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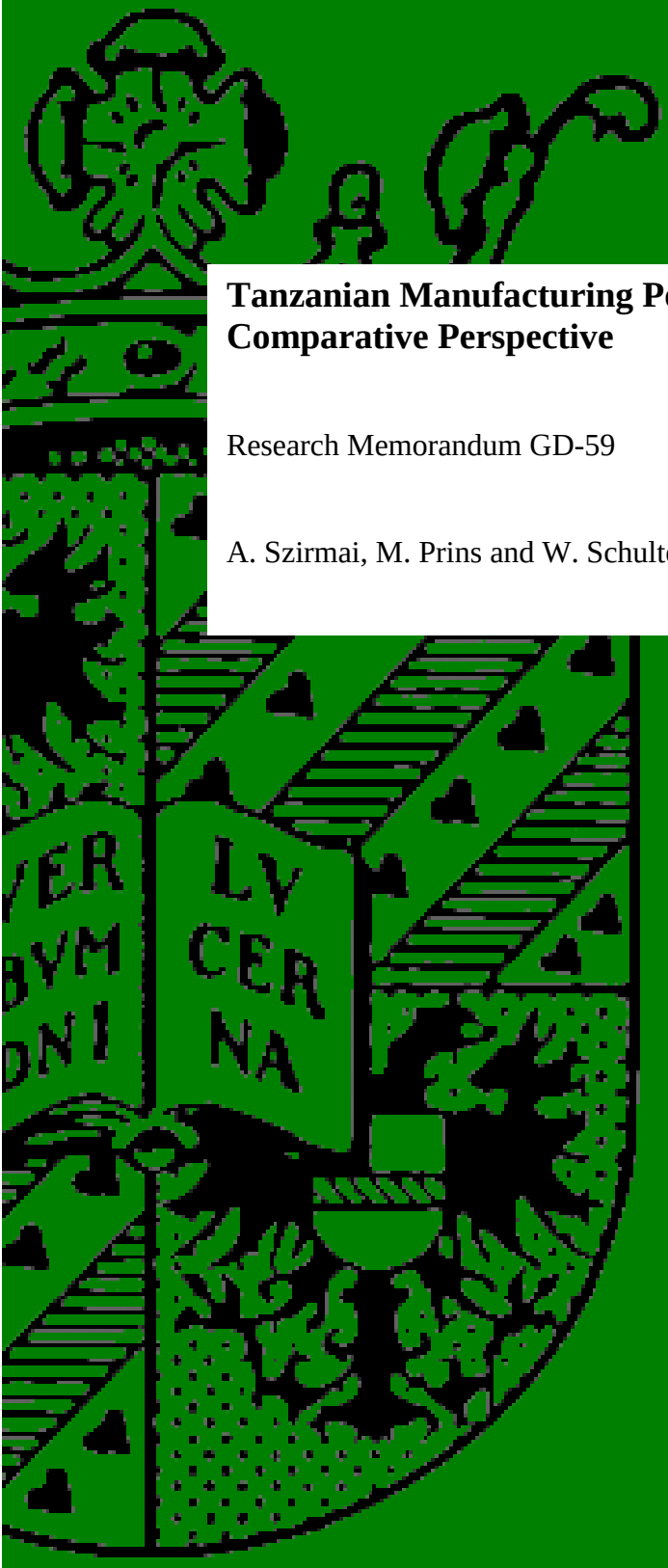

Tanzanian Manufacturing Performance in Comparative Perspective

Research Memorandum GD-59

A. Szirmai, M. Prins and W. Schulte

RESEARCH MEMORANDUM

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by

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Abstract1

This paper presents a summary of new estimates of employment, nominal and real GDP in Tanzanian Manufacturing, 1961-1995. Time series of GDP and employment are placed in comparative perspective by linking them to benchmark level comparisons of GDP and employment for 1989. The first part of the paper (sections 2-4) deals with adjustments to nominal GDP, based on in depth analysis of the data of the 1989 industrial census, earlier census data and industrial surveys. Adjustments are made for undercoverage, omitted establishments, non-response and conceptual adjustments in the concept of value added. After adjustment, nominal manufacturing value added in establishments with 10 is substantially higher. The adjustments vary from 3% in 1978 to 127% in 1988. On average the upward adjustment is 52 per cent. New consistent time series of nominal GDP are presented both for aggregate 10+ manufacturing (1961-1995) and for six branches of manufacturing (1965-1995)

The second part of the paper (section 5) focuses on the construction of a consistent long term index of industrial production, using weighted quantity relatives. The index is constructed for aggregate 10+ manufacturing and six branches. Corresponding indices of employment are derived, using the same adjustments for undercoverage, omitted establishments and non-response as in the case of GDP.

The third section of the paper (section 6) presents a benchmark comparison of real value added relative to world manufacturing productivity leader, the USA. The benchmark uses average unit value ratio's to convert value added for purposes of real comparisons. These unit value ratio's are derived from the industrial census product listings in Tanzania and the USA, according to the industry of origin methodology of the international comparisons of output and productivity project (ICOP). Census listings contain quantity and value information, which are used to make product matches.

In 1965 comparative labour productivity in aggregate manufacturing was around 9 per cent of the US level. It increased until 1973 to 11 per cent, followed by a long period of decline. By 1989 labour productivity stood at 3.7 of the US level.

(Keywords: Industrial Statistics, Labour Productivity, International Comparisons, Tanzania, Manufacturing, JEL codesC82, L60, O47)

1 An abbreviated version of this paper has been published in A. Szirmai and P. Lapperre (eds), *The Industrial Experience of Tanzania*, Houndmills, Palgrave, 2001.

1 Introduction

Tanzania is a late late-comer to the process of industrialisation. The first steps towards industrialisation were taken after World War II. These took the form of processing for export markets. The expansion of manufacturing activities for the local market started in the mid-1950s. This late start is illustrated by the modest numbers of manufacturing establishments in Table 1. Of the establishments with 10 or more persons engaged in operation in 1961, only 101 predated 1945. Including small scale establishments, the number of establishments in 1933 was 321 (Silver, 1984, p. 42). According to official figures, the manufacturing sector contributed 3.5 per cent to GDP at factor cost in 1961 (Central Statistical Bureau, 1961).[2] Since independence, the number of establishments increased sharply to 569 by 1965, peaking at 1282 in 1978 and subsequently declining to 886 establishments in 1989.

Table 1

Indicators of Tanzanian Manufacturing Performance, 1946-1989

Year	Number of Establ. [a]		Persons Engaged [b]	Value Added [c]
	In production	Increase [1]		
	(number)	(annual average)	(thousands)	(% of GDP)
1946	101*			
1957	293*	17		
Independence (1961)	380*	22	22	3.5
1965 [2]	569	38	28	9.2
1978	1282	51	110	12.3
1989	886	-33	124	8.4

Source: (a) Annual Survey of Industrial Production (ASIP) 1965, Table 5;
(b) for 1961: Skarstein and Wangwe 1986: p. 79, for 1965, 1978, 1989, resp.: ASIP 65, Census of Industrial Production 1978, and Census of Industrial Production 1989.
(c) for 1961: Skarstein and Wangwe 1986: p. 79; for 1965, 1978, 1989: BoS March 1995c, Table 7.2.

Notes: All data refer to establishments with 10 or more persons engaged, except for value added data which refer to the entire manufacturing sector. (*) Number of establishments which were still in production in 1965. (1) Annual average increase in establishments in the period previous to the respective years. (2) Data for 1965 and previous years cover the activities Sisal Decortation and Motor Vehicle Repair, which are exluded from manufacturing in later issues of the ASIP issues.

In 1961, the large and medium scale manufacturing sector (10+) employed 22,000 persons. Manufacturing employment increased to 110,000 in 1978, in which year the sector registered a peak share of 12 per cent of GDP. In 1989, employment in medium and large scale manufacturing had increase to 124,000 persons, while its share in GDP dropped to 8 per cent.

One may conclude that Tanzanian industrialisation started almost from scratch in the mid-1950s. The aim of this paper is to chart the course of industrialisation since independence, by contributing to the statistical measurement of manufacturing performance. To this end, we will scrutinise the available statistics on medium and large scale establishments (with 10 or more persons engaged), for which the most reliable data are available. This paper summarises and integrates the results of two bodies of research on Tanzanian manufacturing performance: a reconstruction of nominal and real output and employment in Tanzanian manufacturing (Prins and Szirmai, 1998) and a

[2] Unless indicated otherwise, GDP always refers to the factor cost concept.

benchmark comparison of levels of real output and labour productivity in manufacturing between Tanzania and the world productivity leader, the USA for 1989 (Szirmai and Schulte, 1998).[3]

The paper has the following objectives:

- To present consistent newly revised time series of 10+ manufacturing value added at current prices for the medium and large scale manufacturing sector as a whole and for major branches of manufacturing (section 2-4)
- To present consistent indexes of industrial output and labour productivity for major branches of manufacturing and total manufacturing, for the period 1961-1995 (see section 5)
- To present a benchmark comparison of real output and labour productivity in Tanzania vis à vis the USA in 1989, using the methodology developed in the international output and comparisons project (ICOP) see section 6)
- To combine US and Tanzanian time series and the 1989 benchmark, in order to measure comparative trends of Tanzanian labour productivity (section 7).
- To discuss the implications of the newly constructed series for our understanding of growth, structural change and productivity in Tanzanian manufacturing (section 7).

2 Current Statistical Practice

Current statistical practice in Tanzania involves the following steps. An exhaustive list of medium & large scale (10+) establishments forms the basis for sending questionnaires to these establishments. Responding establishments send back a filled-out questionnaire. In the case of non-response, Takwimu makes an estimate for the non-responding establishment. The questionnaires are sent out and collected on an annual base for *the Annual Survey of Industrial Production*. In the years 1961, 1978 and 1989 an industrial census has been carried out, instead of a survey. In the census years, data are collected in the same way as for the survey. However, efforts are intensified to get a high response rate and the coverage of the census is better than the coverage of the survey. Small scale and sometimes even informal establishments are canvassed as well. 50+ enterprises are canvassed on a quarterly basis of the Quarterly Index of Industrial Production (QSIP)

At the next stage, indicators such as value added, gross output, etc. are constructed from the primary data collected by way of the questionnaires. The results of this stage of data interpretation are published in the annual surveys and censuses of industrial production. The completed questionnaires of the responding establishments are stored and saved, with separate records for each establishment.

To compile time series for the national accounts, the annual nominal value added figures for medium and large scale manufacturing are complemented with estimates for the small scale and informal sector and merged into time series for total manufacturing. Since estimates for the small

3 The work on Tanzanian time series is based on fieldwork carried out by M. Prins at the Tanzanian Bureau of Statistics, from April to October 1996 (M. Prins, *Manufacturing Statistics. Reconstructing Tanzanian Manufacturing Value Added 1965-1995*, M.Sc. thesis, Technology and Development Studies, August 1997). Thanks are due to John Komba and Russel Freeman for supervision and support during the fieldwork. Lex Lemmens collected the original data files for the benchmark study. We thank him for making these data available to us. We thank Marcel Timmer for advice and assistance with the calculation of unit value ratios and their reliability and Cees Withagen for valuable comments.

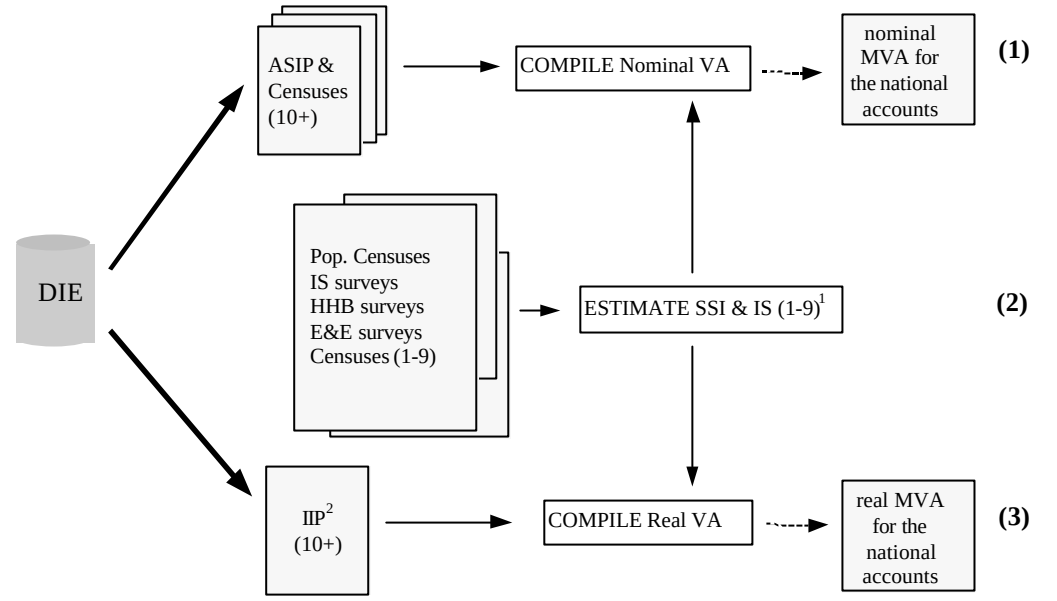
scale (5-10) and informal (1-4) sectors are only available for benchmark years, the compilation of time series total manufacturing involves a procedure of extrapolating the bench-mark estimates for value added in informal and small scale manufacturing forward and backward.

We have presented the procedures for constructing national accounts estimates for manufacturing value added in figure 1. This figure derives in part from the 1985 sources and methods publication of the Bureau of Statistics (BoS May 1985) and in part from discussions with national accounts members of Takwimu and has reference to the so-called 1976 series (1976-1993).[4]

[4] We will deal with the national accounts estimates of nominal and real manufacturing value added in detail in paragraph 2.5.

Figure 1

Compilation of Manufacturing Value Added for the National Accounts, 1976-1993(1976 National Accounts Series)



Notes: DIE= Directory of Industrial Establishments, ASIP = Annual Survey of Industrial Production, IIP = Index of Industrial Production, (M)VA = Manufacturing Value Added, Pop. Census = Population Census, IS-surveys = Informal Sector Surveys, HHB survey = Household Budget Survey, E&E surveys. = Employment and Earnings Surveys. SSI = Small Scale Industries (5-9), IS = Informal Sector (1-4). (1) SSI estimated at 32 million TSh for both real and nominal value added series for the years 1976 onwards. IS is estimated as 1/3 of 10+ manufacturing. (2) And for national accounts purposes the constructed IIP is used to extrapolate 1976 benchmark value added (1+).

The statistics presented in the quarterly and annual survey of industrial production (QSIP and ASIP) and censuses of industrial production are based on the directory of industrial establishments (DIE) serving as a framework for data collection. These statistics in their turn are core inputs for compiling manufacturing value added for the national accounts. On the other hand, various statistics (provided in the population census, household budget survey, etc.) are used to come up with an estimate for small scale and informal manufacturing. Putting together the estimates for medium & large scale, small scale and informal sector manufacturing, national accounts value added is obtained.

The estimates for current and constant prices series are more or less independent. The compilation of the constant prices series is mainly based on a (provisional) index of industrial production. This index is used to update value added data from benchmark 1976 to arrive at a constant price series.[5] The estimation procedure of the small scale and informal sector is the more less the same for current and constant prices.

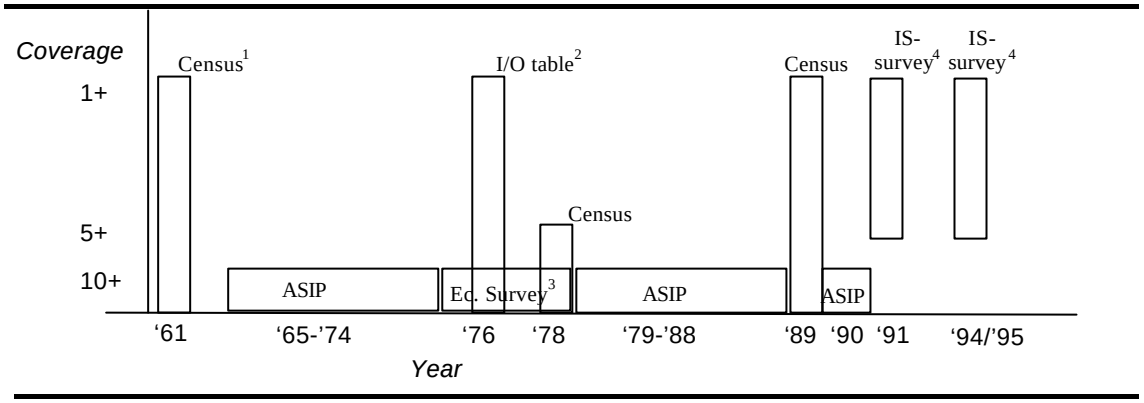
[5] National accountants have constructed an (unpublished) provisional index of industrial production for national accounts purposes only. In the quarterly survey (QSIP), an index of industrial production has been published for 1985-1995.

3 Data Sources for Time Series on 10+ Manufacturing

As indicated in the previous section, the main data sources for the manufacturing sector in Tanzania are the annual survey of industrial production (ASIP), the censuses of industrial production and the quarterly surveys of industrial production covering establishments with 50 or more persons engaged (QSIP). Additional sources are input output tables, informal sector surveys, price indices and economic surveys (see references). Our main source for nominal value added in 10+ manufacturing are the surveys and censuses. Figure 2 summarises these sources and compares their coverage.

Figure 2

Comparison of Coverage of Statistical Sources



Notes: ASIP= Annual Survey of Industrial Production. IS-survey = Informal Sector Survey. I/O table = Input-Output table. Ec. Surv. = Economic Survey. 1) 1961 Census results are not comparable to later industrial surveys/ censuses.
2) The coverage of the I/O table is not based on a canvassing procedure of 1+ establishments, but on estimates based on data s as the 'final demand' for certain manufacturing products. Estimates thus attempt to reflect 1+ coverage. 3) Although no ASIP published in 1975-1977, data were colleced through the ASIP questionnaires and the aggregates were published in the Econon Survey. For 1978, 10+ estimates have been published in the Economic Survey, since census results did not became available t 1985. 4) The Informal Sector Surveys covered establishments with 5 or less *paid employees not using high technology.* This c not correspond to our categorisation of 1-4 persons engaged.

In table 2, we have listed published annual value added estimates for 10+ manufacturing. For the census years we have also presented 50+ value added and the share of 50+ value added in 10+ value added.

Table 2

Nominal Manufacturing Value Added in Medium and Large Scale Manufacturing 1965-1990 (as published)

Year	Nominal Value Added		
	10+	50+	50+ as % of 10+
	(Millions TSh)		(%)
1965	267		
1966	295		
1967	319		
1968	378		
1969	475		
1970	561		
1971	643		
1972	806		
1973	914		
1974	1155		
1975*	1311		
1976*	1756		
1977*	2075		
1978	2815[1]	2586	92%
1979	2927		
1980	2891		
1981	3108		
1982	3204		
1983	3620		
1984	4405		
1985	5129		
1986	6022		
1987	11062		
1988	11358		
1989	21646[1]	18238	84%
1990	23956		

Sources: ASIP: Annual Survey of Industrial Production, several issues, except for: 1974-1976 (Economic Survey 1981), 1978 (Census, 10+) and 1989 (Census, 10+).
Notes: (*) Economic Survey data, because no survey is published for these years.
Data refers to 10+ establishments and is based on ASIP questionnaires.
(1) Censuses recalculated to 10+ coverage.

Table 3 summarises available national accounts series of nominal value added. This table gives us an idea of the major impact of subsequent revisions on estimates of manufacturing value added. A detailed discussion of the different estimates is provided in Prins and Szirmai (1998). Table 3 also documents the increasing gap between total and 10+ manufacturing value added. The analysis in section 4 takes focuses on 10+ manufacturing value added and takes the unadjusted figures of table 2 as a point of departure.

Table 3

National Accounts Data on Manufacturing Value Added at Current Prices

	ASIP	National Accounts												Ratio[2]
		1966 Series[1]				1976 Series				Revised 1976 Series		1985 Series		
		OECD 1971[a]	WB 1976[b]	WB 1980[c]	BoS 1981[d]	BoS 1985[e]	BoS 1990[f]	BoS 1992[g]	BoS 1994[h]	BoS 1995a[i]	BoS 1995b[j]	BoS 1996[k]	BoS 1997[l]	NA/ ASIP
	(10+)	(1+)												
		(MVA in current prices in millions Tsh)												
1960	-	109	202	202										
1961	-	139	258											
1962	-	154	288											
1963	-	156	292											
1964	-	194	371											
1965	267	234	429	429										161%
1966	295	415	525	525	525									178%
1967	319	477	571	571										179%
1968	378	519	648	648										171%
1969	475	597	742	742										156%
1970	561		828	828	828									148%
1971	643		937	947	947									147%
1972	806		1106	1144	1144									142%
1973	914		1227	1260	1260									138%
1974	1155			1482	1482									128%
1975[3]	1311			1774	1774									135%
1976[3]	1756			2047	2047	2811	2811	2811	2811	2811	2811			160%
1977[3]	2075			2416	2424	3287	3287	3287		3287				158%
1978[3]	2815				2860	3859	3859	3859		4091				145%
1979	2927				3277	3868	3868	3868	3868	4368				149%
1980	2891				3262	4097	4097	4097	4097	4477	4477			155%
1981	3108					4501	4501	4501	4501	4671	4671			150%
1982	3204					4361	4361	4361	4361	4861	4861			152%
1983	3620					4527	4869	4869	4869	4969	4969			137%
1984	4405					4630	5932	5932	5982	5932	5932			135%
1985	5129						6665	6665	6663	7763	7763	14567		284%
1986	6022						8551	8551	8551	9839	9839	19471		323%
1987	11062						14792	14792	14792	14761	14761	26810	26812	242%
1988	11358						24453	15187	15187	20725	20725	35931	35923	316%
1989[3]	21646						30353	15197	15197	46064	46064	49247	49202	227%
1990	23956							18301	18301	59961	59961	70380	70472	294%
1991								20680	34647		65600	88745	88720	
1992									36112		82700	104874	104589	
1993									41204		104700	121050	120479	
1994											126397	157859	157445	
1995												200200	200525	
1996													254326	

Sources: ASIP: Table 2-1; (a)
(a) OECD (1971), based on, among others, BoS (March 1971); (b) World Bank (1976), based on revisions published in 1972 & more recent years;
(c) World Bank (1980); (d) BoS (Sept. 1981); (e) BoS (May 1985); (f) BoS (October 1990); (g) BoS (August 1992); (h) BoS (August 1994);
(i) BoS (April 1995); (j) BoS (August 1995); (k) Excel Data Sheets (7/12/96) containing manufacturing series calculations and notes,
performed by R. Freeman; (l)Tables derived from the most recent National Accounts Publication (sent by J.M. Komba 12/12/97).
Notes: (1) OECD and World Bank series are given, because they are backdated to 1960. (2) The ratio of the most recent national accounts figure to ASIP values is taken. (3) Census and Economic Survey data have referance to 10+ coverage.

4 Reconstruction of Nominal 10+ GDP, 1961-1995

Careful analysis of the primary sources identifies three main sources of error (Prins and Szirmai, 1998):

a. Undercoverage of 10+ establishments in the directory of establishments.

b. Underestimation of value added due to treatment of non-response.

c. Underestimation of value added due to conceptual errors.

Adjustments for these sources of error are made for two periods: 1978-1990 and 1965-1978.

Additional sources of error, which will not be discussed in this paper, are errors in the raw data of the 1989 census, the changing categorisation of activities in economic sectors and inadequate treatment of the small scale and informal sector in the national accounts, using rules of thumb (see Prins and Szirmai, 1998, sections 2.2.2, 2.4 and 2.5). The issue of changes in categorisation has been dealt with by aggregating manufacturing sectors into six major branches. The informal sector merits treatment in a separate paper. This paper limits itself to medium and large scale enterprises with 10 or more persons employed.

4.1 Coverage

The framework for data collection is the directory of establishments, maintained at the industrial section of the Bureau of Statistics. The coverage of medium and large scale establishments in the directory varies over time and does not adequately reflect changes in the real volume of activities. There are particularly large differences in coverage between survey years and census years (see Prins and Szirmai, 1998, table 2.2). For instance, the directory for the 1974 survey lists 499 enterprises. This jumps to 1282 in the census year 1978. In the survey year 1988 the directory includes 711 establishments. This jumps to 866 in the census year 1989. In some cases establishments, such as furniture making and tailoring have deliberately been omitted from the annual surveys (*omitted establishments*). In most cases, the differences are unintentional (*undercoverage*).

Adjustments for undercoverage

For the period 1978-1990, coverage adjustments have been based on analysis of a sample of 102 50+ establishments drawn from the 1989 census. For these establishments, files were available with the original survey and census returns for all years. For every establishment, the original questionnaire provides information on since when the establishment has been in operation. From the returned questionnaires one can also deduce in which years an establishment was included in the directory of establishments. Comparing these two kinds of information, we can trace establishments which were not covered in the directory prior to 1989 but were nevertheless already in operation. Thus, we can make estimates of the relative coverage rates in our sample. The coverage rate (*CR*) can be defined as the total number of establishments covered divided by the total number of establishments in operation. In equation form the coverage rate is given by:

$$CR_t = \frac{N_t - nc_t}{N_t}$$

where nc_t is the number of not covered establishments.

We have calculated the coverage rates for three size classes (50-99, 100-499, 500+) and have weighted size class coverage rates with size class value added from the census, to arrive at estimates for the total rate of undercoverage in manufacturing. Table 4 reproduces the coverage rates for sizes classes and the weighted totals.

Table 4

Coverage of Establishments in the DIE from 1978 to 1989

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
50-99	100%	100%	89%	86%	84%	88%	91%	94%	92%	92%	92%	100%
100-499	94%	89%	92%	90%	83%	83%	84%	86%	91%	93%	95%	100%
500+	100%	94%	89%	85%	82%	83%	96%	96%	100%	100%	100%	100%
Weighted Coverage*	97%	92%	91%	87%	83%	84%	89%	91%	95%	96%	97%	100%

Source: calculated from Szirmai and Prins, 1998, table B-10.

Notes: (*) Weighted using value added shares for coverage rate for each size class.
For 1978 the shares for sizeclasses are resp. 7, 50 and 43%. For 1989, 9, 49 and 42%
For the inter censal years, the average of the censuses is taken (9, 49 and 42%)

Coverage rates depend on how quickly establishments which have started operations get included in the directory of establishments and receive survey questionnaires. For the 1989 we assume 100 per cent coverage. Within each size class, coverage rates are calculated as a percentage of the establishments in operation in each year. The coverage rates are used to adjust value added, on the assumption that average value added in non-covered establishments equals average value added in covered establishments. We assume that the coverage rates for our sample are representative for those in the total population of establishments.

For the period 1965-78, we made a rough adjustment. We compared gross output from the 1978 economic survey, which is consistent in coverage with the surveys prior to 1978 with gross output from the 1978 census. Assuming a constant rate of undercoverage between 1965 and 1978, we can backcast the coverage gain achieved in 1978 to 1965. The assumption of a constant rate of undercoverage implies, that the directory of industrial establishments set up in 1965 did not cover all 10+ establishments, due to little experience in this field. By 1978 the statistical registration systems had improved, so that establishments in the 1978 census were covered more adequately than before.

Value added in omitted establishments 1965-78 was calculated as follows (see Prins and Szirmai, 1998, appendix D). For 1966, we calculated omitted value added as a residual, by subtracting unadjusted 10+ value added, estimated value added for non-response (see below) and estimates for 5-9 value added, from total 5+ value added in the national accounts. The 1966 proportion of omitted to total value added was used to adjust value added for the whole period.

4.2 Treatment of Non-Response in Official Statistics

Between 1961-1971 the numbers in the ASIP reflect responding establishments only. No adjustments have been made for non-response. Between 1972 and 1974 the ASIP data have been adjusted for non-response. In 1976, the data in the Input Output table have been adjusted for non-response. For the period 1978-90 no published information is available on treatment of non-response. Interviews within the bureau of statistics revealed that the methodology for dealing with non-response was that of *simple repetition.* If an establishment has not responded in a given year, one takes the previous year's figures. If an establishment does not respond for several years, one takes the figures from the last year in which it responded.

Adjustments for non-response 1978-90

For the calculation of the effects of non-response on value added, we have examined records of a sample of 102 50+ establishments from the 1989 census. The aim of this exercise is to make an estimate of the understatement of value added of non-responding establishments, resulting from the method of *simple repetition of value added.* Our basic approach is to inflate the repeated value added figures with the consumer price index, to account for rapid price changes.[6]

[6] This means that we can correct for price changes, but not for real output changes of the non-responding establishments. Inspection of the real index of industrial production discussed in section 4 of this article shows that aggregate real output was more or less stable between 1983 and 1989. Therefore, our adjustment for price changes does not seriously underestimate aggregate value added.

For the sample, it is known for each year between 1978 and 1990, whether an establishment is a non-respondent in that year and if so, for how many successive years it has been a non-respondent.[7] The establishments in the sample are subdivided into three size classes (50-59, 100-499, 500+). Within each of the three size classes distinguished, we can express the degree of underestimation of value added in year *t* (UE_t in percentages) as a sum of underestimations (*ue* in percentages) caused by subsets (or cohorts) of establishments of which nominal value added data are repeated for a given number of successive years, due to non-response (*I*). For one cohort, the degree of underestimation equals, the proportion of all establishments which are not responding for a given number of years (e.g. 2 successive years), weighted by the price indexes over the period of successive non-response.[8] In formula, the degree underestimation of value added in a size class is calculated as follows:

$$UE_t = \sum_{i=1}^{S_t} ue_{t,i} \text{ , where, } ue_{t,i} = \frac{tnr_t}{N_t} \frac{nr_t(t-i)}{tnr_t} \left[\frac{CPI_t}{CPI_{t-i}} - 1 \right] \text{, where}$$

UE_t is the underestimation of value added due to non-response, expressed as a percentage of unadjusted valuedded

N_t is the number of establishments in the sample which are in production in year *t*,

tnr_t. is the total number of non-respondents in the sample in year *t*,

S_t the maximum number of successive years value added is repeated for a given establishment in year *t*,

$nr_t(t\text{-}i)$ is the number of non-respondents of which value added has been repeated since year *t-i*.

CPI_t is the consumer price index in year *t*.

The estimate for the overall underestimation of value added was calculated as a weighted average of the degrees of underestimation per size class, weighted with value added weights per size class from the census.[9]

Adjustments for non-response 1965-74

The records of the annual surveys enabled us to make estimates for value added of non-responding establishments for the years 1965-1971. For the years 1965-1971 we have calculated non-response rates and calculated non-response value added at branch level (see Prins and Szirmai, 1998, Table E-2 and E-3).

[7] Note that this information is not available for the period 1978-1990 for the full population of establishments in the census.

[8] The assumption here is that value added is roughly proportionate to the number of establishments. We have to make this assumption as no complete value added data are available for the sample for all the intervening years between 1978 and 1990.

[9] The important assumption here is that the degree of underestimation calculated from our sample of 50+ establishments is considered to be representative for 10+ manufacturing.

4.3 Conceptual Errors

A change in the questionnaire design for ASIP, gradually introduced from 1980 onwards, gave rise to errors in the calculations of manufacturing value added. These flaws were discovered during in-depth analysis of the results of the 1989 census, which was based on the same flawed questionnaire design. Due to an ambiguous definition of an intermediate input category labelled *all other costs*, responding establishments were inclined to allocate huge amounts of interest payments to intermediate inputs. Since interest costs are a component of value added rather than intimidate inputs, value added is wrongly defined and, as a consequence, substantially underestimated.

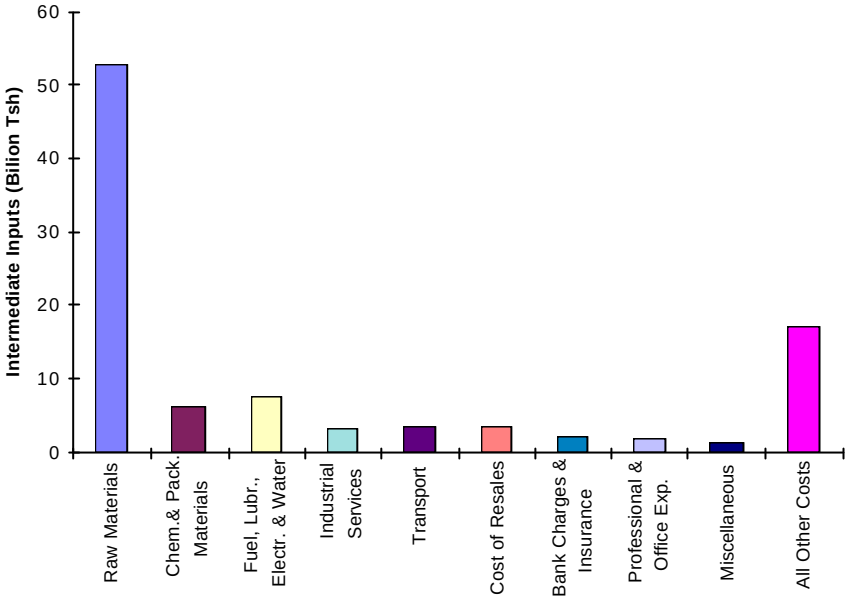
Examination of the cost structure of 10+ establishments in the census revealed that some establishments have enormous amounts of costs allocated to the residual *all other cost* category. In particular they have allocated large amounts of interest payments to this category, where they do not belong.[10]

This conclusion is based on the following reasoning. The questionnaire distinguishes 16 categories for production costs. One of these categories is *bank charges and insurance paid*, which explicitly excludes interest costs. However, the instructions for the category *all other costs* do not indicate that interest costs should be excluded. They explicitly exclude labour costs, sales taxes, corporate taxes, excise duties and depreciation, but there is no mention of interest at all. In Figure 3 we can see how important *all other costs* are compared to most other intermediate input cost categories. From an analysis of firm level data for 175 large firms accounting for 96 per cent of 'all other costs', we conclude that the *all other cost* category indeed includes interest payments which should have been allocated to value added.

[10] Intermediate inputs or *intermediate consumption* consists of the value of the goods and services consumed as inputs by a process of production. (UN 1993: 143). Cost categories such as interests costs, directors fees, and donations are not intermediate inputs, but part of value added.

Figure 3

Cost Structure 1989 Census



Some other components of value added have also been erroneously included in *all other costs*, because they were not identified elsewhere in the questionnaire. These cost categories are *bad debts*, *directors fees*, and *donations.*

A less important, conceptual error is that *Profits from Sale of Fixed Assets* should not have been included in the calculation of gross output. As gross output is too high, gross value added at factor cost is overstated by 0.3 billion Tsh.

Adjustments to value added 1978-1990

The most important conceptual adjustment to the census data has been achieved by reclassifying a portion of the cost category *all other costs* from intermediate inputs to value added. Our estimate of the total amount of non-intermediate inputs incorrectly allocated to *all other costs* was 11 billion out of a total of 17 billion Tsh. in this category (Prins and Szirmai, 1998, Tables A-1 and A-4). Reallocation of these cost categories to value added, resulted in a downward adjustment of intermediate inputs from 98 billion Tsh to 87 billion Tsh. Correspondingly, gross value added was adjusted upwards by 11 billion Tsh. Thus, huge adjustments have been made in 1989 value added for all branches (except branch 39). Total value added has been adjusted upward by 51 per cent. The most notable adjustment is the 241 per cent increase in value added for ISIC category 32 (textiles and leather), which increases its share in total value added from 7.9 per cent to no less than 17.8 per cent!

The questionnaire used for the 1989 census had gradually come into use since 1980. We have made an estimate of the rate of adoption of the new questionnaire and have backcast and forecast the 1989 adjustments to value added and intermediate inputs at branch level. The questionnaire adoption rate was estimated from the sample of 50+ establishments taken from the 1989 database (see Prins

and Szirmai, 1998, Appendix B). For each establishment, we were able to identify the year the 'new' questionnaire design was first used.

Table 5

Adoption Rate of "New" Questionnaire

Year	Number	Share	Adoption Rate
1980	1	1%	1%
1981	3	3%	5%
1982	9	10%	15%
1983	20	23%	38%
1984	26	30%	69%
1985	11	13%	81%
1986	7	8%	90%
1987	1	1%	91%
1988	1	1%	92%
1989	7	8%	100%
Sample Size	86		

Source: Prins and Szirmai, 1998 table B-10.

The adjustments made in the 1989 census have been extrapolated to 1980-1988 and to 1990, multiplying 1989 adjustments to gross output and intermediate inputs with the adoption rate of the new questionnaire for each year.

Estimates of nominal value added 1961-1965 and 1991-1995

Although no annual surveys were held between 1961 and 1964 we do have data for nominal value added in 1+ manufacturing from 1960 to 1966 (OECD 1971, Table 2-4). Assuming that the growth rate of nominal value added for 10+ manufacturing equals that of 1+ manufacturing , we have applied the growth rates of the 1+ series to backcast 1965 10+ value added to 1961.

No annual survey has been published since the 1990 survey. Therefore, we use a real output index and a price index to extrapolate 1990 value in order to arrive at value added estimates in current values for the years 1991-1995. The price index has been derived from two sources: the CPI (1990-1992) and the PPI (1992-1995).[11] The quantity index used is the improved index of industrial production, which will be discussed in section 5.

4.4 Summary of Adjustments

[11] The construction of a price index in this way derives from Mr. R. Freeman who has prepared a similar estimate in draft data files which he has kindly made available to us. The CPI is used for Food manufacturing (Food index), Beverages & Tobacco (Beverages & Tobacco index), Textiles and Apparel (Clothing and Footwear index), Furniture (Furniture and Utensils index) and for all other branches, the total CPI is used. From 1992 onwards the PPI is available at industry level. The CPI and the PPI are spliced in 1992 to construct a series for 1990-1995.

Table 6 provides a summary of all the adjustments to aggregate 10+ manufacturing value added. The adjusted figures for nominal value added by branch of manufacturing are reproduced in Table 7. In the right-hand columns of Table 6 adjustments are expressed as percentage changes relative to value added after previous adjustments.

The overall level adjustments are substantial. The census year 1978 is the only year in which there have been but modest adjustments. The greatest upward adjustment to value added was made for 1988 (135 per cent). In 1990, the adjustment was 61 per cent. Over the whole period the adjusted series tend to be smoothed out as, jumps in coverage have been eliminated and the whole series has become more consistent.

Table 6

Level Adjustments to Nominal MVA, 1960-1995

	Unadjusted MVA	MVA after adjustments for:				Extra-polated	Change of MVA due to adjustment for: [1]				
		OC-adj.	NR-adj.	OE-adj.	UC-adj.		OC-adj.	NR-adj.	OE-adj.	UC-adj.	TOTAL
	(Value Added in Millions TSh.)						(Change in %)				
1961						243					
1962						272					
1963						276					
1964						350					
1965	267		282	307	405			6%	9%	32%	52%
1966	295		297	327	441			1%	10%	35%	49%
1967	319		323	344	460			1%	6%	34%	45%
1968	378		390	402	522			3%	3%	30%	38%
1969	475		497		659			5%		33%	39%
1970	561		571		766			2%		34%	37%
1971	643		657		874			2%		33%	36%
1972	806				1087					35%	35%
1973	914				1244					36%	36%
1974	1157				1537					33%	33%
1975	1246				1863					50%	50%
1976	1480				2143					45%	45%
1977	2075				2678					29%	29%
1978	2186				2926					34%	34%
1978*	2842	2842	2842		2926		0%	0%		3%	3%
1979	2927	2927	2985		3238		0%	2%		8%	11%
1980	2891	2900	3279		3622		0%	13%		10%	25%
1981	3108	3148	3983		4555		1%	27%		14%	47%
1982	3204	3333	4862		5873		4%	46%		21%	83%
1983	3620	3994	5706		6812		10%	43%		19%	88%
1984	4417	5269	7241		8094		19%	37%		12%	83%
1985	5112	6373	8915		9812		25%	40%		10%	92%
1986	6412	8525	11714		12360		33%	37%		6%	93%
1987	11062	14545	20790		21679		31%	43%		4%	96%
1988	11358	15866	25849		26642		40%	63%		3%	135%
1989	21474	32443	32653		32653		51%	1%		0%	52%
1990	23956	37478	38681		38681		56%	3%		0%	61%
1991						48128					
1992						53473					
1993						63535					
1994						82159					
1995						98818					

Source: Unadjusted data: 1965-1974: ASIP; 1975-1978: Economic Survey; 1978*: Census; 1979-1988, 1990: ASIP; 1989: 1989 Census; adjusted data: own analysis as presented in this report (appendixes A-G).

Notes: 1989-adj. = 1989 census based adjustment (conceptual adjustments and data screening); OC = Other Costs based adjustment; NR=Non-Response based adjustment; OE=Omitted Establishments based adjustment; UC=undercoverage based adjustment.

(1) Change is calculated as the percentual change of adjusted value compared to the pre-adjustment value.

Table 7

Adjusted Nominal Value Added 1961-1995

				Adjusted				Unadjusted
ISIC	31	32	33/34	35	36	37/38/39	3	3
Branch	Food, Beverages & Tobacco	Textiles & Leather	Wood Pr. Furn. & Fixt. Paper Pr. Print. & Publ.	Chemicals, Petroleum, Rubber & Plastic Prod.	Non-Metallic Mineral Products	(Basic) Metal Pr., Mach. & Equipm., & Other Man. Industries	Total Manufac-turing	Total Manufac-turing
				(Value Added in Thousands TSh.)				
1961							243439	
1962							271745	
1963							275520	
1964							350061	
1965	131318	93178	42032	25154	5916	107189	404787	266701
1966	135661	144031	42794	26787	11749	79507	440530	295162
1967	121627	152849	45803	52882	21394	65912	460466	318625
1968	180020	143557	47739	53640	23361	73202	521519	378324
1969	202029	193533	55176	62789	28923	116294	658743	475411
1970	235746	278753	70593	65486	30090	84841	765510	560616
1971	286292	300707	64198	81270	33817	107580	873864	642871
1972	310905	368850	61144	121236	49636	174880	1086650	806328
1973	334000	448992	89133	131646	41022	199329	1244123	914327
1974	390272	481125	122775	249184	48491	245445	1537293	1156652
1975	403249	572779	150762	286029	96173	354489	1863480	1245622
1976	477801	675596	177831	337360	60140	414570	2143298	1480345
1977	627467	900910	213552	339244	62566	534159	2677899	2074758
1978	694642	892085	287409	347488	97185	606824	2925632	2842316
1979	800919	970942	323294	471689	99560	571271	3237676	2927333
1980	774318	1227974	359672	558216	120741	581366	3622286	2890897
1981	1134567	1345426	494176	676847	189175	714357	4554547	3108206
1982	2026862	1198534	499515	982171	246378	919253	5872714	3203832
1983	2067669	1812035	549270	889370	326831	1167309	6812485	3619760
1984	2582369	2022511	760200	1228673	170774	1329517	8094045	4417219
1985	3148163	2238412	870414	1398033	384734	1772483	9812238	5111606
1986	3099117	2577458	1107314	2189489	917068	2469293	12359739	6412236
1987	5157851	5331612	1546226	4903191	1237203	3503219	21679302	11062008
1988	7666631	6865440	2044644	4960480	1359874	3744791	26641860	11357863
1989	12441829	5826626	3017332	4901342	1422835	5042905	32652870	21474018
1990	17149464	5597233	3755861	5432448	1176377	5570034	38681417	23955853
1991	21232538	6459244	4328090	6944192	2059175	7105139	48128378	
1992	25522856	7033218	4138842	7650103	1809982	7317953	53472955	
1993	30743364	7567179	7639361	8002358	2427974	7154866	63535101	
1994	43202958	8666806	6716699	10917273	2781754	9873702	82159192	
1995	53931263	12257957	8543564	12284511	3770135	8030217	98817647	

Source: Prins and Szirmai, 1998

5 New Indices of Industrial Production

For most years, official real value added series have only been constructed for total manufacturing. An exception is the index of industrial production (IIP) published in the quarterly survey of industrial production (QSIP) from 1985 onwards. Real value added series have been constructed at 1966 base prices (1960-1980), 1976 prices (1964-1994) and 1985 prices (1986-1994). For 1976-1984 an indirect approach has been followed deflating current value added (1+) from the national accounts with a cost of living index of clothing an footwear (BoS, 1985). For all other years, an direct approach has been followed in which quantity relatives have been weighted with base year value added shares. For the 1966 series no sources and methods are available. The 1976 series are based on quantity relatives for 14 commodities. The 1985 series are based on 120 commodities derived from the quarterly survey amongst 50+ enterprises.

We constructed a new index 1965-1995 based on the following principles: use of as much commodity information as possible; consistent application of the direct approach of weighting quantity relatives. We calculate a Laspeyres fixed base weighted index; and construction of indexes for six branches of manufacturing as well as for total manufacturing.

5.1 IIP 1965-1985

For the construction of an improved index of industrial production as many quantity data as possible were collected for the period 1965-1985 (see Prins and Szirmai, 1998, Appendix H). To construct an IIP for a large time span, it is preferable to rebase the index regularly. The choice of base years was mainly determined by the availability of quantity information and the availability of value added weights for 10+ establishments from the surveys and censuses. The following base years have been chosen: 1966 (coverage 16 commodities); 1970 (coverage 19 commodities); 1975 (coverage 25 commodities); and 1980 (coverage 33 commodities).

The method of constructing the IIP is to select commodities representing given industries and to weight the commodity quantity relatives with the value added of industries which the commodities represent. If no quantity relatives can be calculated for a given industry, this industry is combined with a related industry for which a quantity relative is available. That quantity relative is then weighted with the value added of the combined sectors. Since we construct a fixed base index, we need value added weights for the four base years: 1966, 1970, 1975 and 1980.

The weights are constructed as follows. In a few cases there are more then one commodities representing a four digit manufacturing industry. In such cases, so-called *intra-industry* weights are needed. For the years 1965-1985, we have used the gross-output values of commodities within an

industry from the 1989 census as intra-industry weights.[12] The four digit industry indexes within a three digit ISIC branch are weighted with their industry value added to get a three digit branch index. Industry weights are taken from the ASIP, censuses and the 1976 input-output table. (see Prins and Szirmai, 1998, tables H-5 and H-6 for weights). Each three digit branch index is weighted with its branch value added to arrive at an index for 6 major branches of manufacturing and an index for total manufacturing. In the calculation of the index for total manufacturing, we use the adjusted nominal value added series presented in table 7, as weights.

5.2 Silver's Chain Index 1965-1972

In *The Growth of Manufacturing Industry in Tanzania,* Silver (1984) provides a sophisticated index of industrial production for the years 1965-1972. Utilising an impressive amount of data derived from the QSIP questionnaires, Silver constructs indexes for 38 subindustries conform the 1958 ISIC classification. The Silver index differs from our Laspeyres fixed weighted index. Silver uses a Laspeyres chain index which will yield higher growth rates, since industries growing more rapidly will get higher weights in a chain index. Although we are aware of the methodological differences, we have nevertheless chosen to integrate the Silver's index for 1965-72 into our index, because of the far better commodity coverage of Silver's chain index compared to our IIP 1965-1985. We have recalculated Silver's chain index for our 6 branches, for the period 1965-72, using our adjusted nominal value added weights for our base years (1966 and 1970).

5.3 IIP 1985-1995

For 1985-1995 there is an index of industrial production published in the QSIP. We found that there were significant discrepancies between several of the 1985 base weights applied in the QSIP and the value added data from the 1985 survey. Moreover, the analysis of the surveys made clear that the reliability of the value added data in the mid-eighties is questionable. In our opinion, the most reliable source for reweighting the IIP 1985-1995 is the data from the 1989 census of industrial production, as adjusted in this report (see 4). We have reweighted the index of industrial production utilising (adjusted) 1989 census value added as base year weights. The weighting procedures are the same as explained above for the 1965-1985 index. (see Prins and Szirmai, 1998, Appendix I and Table I-3).

5.4 The New Index of Industrial Production 1961-1995

For the period 1961-1965 no commodity information was available for the construction of an index. To get an estimate for *total* manufacturing, we have retropolated the index figure for total manufacturing in 1966, using a real value added index derived from national accounts real manufacturing value added data for the early period (series OECD 1971, Table 2-5). For the period 1965-1972 we have used Silver's chain index. For 1972-1985 we have used our index, for 1985-1995 we have used the reweighted QSIP index. The resulting indexes for the period 1961-1995 are reproduced in Table 8.

[12] Commodity gross output values were not available for the period 1965-85. We have used 1985 unit value data to cross check and incidentally adjust our 1989 based intra-industry weights.

Table 8

Indexes of Industrial Production 1965-1995

ISIC	31	32	33/34	35	36	37/38/39	3
Branch	Food, Beverages & Tobacco	Textiles & Leather	Wood Pr. Furn. & Fixt. Paper Pr. Print. & Publ.	Chemicals, Petroleum, Rubber & Plastic Prod.	Non-Metallic Mineral Products	(Basic) Metal Pr., Mach. & Equipm., & Other Man. Industries	Total Manufac-turing
				(1976=100)			
1961							22
1962							24
1963							26
1964							28
1965	37	24	100	26	28	24	31
1966	37	30	114	55	57	27	37
1967	41	31	101	57	59	24	38
1968	43	45	116	62	113	33	48
1969	51	47	124	62	118	29	52
1970	51	63	123	65	124	29	57
1971	59	62	145	78	114	48	65
1972	84	80	141	91	130	61	84
1973	86	90	159	88	150	81	93
1974	81	94	142	90	106	91	93
1975	78	92	123	95	115	92	91
1976	100	100	100	100	100	100	100
1977	92	105	151	94	115	112	105
1978	103	97	124	98	105	133	107
1979	90	104	100	80	111	138	103
1980	77	99	108	77	84	130	96
1981	67	90	97	75	107	114	88
1982	64	83	91	71	92	132	83
1983	67	62	68	70	68	167	77
1984	62	60	58	120	102	194	88
1985	57	57	62	77	103	137	72
1986	54	58	83	71	121	152	73
1987	48	75	114	70	126	115	71
1988	57	82	111	64	133	102	75
1989	55	76	109	76	136	110	75
1990	62	77	101	84	157	141	84
1991	64	73	90	84	214	133	84
1992	62	65	71	78	154	100	74
1993	65	68	101	72	164	88	75
1994	66	66	72	79	139	125	79
1995	69	58	66	75	153	69	72

Source: Prins and Szirmai, 1998, table K-2.

5.5 Employment and Labour Productivity

As is the case for nominal and real manufacturing value added, no consistent long run series of manufacturing employment is available at branch level from published statistical sources. We have reconstructed an employment series, consistent in time and consistent with the adjusted nominal value added estimates for 10+ manufacturing. For the period 1965-1978, we have incorporated the level adjustments for non-response and undercoverage in the employment series, under the assumption that the labour productivity of the covered (or responding) establishments is equal to the labour productivity of the non-covered (or non-responding) establishments. Thus we can apply the ratio of value adjusted for coverage and non-response to non-adjusted value added, to the employment figures. Similar adjustments to the employment figures have been made for the years 1978-1989, for

all branches except the textiles/leather branch. This branch was characterised by major discrepancies in employment figures between census and non-census years. For this branch, we have applied an ad hoc adjustment, interpolating between the census years (see for details Prins and Szirmai, 1998, appendix M). The resulting employment figures for 1965-1990 are consistent with our adjusted value added figures. Table 9 presents the employment indexes for six manufacturing branches and for total manufacturing. Table 10 presents the corresponding labour productivity indices.

Table 9

Persons Engaged in 10+Manufacturing, by Branch (1965-1990)

ISIC	31	32	33/34	35	36	37/38/39	3
Branch	Food, Beverages & Tobacco	Textiles & Leather	Wood Pr. Furn. & Fixt. Paper Pr. Print. & Publ.	Chemicals, Petroleum, Rubber & Plastic Prod.	Non-Metallic Mineral Products	(Basic) Metal Pr., Mach. & Equipm., & Other Man. Industries	Total Manufac-turing
1965	10038	12102	9203	955	652	6204	39154
1966	9767	14504	9597	2330	1744	7116	45058
1967	12666	14265	8235	1767	1422	5977	44332
1968	14930	19033	9596	2507	2380	5402	53847
1969	13478	21770	9737	1997	2622	5538	55142
1970	16340	22791	8885	2208	2572	5719	58515
1971	17652	24245	9635	2782	3511	7582	65407
1972	21334	24795	10896	4876	2866	8277	73044
1973	18880	28609	11117	4769	3343	9304	76022
1974	20035	33200	12219	5309	3061	10316	84139
1975	22026	34140	13125	5235	2942	11253	88721
1976	22333	34661	13302	5304	2982	11402	89984
1977	24793	38168	15308	5604	3476	13947	101295
1978	28111	43926	14781	7900	3773	14194	112685
1979	28455	43072	14909	7480	3333	12836	110084
1980	30291	45407	14637	8890	3218	13566	116009
1981	32437	48670	14513	9388	4247	14090	123345
1982	38041	45308	14852	9772	3300	14242	125515
1983	34885	49642	15793	9439	3687	14546	127991
1984	30458	44545	14262	8085	3614	13156	114120
1985	29138	42191	13722	6447	3821	12402	107721
1986	38641	43499	14452	6930	5344	11303	120168
1987	39858	43426	14211	7042	4517	11041	120096
1988	43200	41069	15229	6741	4484	10919	121642
1989	45282	38128	16930	6677	5069	13793	125879
1990	47397	37674	24360	6534	4237	14211	134413

Source: Prins and Szirmai, 1998, Table M-10

Table 10

Labour Productivity Index for Six Branches of Manufacturing, 1965-1990 (1976=100)

	31	32	33/34	35	36	37/38/39	3
	Food, Beverages & Tobacco	Textiles & Leather	Wood Pr. Furn. & Fixt. Paper Pr. Print. & Publ.	Chemicals, Petroleum, Rubber & Plastic Prod.	Non-Metallic Mineral Products	(Basic) Metal Pr., Mach. & Equipm., & Other Man. Industries	Total Manufac-turing
				(1976=100)			
1965	82	68	145	146	128	44	71
1966	85	71	158	126	98	43	73
1967	73	75	162	171	123	47	76
1968	65	83	160	131	141	71	81
1969	84	75	169	165	135	60	84
1970	70	95	184	155	144	59	88
1971	75	89	200	148	97	72	90
1972	88	112	173	99	135	84	104
1973	102	109	191	98	134	99	110
1974	90	98	155	90	103	101	100
1975	79	93	124	96	117	93	93
1976	100	100	100	100	100	100	100
1977	83	96	131	89	99	91	93
1978	82	76	112	66	83	106	86
1979	70	84	89	57	99	123	85
1980	57	75	99	46	78	109	74
1981	46	64	89	42	75	92	64
1982	38	64	81	38	83	106	60
1983	43	43	57	39	55	131	54
1984	45	47	54	79	84	168	70
1985	44	46	60	63	81	126	60
1986	31	47	77	54	68	153	55
1987	27	59	107	52	83	119	53
1988	30	70	97	50	88	107	55
1989	27	69	86	60	80	91	53
1990	29	71	55	68	111	113	56

Source: Table 8 and 9.

6 The 1989 Benchmark

In this section we present a level comparison of real labour productivity in manufacturing between Tanzania and the world productivity leader, the USA, for the year 1989 (see Szirmai and Schulte, 1988). Level comparisons are a useful complement to time series analysis, because they provide information on the absolute size of the gaps in real output and productivity between economies at given points in time. The productivity gaps provide indications of the size of the technology gap between economies. The benchmark comparisons can also serve as an anchor for trend comparisons.

International comparisons require adequate converters. It is well known that comparisons based on exchange rates can substantially underestimate levels of national income and product in developing countries (see Kravis, Heston and Summers, 1982; Ren 1997; Szirmai and Ren, 1998). From the perspective of welfare comparisons, expenditure based Purchasing Power Parities are more realistic converters than exchange rates. However, expenditure based PPPs are less suitable for sectoral comparisons of real output and productivity, because they are not based on producer prices

and because final products include productive contributions of many different sectors of the economy. For sectoral output and productivity comparison, industry of origin converters are required. In this paper, industry of origin unit value ratios (UVRs) are calculated for branches of manufacturing, using the industry of origin methodology developed in the International Comparisons of Output and Productivity Project (ICOP). The UVRs are used to convert 1989 Tanzanian manufacturing GDP into US dollars. For manufacturing, the ICOP project now covers over thirty economies in Asia, Latin America, North America, West and Eastern Europe. Most comparisons take the USA as the reference country. This means that via the USA star comparisons can be made between Tanzania and a variety of developing and more developed economies in different parts of the world.

So far data availability has been a major constraint for the application of the ICOP methodology to an African economy. The methodology requires reliable data on product quantities and ex factory output values, which are seldom available in published form. In the case of Tanzania, the Bureau of Statistics has made the basic files underlying the industrial census of 1989 available to us. This allowed us to reconstruct the necessary data on production quantities and values, from a very basic level. It should be stressed that the benchmark results presented in this paper are preliminary.

6.1 Methodology for the 1989 Level Comparison

The ICOP methodology for level comparisons has been described in detail in several publications (see Maddison and Van Ark, 1988, 1994; Van Ark, 1993; Szirmai and Pilat, 1990; Timmer, 1996). In this paper, we apply the methodology as refined in Timmer (1996). Here, we provide only a brief outline of the methods used.

The primary sources used in this study are the US *1987 Census of Manufactures* , the 1989 *Annual Survey of Manufacturing* (1990), and the Tanzanian *Census of Industrial Production* (Vol. I-V, 1993, 1994) and the data files underlying the Tanzanian published census. These sources provide information on product quantities and corresponding gross output values, making it possible to derive unit values for products or groups of products for both economies.

The basic approach is to make matches of comparable products or product groups from the two censuses and to calculate unit value ratios (UVRs) for each of the matches. Subsequently these are aggregated into average unit value ratio's for industries, branches and total manufacturing. These unit value ratio's are used as conversion factors.

Matches were made in 16 '*sample industries*' The sample industries on the US side consist of one or more four digit industries. For Tanzania, the commodity and output information collected in the 1989 industrial census has not been published. The information from the basic census data files on products and their output value was rearranged into four digit ISIC industries (1968 version, see UN, 1968). These were combined into sample industries comparable to those on the US side.

The conversion factors are calculated in a number of steps.

1. For each product match, UVRs are calculated (Tsh/$). The initial unit value ratios derive from 1989 Tanzanian unit values and 1987 US unit values.

2. UVRs are put on a 1989-1989 basis, using US 1987-1989 price movements for each product group from the Bureau of Labour statistics (1998). The 1989/1989 UVRs are used in all the subsequent calculations.
3. All the UVRs are aggregated into average UVRs) at sample industry level using output quantities of either countries as weights:

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

where

$UVR_j^{XU(X)}$ is the unit value ratio of the Tanzanian Shilling against the US dollar in sample industry j, at quantity weights of Tanzania

$UVR_j^{XU(U)}$ is the unit vale ratio of the Tanzanian Shilling against the US dollar in sample industry j, at quantity weights of the USA.

i = 1.....s is the sample of matched items.

4. Sample industry UVRs are aggregated into branch UVRs. Manufacturing branches in this study consist of one or more ISIC three digit major sectors. Where there is more than one sample industry in a branch (as in food products), the 1989 sample industry UVRs are aggregated at manufacturing *branch level* by taking the weighted average of sample industry UVRs using 1989 sample industry gross output as weights:

$$UVR_k^{XU(U)} = \frac{\sum_{j=1}^{o} [GO_j^{U(U)} * UVR_j^{XU(U)}]}{\sum_{j=1}^{o} GO_j^{U(U)}}, \quad UVR_k^{XU(X)} = \frac{\sum_{j=1}^{o} GO_j^{X(X)}}{\sum_{j=1}^{o} [GO_j^{X(X)} \Big/ UVR_j^{XU(X)}]} \quad (3)$$

where

$GO_j^{U(U)}$ is gross output in US sample industry j in dollars

$GO_j^{X(X)}$ is gross output in Tanzanian sample industry j in Tanzanian Shilling

k branch of industry

j=1..o sample industries belonging to a branch k

However, following Timmer (1996), if the reliability of the UVR for a given sample industry is too low, we weight the original UVRs of the matched items with their output in equation 2.[13]

5 The branch UVRs are aggregated into UVRs for total manufacturing, using branch gross output weights according to equation 2. However, if the reliability of branch UVRs is too low, we use the sample industry gross output weights of step 4 to weight sample industry UVRs.[14]

The general rationale behind these stepwise weighting procedures is to ensure that unit value ratios in large sample industries and large branches receive heavier weights than in small ones (see Van Ark, 1993). However, where the unit value ratios are insufficiently reliable, we use gross output of matched items in a sample industry as weights at branch level and sample industry gross output weights at manufacturing level (see Timmer 1996 for more detail). Thus, the more reliable a UVR the heavier the weight it receives in the aggregation procedure.

6 At each level of aggregation - sample industry, branch and total manufacturing - the UVRs (or average unit value ratio's) can be used to convert 1989 value added into the currency of the other country for purposes of real value added comparisons. In binary comparisons one gets two UVRs at every level of aggregation, one at quantity weights of country X, the other at quantity weights of country U. We use the Fisher geometric average of the two UVRs as a summary measure.

In theory, it would be desirable to calculate UVRs for both inputs and outputs, thus achieving double deflated international comparisons. In practice, there is insufficient information on quantities and values of inputs. Therefore ICOP studies have generally applied output UVRs to value added.

We have made 76 product matches in 16 sample industries, representing 11 of the of the 15 branches of manufacturing. The important Tanzanian industry food manufacturing is represented by 6 sample industries. Another 10 branches were represented by a single sample industry. No matches were realised in Metal Products, Machinery, Electrical Machinery and Other Manufacturing. For these branches, we used the calculated UVRs for total manufacturing based on 11 branches. Annex table A.3 shows the coverage ratios at branch and sample industry levels. The matched value of output represents 31.6 per cent of the total gross value of output in Tanzania and 7.1 per cent in the USA. The low coverage on the US side is due to the fact that we are comparing a tiny industrial sector with a very large one.

6.2 Data Sources for the 1989 Benchmark Comparison

6.2.1 Tanzanian Product Listing

For Tanzania, our basic source for the calculation of unit values consisted of the data files of the *1989 Census of Industries* (1993/1994). The questionnaire for establishments with ten or more persons employed (Form 1C-89-1) contained a question D: 'Principal Products Manufactured during the

[13] The reliability of a UVR depends primarily on the variation in unit values within given category. The smaller the variation of uvrs around the weighted average, the more reliable the calculated UVR is, as representation of the underlying UVR for the category. Reliability is measured as variation of unit value ratios/divided by the average unit value ratio, see Timmer (1996). We used .10 as the cut-off value for reliability.

[14] If matched output value was taken as the sample industry weight in step 4 of the aggregation procedure, it is used as the sample industry weight in step 5 as well.

Year', requesting information on the names of products, the units, installed capacity, production quantities and production values in 1000 shillings. The commodity data thus collected have not been published. However, BoS made the raw data files underlying the census available to us.[15] These files contain information on quantities of different products produced by establishments and their corresponding output values.

We rearranged this list of products into ISIC four digit categories and created product listings for each industry. First, firms were allocated to an ISIC industry on the basis of their most important products. However, firms tend to produce a wide range of primary and secondary products. Therefore, the next step was to reallocate products to the ISIC industry producing those products as primary products. In the course of the data screening it was found that product names were frequently misspelled and units, quantities or values were frequently incorrectly reproduced. For many products information on either unit, quantity or value was lacking.

A process of checking and cross-checking resulted in a valuable listing of commodities and their quantities and values. The provisional nature of this listing needs to be stressed.

6.2.2 Tanzanian Output, Value Added and Employment

For Tanzania we use the revised estimates of gross output, value added and employment for 10+ manufacturing in 1989 (see tables 3 and 5, for Gross Output, see Prins and Szirmai, 1998 Table C-2). These estimates, especially for value added are substantially higher than the official ones.

Gross value added in the US census is measured without deducting the cost of services purchased from outside the manufacturing sector. Thus the *US census concept of value* added involves a degree of double counting. To ensure comparability with the USA, the Tanzanian value added concept has been adjusted to the US census concept of value added, which is gross of service inputs from outside the manufacturing sector. This was done by adding bank charges, insurance costs, transport costs, communication services, accountancy and professional services (, see Methodology Report, BoS, 1993 codes 408-411). The basic data for 1989 are reproduced in Annex Table A-1.

6.2.3 US Product Listing

For the USA our basic source was the *1987 Census of Manufactures* (US Dept. of Commerce, 1990), which lists approximately 11000 products. For most, though not all, products the US census provides both quantity and value information for 1987. First, unit value ratio's were computed on the basis of the two censuses, using Tanzanian 1989 unit values and US 1987 unit values. Subsequently the 1989/1987unit value ratios were adjusted to a 1989-1989 basis using US price indices for each product category for the period 1987-1989 from BLS (1998).

[15] This file contained quantity information for approximately 720 enterprises. Though this is not explicitly indicated, we may safely conclude that this file refers to 10+ establishments.

6.2.4 US Gross Output, Value Added and Employment

The data for 1989 on gross value of output (here, value of shipments), gross value added and employment by industry derive from the *1990 Annual Survey of Manufactures* (US Dept. of Commerce, 1990). The Tanzanian census refers to establishments with 10 or more persons engaged. To ensure comparability, the US data have to be adjusted to a 10+ basis. As the ASM data for 1989 only provide information on output, value added and employment for total manufacturing, we used proportions of 10+/total value added and employment from the general summary of the 1987 census tot adjust the US data to a 10+ basis. The basic data for the USA are reproduced in Annex table A-2.

6.3 Unit Value Ratios

Table 11

Unit Value Ratios and Price Levels by Major Manufacturing Branch Tanzania/USA (Tsh/$), 1989

	UVR (Tsh/US$)			Relative
	at US Quantity Weights	at Tanzanian Quantity Weights	Geometric Average	Price Level Tanzania (USA = 100)
Food Manufacturing	102	45	68	0.5
Beverages	69	81	75	0.5
Tobacco Products	51	51	51	0.4
Textile Mill Products	105	110	107	0.7
Wearing Apparel (b)	42	28	35	0.2
Leather Products & Footwear	36	20	27	0.2
Wood Products, Furniture & Fixtures	90	86	88	0.6
Paper Products, Printing & Publishing	160	139	149	1.0
Chemical Products (incl. oil)	470	110	227	1.6
Rubber & Plastic Products	333	325	329	2.3
Non-metallic Mineral Products	90	143	114	0.8
Basic & Fabricated Metal Products (a)	177	78	117	0.8
Machinery & Transport Equipment (a)	177	78	117	0.8
Electrical Machinery & Equipment (a)	177	78	117	0.8
Other Manufacturing Industries (a)	177	78	117	0.8
Total Manufacturing, Census Weights (b)	177	78	117	0.8
Total manufacturing, implicit PPPs (c)	198	73	120	0.8
Exchange Rate	143	143	143	

Notes: (a) No sample industries for this branch. We used the UVR for the total of branches. (b). The UVR for total manufacturing is the gross output weighted average of branch or sample industry UVRs (see Timmer, 1996). (c) Implicit UVRs calculated from the summed branch value added totals in table 12. These are the preferred UVRs.

The UVRs for different branches of manufacturing are reproduced in table 11. The aggregate UVR (geometric average) for total manufacturing is 120 shillings to the US dollar, lower than the exchange rate of 143.[16] The price level, defined as the UVR divided by the exchange rate, is 0.8. On first sight, this result is surprising given the general complaint that Tanzanian exchange rates tend to be overvalued. However, the discussion concerning overvalued exchange rates refers primarily to internationally tradable goods. A considerable portion of Tanzanian industrial output is directed to the domestic market and does not enter into international trade. The finding that UVRs for developing

[16] There is typical index number type of discrepancy between the directly calculated UVRs for total manufacturing and the implicit UVRs calculated from summed branch values added at US and Tanzanian prices. We choose for the lowest degree of aggregation and therefore use the implicit UVR for total manufacturing.

countries are well below the exchange rate has been found in several studies (e.g. on China, Indonesia and India). However, low UVRs in part also reflect unrecognised quality differences for identical products and a predominance of low quality items in the product mix.

Lowest UVRs are found for food, beverages, wearing apparel and leather. Highest UVRs for rubber, chemicals, paper products and textiles.

UVRs at US quantity weights are much higher than at Tanzanian quantity weights. This is standard in comparisons between high income and low income economies. Products which are relatively cheap and common in the USA will tend to be expensive and rare in a low income country like Tanzania. Products which are cheap and common in Tanzania will tend to be rare in the USA. Therefore matches with high unit values will have high quantity weights in the USA and low quantity weights in Tanzania. Matches with low unit values will have high quantity weights in Tanzania and lower weights in the USA

6.4 Productivity Comparisons

Applying the branch unit value ratios from table 11 to the gross value added figures from annex tables A.1 and A.2 results in real comparisons of gross value added. Dividing these figures by the employment figures from tables A.1 and A.2 results in real labour productivity comparisons. These comparisons are reproduced in table 12.

Table 12

Gross Value Added (Census Concept) per Person Tanzania and the USA, 1989

	|- at Tanzanian Prices -|			|- at US Prices -|			Geometric Average
	Tanzania	USA	Tanzania/ USA (%)	Tanzania	USA	Tanzania/ USA (%)	Tanzania/ USA (%)
	(in Tsh)			(in US$)			
Food Manufacturing	203,370	8,387,897	2.4	4,511	82,572	5.5	3.6
Beverages	816,907	10,413,211	7.8	10,027	150,548	6.7	7.2
Tobacco Products	712,352	15,691,221	4.5	13,871	305,552	4.5	4.5
Textile Mill Products	205,282	4,229,796	4.9	1,871	40,281	4.6	4.7
Wearing Apparel	48,669	1,306,552	3.7	1,734	30,798	5.6	4.6
Leather Products and Footwear	120,675	1,305,577	9.2	6,111	36,648	16.7	12.4
Wood Products, Furniture & Fixtur	150,251	3,828,677	3.9	1,754	42,331	4.1	4.0
Paper Products, Printing & Publishi	321,831	11,517,612	2.8	2,318	72,141	3.2	3.0
Chemical Products	845,705	66,647,074	1.3	7,711	141,811	5.4	2.6
Rubber & Plastic Products	726,943	17,537,943	4.1	2,234	52,669	4.2	4.2
Non-metallic Mineral Products	390,347	5,703,193	6.8	2,737	63,071	4.3	5.4
Basic & Fabricated Metal Products	470,994	10,680,022	4.4	6,072	60,344	10.1	6.7
Machinery & Transport Equipment	419,871	12,819,273	3.3	5,413	72,431	7.5	4.9
Electrical Machinery & Equipment	778,159	11,234,739	6.9	10,032	63,478	15.8	10.5
Other Manufacturing Industries	267,095	12,307,000	2.2	3,443	69,537	5.0	3.3
Total Manufacturing	312,562	13,844,486	2.3	4,278	69,787	6.1	3.7

Source: Gross value added and employment from Annex Tables A-1 and A-2, UVRs from Table 11.

Aggregate real labour productivity in Tanzanian manufacturing in 1989 is 3.7 per cent of that in US manufacturing. There is substantial variance in branch productivity performance, varying from 2.6% in chemical products and 3% in paper products to 12.4 per cent in leather products and footwear and 10.5 percent in electrical machinery and equipment.

These productivity differentials are an indication of the vast technology gap between a developing economy such as Tanzania and economies operating at the technological frontier such as the USA. Productivity in the tiny Tanzanian manufacturing sector is lower than that found for large and dynamic Asian developing economies such as China and Indonesia.

Two qualifying remarks are in order. In the first place, the product listings are not sufficiently detailed to allow for quality adjustments. It is likely that Tanzanian products are of lower quality than the corresponding US products. More detailed analysis of each of the matches, using information from outside the census, should be performed. In the second place, the comparison excludes the important small scale and informal sector in Tanzania, characterised by highly labour intensive activities. In most developing countries, productivity in the informal sector is much lower than in the formal sector, so that productivity comparisons for total manufacturing need to be adjusted downward even further.

At this stage, we can safely say, that our unit values and UVRs are a lower bound and our productivity comparisons are an upper bound. In spite of the low levels of productivity found, real Tanzanian productivity will be even lower than our estimates, after adjustments for quality differences and inclusion of small scale labour intensive enterprises.

7 New Insights

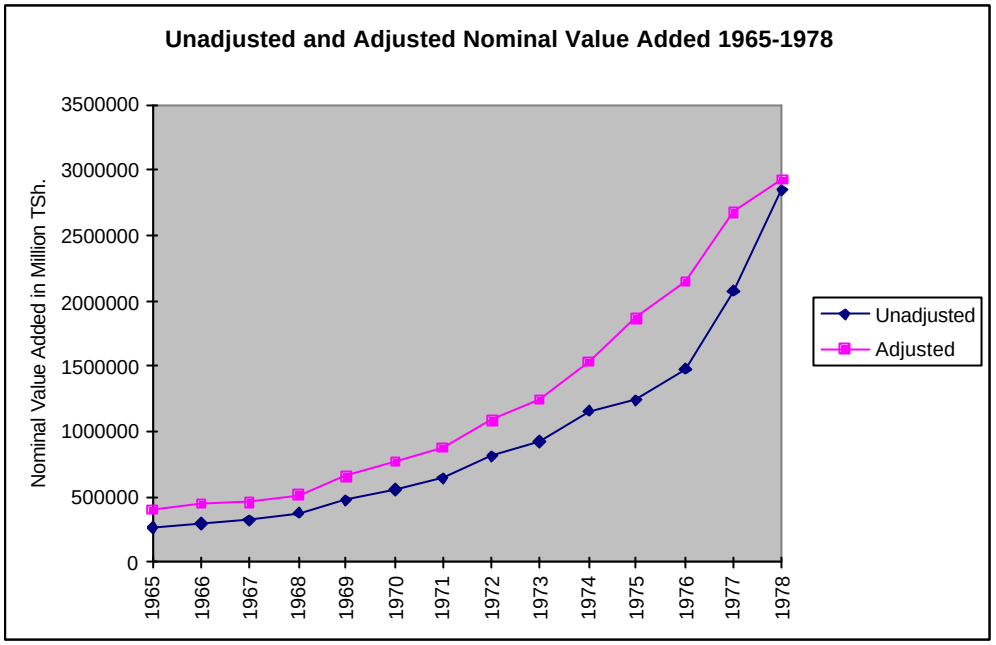
In this section, we discuss the new insights in Tanzanian manufacturing performance arising from revised estimates of value added, employment and comparative productivity discussed above.

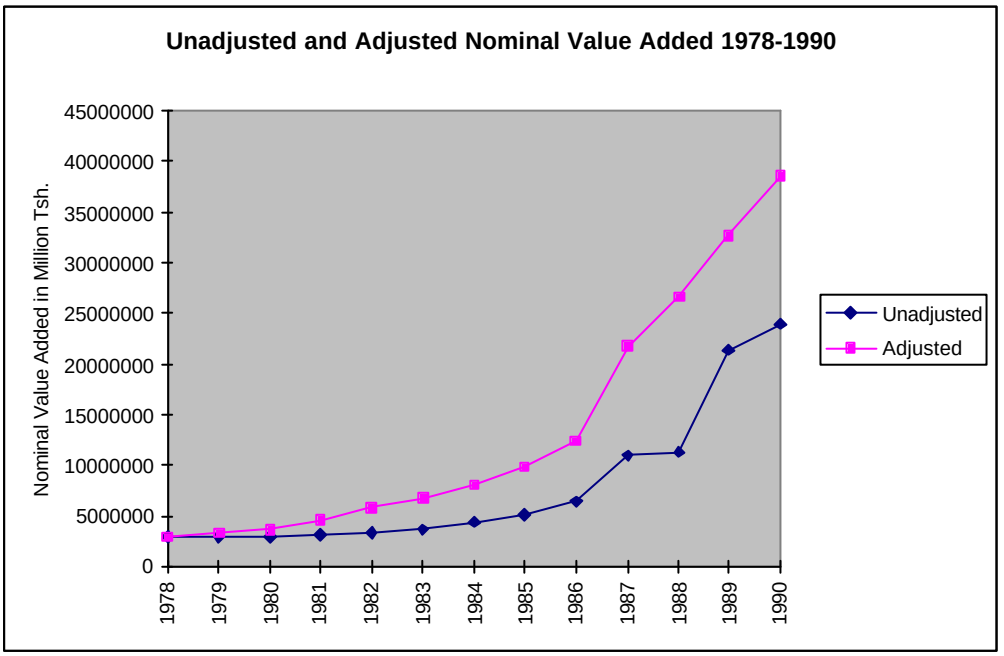
7.1 Level Adjustments in Nominal Value Added

It is beyond doubt that the level of medium & large scale manufacturing performance has been underestimated in the published statistics of Tanzania. In figure 4 our level adjustments are graphically presented for the series 1965-1978 and 1978-1990. Manufacturing value added increased for the entire period, but most pronounced adjustments appeared between 1982 and 1990. Value added increased with 83 per cent in 1982, 135 per cent in 1988 and 61 per cent in 1990. Between 1965 and 1978, value added increased on average with 40 per cent. Though the adjusted levels are much higher, it can be seen that for 1965-1978 the adjusted nominal trend closely follows the unadjusted trend, while this is not true for 1978-1990. Especially between 1986 and 1990 the level adjustments are more pronounced than is the case for earlier years.

Figure 4

Unadjusted & Adjusted Nominal Value Added for 10+ Manufacturing, 1965-1990





Source: Prins and Szirmai, 1998, Appendix C

7.2 Changes in the Structure of Manufacturing

Table 13 compares the adjusted and not adjusted value added shares of 6 branches of manufacturing for the years 1966, 1978 and 1989. For 1978, there is no difference between the unadjusted and adjusted structure of production. In 1966, the adjusted shares for the branches ISIC 37/38/39 (basic metal, machinery and other manufacturing) and ISIC 32 (textile s and leather) are substantially higher, while they are much lower for ISIC 31 (food, beverages & tobacco). In 1989, the most marked difference involved ISIC 32 (textiles and leather), where the adjusted value added share increased was

18 per cent, compared to an unadjusted share of 8 per cent. Overall, there is much less structural change in the revised data, compared to the unrevised data. Changes are less marked, and the textile sector remains a major contributor to manufacturing value added in the late eighties. The light industries Food, beverages, tobacco, textiles and leather together account for 56 per cent of value added, as against 54 per cent in 1978 and 63 per cent in 1966.

Table 13

Structural Changes in Tanzanian 10+ Manufacturing

		1966		1978		1989	
ISIC	Branch	Unadj.	Adj.	Unadj.	Adj.	Unadj.	Adj.
31	Food, Beverages & Tobacco	42%	31%	24%	24%	42%	38%
32	Textiles & Leather	25%	33%	30%	30%	8%	18%
33.4	Wood Pr, Furniture & Fixtures, Paper Pr., Printing & Publ.	12%	10%	10%	10%	11%	9%
35	Chemicals, Petroleum, Rubber & Plastic Products	8%	6%	12%	12%	17%	15%
36	Non-metallic Mineral Products	3%	3%	3%	3%	5%	4%
37,8,9	(Basic) Metal Products, Mach. & Equipm. & Other Man. Ind.	10%	18%	21%	21%	17%	15%
3	Total Manufacturing	100%	100%	100%	100%	100%	100%

Prins and Szirmai, 1998, table G-2

7.3 Trends in Real Growth

In figure 5 the new index of industrial production for 1961-1995 is compared with a national accounts based real manufacturing index for total manufacturing (BoS 1995) and the 50+ QSIP index (see Prins and Szirmai, 1998, Table L-3). Inspection of figure 5 reveals that real value added in 1961 is lower for the new index and that the index of BoS 1995 shows less growth between 1961 and 1978. A steep decline in the early eighties is identified by the BoS 1995 index as well as by our new index. From 1985 onwards, the various indexes show very divergent trends. Where BoS 1995 registers relatively rapid growth, BoS 1994 shows far less growth. The QSIP index indicates growth between 1985-1990 and decline after 1990. Our index shows the same pattern as the QSIP index: recovery from 1985-1991, followed by renewed stagnation in the nineties. In general, the periods of growth and stagnation of the Tanzanian manufacturing sector are more clearly distinguished by our index. The main turning points in the industrialisation pattern of Tanzania are the years 1978 and 1985. The new index shows more rapid growth before 1978, a more dramatic collapse between 1978 and 1985. After 1985, performance is uneven, though there is some slight improvement compared to 1985.

Figure 5

National Accounts, QSIP and the New Index of Real Value Added 1965-1994

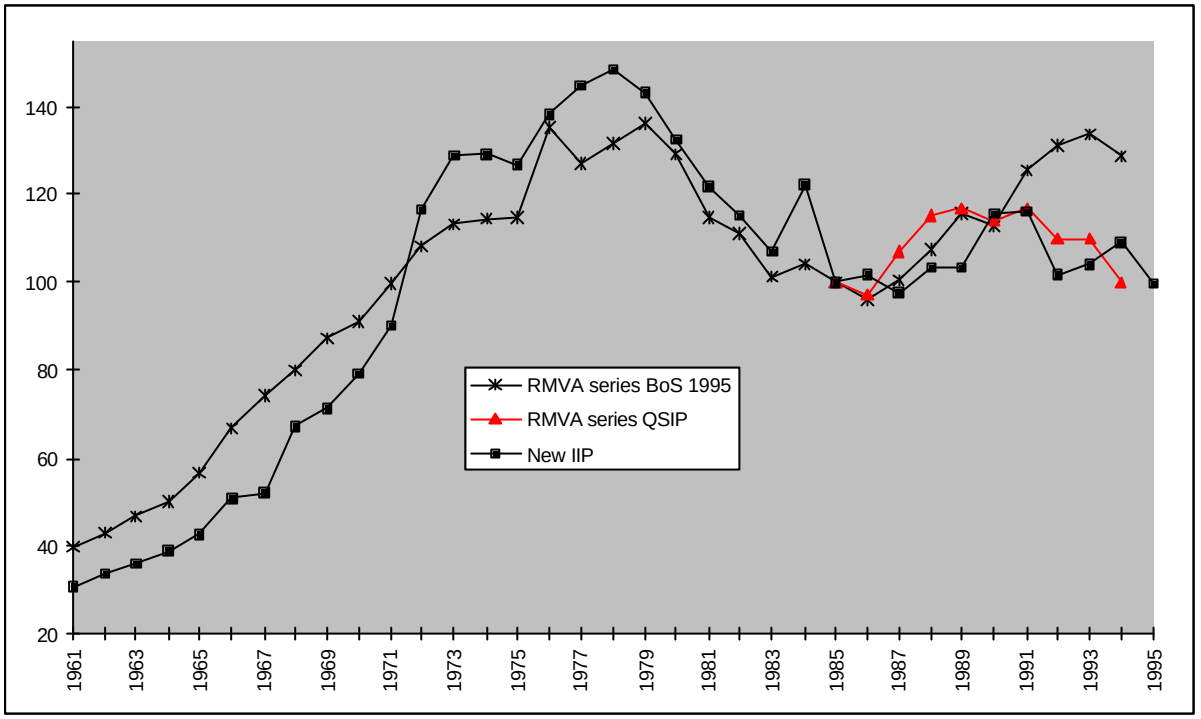


Figure 6

Manufacturing Value Added at 1989 Prices, 1961-1995
Comparison of the New Index of Industrial Production with
Index based on the National Accounts and QSIP

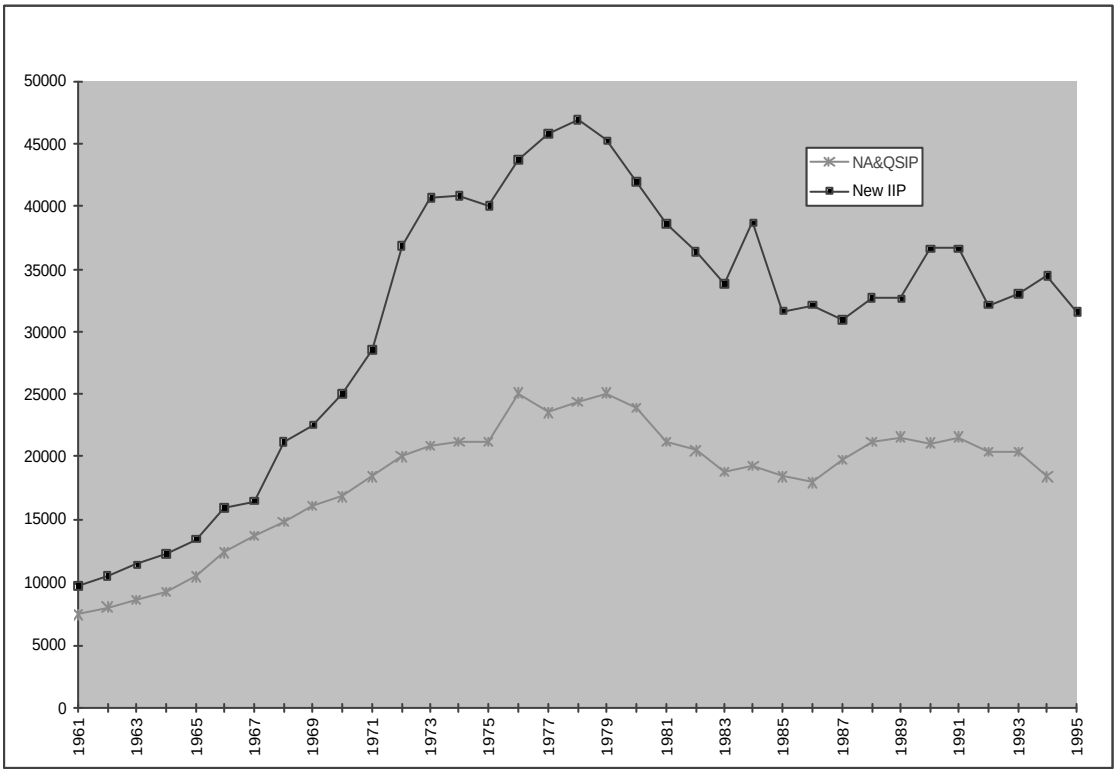


Figure 6 combines our level and trend adjustments. The top line represents adjusted value added for 10+ manufacturing in 1989, extrapolated with the new index of production. The bottom line represents unadjusted 1989 value added extrapolated with an unadjusted index of industrial production. This unadjusted index consists of the national accounts index up to 1985 (BoS, 1995, see Prins and Szirmai, 1998, Table L-3), linked with the QSIP index available since 1985. Figure 6 has a double message. On the one hand, the rise and collapse of manufacturing is more dramatic in the new estimates, than the old ones. Real value added in 1995 is about the same as in 1972. But, on the other hand, the adjusted level of manufacturing 1995 value added in 1995 turns out to be substantially higher than in the old estimates.

An important outcome of this research consists of indices of real output for different manufacturing branches for the period 1965-1985. No such series were previously available. In table 8, we have presented indices for six manufacturing branches for the period 1965-1995.

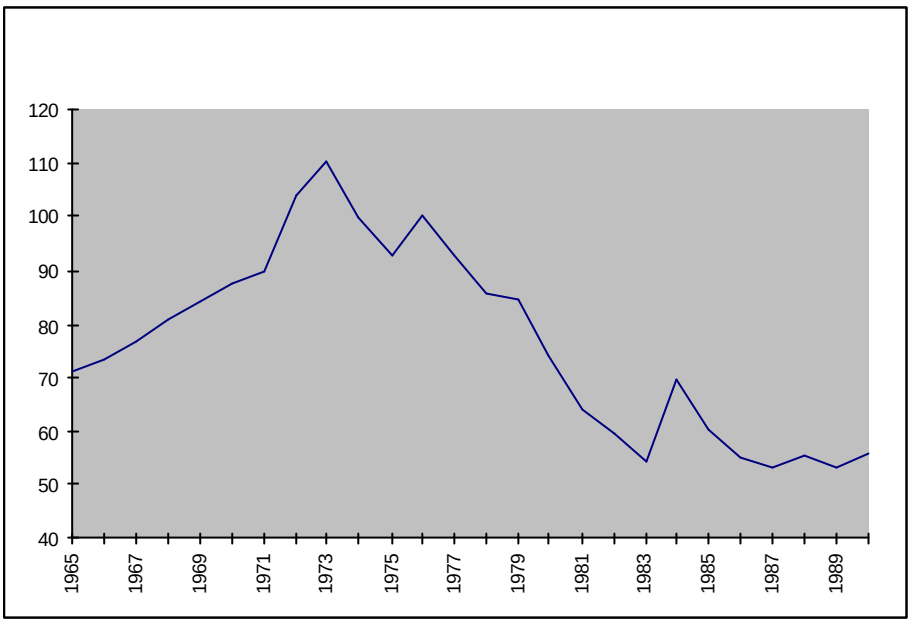
The growth trends for the branches food, beverages & tobacco, and textiles & leather more or less correspond to the pattern for total manufacturing, represented in figure 6. The trends for the branch wood are irregular and show long term decline. Chemicals, petroleum, rubber and plastics show modest growth till 1977 and stability thereafter. Non-Metallic Mineral products showed growth till 1973, stagnation between 1973-1983 and recovery in the post 1983 period. Real GDP in metals and machinery (ISIC 37, 38 & 39) increased up till 1984, followed by a period of decline between 1984 and 1995.

7.4 Trends in Labour Productivity

Figure 7 presents the new index of labour productivity for total manufacturing. Initially, labour productivity increased rapidly after 1965, reaching a peak in 1973. Well before, the turning point in real output trends in 1978, labour productivity started declining after 1973. The decline continued throughout the seventies and eighties, probably due to the inability of Tanzanian firms to shed labour as their output contracted. By 1990 labour productivity in total manufacturing was about one half the level in 1973, and 21 per cent below the level of 1965. Labour productivity trends by branch of manufacturing have already been presented in table 10.

Figure 7

Labour Productivity Index for Total Manufacturing, 1965-1990
(1976=100)



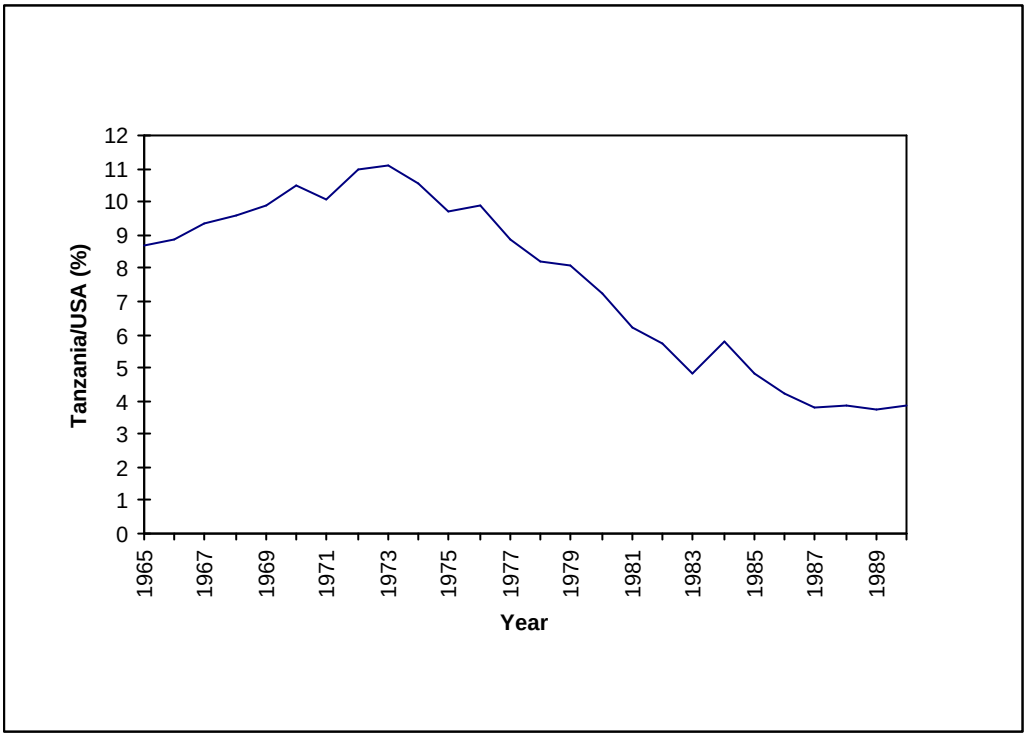
Source: Table 10

7.5 Comparative Labour Productivity

Figure 8 combines the benchmark productivity comparison for 1989, with Tanzanian and US time series on labour productivity. Comparative labour productivity trends show an interesting pattern. Starting from a fairly high level of almost 9 per cent of the US level, there is productivity catch up till 1973. Increases in the amount of capital per worker is one of the causes of this. After 1973 one sees an extend period of comparative productivity decline. Initially, this is due to absolute declines in labour productivity in Tanzanian manufacturing. But, the absolute decline evens out after 1983. After that year comparative productivity decline is caused by stagnation in Tanzania and increasing productivity in the lead country.

Figure 8

Comparative Labour Productivity in Tanzanian Manufacturing, 1965-1990 (USA=100)



Source: 1989 Tanzania/USA benchmark from table 12; index of GDP per person in Tanzania from figure 7; GDP per person in USA from national accounts sources. 1965-1982 GDP at constant prices from Department of Commerce, (1986), 1977-90 from Survey of Current Business, Various Issues, Persons employed, 1965-1990 from NIPA, 1959-88, Department of Commerce, 1992, and Survey of Current Business, Various Issues.

The trend is also worth noting. In most productivity studies for Asian low income economies, such as China, India and Indonesia (Timmer and Szirmai, 1999), we see productivity starting at lower levels than in Tanzania, little change in productivity performance over time and some catch up in the nineties. Tanzania starts at much higher levels in the sixties and ends up doing much worse in the eighties, reflecting inefficiencies in the Tanzanian process of industrialisation.

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Annex Table A. 1

Basic Data on Output and Employment for Tanzania 1989, (Establishments with 10 or more persons engaged)

	Number of Establish-ments	Gross Value of Output at factor cost	Gross Value Added at factor cost	Gross Value Added at factor cost US census concept. (a)	Gross Value Added in Branch as % of Total	Employment	Gross value added per person employed
		(mill. TSh)	(mill. TSh)	(mill. TSh)		(persons)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 Food Manufacturing (311/12)	146	24,531.6	5,630.9	7,177	18.24	35291	203,370
2 Beverages (313)	19	8,959.6	3,003.1	4,116	10.46	5039	816,907
3 Tobacco Products (314)	3	6,237.2	3,359.7	3,528	8.97	4952	712,352
4 Textile Mill Products (321)	83	17,701.0	5,256.4	6,367	16.18	31014	205,282
5 Wearing Apparel (322)	54	519.5	105.8	136	0.35	2803	48,669
6 Leather Products and Footwear (323/324)	21	1,883.2	401.1	520	1.32	4311	120,675
7 Wood Products, Furniture & Fixtures (331/2)	214	4,399.7	1,115.4	1,454	3.69	9674	150,251
8 Paper Products, Printing & Publishing (341/2)	62	7,411.8	1,865.7	2,335	5.94	7256	321,831
9 Chemicals Products (351-53)	51	11,680.3	3,515.8	4,201	10.68	4967	845,705
10 Rubber and Plastic Products (355/6)	15	4,900.7	954.0	1,243	3.16	1710	726,943
11 Non-metallic Mineral Products (361-69)	22	5,608.1	1,413.7	1,979	5.03	5069	390,347
12 Basic & Fabricated Metal Products (371-81)	94	13,583.2	2,231.6	2,882	7.32	6118	470,994
13 Machinery & Transport Equipment (382/4)	72	8,062.1	1,768.3	2,234	5.68	5320	419,871
14 Electrical Machinery & Equipment (383)	6	2,303.4	710.0	830	2.11	1067	778,159
15 Other Manufacturing Industries (385-90)	24	1,126.4	278.9	344	0.87	1288	267,095
Total Manufacturing	886	118,907.7	31,610	39,345	100.00	125,879	312,562

Sources: Prins and Szirmai, 1998: Gross output and value added Table A.4, employment Table A-5. Original source: data files of 1989 Census of Production.

Notes: (a). US Census value added defined as: gross value of output at factor cost minus intermediate inputs, except intermediate service inputs from outside the industrial sector.

Annex Table A. 2

Basic Data on Output and Employment in Manufacturing, USA 1989 (Establishments with 10 or more persons engaged)

	|---------Annual Survey of Manufactures---------|			
	Gross Value of Output	Gross Value Added	Gross Value Added in Branch as % of Total	Employment (b)	GVA / Person
	(mill. US$)	(mill. US$)		(1000)	
	(1)	(2)	(3)	(4)	
Food Manufacturing	310,109.7	106,053.8	8.31	1,284.4	82,572.0
Beverages	49,695.9	24,103.4	1.89	160.1	150,547.9
Tobacco Products	25,789.9	18,916.2	1.48	61.9	305,552.2
Textile Mill Products	67,072.6	27,123.1	2.12	673.4	40,280.7
Wearing Apparel	61,451.2	31,361.7	2.46	1,018.3	30,798.2
Leather Products and Footwear	9,757.4	4,543.6	0.36	124.0	36,648.4
Wood Products, Furniture & Fixtures	108,550.5	47,791.0	3.74	1,129.0	42,331.0
Paper Products, Printing & Publishing	271,117.7	152,708.2	11.96	2,116.8	72,140.8
Chemicals, incl. petrol. refining	415,580.0	168,705.0	13.21	1,189.6	141,811.3
Rubber and Plastic Products	96,725.5	46,850.0	3.67	889.5	52,668.9
Non-metallic Mineral Products	60,938.3	32,895.4	2.58	521.6	63,071.2
Basic & Fabricated Metal Products	308,697.4	132,557.2	10.38	2,196.7	60,344.0
Machinery & Transport Equipment	618,891.6	282,524.5	22.13	3,900.6	72,431.1
Electrical Machinery & Equipment	190,906.6	105,044.9	8.23	1,654.8	63,478.2
Other Manufacturing Industries	150,519.0	95,611.5	7.49	1,375.0	69,536.7
Total Manufacturing	2,745,803.2	1,276,789.4	100.00	18,295.6	69,786.6

Source: U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures, 1990
Notes: (a) Ratio of 10+ to total manufacturing from 1987 Census of Manufactures, General Summary. (b) including head office and auxiliary employment. Totals distributed across branches using 1987 proportions from Census of Manufactures.

Annex Table A. 3

Number of UVRs, Coverage Rates and Reliability

	Number of UVRs	Coverage USA	Coverage Tanzania	Reliability PPP at US Quantity Weights	Reliability PPP at Tanzanian Quantity Weights
Food Manufacturing	**22**	**20.3**	**46.6**	**0.10**	**0.27**
Dairy Products	4	38.6	39.0	0.1	0.0
Preserved fruits and vegetables	4	31.1	3.2	0.5	1.4
Fats and Oils	4	51.5	53.4	0.1	0.2
Grain Mill Products	4	59.2	80.3	0.1	0.1
Bakery Products	1	34.4	16.3	0.0	0.0
Sugar and Confectionary, food n.e.c.	5	41.0	34.1	0.2	0.7
Beverages (208)	**2**	**28.0**	**15.7**	**0.18**	**0.79**
Malt and Malt beverages	2	89.5	37.1	0.1	0.7
Tobacco Products	**1**	**8.6**	**21.4**	**0.00**	**0.00**
Tobacco Stemming and redrying	1	86.5	42.1	-	-
Textile Mill Products	**6**	**15.4**	**39.5**	**0.09**	**0.08**
Textile Mill Products	6	48.4	45.9	0.1	0.1
Wearing Apparel	**7**	**20.3**	**17.3**	**0.26**	**1.20**
Wearing Apparel	7	61.0	19.1	0.2	1.2
Leather Products and Footwear	**2**	**39.9**	**2.1**	**0.43**	**0.11**
Leather footwear	2	90.5	7.8	0.0	0.1
Wood Products, Furniture & Fixtures	**13**	**27.6**	**41.8**	**0.13**	**0.13**
Wood Products and Furniture	13	57.7	41.9	0.1	0.1
Paper Products, Printing & Publishing	**9**	**11.6**	**40.0**	**0.16**	**0.15**
Paper, printing and publishing	9	24.1	40.2	0.1	0.2
Chemicals, incl. petrol. refining	**9**	**3.4**	**19.4**	**0.67**	**0.86**
Chemical Products	9	44.1	38.1	0.5	0.8
Rubber and Plastic Products	**2**	**6.1**	**24.1**	**0.00**	**0.02**
Rubber Tyres and Tubes	2	50.0	69.2	0.0	0.0
Non-metallic Mineral Products	**3**	**6.5**	**38.3**	**0.41**	**0.01**
Cement and bricks	3	67.1	109.0	0.2	0.0
Basic & Fabricated Metal Products					
Machinery & Transport Equipment					
Electrical Machinery & Equipment					
Other Manufacturing Industries					
Total manufacturing	76	7.1	31.6	0.14	0.12

Note: Coverage refers to matched output as percentage of total gross value of output. The measure for reliability is calculated as the variation of unit value ratios divided by the uvr for the sample industry or branch. The 90 per cent confidence interval equals the uvr plus or minus a percentage equal to twice the reliability measure.

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