



**A Benchmark Comparison of East and West
German Industrial Labour Productivity in 1954**

Research Memorandum GD-57

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Abstract

This paper presents a level comparison of the East and West German industrial labour productivity in 1954. According to this estimate, which is based on the quantity approach, the East German industrial labour productivity in 1954 amounted from 61.6 to 64.7 percent of the West German level. For the manufacturing sector only the relative labour productivity amounted from 58 to 60 percent of the West German level. East German relative labour productivity based on value added is somewhat higher than based on sales value as shown above. Shift share analysis shows that the productivity gap is primarily located in the branch "Metal, Machinery, Transports". This branch suffered a lot from the reparations to the Soviet Union.

1. Introduction

This paper studies the industrial labour productivity in East and West Germany in 1954. That is five years after East Germany was established as an independent country and only one year after the reparations towards the Soviet Union had ended. At that time East Germany was already lagging behind the West German level of labour productivity, although there is some dispute how far. Earlier estimates of the East German labour productivity as a percentage of the West German level in 1950 vary from 69 percent of Ritschl¹, who extended it from 1936, to less than 40 percent of Van Ark² who used backward extrapolation from 1987.

The interpretation of the productivity gap is also difficult. After World War II the differences between the two parts of Germany are numerous. Although the comparison of East and West German economies before separation suggest comparable initial conditions, for a comparison of the industrial labour productivity several differences might have been important. Firstly, in size East Germany was much smaller than West Germany. Secondly, East Germany retreated from international trade. Thirdly, East Germany suffered the reparations to the Soviet Union. Finally, the East German regime introduced the economic system of socialism.

It is the aim of this paper to improve the estimate for the relative industrial labour productivity in East Germany in comparison with West Germany. Moreover this paper aims to provide some explanation for the productivity gap. Section 2 shows the benchmark comparison that was made, discussing the data, methods, and results. Section 3 examines the relative levels that follow this 1954 benchmark in comparison with earlier estimates. In section 4 the industrial structure is analysed, using shift share techniques.

2. A Benchmark Comparison for 1954

There are several benchmark comparisons for the East and West German economies most of them refer to either the 1960s or the 1980s. The focus on the 1960s is guided by the availability of data, whereas the focus on the 1980s is partly determined by the new data that has become available after the fall of the Berlin Wall as well as the renewed political interest because of the reunification. For the 1950s there are some data constraints, of which the lack of East German prices is the most obvious.

Despite the data constraints it is useful to make a benchmark comparison for the 1950s as the extrapolations from benchmarks for which more data were available, i.e. 1936 and 1987, lead to very different results. Ritschl, extrapolating from 1936, estimated the East German industrial labour productivity in 1950 at 69 percent of the West German level.³ Van Ark, extrapolating from 1987, estimated it at 32 percent.⁴ These large differences are difficult to reconcile. Especially from the perspective of a major debate on the history of East German economic growth: is it explained by “a bad start” or by “a bad performance” ?

1 Albrecht O. Ritschl, “An exercise in futility: East German economic growth and decline, 1945-89” in: Nicholas Crafts and Gianni Toniolo, *Economic Growth in Europe since 1945* (Cambridge 1996)

2 Bart van Ark, “The Manufacturing Sector in East Germany: A Reassessment of Comparative Productivity Performance” in: *Jahrbuch für Wirtschaftsgeschichte* 1995/2

3 Albrecht O. Ritschl, “An exercise in futility: East German economic growth and decline, 1945-89” in: Nicholas Crafts and Gianni Toniolo, *Economic Growth in Europe since 1945* (Cambridge 1996)

4 Bart van Ark, “The Manufacturing Sector in East Germany: A Reassessment of Comparative Productivity Performance” in: *Jahrbuch für Wirtschaftsgeschichte* 1995/2

Without data on prices, how is it possible to estimate the relative level of industrial labour productivity? The benchmark for 1964 by Sturm sets a good example. Sturm estimated the relative productivity level without using East German prices, by means of a quantity approach.⁵

The estimate is based on physical output data for the two countries. For the production of a total of 83 industrial commodities East German output data was matched with West German quantity and value data for corresponding commodities. These products were classified into 11 industrial branches according to the classification of the industrial comparisons of output and productivity (ICOP) project.⁶ Within each branch (i) relative East German gross production was estimated in two steps. Firstly the matched value (m) of gross production was estimated:

$$V_i^{E(m)} = \sum_j (Q_{ij}^E / Q_{ij}^W) V_{ij}^{W(m)}$$

where Q stands for physical quantity of output, V for sales value, j for product j, and the superscripts E stands for East Germany, and W for West Germany. Thereafter the total branch value was estimated:

$$V_i^E = V_i^{E(m)} * (V_i^W / V_i^{W(m)})$$

The second equation is the major underlying assumption of this method. It will be discussed in more detail below (p. 5 and 6).

Backgrounds to the sample

Before jumping into the results it is first examined if the acquired sample is appropriate for making a benchmark comparison of the relative industrial labour productivity in the two countries. Table 1 shows the product matches and the matched sales value as a percentage of the gross value of output for West Germany. Ideally the table would include the East German matching percentage as well. Since the East German statistics merely show *product* quantities and *branch* values there is no information on product prices or output values of specific products. Therefore table 1 only shows the West German matching percentage.

⁵ P. Sturm, *A Comparison of Aggregate Production Relationships in East and West Germany* (Yale 1974);

⁶ Bart van Ark, *International Comparisons of Output and Productivity: Manufacturing, Productivity Performance of Ten Countries from 1950 to 1990* (Groningen 1993)

Table 1
*Product Matches and West German Matching as Percentage of
Gross Value of Output*

	Product Matches	Matching Percentage
Mining	7	59.1 %
<i>Manufacturing:</i>	76	38.0%
Food, Beverages, Tobacco	12	44.2 %
Textiles, Wearing Apparel	9	17.6 %
Leather products, Footwear	1	48.8 %
Wood products, Furniture	4	21.1 %
Paper, Printing	7	46.3 %
Chemicals, rubber, plastic, oil refining	13	28.6 %
Stone, Clay, Glass	5	26.6 %
Metal, Machinery, Transport	17	52.5 %
Electrical equipment	3	7.2 %
Optics, Fine mechanics	5	30.6 %
Total	83	39.2 %

How many product matches are needed to make a good sample? Is a West German matching percentage of 39.2 percent high, or is it low? Does it matter that the matching percentage for East Germany is lacking?

The matching percentage reflects the coverage of the sample. It shows the size of the sample in comparison to the entire branch for which it is held to be representative. Compared with other benchmark comparisons, for instance Van Ark (1993)⁷, the coverage ratio of the sample is very good. In his dissertation Van Ark showed the coverage of unit value ratios in terms of total manufacturing sales for ten benchmark comparisons. The coverage ratio varied from 9.6 to 36.7 per cent of total sales, and was just over 20 per cent on average.

At the same time the number of matches were much higher in Van Ark. The combination of a good coverage ratio and a low number of product matches indicates that these products are themselves already aggregates.⁸ Here it should be noted that the benchmarks in Van Ark refer to the late 1980s. In comparison to other historical benchmarks for the 1950s the number of matches for this benchmark comparison of East and West German industries in 1954 is quite good.⁹

⁷ Bart van Ark, *International Comparisons of Output and Productivity: Manufacturing, Productivity Performance of Ten Countries from 1950 to 1990* (Groningen 1993) pp. 26, 27

⁸ For more details see Annex B

⁹ In an overview of studies on international comparisons of real output and labour productivity in manufacturing Van Ark mentions 8 benchmark comparisons referring to a year before 1960 of which only two (both comparisons of the United States and the United Kingdom) had more product matches than the benchmark that is presented here.

For the individual branches the sample seems good as well, although some caution with regard to “Leather products, Footwear” because of the low number of product matches and with regard to “Electrical equipment” because of the low matching percentage is recommended.

It is concluded that the size of the sample and the matching percentage are satisfactory. For this conclusion it is not very important that the East German coverage ratio is lacking, as it is unlikely that the matched products account for a much smaller part of East German than of West German production. In fact there is some indication that the East German coverage ratio is somewhat higher than the West German ratio.

Another problem that is introduced by the absence of East German prices is the Gerschenkron effect. The pure reliance on West German prices introduces an upward bias in the East German value of production. This problem, as well as the problem of the East German coverage ratio, will be discussed in more detail below.

Adjusting for the Gerschenkron effect

Using the quantity approach the level of East German labour productivity can be estimated without data on East German prices. Considering the data constraints, in particular the lack of East German price data, the quantity approach is a good tool for estimating the relative level of labour productivity in the two Germany’s in the early 1950s. Nevertheless it is clear that this method introduces a bias, due to the Gerschenkron effect.

In his analysis of relative backwardness in historical perspective Gerschenkron described that an item with a relatively high price will be associated with relatively small quantities in the own country. Consequently the results would have been different if based on East German prices (Paasche index) instead of West German prices (Laspeyres index). Normally this effect results in a relative lower output of the least advanced country when use is made of its own prices. In the case of the comparison of East and West Germany this means that East German labour productivity as a percentage of West Germany would be lower if based on East German prices. Therefore the geometric average of the Paasche index and the Laspeyres index, the Fisher index is frequently used.

Although the product prices in East German currency are unknown, “branch values” in East German currency was published. The introduction of these “branch values” is useful for improving the estimate.¹⁰ A method that has been inspired by the paper of Horlings and Van Ark first calculates the “purchasing power parities”, the implicit unit value ratios, for each branch as follows:

$$UVR_i = (V_i^{E(e)} / V_i^{E(w)})$$

10 Edwin Horlings and Bart van Ark, Benchmark Comparisons of Manufacturing Productivity in Eastern Europe, 1937-1989 (Leuven 1996)

Thereafter the UVRs are weighted according to the West German (Laspeyres) and the East German (Paasche) branch structure. The average is the desired Fisher index.

To adjust for the Gerschenkron effect the Laspeyres/Fisher ratio was applied to the “plain” benchmark for each branch. Annex C shows the calculations and the underlying data.

The main results

What are the results of the benchmark comparison for 1954? For a moment it is relaxed upon the issue of the East German coverage ratio, to show the results of the (adjusted) quantity approach.

Table 2.
*East and West German Sales Value in 1000 DM, Employment and
Relative Labour Productivity in Industries in 1954 (in 1954 DM)*

	East Germany		West Germany		East Germany
	Sales Value	Employment	Sales Value	Employment	WG = 100
Mining	3817461	184285	7718100	641600	172.2
Manufacturing	43197834	2938811	132666100	5392900	59.8
Food, Beverages, Tobacco	10864942	280323	22343100	403000	69.9
Textiles, Wearing Apparel	8978299	534771	16240800	860600	89.0
Leather Products, Footwear	580766	99009	2969600	163100	32.2
Wood Products, Furniture	2328927	235332	5543800	336000	60.0
Paper and Printing	1729997	112576	6252400	279200	68.6
Chemicals, rubber, plastic, oil refining	6406342	267420	16885900	469800	66.7
Stone, Clay, Glass	1329506	153738	5938200	375200	54.6
Metal, Machinery, Transports	7715665	869332	47046700	1984700	37.4
Electrical Equipment	2897634	287056	7906800	402800	51.4
Optics and Fine Mechanics	365756	99254	1538800	118500	28.4
Total	47015295	3123096	140384200	6034500	64.7

Sources: See Annex C.

According to table 2 in 1954 East German labour productivity only surpassed the West German level in mining. This branch was already at a higher level in East Germany in 1936.¹¹ In all other branches the East German labour productivity was below the West German level. Especially “Leather Products, Footwear”, “Metal, Machinery, Transports” and “Optics and Fine Mechanics” show relatively low levels of branch productivity. “Textiles, Wearing Apparel” was the only branch within manufacturing where the productivity gap between the two Germany’s was not very large. The overall result estimates the East German industrial labour productivity at 64.7 percent of the West German level.

¹¹ Jaap Sleifer, “Separated Unity: The Industrial Sector in 1936 in the Territory of the German Democratic Republic and the Federal Republic of Germany” in: *Jahrbuch für Wirtschaftsgeschichte* 2001/1

The East German coverage ratio and the estimation procedure

Estimating the branch production somehow involved adding up the matched output to the total output of a particular branch. Without information on the matched output as a percentage of total output, it was necessary to make an assumption. Although it was possible to value matched products at West German prices, what does it tell about total production if it is not clear if the sample gives 30, 40 or 50 percent of total output?

For this purpose the coverage ratio, calculated as the value of matched output as a percentage of total output, could provide the proper information. Alternatively detailed employment statistics might give some indication. In the case of East Germany in 1954 both approaches are not possible due to data constraints. To solve this problem it was assumed that covered output is representative for total output, which allows the use of the West German coverage ratios to add up the matched output to a branch total.

What would be the effect if the assumption does not hold? Naturally this depends on the outcome of the East German coverage ratio relative to the assumed ratio, i.e. the West German ratio. If the East German ratio is higher, the assumption blows up the East German branch value and thus overestimates East German production. If the East German ratio is lower, East German production would be underestimated.

In the case of this comparison the East German coverage ratio is probably higher than the West German coverage ratio, estimating East German production too high. As the coverage ratio shows the matched output as a percentage of the total output, a high ratio indicates that few products are produced outside the range of the sample. Because the East German economy is much smaller than West Germany, it is very likely that East Germany produced fewer products outside the range of the sample than West Germany.

At least the coverage ratio was higher for East Germany than for West Germany in benchmark comparisons for 1987 and 1992.¹² Another indication for a higher East German coverage ratio follows analogous reasoning. In a paper by Horlings and Van Ark the effects of the assumed representativity of the covered output for the total output of the quantity approach is tested for a benchmark of West Germany and the United States in 1954 and a benchmark for Hungary and the United States in 1954. For both West Germany and Hungary the result is that the production is estimated too high, because the actual coverage ratio was higher than for the United States.¹³ According to Horlings and Van Ark the analogy implies that the East German coverage ratio is higher than the West German coverage ratio, thus East German production is overestimated.

Therefore the actual East German industrial labour productivity might be even lower than 64.7 percent of the West German level. A straightforward method that will be applied to show the

¹² Bart van Ark, "The Manufacturing Sector in East Germany: A Reassessment of Comparative Productivity Performance, 1950-1988" in: *Jahrbuch für Wirtschaftsgeschichte* 1995/2; Unpublished results of a benchmark comparison for 1992 by Bart van Ark and Erik Monnikhof

¹³ Edwin Horlings and Bart van Ark, *Benchmark Comparisons of Manufacturing Productivity in Eastern Europe, 1937 - 1989* (Leuven 1996)

significance of this problem is a sensitivity test. Table 3 gives the relative East German labour productivity in manufacturing and total industry for three different assumptions on the East German coverage ratio. First it shows labour productivity when the East German coverage ratio is the same as the West German coverage ratio, as has been assumed so far. Second it shows labour productivity for an East German coverage ratio that is 2 percent above the West German ratio, which seems a realistic guess for the actual upperbound based on qualitative data on the two German economies. Finally it shows the results for a coverage ratio that is 8 percent above the West German ratio, as it was found in a benchmark for 1987.¹⁴

Table 3.

Sensitivity of the Assumed East German Coverage Ratio for the East German Industrial Labour Productivity Relative to West Germany (=100)

Assumed East German Coverage Ratios		East German Labour Productivity (WG = 100)	
Industry	Manufacturing	Industry	Manufacturing
39.2	38.0	64.7	59.8
41.2	40.0	61.6	56.8
47.2	46.0	53.7	49.4

Source: own calculations

Of the assumed East German coverage ratios of 41.2 percent and 47.2 percent of total output, the ratio of 41.2 percent is the most realistic upper-bound for 1954, although there is no hard evidence. To begin with in 1936 most industries that were apparent in West Germany were also apparent in East Germany.¹⁵ The period after World War II is often characterised as a period of recovery. For the consumer goods it is known that product variety in West Germany increased from the mid-1950s onwards, but especially during the 1960s.¹⁶ Unless East Germany stopped producing the products that it produced in 1936, there is little reason to expect that the coverage ratio differed more than 2 percent of the West German ratio.¹⁷

3. Gross Output and Value Added

In the previous section I concluded that East German industrial labour productivity in 1954 reached at least 61.6 percent, and at most 64.7 percent of the West German level. In manufacturing East German labour productivity was between 56.8 and 59.8 percent of the West German level. These estimates are

¹⁴ Bart van Ark, "The Manufacturing Sector in East Germany: A Reassessment of Comparative Productivity Performance, 1950-1988" in: *Jahrbuch für Wirtschaftsgeschichte* 1995/2

¹⁵ Jaap Sleifer, "Separated Unity: The Industrial Sector in 1936 in the Territory of the German Democratic Republic and the Federal Republic of Germany" in: *Jahrbuch für Wirtschaftsgeschichte* 2001/1

¹⁶ Peter Christian Ludz et al., *Materialien zum Bericht zur Lage der Nation 1974* (Berlin 1974) p.254

¹⁷ Of course industries have been dismantled by the Soviet Union. However, except for some typical military-industries (weapons, munition) the balance with newly built capacities in the early 1950s suggests a reduction of the capacities, not a disappearance of the products. See: Rainer Karlsch, *Allein bezahlt? Die Reparationsleistungen der SBZ/DDR 1945-53* (Berlin 1993) pp. 87-93

based on gross output values (sales value) rather than value added. How important is the distinction between estimates based on gross output and estimates based on value added?

Existing estimates extrapolate a benchmark comparison for 1936 based on value added, and a benchmark comparison for 1987 – also – based on value added. As a result of extrapolations from 1936 Ritschl estimated the level of East German industrial labour productivity in 1950 between 61 and 69 percent of West Germany.¹⁸ Ritschl used two main time series for his extrapolation, to which I will refer as the Stolper-series and the Barthel-series. According to Ritschl the “pessimistic” Stolper-series show the lower bound, and the “plausible” Barthel-series give the most probable estimate. Clearly the estimates of Ritschl fit into the results of this “gross output” benchmark.

Based on extrapolations from 1987 Van Ark arrives at the much lower level of East German labour productivity relative to West Germany of 39 percent.¹⁹ It is noted that Van Ark refers to manufacturing rather than total industry. It was shown above that East German labour productivity in manufacturing relative to West Germany was lower than labour productivity in total industry. Nevertheless Van Ark’s estimate does not fit into the benchmark results for 1954. Interestingly this is completely explained by the difference between gross output and value added. Van Ark’s estimate for the relative East German labour productivity in manufacturing based on gross output, that is 58.6 percent of the West German level, does fit in the boundaries of this study’s benchmark.

Value added is defined as gross output minus the use of intermediate inputs, i.e. raw materials, semi-fabrics and energy. The different estimates for the 1950s are mainly explained by the shares of intermediate inputs in gross output, the input/output ratios. Whereas the East German input/output ratio for 1936 was approximately 49 percent; in 1987 it was almost 66 percent.

Unfortunately there are no detailed data on these issues for East German industries during the early post-war period. However, the official East German statistics do allow for the calculation of an input/output ratio for the entire industrial sector in current prices. In 1950 West German industries realised an I/O-ratio, or “Materialquote”, of 51 percent. This means that value added was 49 percent of gross output value. The material inputs include raw materials and semi-manufactures, fuel and electrical energy, and parts, all valued at in-factory prices.

Ideally the definition of material inputs which are used for the calculation of the I/O-ratio are exactly the same in both countries. The East German statistics that correspond the most to the West German definition of material inputs are those on “Verbrauch von Material und Produktiven Leistungen”. This category consists of raw materials, semi-manufactures, energy, fuels, repairs, and transport costs.

“Verbrauch von Material und Produktiven Leistungen” is one of the two sub-categories of “Verbrauch an Produktionsmittel”. The other sub-category is “Abschreibungen, Mieten, Pachten und

¹⁸ Albrecht O. Ritschl, “An exercise in futility: East German economic growth and decline, 1945-89” in: Nicholas Crafts and Gianni Toniolo, *Economic Growth in Europe since 1945* (Cambridge 1996)

¹⁹ Bart van Ark, “The Manufacturing Sector in East Germany: A Reassessment of Comparative Productivity Performance, 1950-1988” in: *Jahrbuch für Wirtschaftsgeschichte* 1995/2

Nutzungsentgelte” which contains rents and depreciation.²⁰ For the calculation of the I/O ratio this paper used the current prices for East German material inputs and gross output (Brutoproduktionswert) as shown in Schwarzer.²¹

For 1954 the results are the following:

	Current Prices	Percentage
Gross Output	59369	100.0
Material Inputs	27666	46.6
Value Added	31703	53.4

According to the official statistics the East German I/O ratio in 1954 was more or less the same as it was in 1936, and somewhat below the West German ratio. Consequently the productivity gap between East and West Germany in 1954 would be narrower based on value added than based on gross output. It also suggests that the East German use of intermediate inputs shows a huge increase between the 1950s and the 1980s, considering Van Ark’s ratio of 66 percent in 1987. However, the use of current prices incorporates the risk that it is due to changes of the prices of material inputs relative to outputs.²²

To improve our view on the *real* development of the East German I/O ratio requires the examination of series that use double deflation techniques. However, the double deflated series that are available for East Germany were heavily criticised for methodological shortcomings.²³ Because the focus of this paper is on a benchmark rather than timeseries – and because the double deflated series cannot be easily adjusted – I decided not to elaborate on this issue here. It is clear, however, that this matter necessitates further research.

²⁰ Staatlichen Zentralverwaltung für Statistik, *Statistisches Jahrbuch der Deutschen Demokratischen Republik 1955* (Berlin 1956) p 91; Staatlichen Zentralverwaltung für Statistik, *Statistisches Jahrbuch 1969 der Deutschen Demokratischen Republik* (Berlin 1969) p35-41

²¹ Oskar Schwarzer, *Sozialistische Zentralplanwirtschaft in der SBZ/DDR: Ergebnisse eines ordnungspolitischen Experiments (1945-1989)*

²² In the 1960s the new economic system was introduced. Part of the underlying idea was to raise prices of inputs relative to outputs, to give an incentive for a more efficient use of material inputs. See Gert Leptin, Manfred Melzer, *Economic Reforms in East European Industry: East Germany* (Oxford 1978)

²³ See: Paul Marer, *Dollar GNPs of the U.S.S.R. and Eastern Europe* (Washington 1985)

4. The industrial structure

What explains the different productivity levels between East and West German industries in 1954? On the one hand the relative East German industrial labour productivity in comparison with West Germany shows differences within every branch. These branch differences are usually referred to as “intra branch” and its contribution to the aggregate relative productivity difference is called the “intra branch effect”. On the other hand the aggregate difference can be the result of so called “structure effects”. This refers to differences in the composition of production, for instance whether there are more people employed in textiles or in chemicals. Since some branches realise higher productivity levels than others the composition, or structure, has effect on the aggregate outcome of the relative productivity level.

Shift share analysis allows the estimation of the structure effects and of the intra branch effects. Pioneers in this type of analysis were Kuznets, Chenery and Syrquin. The following equation was derived from Timmer (1999)²⁴, where LP = Labour Productivity and S_i = Share of employment in particular branch or industry.

$$LP^{\text{West}} - LP^{\text{East}} = \sum_{i=1}^n (LP_i^{\text{West}} - LP_i^{\text{East}}) \frac{1}{2} (S_i^{\text{East}} + S_i^{\text{West}}) + \sum_{i=1}^n (S_i^{\text{West}} - S_i^{\text{East}}) \frac{1}{2} (LP_i^{\text{East}} + LP_i^{\text{West}})$$

In the right hand side of the equation differences of labour productivity are decomposed into an “intra branch effect” and a “structure effect”. The “intra branch effect”, which is the first term, accounts for differences in branch productivity levels. The “structure effect” is in the second term and accounts for differences in employment structures. If these calculations are carried out at the branch level the structure effect appears almost absent and in fact shows a – be it minor – positive effect of the East German structure in comparison with West Germany. Table 4 shows the results.

²⁴ Marcel Timmer, *The Dynamics of Asian Manufacturing: A Comparative Perspective, 1963-1993* (Eindhoven 1999) pp 109-112

Table 4.

*Decomposition of the East German productivity difference
in comparison with West Germany in 1954 in % of total*

	Intra branch	Structure	Total
Mining	- 8.75	9.44	0.69
Food, Beverages, Tobacco	15.91	- 13.18	2.72
Textiles, Wearing Apparel	3.98	- 6.22	- 2.24
Leather Products, Footwear	4.41	- 0.69	3.73
Wood Products, Furniture	5.27	- 3.16	2.11
Paper and Printing	3.52	2.35	5.87
Chemicals, rubber, plastic, oil refining	11.93	- 2.84	9.10
Stone, Clay, Glass	4.87	1.93	6.80
Metal, Machinery, Transports	54.85	10.03	64.87
Electrical Equipment	9.21	- 4.56	4.66
Optics and Fine Mechanics	2.91	- 1.23	1.68
Total	108.13	- 8.12	100.00

Table 4 allows for several interesting observations. Firstly intra branch differences prove to have been very important. In fact the structure effect makes clear that the employment structure of East Germany was favourable in comparison with West Germany. Secondly the productivity difference between East and West Germany is largely situated in the branch “Metal, Machinery, Transports”. Now that we have categorised and localised the productivity gap: how can it be explained?

There are three elements that can explain the falling behind of East Germany relative to West Germany during this period. Firstly there are the reparations to the Soviet Union, which in the German literature are referred to as *Kriegsfolgelasten*. This included dismantling as well as deliveries out of current production. Secondly there is the ambition of autarky by the East German government. The retreat from international trade – *ergo* from the international division of labour – potentially endangered the level of labour productivity. Thirdly East Germany was the small part of a formerly integrated nation. Existing interdependencies are believed to have created serious bottlenecks.

As the productivity gap between East and West Germany is to such a large extent situated in the branch “Metal, Machinery, Transports” it is interesting to find out whether the elements of dismantling, autarky and interdependency can be linked up specifically with this branch. In 1936 the production of “basic and fabricated metal” largely took place in West Germany, which was specialised in these type of products.²⁵ The employment shares in “machinery and transports” were approximately the same in the two parts of Germany in 1936. Unfortunately it is not possible to distinguish between these two branches for 1954, because in the East German classification some of the products groups

²⁵ Jaap Sleifer, “Separated Unity: The Industrial Sector in 1936 in the Territory of the German Democratic Republic and the Federal Republic of Germany” in: *Jahrbuch für Wirtschaftsgeschichte* 2001/1

which belong to “basic and fabricated metal” according to the West German scheme are categorised in “machinery and transports”.

As a consequence of the division of East and West Germany after World War II the previously existing pattern of specialisation was cut loose. The Soviet Union largely dismantled East German plants of “basic and fabricated metal”.²⁶ Furthermore this branch faced difficulties in retrieving the necessary inputs which were produced insufficiently by East German mining. It started using alternative inputs, especially (metal) scrap.²⁷ Such a use of alternative inputs can be explained from the ambition of autarky.

On its turn the branch “basic and fabricated metal” could not supply the necessary inputs for the branch “machinery and transports” either. Within the branch “machinery and transports” there is a high interdependency of parts that are produced in different plants. According to Barthel there existed discontinuities in production due to shortages of specific parts.²⁸ Moreover the branch “Machinery and Transports” was confronted with a largely worn off capital stock. Clearly, the branch “Metal, Machinery, Transports” can be seen as the bottleneck sector of the East German economy during the 1950s.²⁹

In West Germany after the currency reform in 1948 industries like iron and steel, metal manufacturing and vehicles took the lead in the growth race together with ‘productive’ services such as banking, transport and insurance.³⁰ However, a lead in the growth race should not be confused with a high labour productivity level. In comparison to other European countries the West German metal industries realised an average level of labour productivity.

Table 5.

Labour Productivity Levels in Metal Industries (West Germany = 100)

	1950	1960
France	70	94
United Kingdom	116	104

Source: Mary O’Mahony, *Britain’s Productivity Performance 1950-1996: An International Perspective* (London 1999) p 18

Logically the explanation for the relatively low productivity level in this particular branch should be found in East Germany. According to Baar, Karlsch and Matschke “Metallurgy” and

²⁶ Karl Eckart, *Die Eisen- und Stahlindustrie in den beiden deutschen Staaten* (Stuttgart 1988)

²⁷ Wolfgang Mühlfriedel, Klaus Wiessner, *Die Geschichte der Industrie der DDR bis 1965* (Berlin 1989) p 213

²⁸ Horst Barthel, *Die wirtschaftlichen Ausgangsbedingungen der DDR* (Berlin 1979) p 155

²⁹ Wolfgang Mühlfriedel, Klaus Wiessner, *Die Geschichte der Industrie der DDR bis 1965* (Berlin 1989) pp 245–258; Stefan Unger, *Eisen und Stahl für den Sozialismus: Modernisierungs- und Innovationsstrategien der Schwarzmotallurgie in der DDR von 1949 bis 1971* (Berlin 2000) pp 147-169

³⁰ Herbert Giersch, Karl-Heinz Paqué, Holger Schmieding, *The Fading Miracle: Four Decades of Market Economy in Germany* (Cambridge 1992) p 47

“Machinery” were the branches that suffered most from expropriation by the Soviet Union.³¹ Initially it was their purpose to destroy the (East) German potential of production which could be used for military objectives, which in particular led to dismantling in “Metallurgy”, “Machinery”, “Optics and Fine Mechanics”.

The different levels of productivity between East and West German industrial branches which were shown in table 3 make clear that the branches that suffered the most from dismantling are the same as the branches that realised a relatively low productivity level.

5. Conclusion

This paper compared the levels of East and West German industrial labour productivity in 1954. The benchmark was based on the quantity approach and estimates the East German industrial labour productivity from 61.6 to 64.7 percent of the West German level. For manufacturing the relative labour productivity amounted from 56.9 to 59.8 percent of West Germany.

Shift share analysis showed that the different productivity is primarily located in the branch “Metal, Machinery, Transports”. This branch suffered major expropriations of its capital stock as part of the reparations to the Soviet Union. It can be observed that another branch that was heavily affected by the reparations, “Optics and Fine Mechanics”, also shows a very low level of labour productivity in comparison with West Germany.

Finally it shows that estimates based on value added lead to a higher relative productivity level of East Germany in comparison with West Germany. However, this requires further research.

³¹ Lothar Baar, Rainer Karlsch, Werner Matschke, “Kriegsschäden, Demontagen und Reparationen” in: Enquete-Kommission ‘Aufarbeitung von Geschichte und Folgen der SED-Diktatur in Deutschland’, *Machtstrukturen und Entscheidungsmechanismen im SED-Staat und die Frage der Verantwortung* (Frankfurt/M 1995) pp 868-989

Annex A Employment

The East German employment figures are based on a publication of the (West) German statistical office after the reunification of the two parts of Germany, Sonderreihe mit Beiträgen für das Gebiet der ehemaligen DDR. Heft 14. Erwerbstätige 1950 bis 1989 (Wiesbaden 1994). On a branch level this source gives figures for 1970, 1975, 1980, 1985, 1988 and 1989. To arrive at employment estimates for 1954 the figures for 1970 were extrapolated using the employment series of Manfred Melzer: Anlagevermögen, Produktion und Beschäftigung der Industrie im Gebiet der DDR von 1936 bis 1978 sowie Schätzung des künftigen Angebotspotentials (DIW/Berlin 1980) Heft 59. The West German figures were derived from Statistisches Bundesamt, Die Industrie der Bundesrepublik Deutschland – Reihe 3 – Die industrielle Produktion. Jahreszahlen 1954 bis 1958 (Stuttgart/Mainz 1958).

	East Germany	West Germany
Mining	184285	641600
Food, Beverages, Tobacco	280323	403000
Textiles, Wearing Apparel	534771	860600
Leather Products, Footwear	99009	163100
Wood Products, Furniture	235332	336000
Paper, Printing	112576	279200
Chemicals, Rubber, Plastic, Oil Refining	267420	469800
Stone, Clay, Glass	153738	375200
Basic and Fabricated Metal Products	330950	581400
Machinery, Transport	538382	1403300
Electrical Equipment	287056	402800
Optics, Fine Mechanics	99254	118500
Total	3123096	6034500

Annex B Production

East German quantities were obtained from the Staatlichen Zentralverwaltung für Statistik, *Statistisches Jahrbuch der deutschen demokratischen Republik 1955* (Berlin-Ost 1956). West German quantities and sales values were obtained from Statistisches Bundesamt, *Die Industrie der Bundesrepublik Deutschland – Reihe 3 – Die industrielle Produktion. Jahreszahlen 1954 bis 1958* (Stuttgart/Mainz 1958).

Mining	<i>Unit</i>	<i>EG</i>	<i>WG</i>	<i>WG-value</i>	<i>EG-value</i>
Steinkohle	th t	2648	65140	3293484	133883
Rohbraunkohle	th t	181913	87813	192935	399683
Braunkohlenbriketts	th t	46886	15951	483448	1421036
<i>Braunkohlenschwelkoks</i>	th t	6240	686	16910	153817
Eisenerz eff.	th t	1470	13036	227538	25658
Kalisalze auf K ₂ O	th t	1463	1936	324535	245245
Schwefelkies	th t	130.1	596.4	25340	5528
Total				4564190	2384850

Food, Beverages, Tobacco

Mehl aller sorten, Mahlmühlenerzeugnisse	th t	1308.2	3725.2	1864956	654927
Nährmittel aller Sorten	th t	134.1	319.4	650496	273111
Fleisch und Wurstwaren	th t	193.8	174.6	745549	827534
Fleisch und Wurstconserven	t	128362	47255	208658	566792
Margarine	th t	144.3	589.9	960031	234841
Butter	th t	108.7	229.9	1290410	610124
Verbrauchszucker	t	733198	1098964	941850	628376
Malz	t	137445	188404	140990	102855
Bier	th hl	10617	27479	1741405	672823
Alkoholfreie Getränke	th l	154260	509166	199639	60484
Rauchtabak	t	2865	15706	185700	33874
Zigaretten	Mill P	16999	39499	941670	405262
Total				9871354	5071003

Textiles, Wearing Apparel

Kunstseide (Reyon)	t	20897	59795	4311	1507
<i>Garne</i>	t	243275	637186	34454	13154
Gewebe, Rohgewebe	th qm	483310	617732	733553	573928
Möbelstoffe	th qm	7484	54681	279330	38231
Teppiche und Läufer	th qm	4668	15677	285006	84864
Tüll und Gardinen	th qm	38177	55177	100362	69441
Strumpfe und Socken	th pares	146586	182741	482483	387025
Untertrikotagen (Leibwäsche)	th P	119135	196434	524036	317822
Obertrikotagen (Oberbekleidung)	th P	13460	30429	415923	183980
Total				2859458	1669952

Leather Products and Footwear

Schuhe	th pares	19374	93774	1448541	299273
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Unit EG WG WG-value EG-value

Wood Products and Furniture

Schnittholz und Schwellen	th cbm	3446.3	6881.6	982647	492109
Furniere	cbm	21230	312708	105735	7178
Hartfaserplatten (Holzfaserplatten)	cbm	13434	163180	63182	5202
Pianos und Flügel	P	6136	7147	15836	13596
Total				1167400	518085

Paper and Printing

Zellstoff aller Sorten (atro)	th t	302.3	629.3	381707	183363
Papier aller Sorten	th t	391.4	1706.6	1491917	342164
Karton und Pappe	th t	216.2	581.4	289486	107649
Papiersäcke	t	26292	131484	160583	32111
Tüten und Beutel	t	21669	78636	142551	39282
Kartonagen	t	76185	192169	241963	95926
Wellpappe und -erzeugnisse	t	51189	208713	188725	46287
Total				2896932	846782

Chemicals, rubber, Plastic and oil refining

<i>Schwefelsäure ber auf SO3</i>	th t	433.7	1708	1364934	346588
<i>Ätznatron ber auf Na OH</i>	t	227699	498155	398096	181964
<i>Salzsäure ber auf HCl</i>	t	80318	144586	115545	64186
<i>Calciumcarbid</i>	t	735374	803935	642458	587668
Stickstoffdünger ber auf N	t	276681	696032	687414	273255
Phosphordünger ber auf P2O5	t	79203	490783	261019	42124
<i>Essigsäure</i>	t	28196	83033	66355	22533
Waschpulver	t	67813	176083	254086	97854
Lacke und Anstrichmittel	t	95096	272267	695481	242914
Kraftfahrzeugdecken	th P	1139.7	5902	248825	48049
Kraftfahrzeugschläuche	th P	1128	5011	26658	6001
Fahrraddecken	th P	4951.9	15395	57085	18362
Fahrradschläuche	th P	5005	13491	16699	6195
Total				4834655	1937693

Stone, Clay, Glass

Gebrannter Kalk	th t	2303	6757	278355	94872
Zement	th t	2635	15618	831653	140313
Dachziegel	th P	181381	1011718	205397	36824
Schamotteerzeugnisse	th t	593.6	296.5	17568	35172
Haushaltsporzellan	t	17511	65068	248308	66824
Total				1581281	374005

Basic and Fabricated Metal Products

<i>Roheisen</i>	th t	1317.8	12512	6685996	704188
<i>Rohstahl in Blöcken</i>	th t	2330.5	16960	9062859	1245342
Walzstahl, ohne Walzbleche	th t	2552.2	7953	3891907	1248953
Walzbleche	th t	666.8	3494	2006072	382842
Bandagen	th t	34.6	52	216168	143835
Drahtgeflechte	t	3288	85708	76335	2928
Total				21939337	3728088

	<i>Unit</i>	<i>EG</i>	<i>WG</i>	<i>WG-value</i>	<i>EG-value</i>
Machinery and Transport					
Rohrleitungen	t	45815	81791	148561	83216
Traktoren -Sä- und Drillmaschinen	P	6807	15837	11650	5007
Grasmäher	P	400	7534	7076	376
Mähdrescher	P	3376	5210	48355	31333
Heu- und Strohpressen	P	53861	9209	16169	94568
Dampflokomotiven	P	87	273	90222	28752
<i>Personenkraftwagen</i>	P	19677	518190	1397608	53071
<i>Lastkraftwagen</i>	P	12222	113146	457748	49446
Motorräder	P	50270	256869	346400	67792
Fahrräder	th P	728.4	890.2	101134	82752
Nähmaschinen für den Hausbedarf	P	199718	526429	152317	57786
Total				2777240	554099

Electrical Equipment

Glühlampen	th P	71437	78658	50579	45936
Radioempfänger	P	896674	2632801	442945	150857
Fernsehempfänger	P	40565	128930	78964	24844
Total				572488	221637

Optics and Fine Mechanics

Armbanduhren	th P	1732	5859	142821	42220
Taschenuhren	th P	675.4	557	3702	4489
Wecker	th P	1156.3	8407	44696	6148
Fotoapparate	P	804087	3009210	194168	51883
Buchungsmaschinen	P	5113	32388	85481	13495
Total				470868	118235

Annex C Implicit Unit Value Ratios

The table below shows the output value of the matched products in West German prices in column (a) and column (c). The total output values per branch in the own currency's, that are in column (b) and column (d) were derived from the official statistics. Column (e) hides the underlying assumption that the quantity relationship between matched output in the two countries applies to the entire branch. Finally the implicit unit value ratio was derived from the columns (d) and (e).

The "plain" benchmark and the Implicit Unit Value Ratio for 1954

	West Germany		Implicit UVR OM/DM (d)/(e)	East Germany		
	Matched DM (a)	Total DM (b)		Matched DM (c)	Total OM (d)	Total DM (e)
Mining	4564.19	7718.10	0.48	2384.85	1928.1	4032.81
<i>Manufacturing:</i>	<i>50419.55</i>	<i>132666.10</i>	<i>0.83</i>	<i>15338.84</i>	<i>38034.90</i>	<i>45634.69</i>
Food, Beverages, Tobacco	9871.35	22343.10	0.60	5071.00	6933.4	11477.85
Textiles, Wearing Apparel	2859.46	16240.80	0.65	1669.95	6177.6	9484.78
Leather Products, Footwear	1448.54	2969.60	1.60	299.27	982.9	613.53
Wood Products, Furniture	1167.40	5543.80	0.73	518.09	1797.5	2460.31
Paper, Printing	2896.93	6252.40	0.70	846.78	1281.9	1827.59
Chemicals, rubber, plastic, oil refining	4834.66	16885.90	0.99	1937.69	6705.2	6767.73
Stone, Clay, Glass	1581.28	5938.20	1.01	374.01	1416.7	1404.51
Metal, Machinery, Transport	24716.58	47046.70	1.13	4282.18	9214.8	8150.92
Electrical equipment	572.49	7906.80	0.89	221.64	2727.5	3061.09
Optics, Fine mechanics	470.87	1538.80	2.06	118.23	797.4	386.39
Total		140384.20	0.80		39963.0	49667.50

Source: Annex B, Column (d) is from Staatlichen Zentralverwaltung für Statistik, *Statistisches Jahrbuch der Deutschen Demokratischen Republik 1955* (Berlin 1956) pp 154, 155

The Fisher index is the geometric average of the Laspeyres index that is shown above (0.80) and the Paasche index that can be calculated by weighting the implicit UVRs at East German weights (column d). This makes the Paasche UVR (0.89) and the Fisher index at (0.85).

Using the Fisher UVR the total value of industrial output in East Germany amounts to $(39963/0.85) = 47015.29$ DM. The Laspeyres index summed up to 49667.50 DM. The Fisher/Laspeyres ratio was calculated as follows: $(47015.29/49667.50) = 0.9466$. This ratio was used to adjust the Laspeyres results in column e.

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