2Food and beverages	1,971	62,424	3.2	2.0	41.8	4.8	3.9
1 Food Manufacturing	1,845	54,906	3.4	2.0	38.2	5.2	4.2
2 Beverages	5,497	123,078	4.5	3.2	70.9	4.5	4.5
3 Tobacco Products	3,537	98,383	3.6	4.3	121.9	3.5	3.6
4 Textile Mill Products	1,756	16,207	10.8	2.3	17.8	12.8	11.8
5 Wearing Apparel	1,135	8,239	13.8	2.2	16.1	13.8	13.8
6 Leather Products and Footwear	2,294	9,635	23.8	4.7	17.6	27.0	25.3
7 Wood Products, Furniture & Fixtures	3,181	25,668	12.4	2.5	20.8	11.9	12.2
8 Paper Products, Printing & Publishing	3,121	54,385	5.7	3.6	35.9	10.0	7.6
9 Chemical Products	12,845	129,747	9.9	8.5	61.7	13.8	11.7
10 Rubber & Plastic Products	1,640	28,381	5.8	2.7	26.1	10.4	7.7
11 Non-metallic Mineral Products	3,044	27,837	10.9	2.8	30.7	9.1	10.0
12 Basic & Fabricated Metal Products	8,463	42,791	19.8	7.2	28.3	25.4	22.4
13 Machinery & Transport Equipment	4,573	56,910	8.0	6.4	34.7	18.4	12.1
14 Electrical Machinery & Equipment	3,483	21,066	16.5	5.9	30.4	19.3	17.9
15 Other Manufacturing Industries	1,468	51,606	2.8	1.4	33.2	4.1	3.4
Total Manufacturing	3,453	47,747	7.2	3.5	33.0	10.5	8.7

Source: Value added and employment from table 2; Average hours worked per year from Annex table A2. Average hours by branch calculated by applying proportions from BPS, Keadaan Angakatan kerja di Indonesia, 1990, table 20a.

In Indonesia annual hours worked per person in 1987 were estimated at 2178 hours against 1909 hours in the USA. This puts productivity per hour actually worked in Indonesia at 8.7 per cent of the US level. This figure is still very tentative, because of the nature of data on hours worked (see Annex table A.2 for calculation of hours worked). These estimates are presented here to stimulate discussion about hours worked in manufacturing. In the subsequent analysis we will focus on value added per person.

Reliability of the Estimates[7]

The productivity comparisons are ultimately based on product matches. In most cases the outcomes turn out be very robust, in the sense that decisions on individual matchings have very little influence on the final outcomes. In a few cases, however, the outcomes are sensitive to matching decisions. Some of these decisions are documented in this paragraph.

The results for tobacco are influenced by the inclusion of *kretek* cigarettes in the comparison. Though *kretek* cigarettes are not made in the USA, I have assumed they can be matched with normal cigarettes. *Kretek* cigarettes are much more expensive than normal cigarettes. Excluding Kretek results in a lower PPP (373 rupiahs to the dollar) and higher relative productivity (5.7% of the US level). However, exclusion of *kretek* would mean that Indonesia's most important tobacco product is left out.

In the wood products sample industry, the unit value for Indonesian veneer (415 rupiah per cubic metre) was so unrealistically low that the whole sample industry PPP was biased downwards. On the basis of a comparison with survey data from other years, I concluded that published quantities referred to sheets rather than cubic metres.

In the chemical products branch data for oil refining were derived from the Mining census, rather than the manufacturing census. These figures refer to total manufacturing. Gas refining was excluded from the comparison, because no gas refining can be found in the US manufacturing census. If the capital intensive gas refining sector had been included relative productivity in Indonesia in chemicals would have gone up. Liquid gases in the inorganic chemical products industry had to be excluded from the matchings in inorganic chemical products because the Indonesian unit values were so excessively high that the data must be wrong. As a result the matching percentage in this industry fell below 20 per cent and it was not included as a sample industry.

The results for leather products and footwear are affected by the exclusion of plastic shoes from the comparison. Though it is not always explicitly specified whether shoes are made of leather or plastic, the exceptionally low unit values of items such as sandals and contracted shoes suggest that they refer to plastic footwear.

5. Effects of Firm Size and Economic Structure on the Productivity Gap

In this section a first step will be made towards explaining the productivity gap in terms of economic structure and firm size.

Small scale and cottage manufacturing

As no product information is available for manufacturing establishments with less than 20 persons employed, no PPPs can be derived for the small scale sector which is so important in Indonesia in terms of employment.[8] Therefore the basic US/Indonesia comparison was limited to medium and large scale manufacturing. The exclusion of small scale and cottage industry from the productivity comparisons will tend to bias Indonesian labour productivity performance in an upward direction. Labour productivity in small scale manufacturing is much lower than in large scale manufacturing and the small scale sector is much bigger in Indonesia than in the USA.

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[7] An annex with the complete matching tables is available on request.

[8] In the Indonesian census a distinction is made between small scale manufacturing (5-19 persons employed) and cottage industry (less than 5 persons employed). In the comparison with the USA small scale manufacturing refers to all establishments employing less than 20 persons.

Using information on employment and value added from the 1986 census of small scale industry and cottage industry (BPS, 1989a, 1989b), I have calculated that labour productivity in Indonesian small scale and cottage manufacturing is only 10 per cent of labour productivity in Indonesian medium and large scale manufacturing. Labour productivity in total manufacturing including the small scale and cottage sector is 39 per cent of labour productivity in large and medium size manufacturing. In the USA labour productivity in the small scale sector in 1987 is also lower than in the large scale sector, but value added in the small scale sector only accounts for 5.6 per cent of total value added so that labour productivity in total manufacturing ends up at 98 per cent of labour productivity excluding small scale manufacturing. These ratios have been used in the bottom row of table 6 to make a rough adjustment of the 1987 productivity comparisons.[9] After inclusion of small scale and cottage industry production, labour productivity in Indonesia drops from 10 per cent to 4 per cent of the US level (see Annex table A3).

Much of cottage industry, however, can hardly be called manufacturing in the sense of factory production. Therefore it is not directly comparable to manufacturing activities in the USA. Cottage industry activities include off-season activities in rural areas and are often more of a handicraft than an industrial nature. Both for data and for substantive reasons therefore, I will continue to focus on medium and large scale manufacturing.

Adjusting for size categories

TABLE 8
Labour Productivity Comparisons US-Indonesia, 1987
Adjusted for Establishment Size (Medium and Large Scale Manufacturing)[a]

	Employment share		Gross value added per person:						
			|– at Indonesian Prices –|		|—— at US Prices——|		Geometric	
	Indo-nesia	USA	Indo-nesia (in 1000 Rp.)	USA	Indo-nesia/ USA (%)	Indo-nesia (in US$)	USA	Indo-nesia/ USA(%)	Indo-nesia/ USA(%)
Establishment Size									
20 - 50	0,11	0,11	2.092	64.481	3,2	2.259	44.967	5,0	4,0
50 - 99	0,08	0,12	3.541	71.099	5,0	3.823	49.582	7,7	6,2
100 - 500	0,28	0,38	6.214	81.502	7,6	6.708	56.837	11,8	9,5
500 - 999	0,18	0,13	6.548	101.351	6,5	7.069	70.679	10,0	8,0
>= 1000	0,35	0,26	8.608	116.581	7,4	9.293	81.300	11,4	9,2
Total (a)	1,00	1,00	6.431	90.075	7,1	6.943	62.815	11,1	8,9
Total at Indonesian employment size weights					6,8			10,5	8,5
Total at US employment size weights					6,8			10,5	8,4

Source: Indonesia: LPEM data base of manufacturing survey statistics, original source: *Statistik Industri, 1987*; US, *Census of Manufactures, Summary Volume*, 1987. PPPs from table 3.
Note: a) excluding oil and gas refining.

[9] Lacking other information, I have to make the assumption that the PPPs calculated for medium and large scale manufacturing also apply to small scale manufacturuing.

For medium and large scale manufacturing excluding oil and gas refining a breakdown can be made in both countries by employment size in the following categories of employment: 20-50, 50-99, 100-499, 500-999 and 1000 and over (see table 8). The size structure in the two countries is different. In the USA 38 per cent of employment is in the 100-500 category, 13 per cent in the 500-999 category and 26 per cent in the over 1000 category. In Indonesia the percentages are 28 per cent, 18 per cent and 35 per cent respectively. Thus, larger establishments are clearly overrepresented in Indonesia versus the USA.

We can now examine the effects of size on the aggregate productivity comparisons by holding the distribution of employment over size categories constant. We can either apply the Indonesian employment shares to the USA or the US employment shares to Indonesia. Rather surprisingly the aggregate effects of the adjustments for establishment size are very small, even though labour productivity in both countries is clearly higher in larger than in smaller establishments. Both at Indonesian shares of employment and at US shares of employment, aggregate relative labour productivity drops about half a percentage point from about 8.94 per cent to about 8.44 per cent of the US level. Thus, apart from small scale manufacturing, differences in establishment size do not contribute to an explanation of the labour productivity gap between the two countries.

Adjusting for Differences in Economic Structure

In table 9 I examine to what extent the productivity gap between Indonesia and the USA can be explained by differences in production structure. I have made comparisons of productivity at both US labour shares and at Indonesian labour shares. If Indonesian employment were concentrated in sectors with low relative productivity, while US employment were concentrated in sectors with high relative productivity, part of the productivity gap might be explained by the effects of production structure. This expectation, however, is not borne out by the data.

TABLE 9
Labour Productivity Comparisons US-Indonesia, 1987
Adjusted for Differences in Industrial Structure (Large and Medium Sized Establishments)

	Indonesia/ USA (%) at Indon. prices	Indonesia/ USA (%) at US prices	Indonesia/ USA (%) geometric average
Total Manufacturing incl. oil	8.3	12.0	10.0
Total at Indonesian employment shares	8.2	9.9	9.0
Total at US employment shares	10.3	16.0	12.8
Total at geometric average of country shares	9.2	12.6	10.8

Sources: Labour shares from table 2; productivity comparisons at own country weights from table 6.

The labour productivity comparisons at Indonesian employment shares result in somewhat lower relative productivity, especially at US prices. In this case labour productivity relative to the USA drops from 12 to 9.9 per cent. The use of US employment shares results in substantially higher relative productivity (16 per cent at US prices and 10.3 per cent at Indonesian prices, compared to the original figures of 12 per cent and 8.3 per cent). If we finally look at the geometric average of Indonesian and US prices in the last column, it

becomes clear that if Indonesia had the same employment structure as the US, relative productivity would increase from 10 to 12.8 per cent. This means that only a small part of the large productivity gap of 90 per cent can be explained by differences in economic structure.

6. Trends in Relative Labour Productivity: Indonesia/USA, 1975-1990

Table 10 presents trends in relative labour productivity derived by applying indices of growth of real value added and employment in the USA and Indonesia to the benchmark productivity comparisons of table 6.[10] The changes in relative productivity are the net effect of productivity trends in two countries. The aggregate relative productivity trend also depends on changes in the structure of production in the two countries. Table 11 shows index numbers of labour productivity for Indonesia and the USA separately, so one relate changes in relative performance to trends in each of the countries. More detailed information on Indonesian productivity trends is presented in Annex table A5. The effects of changes in the composition of production are shown in table 12.

Table 10 shows that relative labour productivity for Indonesian manufacturing as a whole increased between 1975 and 1980 and remained at about the same level between 1980 and 1990. In 1990 labour productivity was 10.9 per cent of the US level, against 10.6 per cent in 1980 and 7.7 per cent in 1975. On the Indonesian side there was rapid productivity growth from 1975 to 1981, followed by stagnation in 1982-1984. This period of stagnation coincided with almost zero growth of production in 1982 and 1983 (Hill, 1992). After 1984 productivity growth in Indonesia resumed, with sudden dips in 1987 and 1989. Over the whole period 1975-90 labour productivity increased by a factor 2.3 (table 11). In the USA labour productivity remained stagnant from 1977 till 1982. Between 1982 and 1990 US labour productivity resumed. Productivity went up by 51 percentage points. Over the whole period labour productivity went up by a factor 1.6.

Table 10 allows us to make a comparison at branch level for 1984 between the results of this study and exchange rate comparisons presented by Hill (1990). Hill's figures for Indonesian labour productivity relative to the USA are 4.0 per cent for food and beverages, 7.2 per cent for textile mill products, 7.2 per cent for wearing apparel, 4 per cent for paper products, 9.8 per cent for chemicals, 8.9 per cent for basic metals and 8.3 per cent for transport equipment. With the exception of food and beverages, his productivity comparisons place Indonesia one third to a half lower than comparisons based on ICOP PPPs in this paper.

There is considerable variation in productivity developments at branch level. Exceptionally rapid improvement in relative productivity took place in tobacco products and in basic and fabricated metal products. Productivity in basic and fabricated products rose from 5.5 per cent of the US level in 1975 to a peak of 32.1 per cent in 1986, declining to a still respectable 19.4 per cent in 1990. Labour productivity in metal products in Indonesia improved almost five fold from 1975 to 1990. In recent years Indonesia has even started exporting steel and aluminum products. It is interesting to note that these formidable productivity increases occurred in a sector well known for its high level of protection. However, much of the increase is due to massive investment in highly capital intensive production. In the USA productivity in metal products increased by only 28.5 per cent in the same period.

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[10] Food manufacturing and beverages have been combined to form a single branch food and beverages. Labour productivity trends in the USA are for the whole of manufacturing, those for Indonesia for large and medium sized industry only. However, the share of small establishments in value added and employment in the USA is modest (5.6% of value added and 7.7% of employment in 1987).

TABLE 10
Comparative Labour Productivity by Manufacturing Branch
Indonesia/USA, 1975-1990, USA=100

	Food & Beverages	Tobacco Products	Textile Mill Products	Wearing Apparel	Leather Products & Footwear	Wood Products, Furniture, Fixtures	Paper Products, Printing & Publishing	Chemicals, Petroleum & Coal Products excl. oil/gas	Chemicals, Petroleum & Coal Products incl. oil/gas	Rubber and Plastic Products	Non-Metallic Mineral Products	Basic & Fabricated Metal Products	Machinery and Transport Equipment	Electrical Machinery and Equipment	Other Manufac-turing	Total Manufac-turing
1975	6,0	0,7	7,6	6,9	35,1	5,0	5,4	10,5		11,3	5,1	5,5	13,1	23,6	3,7	7,7
1976	4,4	1,1	8,2	11,3	28,1	5,2	3,7	17,1		16,2	8,0	6,0	10,3	27,8	3,1	8,0
1977	5,6	0,9	5,8	9,8	23,6	6,5	4,6	15,7		15,9	11,2	5,3	10,8	27,5	3,6	8,0
1978	5,7	0,9	9,2	12,5	24,3	7,1	4,2	19,9	18.9	22,0	12,9	6,4	13,4	23,6	4,2	9,4
1979	5,5	1,0	7,5	12,3	31,8	6,7	5,0	14,5	24.7	16,9	12,6	6,9	14,2	18,1	3,6	9,0
1980	4,4	1,6	8,5	8,5	26,7	10,4	5,2	18,1	43.4	13,5	11,5	8,1	21,1	26,9	6,1	10,6
1981	5,4	1,7	8,6	11,0	18,9	12,3	3,9	23,3	38.3	11,6	14,2	8,6	30,0	22,9	3,7	11,5
1982	5,1	1,7	9,1	17,8	26,4	9,5	4,5	17,5	30.8	12,1	9,2	11,3	21,4	30,0	3,7	10,5
1983	4,7	1,8	8,3	17,4	37,2	8,4	3,9	15,1	25.9	12,3	10,1	14,7	14,5	20,5	3,0	9,3
1984	4,9	2,2	12,0	21,7	39,3	5,9	5,5	15,8	30.5	13,3	10,0	22,6	14,5	21,0	3,7	9,9
1985	4,6	2,5	11,9	16,9	32,1	11,9	7,3	18,1	26.4	17,8	9,9	20,1	15,7	30,4	4,6	10,5
1986	4,2	2,7	15,3	28,2	67,0	17,5	7,7	14,9	17.9	10,7	10,6	32,1	13,7	26,9	4,3	11,5
1987	4,2	3,9	12,7	17,1	30,5	13,9	9,0	13,4	13.4	8,6	11,0	25,2	14,0	21,0	4,0	10,0
1988	5,7	6,5	16,1	21,6	34,4	14,4	14,1	17,1	10.6	11,5	10,7	24,2	14,5	24,4	4,5	11,0
1989	4,9	7,4	18,8	22,5	32,5	12,9	12,0	14,7		12,0	7,5	26,6	15,1	22,0	5,6	10,5
1990	7,0	5,6	17,4	22,0	32,5	11,9	14,8	17,1		11,9	10,2	19,4	16,6	24,0	4,3	10,9

Source: US GDP and Employment from US Dept. of Commerce, National Income and Product Accounts of the United States, 1929-1982, Washington, 1986; idem, 1959-1988 Washington, 1992; and US, Dept. of Commerce, Survey of Current Business, January and April 1991 and November 1992. Indonesian GDP and Employment from Annex Table A5. Original sources: Statistik Industri, 1975-1990 (Revised figures on tape LPEM); deflators 1975-1990 from Indikator Ekonomi various issues. Benchmark productivity comparisons for 1987 from table 6. Indonesian time series including oil and gas provided by BPS (1991).

TABLE 11
Index Numbers of Labour Productivity by Manufacturing Branch, 1975-1990 in Indonesia and the USA (1975=100)

	Indonesia	USA	Indo-nesia/USA
	1990	1990	1975-9
Food & Beverages	171.5	146.7	116.9
Tobacco Products	551.2	74.1	743.6
Textile Mill Products	419.2	182.6	229.6
Wearing Apparel	445.5	138.4	321.8
Leather Products & Footwear	111.1	120.0	92.6
Wood Products, Furniture, Fixtures	308.7	130.9	235.8
Paper Products, Printing & Publishing	325.4	118.9	273.6
Chemicals, Petroleum & Coal Products	320.1	197.6	162.0
Rubber and Plastic Products	162.7	153.5	106.0
Non- Metallic Mineral Products	251.9	125.0	201.6
Basic & Fabricated Metal Products	477.0	135.0	353.2
Machinery and Transport Equipment	233.9	185.7	126.0
Electrical Machinery and Equipment	202.5	199.3	101.6
Other Manufacturing	170.6	145.7	117.1
Total Manufacturing	225.9	159.6	141.5

Sources: see source note for table 10.

In tobacco products productivity rose from 0.7 per cent of the US level in 1975 to 5.6 per cent in 1990. In Indonesia productivity increased by a factor 5.5. In the USA it declined by more than 50 per cent. The Indonesian tobacco sector is dominated by the very rapidly growing *kretek* cigarettes industry, where mechanisation is proceeding at a fast pace (Poot et. al., 1990; Hill, 1988). Nevertheless, relative labour productivity is still extremely low in this sector.

Four other sectors with a dramatic improvement in both absolute and relative productivity performance were: a. textile mill products; b. wearing apparel; c. wood products, furniture and fixtures and d. paper products, printing and publishing. The gains in relative performance were due to large increases in labour productivity in Indonesia, accompanied by modest productivity increases in the USA. It is interesting to note that these four sectors were all involved in Indonesia's export drive since the mid 1980s, particularly textiles, wearing apparel and wood products (Thee, 1989, 1992; Hill, 1988).

Several authors have drawn attention to a technological revolution in textiles and garment production (McCawley, 1984; Hill, 1983; Poot et. al., 1990). The take-off in wood production dates from 1980 when the government introduced a ban on the export of primary wood products. Both production and exports of plywood have expanded rapidly since then. Since 1986 the exports of raw rattan have also been prohibited, with subsequent rapid growth of furniture production for export purposes (Thee, 1992). Paper products was another resource based industry which has grown rapidly in recent years.

On the other hand there were five branches, where relative productivity stagnated between 1975 and 1990: a. leather products and footwear; b. electrical machinery and equipment; c. chemical products (including oil refining and natural gas); d. rubber and plastics and e. other manufacturing. The most intriguing pattern is to be seen in the branch with the highest

relative productivity, leather products and footwear, where relative productivity declined from 35.1 per cent of the US level in 1975 to 32.5 per cent in 1990. In absolute terms productivity in this sector declined substantially between 1975 and 1982 with a modest recovery since then. Nevertheless, this sector still registered by far the highest relative labour productivity in 1990. Until recently one very large foreign owned (Bata) plant produced two thirds of all Indonesian footwear (Hill, 1988), which provides a possible explanation of the exceptionally high productivity in this branch. The slow growth of productivity in this sector is probably related to the entry of many small scale producers in more recent years.

In the case of electrical machinery and equipment relative productivity increased from from 23.6 per cent of the US level in 1975 to 30 per cent 1982 and declined after 1985. In 1990 relative productivity was at 24 per cent. This decline may reflect the shift in recent from high value applications to low value assembly operations. One should not forget, however, that labour productivity in absolute terms doubled over fifteen years. That relative productivity did not increase is due to a similar productivity increase in the USA.

In the chemical products branch it is important to make a distinction between chemicals including or excluding gas and oil refining. For Indonesian productivity trends the basic time series sources for table 10 are the manufacturing surveys. These exclude the gas and oil refining sector. I have added a separate column for the chemical branch based on time series on a national accounts basis supplied by BPS for the period 1978-1988, which include gas and oil refining and which show very different trends.[11] Excluding gas and oil relative labour productivity initially increased from 10.5 per cent of the US level in 1975 to 23.3 per cent in 1980, subsequently falling to 17.1 per cent by 1990. In absolute terms labour productivity in Indonesian chemicals increased more than three times in Indonesia against twice in the USA. The picture is very different if one includes oil and gas refining. From 1978 to 1980 relative productivity increased dramatically from 19 to more than 43 per cent of the US level. After this year relative decline set in with labour productivity dropping to 10.6 per cent in 1988. From 1978 to 1988 productivity in absolute terms declined by 6.5 per cent. In spite of the differences both series point to a decline of relative labour productivity in the 80s in chemical production. In this sector there has been considerable government investment among others in oil refining and fertilisers. These activities have frequently been criticised as inefficient and overprotected, in particular in the case of fertilisers.[12]

Composition effects

Table 10 reveals that increases in relative productivity in separate branches are more marked than at the aggregate level for manufacturing as a whole. To analyse the effects of changes in industrial structure on aggregate relative productivity trends, I have reestimated productivity trends in table 12 using both 1975 labour shares and 1975 output shares in both countries as weights for the subsequent years. At constant 1975 labour shares aggregate productivity would have increased from 7.7 per cent of the US level in 1975 to 15.5 per cent in 1990. At constant 1975 output shares, aggregate productivity in 1990 would have been 14.4 per cent. Thus the relative increases in productivity at branch level are counterbalanced by the increasing weight of sectors with lower productivity. This effect is particularly manifest in the 1980s and is consistent with a shift towards more labour intensive production in Indonesia, in line with its comparative advantage.

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[11] The figures for total manufacturing in the final column are based on the census data, and thus exclude productivity trends for oil and gas. The 1987 benchmark does include oil refining. As chemicals excluding oil refining show a more positive trend, than chemicals including oil refining, the aggregate productivity increase is slightly upward biased.

[12] Over the whole period census data show a substantially greater increase in labour productivity than national accounts data I used in a previous article for the 1978-1988 period (Szirmai, 1993). The differences are in part due to relative productivity increases in the periods 1975-78 and 1988-1990 which were not covered by the earlier data. With exception of chemical products, the trends derived from the two sources, however, are rather similar.

TABLE 12
Composition Effects on Comparative Productivity Trends
Indonesia/USA, 1975-1990, USA=100

	Total Manufac-turing	Total Manufacturing at constant 1975 labour shares	Total Manufacturing at constant 1975 gva shares
1975	7.7	7.7	7.7
1976	8.0	8.6	8.7
1977	8.0	8.6	8.9
1978	9.4	10.2	10.4
1979	9.0	9.4	9.4
1980	10.6	11.3	11.3
1981	11.5	12.5	13.0
1982	10.5	11.5	11.6
1983	9.3	10.6	10.5
1984	9.9	11.9	11.5
1985	10.5	12.3	12.3
1986	11.5	13.8	12.8
1987	10.0	12.5	11.8
1988	11.0	14.3	13.6
1989	10.5	14.1	13.0
1990	10.9	15.5	14.4

Sources: see table 10.

This interpretation is supported by an analysis of productivity trends in both countries separately. On the US side the application of 1975 employment and value added shares makes little difference to the overall productivity trends. On the Indonesian side, the index for labour productivity in 1990 (1975 = 100) jumps from 226 to 318, when one applies constant labour shares and to 294 when one applies constant value added shares.

7. Indonesian Labour Productivity in International Perspective

Though this study takes the USA, the leading country in world manufacturing, as the reference country, it is also of interest to make comparisons between Indonesian productivity performance and that of other Asian economies.

Table 13 presents binary comparisons with the USA for six major branches of manufacturing in 1987 for four Asian countries involved in the ICOP project: Indonesia, Korea, Australia and Japan. These comparisons are all derived in the same fashion as above, namely by taking the geometric average of the PPPs at country quantity weights as the appropriate conversion factor for value added. On the basis of these binaries with the US one can make indirect comparisons between the countries themselves.

Indonesian manufacturing productivity is 38 per cent of that in Korea and 48.4 per cent of that in Australia. In comparison with Korea highest relative productivity is achieved in chemical products, metals and textiles. The contrasts between the branch and the overall results serve once more to illustrate how much of Indonesian manufacturing is concentrated in labour intensive sectors such as food products, wood products etc. In comparison with Australia best productivity performance is found in metal products and machinery.

TABLE 13
International Comparisons of Real GDP per Person Engaged in 1987 in Six Branches of Manufacturing (USA=100)

	Indonesia (b)	Korea	Australia	Japan	USA
Food, Beverages and Tobacco	5.4	12.8	47.2	29.1	100
Textiles, Wearing Apparel and Leather	16.5	31.8	61.7	76.6	100
Chemicals, Petroleum, Coals, Rubber and Plastics	10.6	15.4	52.3	81.6	100
Basic and Fabricated Metals	25.2	45.0	54.1	104.3	100
Machinery, Electrical Machinery and Transport Equipment	15.3	42.4	43.0	114.1	100
Other Manufacturing (a)	9.0	25.1	43.4	66.9	100
Total	10.0	26.4	48.4	81.8	100

Notes: (a) Wood Products, Furnitures and Fixtures, Paper, Printing and Publishing, Non-Metallic Mineral Products, Precision Instruments and Other Manufacturing.
(b) Indonesia/USA comparison for establishments with more than 19 persons employed. Other comparisons for total manufacturing.
Sources: Indonesia/USA table 6; South Korea/USA from Pilat, 1993; Australia/USA from Pilat, Rao and Shepherd, 1993; Japan/USA from Van Ark and Pilat, 1993.

TABLE 14
Real GDP per Person Engaged in Manufacturing (USA=100)

	India (a)	Korea	Japan (a)	Indonesia	USA
1970	7.0	13.8	58.9		100
1971	6.3	15.8	57.8		100
1972	6.1	14.5	59.9		100
1973	6.0	15.4	61.6		100
1974	6.0	14.3	63.4		100
1975	5.8	17.6	64.1	7.7	100
1976	5.7	17.3	66.8	8.0	100
1977	5.8	17.8	67.7	8.0	100
1978	6.2	20.6	71.6	9.4	100
1979	5.7	18.4	77.7	9.0	100
1980	5.6	20.4	82.3	10.6	100
1981	6.1	22.7	84.3	11.5	100
1982	6.9	23.9	88.3	10.5	100
1983	7.1	24.4	83.6	9.3	100
1984	7.1	25.3	83.7	9.9	100
1985	7.7	24.5	85.0	10.5	100
1986	7.9	25.4	79.7	11.5	100
1987		26.4	81.8	10.0	100
1988		26.7	83.1	11.0	100
1989		28.9	87.1	10.5	100
1990			89.4	10.9	100

Notes: (a) The India/USA and Indonesia/USA comparisons are for large and medium sized establishments, the Korea/USA and Japan/USA comparisons are for total manufacturing.
Source: India/USA from van Ark (1991), Japan/USA from van Ark and Pilat (1993); Korea/USA from Pilat (1993).

Table 14 contains the results of binary comparisons of labour productivity per person engaged between Indonesia, Korea, Japan and India on the one hand and the USA from 1970 to 1990. Table 14 shows that Indonesia is somewhat ahead of India in terms of labour productivity. However, it has not attained productivity levels comparable to those obtaining in South Korea in the early seventies. In spite of rapid industrial growth, Indonesia still has far to go, before it can embark on a path of industrialisation comparable to that of Korea in the 1970s and 80s.

Compared to the USA relative productivity improved in between 1975 and 1980 and remained constant in the eighties. Compared to the leading Asian economy Japan the productivity gap remained unchanged from 1975 to 1990. Compared finally to South Korea, there is even some evidence of relative decline. Productivity in 1975 was at 45 per cent of the Korean level. In 1990 it was at 36 per cent. These figures say more about the dynamic economic environment in Asia than about lack of dynamism in the Indonesian economy. However, in comparison with these dynamic models, Indonesia presents an example of rapid growth without catch up.

8. Annexes

8.1 Coverage ratios by sample industry

TABLE A1
Coverage Ratio: Gross Value of Matched as % of Total Gross Value of Output in Sample Industries

Branch and Sample Industries within the Branch	Indonesia 1987	USA 1987	Number of Matches
1. FOOD MANUFACTURING @	51.92	28.87	41
1 Meat Products	44.27	50.02	11
2 Dairy Products	54.23	38.91	8
3 Fats and Oils	16.78	65.65	8
4 Grain Mill Products	97.12	40.81	3
5 Sugar & Sugar Factories	98.82	67.12	2
6 Confectionery Products	90.55	74.46	7
7 Roasted Coffee	75.07	67.22	2
2. BEVERAGES	32.72	27.49	1
9 Malt and Malt Beverages	94.98	91.94	1
3. TOBACCO AND TOBACCO PRODUCTS	94.80	91.49	4
10 Tobacco and Tobacco Products	94.80	91.49	4
4. TEXTILE MILL PRODUCTS	60.26	49.24	13
11 Textile Yarn and Cloth	70.53	68.41	9
12 Carpets and Rugs	92.23	89.88	1
13 Cordage and Twine Products	81.19	50.20	3
5. WEARING APPAREL	85.92	36.08	20
14 Men's and Women's Clothing	91.29	57.57	20
6. LEATHER PRODUCTS AND FOOTWEAR	65.03	57.11	7
15 Leather Footwear	85.52	80.46	5
16 Leather Tanning and Finishing	40.48	86.11	2
7. WOOD PRODUCTS, FURNITURE AND FIXTURES	86.94	19.21	10
17 Sawmills, Planing & Other Woodmills	95.14	55.21	0
8. PAPER PRODUCTS, PRINTING & PUBLISHING	37.25	12.55	13
18 Pulp and Paper	63.57	65.51	13
9. CHEMICALS, PETROLEUM & COAL PRODUCTS (@)	70.33	31.01	36
19 Agricultural Fertilizers	76.79	31.90	5
20 Paints	96.50	65.92	7
21 Soap and Detergents	46.57	38.04	2
22 Petroleum refining	85.58	77.28	8

TABLE A1: Coverage Ratios (Continued)

10. RUBBER AND PLASTIC PRODUCTS	10.27	2.58	7
23 Tires and Inner Tubes	80.94	19.04	4
24 Rubber and Plastic Footwear	40.35	44.58	3
11 .NON-METALLIC MINERAL PRODUCTS	50.63	6.48	4
25 Bricks	35.24	70.08	3
26 Cement	98.30	59.09	1
12. BASIC AND FABRICATED METAL PRODUCTS @	61.18	17.89	34
27 Ferrous and Non-Ferrous Metal roducts	66.85	47.87	30
13. MACHINERY & TRANSPORT EQUIPMENT	29.83	16.04	15
28 General and Agricultural Machinery	35.09	22.68	6
32 Motor Vehicles and Equipment	58.89	40.58	9
14. ELECTRICAL MACHINERY & EQUIPMENT	25.24	4.64	11
29 Radio and TV Receivers	33.31	80.81	6
30 Lamps and Bulbs	14.88	46.67	4
31 Storage batteries	84.25	52.14	1
TOTAL MANUFACTURING	60.67	19.63	214

Note: (a) including matches outside sample industries

8.2 Hours worked

No previous estimates of hours worked by branch of manufacturing have been published for Indonesia. This annex provides a rough first estimate based on an interpretation of labour force survey data for 1987 and 1990.

The labour force surveys provide data on numbers of persons of 10 years and over per category of hours worked. These data are available for total persons engaged and for employees, for total manufacturing and for urban manufacturing. I base my estimate of 2178 hours worked per year in medium and large scale manufacturing in 1987 on the figures for urban employees.

TABLE A2
Hours Worked in Manufacturing 1987(a)

Hours worked per week (on main job)	Persons Engaged in Manufacturing (000)		Employees in Manufacturing (000)	
Category	urban	urban and rural	urban	urban and rural
0	13.0	55.5	10.5	25.4
1-9	15.2	115.4	0.8	12.6
10-24	123.3	795.2	36.9	116.0
25-34	138.8	701.5	70.2	187.6
35-44	616.2	1599.9	515.6	1005.7
45-59	1034.5	2188.7	902.0	1623.1
>60	151.2	361.4	105.3	212.7
Not stated		0.7		
Total	2092.2	5818.5	1641.2	3183.2
Total excl. not stated & 0	2079.2	5762.2	1630.7	3157.8
Average hours per week	45.3	40.8	47.1	46.1
Average hours per year (b)	2095.6	1888.2	2178.1	2131.0

Sources: Persons engaged from Keadaan Angkatan Kerja di Indonesia (Labor Force Situation in Indonesia, 1987, BPS, 1987, Urban, table 20.3, p. 174, Urban + Rural, table 20.9 p. 180. (Working hours on main job); Employees from Keadaan Buruh/Pekerja di Indonesia, Laborers/employees Situation in Indonesia, 1987, BPS, 1987, table 10.5, pp. 56 and table 10.1, page 52.
Notes: (a) Population of 10 years and over who worked in the previous year.
(b) calculation procedure, see text. Estimate based on 277.5 days actually worked per year.

Hours worked have been estimated as follows. Multiplying the numbers of persons in each category by the midpoint of the category gives total hours worked per week. Division of total hours by total number of persons gives average hours worked per week. Dividing average hours worked per week by six workdays gives average hours worked per day. This is multiplied by the number of days worked per year. This number is estimated as 365 minus 52 Sundays, minus 12 holidays, minus 12 religious days. Finally we assume that 4 per cent of the remaining days are lost due to strikes, absence due to sickness etc. This gives 277.4 days per year. Average weekly hours in table A2 are estimated at 47.1 including overtime. The resulting estimate on a yearly basis is 2178 hours per person engaged.

The following assumptions underly the calculations:

1. A six day working week. Some export oriented industries may have a five day working week. In absence of reliable detailed information, I will stick with a six day working week for the time being.
2. The number of days per week is estimated at 365 minus 52 Sundays, minus 12 holidays, minus 12 religious holidays: i.e. 289 days.
3. 4 per cent days lost due to sick leave and strikes. No figures are available for days lost per year due to absense because of sick leave and strikes. The rather unhealthy climate would tend to make for high absence figures due to sickness. On the other hand the lack of social security provisions would make for low absence figures.

Though data on days lost are lacking, the labor force survey does show the number of persons who are part of the labor force, but are temporarily not working due to illness, leave, waiting for harvest or on strike. These only account for .6 per cent of total employment. In the USA, hours worked are no less than 9 per cent lower than hours paid. The Indonesian figure of .6 per cent is therefore not realistic. For Indonesia I made a modest assumption that 4 per cent of the 289 days calculated above are lost due to sick leave, accidents or strikes, leaving on average 277.5 days per person per year.

4. I use the 1987 labour force survey figures for urban employment, rather than total urban and rural employment. Almost all medium and large scale manufacturing is located in urban settings. Cottage industry consists for an important part of off-farm employment.

The total number of persons engaged in urban manufacturing in 1987 reported in Sakernas is 2,092,175. This figure is in the same order of magnitude as the figure of 1,788,325 persons engaged in the medium and large scale manufacturing reported in the 1987 *Statistik Industri*. Total urban and rural manufacturing employment in Sakernas is 5,762,209 which is not in the same league as the Survey figures. This supports the interpretation that the urban employment is the preferred figure to be used from Sakernas

5. I use the Sakernas data for urban persons employed, rather than total number of persons engaged. Persons engaged includes self-employed people and unpaid family workers. In Statistik Industri, 1987, only .6 per cent of total employment in medium and large sized establishments consists of unpaid family workers. The total number of employees from Sakernas (1987) - 1,641,216 - is roughly equal to the number of employees reported in Statistik Industri - 1,777,046. In addition the bulk of the employees are found in the categories 35-45 hours (1.6%) and 45-59 hours (55.3%) which is consistent with a statutory working week of fourty hours plus overtime.
6. An mimeographed annex to the 1990 Sakernas provides the first breakdown on hours worked by four subcategories of manufacturing for persons engaged in urban manufacturing (the totals from this annex are consistent with the published figures in BPS, 1990b). Applying the same procedure as above, I find the following estimates for hours worked per year:

Food, beverages and tobacco:	2000 hours
Textiles, clothing and leather:	2177 hours
Wood and Wood products:	2160 hours
Other:	2137 hours
Total:	2137 hours

I have applied the ratios of hours worked per branch by persons engaged to average hours in total manufacturing in 1990 to the totals for 1987 to derive rough estimates of hours worked by manufacturing branch in tables 2 and 7 of the main text.

8.3 Adjustment for Small Scale Manufacturing

TABLE A3
Adjustment for Labour Productivity in Small Scale and Cottage Industry

	Employment Persons	Gross Value Added at market prices (000,000)	Value Added per person	GVA/person Small (<20) as % of M & L Manufacturing	GVA/person Total as % of M & L Manufacturing
Indonesia 1986 (a)					
Survey, large and medium, excl. oil and gas	1,691,435	9,348,483	5,526,954		
Survey, Small Industry	770,144	775,304	1,006,700		
Survey Cottage Industry	2,727,250	1,169,371	428,773		
Survey small + medium	3,497,394	1,944,675	556,035	10.1%	
Survey Total Manufacturing	5,188,829	11,293,158	2,176,437		39.4%
USA 1987 (a)					
Census 20 or more persons	17,345,100	1,082,632.4	62,417		
Census, less than 20 persons	1,451,600	64,596.1	44,500	71.3%	
Census Total Manufacturing	18,796,700	1,147,228.5	61,034		97.8%

Sources: Indonesia: Medium and large sized establishments from Statistik Industri, 1986, Vol. 1; small industry statistics from Statistik Industri Kecil, 1986; cottage industry figures from Home Industry Statistics, 1986, table 16b. United States figures from 1987 Census of Manufactures, General Summary.
Note (a): Productivity figures excluding gas oil refining.

8.4 Trends in labour productivity in Indonesia, 1975-1990

To the best of my knowledge there are no officially published figures on trends in real output by branch of manufacturing (medium and large sized establishments) over longer periods. The only published figures are provided in a recent paper by Hal Hill (1991b). This paper presents graphs on real output per person employed from 1975 to 1979 for three ISIC divisions (31, 32 and 37) and for manufacturing as a whole.

In a previous paper (Szirmai, 1993), I made use of trends of real output per person employed in medium and large scale manufacturing on a national accounts basis from 1978 to 1988, provided by BPS. The productivity levels from year to year differ considerably from those presented here, though the general trends are fairly similar. Where there are differences I will mention them.

The primary source for the present estimates is a database availabe at the UI Institute for Economic and Social Research (LPEM) based on the manufacturing surveys, providing among others value added at current factor cost and numbers of persons employed at three digit level from 1975 to 1990. Previous to 1987, the data in this database differ from the figures as published annually in the Statistik Industri, because they incorporate the results of the so-called backcasting project carried out by the members of the development studies project (DPS) at BPS (see Korns, 1993). The backcasting procedures identify establishments which have not been covered in the Industrial Survey and then project output, value added and employment back to the date at which these establishments started to operate. Also the backcasting procedure aims at eliminating double counting of establishments in the survey. These results are still provisional. The work on this impressive backcasting project will be finalised somewhere in 1993 and should result in official constant price estimates of manufacturing production. Especially for the years 1984 from 1986 the data here are still subject to revision, but they will not affect the overall trends.

As deflators I have used the wholesale price indices published in *Indikator Ekonomi*. For the period 1975-1983 I have used an index with 1975 as base year (*Indikator Ekonomi*, December, 1984, pp. 12-15.). For the period 1983-1975 I have used an index with 1983 as base year (*Indikator Ekonomi*, December 1990, p. 22-24. The indices have been linked in the overlapping years 1983 and 1984. From september 1982 onwards *Indikator Ekonomi* publishes price indices for 28 subsectors of manufacturing (Medium and large sized establishments). I have used 1975 value added weights to aggregate the price indices into indices for divisions and ICOP branches.[13]

At two digit division level my linked price indices turn out to be identical to those contained in an annex to Hill's paper 'Indonesia's Industrial Technology Capability' (1991). However, the indices with base year 1975 published in *Indikator Ekonomi* start in 1981, with no figures for 1976 to 1980. For these years, I have used the indices from Hill's paper. At branch level I have interpolated the years 1976-1980 using the indices for the division to which a branch belongs.

For basic metal products (division 37) I used the price index with base year 1971 rather than the price index with base year 1975 preferred by Hill. The 1975 price index gives very implausible results. It declines from 100 to 34 in 1976, reaching 94 in 1981. Use of this index as a deflator results in a more than fourty fold increase in labour productivity from 1975 to 1979. The use of the 1971 index results in an increase by more than a factor twelve which is more plausible.

For the ICOP branch 'basic and fabricated metals', I deflated basic metals and fabricated metals separately, rather than using a combined index based on rather arbitrary weights.

The Indonesian labour productivity trends are presented in table A5. In comparison with

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[13] The 1975 three digit value added figures are from the LPEM, Statistik Industri database. Where the sub sectors coincided with five digit industries, I have used published figures from Statistik Industri, 1975 as weights.

the results for 1978 to 1988 based on national accounts trends published in Szirmai (1993), the following differences are worth noting. Taking 1978 as a base year, the index of labour productivity in leather products and footwear increased to 156 against a decrease to 82 in the previous version. Chemical products excluding gas and oil refining increased to 143 against a decrease, including gas and oil to 94. Rubber and plastic products registered a decline to 75 against an increase to 120 on a national accounts basis. This difference however depends very much on the year chosen, as labour productivity varies greatly from year to year.[14] Growth of labour productivity in metal products was even more dramatic (485) than previously to 258. Finally the index for other manufacturing increased to 146 against a decline in the previous version to 61. The productivity trends based on the manufacturing survey are more plausible than those based on the national accounts. For instance the declines in labour productivity for leather products and chemicals and the slow growth in electrical machinery in the national accounts were hard to explain. In the second place the branch trends seem to be in line with the aggregate results for manufacturing. Finally, the survey data are more clearly described so that other researchers can crosscheck these results and come up with improvements. Even though the national accounts provide a more complete picture of economic activity, a source such as Statistik Industri which provides both output and employment figures based on the same survey is preferable for the purposes of productivity analysis.

[14] This may be due to the interpolation procedure for the years 1976-1980.

TABLE A4
Wholesale Price Indices of Manufacturing Commodities, 1975-1990
by Division of Industry (Large and Medium Sized Establishments, 1975=100 (a)

ISIC Code		ICOP branch	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	311/312	Food manufacturing	100	123	142	162	208	250	289	306	365	402	426	460	500	558	624	691
2	313	Beverage industries	100	95	110	125	161	193	223	243	275	311	333	347	363	380	415	437
3	314	Tobacco Products	100	95	110	125	161	194	224	245	268	284	287	300	319	324	335	354
4	321	Textiles	100	103	111	117	153	182	194	209	223	239	250	261	292	306	319	332
5	322	Wearing apparel	100	103	111	117	153	182	194	209	223	239	250	261	292	306	319	332
6	323	Leather and footwear	100	105	113	119	156	185	197	213	241	268	287	308	340	354	369	383
7	33	Wood products (b)	100	109	118	130	162	200	235	253	271	276	295	314	358	377	401	420
8	34	Paper products (c)	100	127	129	133	171	205	235	253	271	276	295	314	357	376	401	420
9	351/2	Chemicals (excl. oil/gas)	100	78	82	88	121	151	158	167	184	200	217	236	290	304	315	336
10	355/56	Rubber and plastic products	100	122	128	137	190	236	247	239	276	293	284	326	466	541	511	491
11	36	Non metallic mineral products	100	93	97	103	128	159	184	204	227	247	263	277	295	306	345	393
12	371/81	Basic and fabr. met. (e)	100	89	100	108	160	182	163	174	197	213	227	233	270	323	364	407
13	382/4	Machinery and Tr. equipment	100	106	115	122	176	199	222	230	261	292	325	351	398	422	452	487
14	383	Electr. machin. and equipment	100	83	90	95	138	156	174	180	207	221	230	261	306	325	346	360
15	385/39	Other	100	106	118	131	173	209	234	257	301	328	331	361	424	445	461	470
		Total Manufacturing (L+M)	100	106	118	131	173	209	234	257	301	325	346	373	430	470	500	530

Sources: 1981-1983 from Indikator Ekonomi, December 1984 (1975 = 100); 1983-1989 from Indikator Ekonomi, December 1990 (1983 = 100). 1989/1990 from Indikator Ekonomi, February 1993. I interpolated 1976-1980 using trends by division of manufacturing from Hill, 1991. table 1. Price indices for subsectors were combined into branch indices using 1975 gross value added weights at factor costs. Value added weights at three digit level from LPEM printout (1993), the value added weights at five digit level are from Statistik Industri 1975.

Notes: (a) Two series of price indices were linked in the overlapping year 1983.
(b) The index for the wood products branch is the combined index for wood and paper products.
(c) There is no separate published index for paper, printing and publishing products. From 1981 onward Hill has used the combined index for wood and paper products. Between 1975 and 1981, however, Hill's index for paper, printing and publishing differ somewhat from those for wood products. I have used Hill's figures.
(d) I assume that other chemicals refers to all products in industries 351/2 except fertilizers and insecticides. I have used value added weights from Statistik 1975.
(e) I used value added weights of 1975 to aggregate price indices between 1975 and 1980. From 1981 onwards I used 1981 value added weights, to reflect the great increase in basic metal production. Prices of fabricated metals increased much more than those of basic metals. If I had not reweighted, the price increase of the branch would have been too high. After 1983 the two subindices run parallel.

TABLE A5
GDP at Factor Cost per Person Engaged by Branch of Manufacturing, Indonesia, 1975-1990
at constant 1975 prices (Medium and Large Sized Establishments) (000 Rp.)

Code	ICOP branch	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
311/12/13	Food and Beverages	773	596	750	825	830	683	832	839	813	829	827	756	764	1034	932	1326
311/312	Food manufacturing	727	538	682	791	777	609	759	738	679	718	775	717	695	948	882	1257
313	Beverage industries	1914	2409	2382	1670	2058	2250	2373	2944	3430	2972	2227	1779	2687	3339	2367	3493
314	Tobacco Products	570	830	709	758	764	1325	1341	1264	1254	1494	1400	1802	2071	2443	2457	3140
321	Textiles	401	499	430	653	553	630	632	693	692	987	1022	1413	1168	1421	1671	1680
322	Wearing apparel	230	381	344	446	449	318	397	645	670	828	674	1201	763	984	1035	1025
323/4	Leather and footwear	1353	1125	924	963	1129	1015	715	1020	1425	1548	1283	2519	1317	1497	1415	1503
33	Wood products	511	551	680	731	729	1210	1225	995	942	675	1347	2044	1770	1829	1624	1578
34	Paper products	915	657	838	779	914	900	692	803	730	1007	1344	1440	1730	2725	2210	2976
351/2	Chemicals (excl. oil/gas)	1468	2640	2565	3254	2448	2740	3644	2971	2971	3459	3985	3634	3539	4668	3958	4700
355/56	Rubber and plastic products	639	886	916	1271	974	798	752	776	861	961	1381	831	707	951	996	1039
36	Non metallic mineral products	793	1364	1869	2097	2023	1796	2179	1414	1709	1734	1822	2029	2011	1995	1443	1997
371/81	Basic and fabr. met. (e)	809	942	826	1019	1101	1297	1417	1694	2246	3698	3446	5540	4767	4942	5344	3860
382/4	Machinery and Tr. equipment	1346	1140	1240	1487	1489	2108	2973	2101	1706	1904	2261	2113	2282	2645	2866	3148
383	Electr. machin. and equipment	1398	1739	1950	1744	1362	2146	1867	2430	1737	1849	2723	2495	2218	2605	2458	2830
385/39	Other	467	404	487	531	461	720	495	474	379	547	659	670	644	776	933	797
	Total Manufacturing (L+M) (a)	708	775	801	947	906	1049	1150	1051	1008	1149	1263	1446	1330	1546	1490	1600

Source: Gross value added at current prices from LPEM data base of Manufacturing Survey Data, 1975-89. Original Source: Statistik Industri (revised); 1990 from Statistik Industri, 1990; deflators from table A4.

Notes: (a) using deflator for total manufacturing GDP. The column totals are higher than the deflated aggregate figures, especially in the later years (up to 25% higher.
(b) We used separate deflators for basic metals (351) and fabricated metals (352) and summed the results at constant prices.

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