I. Introduction

For nearly forty years, the mainstream interpretation of the West German economic miracle has been built on an inspiring growth model developed by the Hungarian economist Ferenc Jánossy to explain the extraordinary growth performance of war-shattered economies during the 1950s and early 1960s.[1] The central assumption of the reconstruction thesis, as it is referred to in western historiography, is that over the long run productive potential is determined by the size and qualification structure of the labour force. In the short run, however, actual output is limited by the workplace structure of the economy, i.e. the capital stock and its technological composition. Hence, in the immediate aftermath of a war or a major depression, a large gap between actual and potential output can open up due to a severe distortion in factor proportions. This phenomenon is termed 'structural incongruence' and is assumed to result from the depletion of physical capital, especially machinery, as a consequence of wartime destruction and depressed investment activity.

In the reconstruction thesis, structural incongruence constitutes an extraordinary growth potential. Due to the initially low capital-labour ratio, returns on capital are very high, inducing exceptional rates of investment and, consequently, accelerated capital accumulation during a reconstruction period. With constantly rising capital input, however, structural incongruence is gradually eliminated, and as the economy approaches its long-run potential growth path, incremental output generated by additional investment is decreasing. When the reconstruction period is completed, productive potential once again solely depends upon the size and qualification structure of the labour force, since the complementary workplace structure of the economy can no longer develop faster. Technically speaking, the slope of the long-run potential growth path is determined by the rate of accumulation in labour qualifications and is thus unaffected by the investment rate.

The Jánossy model has been specifically applied to explain the West German economic miracle by Manz, Abelshauser and Borchardt among others.[2] According to Ableshauser, after two world wars and two severe interwar slumps, there was in 1945 an enormous discrepancy between actual output and the productive potential determined by the country's pre-1914 growth path. 'This accumulated developmental deficit made it possible, at least as long as it

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The following abbreviations will be used in the footnotes: IndBRD = Industrie der Bundesrepublik Deutschland; StBRD = Statistik der Bundesrepublik Deutschland; StDR = Statistik des Deutschen Reichs. References with no author are publications of the Statistisches Bundesamt or Statistisches Reichstamt.

[1] Jánossy (1969)

[2] Manz (1968); Abelshauser (1975, 1983); Borchardt (1991)

has not been fully absorbed, to achieve significantly higher growth rates of *per capita* national product than prior to the onset of [the above] crises'.[3] As the growth potential inherent in economic reconstruction had been exhausted by the early 1960s, the ensuing gradual slowdown must also be interpreted as the economy's return to its potential growth path, leaving no, or at least limited, room for the conventionally emphasised macro-economic policy failures.[4] This interpretation effectively implies that the process of economic growth in Germany has been determined by the long-term accumulation of factor endowments and, therefore, must be seen as a historical continuum.[5]

More recently, cliometric investigations have demonstrated the existence of a strong reconstruction effect in western industrialised economies during the early post-war period.[6] However, the reconstruction thesis as formulated by Jánossy does not simply rest on the assumption that economies shattered war are characterised by a serious mismatch between complementary factors of production that entails the potential for a subsequent growth miracle. It specifies that this transient anomaly is chiefly explained by the wartime destruction, or at least unusually slow accumulation, of fixed capital, machinery in particular, in the face of a continued expansion of labour supplies – both in a quantitative and qualitative sense. Therefore, to test the direct applicability of the model, the first question we need to answer is whether the historical evidence demonstrates a shortage of physical capital, and a corresponding labour surplus, in the Federal Republic at the onset of her sovereign statehood. If this precondition is not met, than it cannot be argued that the West German economic miracle was driven by capital deepening in the course of the 1950s.

An extensive literature and an ample source of contemporary statistical publications offer some insights. On this basis, Section II draws an overall picture on the development of factor endowments at the macro level. In Section III, I present data on gross value-added and factor endowments for different industrial branches in the period 1939-50. In Section IV, I employ growth-accounting and shift-share techniques to investigate the productivity performance of West German industry over the same years and to account for its causes. Finally, Section V recapitulates on my most important findings and draws attention to their potential growth-theoretical implications, with particular emphasis on the Jánossy model.

[3] Abelshauser (1983), p. 92.
[4] Idem (2004), pp. 281-82.
[5] Borchardt (1991), pp. 127-30.
[6] Dumke (1990); Wolf (1995); Vonyo (2008).

II. Factor accumulation at the macro level

Measuring the impact of wartime destruction on the stock of industrial fixed capital was already a primary concern prior to the cessation of hostilities when the United States Strategic Bombing Survey (USSBS) began to take account of material damage caused by aerial bombardment in the West of Germany. The survey repeatedly stressed the surprisingly small magnitude of capital depletion directly caused by Anglo-American air raids. 'The Allies did not attempt to destroy the German economy as a whole. The bombing offensive sought rather to stop it from operating by damaging key points'.[7] Moreover, the report emphasised the existence of ample capacities in both steel manufacturing and machine tools on the eve of the war, only to be extended further in later years. As a result, the German economy had never been is short of capital goods until the final breakdown of the transportation system.[8] A prime evidence for this argument is that most branches of heavy industry continued to operate on a single shift, while American machinery was working practically day-and-night, seven days a week. Expressed in numbers, the machine-tool stock of German industry was estimated to have grown from around 1.33 to 2 million pieces between 1938 and 1943.[9]

In contrast to popular beliefs, only 17.4 per cent of industrial fixed assets on the territory of the later West German state was destroyed as a consequence of aerial bombardment and ground fighting, and a mere 6.5 per cent of all machinery and equipment suffered significant damage.[10] On 30 March 1945, Hitler issued an order (*Nero-Befehl*) to demolish non-movable industrial assets prior to the arrival of Allied troops, but – with the support of factory owners and often providing the workforce with weapons – armaments minister Albert Speer successfully sabotaged the implementation of this suicidal creature of a most monstrous mind. Following the disintegration of the war economy, industrial firms were in the position to divert resources from production to reconstruction work, while building up inventories of precious input materials.

In the aftermath of World War II, net capital formation was mostly affected by reparations and, as part of that, the dismantlement of industrial machinery. The First Industrial Plan of the Allied Control Panel, issued on 28 March 1946, limited production to 65 per cent of the 1936 level, prohibited the manufacturing of explosives and armaments, and severely constrained production in several other branches of heavy industry. The capacity deemed

[7] USSBS (1945), p. 37.
[8] Ibid., pp. 75-81, 84-86.
[9] Kaldor (1946), p. 55.
[10] Abelshauser (2004), p. 68.

unessential for attaining the output ceiling was to be dismantled for reparation purposes.[11] However, due to a marked shift in Anglo-American occupation policy, actual dismantling activity never came even close to meeting the schedules, although they were substantially downgraded in August 1947 and later by the 1949 Treaty of Petersberg.[12] Until 1951, total dismantlement amounted to 4.8 billion marks, estimated to be less than 4 per cent of the gross capital stock of West German industry.[13] Allied reparations arguably exerted more negative influence on capital formation indirectly because firms placed on the dismantlement schedules had no incentive to invest in new machinery or even to carry out essential repairs. The diminution of industrial fixed capital due to these factors was estimated at 2.8 per cent between April 1945 and June 1948.[14]

The precise quantification of capital accumulation in the industrial sector, adjusted for territorial changes after the war, was undertaken by the West Berlin based German Institute of Economic Research (DIW) from the mid 1950s onwards. It immediately became clear that the stock of industrial fixed capital had not simply been saved to a large extent from war-related damage. It had also been significantly expanded as a consequence of colossal investments in new machinery, levels of which continued to increase rapidly well into 1942. Furthermore, due a massive diversion of investment materials and financial resources from other sectors of the economy, net capital formation in the locomotive branches of heavy industry remained strongly positive in 1943 and, in some cases, even in 1944.[15]

In a string of publications, Rolf Krengel presented the first, and until today only available, estimates on gross and net capital stock broken down into building structures and machinery in West German industry, going back to the mid 1920s and accounting for war damage as well as post-war dismantlement.[16] His calculations demonstrated that, despite a substantial loss of fixed assets – especially machinery – in the mid 1940s, manufacturers experienced between 1939 and 1950 a quite remarkable period of capital accumulation. Gross industrial fixed capital increased by no less than 10 per cent, despite a 24 percent decline in 1943-48.[17] Furthermore, as shown in Table 1, accelerated net capital formation was markedly in favour of machinery against building structures and also of the production and investment goods industries at the expense of producers of consumption goods and of foodstuffs.

[11] Henning (1993), p. 189.
[12] Weimer (1998), pp. 25-26.
[13] Plumpe (1999), p. 43.
[14] Abelshauser (1983), p. 22.
[15] DIW (1954), pp. 57-59.
[16] Krengel (1956, 1957 and 1958).
[17] Idem (1958), p. 94.

Table 1: *Gross capital stock in West German industry in 1950 prices (billion DM)*

Industrial Sectors	Building structures				Machinery and equipment			
	1939	1943	1948	1950	1938	1943	1948	1950
Mining, production goods	9.53	11.76	8.58	9.27	20.24	28.18	22.38	23.35
Investment goods	4.58	5.55	4.16	4.64	7.30	9.29	7.36	8.04
Consumption goods	3.05	3.31	2.91	3.34	5.58	6.06	5.57	6.17
Food and tobacco	1.68	1.83	1.62	1.84	3.90	4.20	3.84	4.40
Industry overall	18.83	22.44	17.27	19.09	37.03	47.74	39.15	41.96

Source: Krengel (1958), pp. 94-95.

The above result are especially striking, if one considers that annual gross investment in German industry had already increased over tenfold between 1932 and 1939, compounded with profound structural shifts.[18] The share of heavy industry in gross capital formation increased from 75% in 1935 to 81% in 1939 and 87% by 1943/44. Most investment went into metallurgy, chemicals, machine tools, motor vehicles and aircraft manufacturing as well as electrical and precision engineering.[19] Due to vigorous capital-stock expansion in German industry, not only the structure, but also the age composition of available machinery went through significant improvement. All in all, the massive investments of the late 1930s and early 1940s by far outweighed the diminutive effects of wartime hostilities and dismantlement both is quantitative and qualitative terms. Contemporary claims, which estimated capital destruction at 30 to 50 per cent of available production capacities and which, consequently, accentuated fears of 'deindustrialisation', were found to be erroneous.[20] West German industry was not simply well-endowed with physical capital at the start of the economic miracle; it was much better endowed than ever before World War II.

On the other hand, although the human casualties of the war were unquestionably enormous, labour supplies still continued to expand. In June 1939, 39.35 million people lived on the territory of the later Federal Republic, whose inhabitants numbered 47.7 million in September 1950.[21] The total number of working-age men and women employed or seeking employment also increased from 19.69 million to slightly over 22 million between 1939 and 1950.[22] This astonishing development was the consequence of two critical features of demographic change in West Germany over the period: the expulsion of minority Germans from East and Central Europe and the mass flight of East German refugees. The federal census conducted on 13 September 1950 registered 7.98 million expellees and 1.56 million

[18] Länderrat des Amerikanischen Besatzungsgebiets (1949), p. 605.
[19] Eichholz (1999), p. 343-344.
[20] Niederschlag (1947), p. 41; Seume (1947), p. 143; Eisendrath (1950), p 126.
[21] Steinberg (1991), p. 155.
[22] Ambrosius (1996), pp. 47-48.

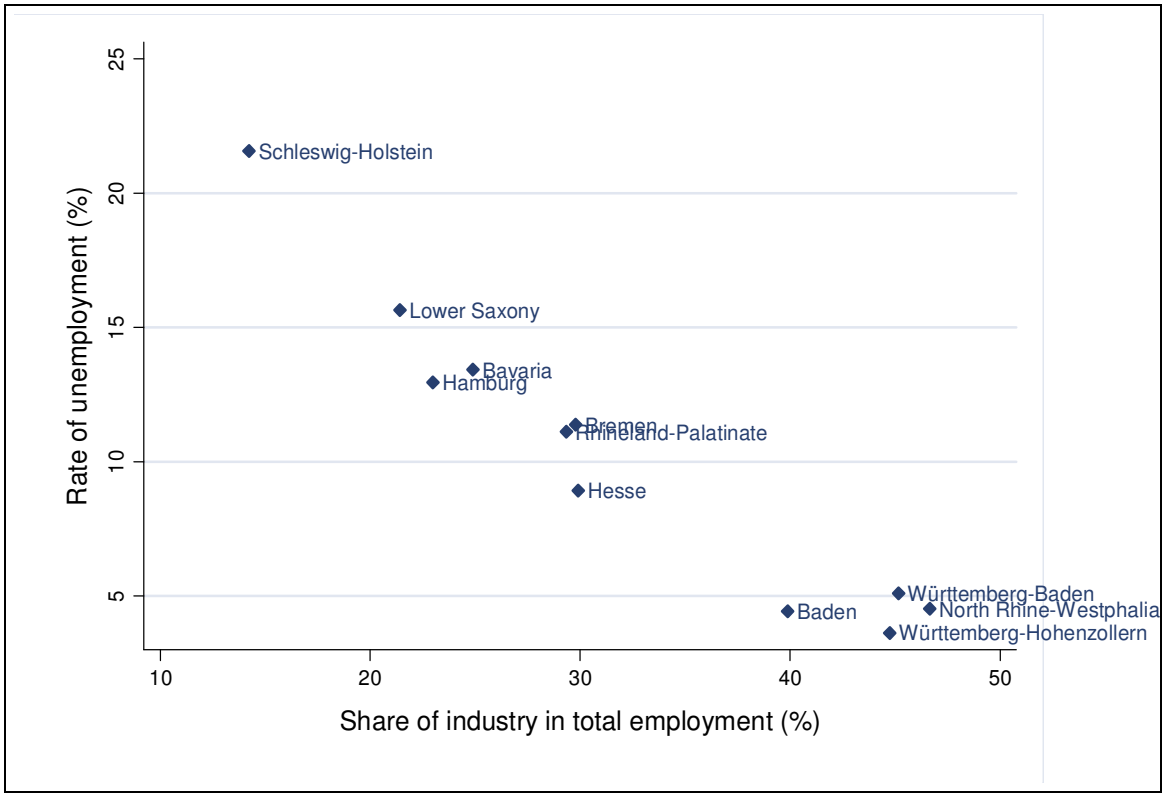
immigrants with a permanent pre-war residence on the territory of the later Soviet zone of occupation.[23] It is important to emphasise the distinction official terminology makes between the two population groups. Immigrants of German ethnicity residing in 1939 in East and Central European states and in parts of the former Reich ceded to Poland and the USSR are referred to as expellees. Those migrating from the later GDR are classified as refugees.

This astounding labour-force expansion urged several German economists to argue that, in line with the Jánossy model, the early years of post-war reconstruction were characterised by a relative shortage of capital and hence an initially low capital intensity of production.[24] The meteoric rise of the unemployment rate from just over 5 per cent in July 1948 to 14.2 per cent in February 1950 – allegedly the result of post-currency reform rationalisation – also appears to confirm this view.[25] Consequently, the pace of economic growth during the reconstruction period is believed to have been determined primarily by the rate of net capital formation, as Jánossy originally argued.[26] Mass unemployment, however, can only be interpreted as a sign of capital shortage and of a corresponding relative abundance of labour supplies, if capacity utilisation is at normal levels. This was clearly not the case, as 44.4 percent of industrial machinery laid idle in late 1948 and the average utilisation rate was still only 66.8 per cent in 1949.[27] Low levels of capacity utilisation could, in theory, be explained by a number of different factors. However, in my view, it was a relative scarcity of labour, not a labour-quality adjusted shortage of capital, which limited the rate of expansion in urban industry, where the economic miracle of the 1950s effectively took place.

The prime evidence for this proposition is the high regional dispersion of average unemployment rates. Based on data derived from monthly statistics for December 1950, I calculated the share of unemployed in the labour force, and the rate of industrialisation, measured by the industrial share in total employment, for each of the federal states. Figure 1 demonstrates a practically functional relationship between the two variables, confirmed by a correlation coefficient of -0.963 significant at the 1 percent level. In the heavily industrialised regions of North Rhine-Westphalia and the three components of the later Baden-Württemberg, unemployment stood below 5 per cent, whereas in the agrarian states of Schleswig-Holstein and Lower Saxony, 21.6 and 15.6 per cent of the labour force respectively laid idle.[28]

[23] Reichling (1989), p. 14; Heidenmeyer (1994), p. 43.
[24] See Krengel (1962), pp. 40-41; Paqué (1987), pp. 11-17.
[25] Roeper and Weimer (1997), p. 76.
[26] Abelshauser (2004), p. 282.
[27] Krengel (1960), p. 81.
[28] Data on unemployment from Bundesministerium für Arbeit (1951), p. 6; on total employment from Idem (1955), pp. 10-11; on industrial employment from *IndBRD*, Teil 1, vol. 1, 10 (1951), p. 5.

Figure 1: *Regional levels of industrialisation and unemployment on 30.12.1950*



Source: See footnote 28.

A regression of the rate of unemployment on the share of industrial employment yields an R^2 of 0.92 and coefficients of -0.496 for the explanatory variable and 25.99 for the constant term. These results predict an unemployment rate of 1% in an area where 50% of the labour force is employed in industry. Therefore, labour-supply conditions must have been extremely tight in the major industrial cities of the Rhine-Ruhr agglomeration and Baden-Württemberg, allowing for critical labour shortage in the most dynamic branches of the economy – only to be aggravated by the world-wide investment boom emerging after the outbreak of the Korean War. With strong demand on both domestic and international markets, rising productivity and moderate wages, the parallel existence of surplus capacity, regional labour shortage and mass unemployment at the macro level can only be explained by a severe geographic dislocation of complementary factors of production and/or the worsening of effective labour qualifications relative to the technological requirements of the available production apparatus.

In another paper, I analyse the geography of wartime dislocation in West German industry in great detail. Here, it is sufficient argue that the main structural bottleneck of industrial reconstruction was a severe urban housing shortage in major urban agglomerations, whose residential areas were devastated by Allied aerial bombardment. Consequently, a

significant expansion of the West German population across the war did not stop the number of inhabitants residing in the largest cities from falling considerably.[29] Population aggregates, however, also disguise massive distortions in the age and gender composition of West German society. Thus, before we turn to analysing the structural dynamics of wartime dislocation in detail, it is essential to briefly discuss the qualitative development of the labour force during the years of World War II and Allied occupation.

Tremendous casualties suffered by middle-aged men, traditionally constituting the backbone of industrial employment, generated a 20 percent female surplus by 1946. The share of male inhabitants aged 20 to 35 in the total population declined from 12.1 to a mere 7.4 per cent across the war.[30] The return of German soldiers from Allied prisoner of war camps abroad could only moderate this distortion; it did not eliminate it. Furthermore, returnees were often physically and/or mentally incapacitated for work. However, increased female participation could not sufficiently substitute for male employment as manual work in most industries was physically demanding and female employees had significantly lower qualification levels than their male colleagues. Based on data drawn from the published records of the 1950 federal employment census, I calculated that the proportion of qualified workers in the industrial workforce reached 50 per cent for men and only 16.2 per cent for women, while the share of industrial apprentices was also more than twice as high among male as under female workers.[31]

On the other hand, Abelshauser has argued that the introduction of a compulsory national apprenticeship system in 1938 – obligating all male school leavers to absolve three years of vocational training, and offering one year of optional training for girls – generated considerable improvements in industrial labour qualifications.. Furthermore, the reallocation of labour reserves to the capital intensive and high-productivity sectors of the economy during the war allowed for substantial learning-by-doing effects, potentially acting to increase productivity in subsequent years.[32] As compelling as this proposition may seem at a glance, it does not find support in the historical evidence.

First, there are no territorially adjusted estimates on the number of apprentices prior to the war that would allow for a direct comparison with post-1945 West German figures. However, if we take into account that the Federal Republic was slightly more advanced than the Reich as a whole, then a decline in the share of apprentices in total employment across the

[29] See Länderrat des Amerikanischen Besatzungsgebiets (1949), p. 19 and Bauer (1947), pp. 28-29.
[30] Kramer (1991), pp. 10-11.
[31] *StBRD*, vol. 45 (1952), p. 81.
[32] Abelshauser (1999), pp. 533-35.

war should certainly not signify an overall improvement in labour qualifications. According to my calculations the figures are 7.4 per cent in 1940 for the Reich and only 7.1 per cent in 1950 for West Germany.[33] Second, apprenticeship numbers mostly affect labour qualifications in subsequent periods, while the vocational structure of current employees depends on the scale of training programmes completed in previous years. Using currently available data, it is impossible to quantify what percentage of those absolving an apprenticeship during the war survived unwounded and were able to pursue their original occupations where they had received their training. Even if there had been no wartime casualties, apprentices trained under the new regime could not have joined the labour force 1944, because most of them had to complete their compulsory military service first.

Third, the reallocation of labour reserves in favour of the leading branches of heavy industry was facilitated primarily by the increased application of voluntary and forced foreign labour, which provided over three million employees in August 1944. Besides mining and agriculture, migrant and prison labour was primarily employed in the rapidly expanding and developing defence industries.[34] In the workforce of several plants manufacturing armaments, the proportion of foreigners surpassed the 70 per cent mark.[35] As a consequence, the sectoral reallocation of indigenous labour reserves was relatively slow and remained very limited. Due to the labour-market policies of the Nazi government, female employment was also kept at a depressed level, so that most women were unable to acquire industrial working skills. From the outbreak of the war, female participation fell back rapidly until the end of 1941 and even in September 1944 only exceeded the pre-war level by a mere 271 thousand.[36]

Finally, wartime conscription, sluggish economic activity in the late 1940s, the regional dislocation of labour reserves and the disadvantageous gender balance, if anything, must have acted to diminish, not augment, effective working skills, and must have severely constrained the scope for productivity improvements through learning-by-doing. According to my own calculations, industrial labour productivity, measured as net industrial production per employee, fell by 21.3 per cent between 1939 and 1950. This massive decline occurred despite vigorous capital-stock expansion and a 34.4 percent increase in average plant size – expressed as number of persons employed – which should have allowed for significant scale economies.[37]

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[33] *Statistisches Jahrbuch* (1940/41), pp. 418-19; Länderrat des Amerikanischen Besatzungsgebiets (1949), p. 478; Bundesministerium für Arbeit und Sozialordnung (1962), p. 22.
[34] Herbert (1987), p. 171; Ambrosius (2000), p. 347.
[35] Müller (1993), pp. 368-369.
[36] Milward (1977), p. 87.
[37] Own calculations based on data from *StDR*, vol. 568 (1942-44); *StBRD*, vol. 45/2 (1952); *IndBRD*, Sonderveröffentlichungen, 8 (1956), p. 17 and Statistisches Bundesamt (1972), p. 260.

This paper puts forward the following hypotheses. The enormous discrepancy between actual and potential output in West German industry at the start of the economic miracle resulted from a severe geographic dislocation of complementary factors of production, generating labour shortage in the country's industrial heartlands. Regional labour scarcity was further aggravated by the deterioration of effective labour qualifications across and after the war. Therefore, the high marginal returns on capital, observed by many at the start of the 1950s, were not the consequence of an initially low capital intensity of production. They resulted from an exceptionally low utilisation rate of available capacities that subsequently enabled firms to rapidly increase their effective capital input without major investments in new plant and equipment.

III. Factor accumulation and industrial production at the branch level

In quantitative terms the most important feature of industrial development in West Germany across the years of World War II and Allied occupation was a large overall decline in output levels in practically all branches coupled with an even sharper fall in labour productivity. Industrial production plummeted by more than 50 per cent between 1938 and 1948 before experiencing a rapid recovery until 1950 which, however, failed to propel most industries back to their pre-war levels of output, despite the expansion of factor endowments described in the previous section.[38] According to the reconstruction thesis, this phenomenon must have been induced by a relative shortage of capital and, correspondingly, a relative abundance of labour reserves in the declining branches of West German industry. In an econometric framework, this implies a strong positive correlation between net capital formation and net industrial production on the one hand, and an analogous relationship between capital intensity and labour productivity on the other. On the contrary, my hypothesis arguing for relative labour scarcity points to employment expansion as the dominant factor behind the growth of output. As for the productivity meltdown, a satisfactory explanation must account for structural shifts among industrial branches as well as between plants of different size within the leading industries and for the deterioration in effective labour qualifications during and immediately after the war.

To test these alternative hypotheses, I constructed a dataset of comparable figures for 1939 and 1950 on gross capital stock, net industrial production, total employment, female participation and the number of industrial plants for 36 branches, covering the entire secondary sector except construction and public utilities. For the past half a century, 1936 has been used

[38] *IndBRD*, Sonderveröffentlichung, 8 (1956), p. 17

as the conventional pre-war benchmark year in analyses of industrial development.[39] In 1939, the German Imperial Office for the Economic Planning of Warfare published a volume on the results of the 1936 industrial census it carried out in 30 branches and around 120 sub-branches at the provincial level.[40] On the basis of this source, the scholars of posterity managed to reconstruct levels of industrial value-added, employment and sales revenue as well as the value of exports for both West Germany and the later GDR. The original records of the census were also recently discovered in the federal archives of Berlin-Lichterfelde, allowing researchers to disaggregate even more and to correct for the occasional misreporting in the published volume, which were the deliberate products of military-strategic considerations.[41]

However, if one truly strives to understand the growth dynamics prevailing in the years of World War II and the post-war turmoil, one can not adhere to 1936 as a pre-war benchmark. The last four years preceding the outbreak of the war represented a period of remarkable industrial expansion in Germany and, consequently, would distort a trans-war comparison in output levels and factor endowments. Therefore, we need to obtain territorially adjusted figures for 1939 instead. Since capital-stock estimates are the most difficult to obtain, their sources essentially determined the level of disaggregation upon which the dataset was constructed. The DIW published estimates of gross capital stock for 41 branches, broken down into building structures and machinery, for the years between 1950 and 1968 and of the relevant levels of gross investment in 1962 prices, adjusted for wartime damage, post-war dismantlement and territorial changes, going back to 1924.[42] Capital-stock figures were determined only from 1950 onwards because the perpetual inventory method used in the estimation required investment series sufficiently long to cover the hypothesised maximum working life of fixed assets in various branches under the assumption of non-linearity for capital retirement.

Unfortunately, the non-linear retirement function employed by the authors can not be used to derive capital-stock estimates for the pre-war years by interpolation since that would require comparable investment figures for prior to 1924, which are not available. Thus, for this purpose, I assumed the rate of capital retirement to be constant over time, meaning that at zero gross investment in fixed assets, the capital stock would shrink at a constant rate. I computed the later as the reciprocal of the hypothesised maximum working life. This procedure, even if not precisely correct, enabled me to derive capital stock estimates for any given year using

[39] See Mertens (1964), pp. 25-29; Sleifer (2006); Fremdling (2007).
[40] Reichsamt für Wehrwirtschaftliche Planung (1939).
[41] Fremdling (2005), pp. 3-4.
[42] Baumgart and Krengel (1970), pp. 48-82. For DIW estimates on other sectors of the economy at a lower level of disaggregation see Kirner (1968) and Görzig and Kirner (1976).

investment and capital-stock figures of subsequent years. In accounting for capital endowments, I focus especially on the stock of machinery and equipment, which is specifically referred to by Jánossy and is significantly more important than buildings in determining production capacities. Baumgart and Krengel offer different estimates for the duration of the period machine tools can generally be used in different branches, which allowed me to compute branch-specific rates of capital retirement.[43] The approach I used to calculate gross capital stock prior to 1950 is summarised in the following formula, where *t* denotes the year for

$$K_i^t = K_i^{t+1} - I_i^t + A_i^t$$

which the capital stock of a particular branch (K_i) is being estimated, whereas I_i stands for investment in fixed assets and A_i for capital retirement in the same branch. The later is, in turn, the product of the branch-specific retirement rate (a_i) and the capital stock of the particular branch

$$K_i^t = K_i^{t+1} - I_i^t + a_i K_i^t$$

in a given year. The above formula can be rewritten in a way to express the capital stock of a particular year with variables for which figures are available or had already been calculated in a sequential procedure starting from 1950 and moving backwards to 1939.

$$K_i^t = \frac{K_i^{t+1} - I_i^t}{1 - a_i}$$

The establishment of correct capital-stock estimates was still more complex than that, however. While adjusting their investment figures for wartime damage and post-war dismantlement, Baumgart and Krengel distributed the estimated losses evenly over all potentially affected investment years. Therefore, their figures do not account for the precise timing of the damage that occurred to fixed assets in West German industry during the mid 1940s. Albeit perfectly suitable for the purpose of determining capital-stock levels for the post-1950 period, these estimates were inappropriate for my objectives. As a first step, I had to readjust investment figures to exclude the evenly distributed effects of wartime damage and post-war dismantlement. Second, based on estimates published in an earlier study by Krengel – and frequently referred to in the literature – I was able to determine the size of these effects as a proportion of the 1950 capital stock and the timing of the losses.[44] Third, I assumed lower retirement rates for all branches for the period 1945-49 since, at very low levels of capacity

[43] Ibid, p. 49.
[44] Krengel (1958), pages 95 and 104.

utilisation, the stock of industrial machinery was not run down as fast as in normal periods, and with little market incentive to increase production, firms employed a substantial share of their workforce to carry out essential repairs.

$$K_i^t = \frac{K_i^{t+1} - I_i^t}{1 - a_i} + DAM_i^t$$

Following these adjustments, I used the above extended formula to determine capital-stock, where DAM_i^t is the amount of capital lost in particular branch in a given year as a consequence of either war damage or post-war dismantlement and I denotes gross investment unadjusted for these effects. Aircraft manufacturing is excluded from the dataset on the ground that it was essentially banned until the accession of the Federal Republic to NATO in 1955 and its capital stock was fully dismantled after the war. The final results of my calculations are presented in Appendix 1. The estimates for 1945 are relatively high because the approach I used determines the capital stock at the start of any given year, and thus the damaging impact of Allied air raids and ground offensives in the final months of the war is reflected in the figures for 1946.

There is currently no other source of territorially adjusted estimates for industrial capital stock prior to 1950 at any comparable level of disaggregation. The establishment of these figures, therefore, provides new quantitative evidence on the development of German industry in a crucially important period. For this reason, Appendix 1 also reports data on the stock of building structures, also determined by using the above formula. In this case, however, an identical rate of capital retirement is assumed for all branches and all periods since the number of years buildings are expected to last is unlikely to be substantially affected by the type and intensity of industrial activity carried out in them.

The appendix tables present several interesting results that deserve discussion. First, the stock of building structures appears to have increased between 1939 and 1950, despite considerable bombing damage in 1944 and 1945. It indicates that, contrary to traditional accounts, building activity was quite strong during the war as well. As for the immediate post-war years, sluggish investment was not as detrimental to plants as to their equipment due to the significantly higher retirement rates of the later. Furthermore, dismantlement for reparation purposes largely focused on machinery without buildings actually being demolished. Thus whereas the stock of industrial machinery and equipment declined by 11.2 per cent between early 1945 and 1950, that of structures diminished by only 6.7 per cent – despite the much heavier bombing damage they suffered during the last months of the war.

The branch-specific figures confirm that dismantlement and sluggish investment during the late 1940s affected most heavily those industries whose capital stock had expanded most rapidly during the war. Prominent examples are hard coal mining, iron and steel, machine tools and other metal working industries as well as chemicals. This pattern offers no surprises, however, since the above branches were considered to be strategically important for the war effort and were, consequently, seen by the Allies as potentially capable of reinvigorating German expansionism. Firms operating in defence-related industries often made arduous efforts to convert their equipment to the production of commodities which were in no way relevant for the country's war potential. Civilian conversion was significantly easier in German industry than in its American counterpart, for example, due to the widespread application of multi-task universal machine tools. However, changes in product selection remained largely limited to shifts within branches. After all, blast furnaces and steam presses would have been difficult to convert into sewing machines.

In any way, the industries which were deprived of resources and faced depressed demand levels under the Nazi regime – most consumption goods branches and producers of foodstuffs and tobacco – managed to increase their stock of machinery after 1945. The timber industry is a special case as it provided vital inputs for urgent reconstruction projects and hence had to expand its capital stock quite significantly. Within heavy industry, electrical engineering enjoyed a relatively strong recovery in the late 1940s despite having been adversely affected by dismantlement. The industry was heavily concentrated in Berlin prior to the war, and numerous firms resident in the western sectors of the imperial capital resettled to West Germany proper after 1948, together with most of their qualified workers and movable light equipment.

Turning to the remaining variables of my dataset, the Federal Statistical Office published estimates for net industrial production based on an identical nomenclature of industrial branches for 1936, 1938, 1948 and then from 1950 onwards.[45] The pre-1950 data, however, does not account for the major components of the food industry. Hence my dataset treats this sector as one, although on the basis of capital-stock figures a slightly more differentiated picture could be drawn.

Data on industrial employment, the number of female employees as well as of plants excluding handcraft workshops can be obtained from the 1939 and 1950 non-agricultural workplace censuses.[46] The provincial records of the former allowed me to construct aggregate figures for the later West Germany. Since employment censuses are based on a nomenclature

[45] *IndBRD*, Sonderveröffentlichung, 8 (1956), p. 17; Fachserie D, Reihe 4 (1965), pp. 26-27.
[46] *StBRD*, vol. 45/2 (1952), pp. 4-18; *StDR*, vol .568 (1942-44).

different from the one followed in post-war industrial surveys, I calculated figures for both years on the same level of disaggregation. My results are certainly not the first territorially adjusted estimates on industrial employment for West Germany prior to the outbreak of World War II. However, the alternative sources are not suitable for my work for different reasons.

The Federal Statistical Office published comparable figures for 1939 and 1950 at a highly disaggregated level, but these are based on the pre-war industrial nomenclature, which is incompatible with the one used in my dataset.[47] The Federal Ministry for Labour also established territorially adjusted employment estimates based on the annual work-book statistics (*Arbeitsbucherhebung*) of 1938.[48] This classified document theoretically present us with the opportunity of creating a 1938 benchmark, for which output estimates are also available. However, the level of disaggregation is insufficient to match that of my sources for industrial output and capital stock – especially in metallurgy and the metal working industries as well as chemicals, which constituted the locomotive branches of German industry.[49]

Furthermore, the provincial labour office districts (*Landesamtbezirke*) did not correspond to actual provincial boundaries. In particular, the territories of *Nordmark* and *Mitteldeutschland* contained areas both under West and East German rule after 1949. These two districts had a very large weight in industrial employment: the former included the port cities of Hamburg, Kiel and Lübeck, whereas the later harboured the emerging industrial cluster around Braunschweig, Salzgitter and Wolfsburg.[50] Since no results are reported for the local labour office districts, we can not precisely adjust the figures for territorial changes. As a result, we need to adhere to the data derived from the 1939 non-agricultural workplace census, although we do not have access to territorially adjusted figures on net industrial production for the same year. The results of my calculations are presented in Table 2.

As with capital stock, the modest 8.63 percent overall growth of industrial employment disguises widely divergent patterns in different branches. The bulk of the production goods sector and the fabricated metal products industry as well as the miscellaneous food industries – chiefly tobacco – suffered a sharp fall in employment. On the contrary, the mining enterprises and most manufacturers of investment and consumption goods managed to increase the number of their workers by a massive margin. This pattern partially reflected trends already observable during the war, but also has an important regional aspect.

[47] *StBRD*, vol. 47.1 (1956), pp. 98-103.
[48] Bundesministerium für Arbeit (1952), pp. 12-23.
[49] Reichsministerium für Arbeit , pp. 19-21.
[50] Ibid, pp. 9-10.

Table 2: *Comparable employment figures for West German industry in 1939 and 1950*

Industrial Branches	**Employment**		**Female Employment**		**No. of Workplaces**	
	1939	*1950*	*1939*	*1950*	*1939*	*1950*
Hard coal	360,621	454,247	1,045	5,360	348	296
Brown coal and lignite	31,792	48,968	477	2,262	246	318
Iron ore	24,678	18,995	444	355	165	95
Rock and potassium salt	9,787	15,106	162	346	59	55
Crude oil and natural gas	4,492	9,022	54	312	71	105
Other mining	11,864	13,569	237	389	79	84
Construction materials	255,984	260,214	12,287	14,910	12,378	11,991
Iron making	299,624	196,695	4,629	9,186	536	206
Iron and steel foundries	118,564	96,779	7,470	6,300	913	626
Rolling mills	56,186	42,001	4,850	5,162	620	617
Non-ferrous metallurgy	77,248	73,667	12,746	8,899	1,246	915
Chemical industry	192,909	272,201	52,278	74,610	5,768	6,335
Crude-oil processing	19,101	16,198	1,051	1,268	177	184
Rubber and asbestos industry	90,767	111,040	6,626	9,438	11,737	10,395
Timber industry	49,275	61,797	9,362	12,168	644	449
Pulp and paper production	43,832	58,682	15,999	21,536	615	538
Steel industry	97,363	131,133	2,726	6,911	1,121	1,468
Machine tools	382,757	485,345	31,003	47,078	3,954	5,637
Motor vehicles	144,815	190,294	15,206	19,981	1,188	1,322
Shipbuilding	91,488	47,586	2,562	1,052	213	223
Electrical engineering	165,887	276,947	42,965	90,894	1,934	3,064
Optical and precision engineering	78,948	85,277	22,895	28,005	1,889	1,893
Fabricated metal products	442,790	342,278	90,329	78,382	13,402	10,579
Pottery industry	48,289	59,370	18,591	24,354	664	757
Glass industry	28,259	49,843	5,030	12,047	439	1,044
Woodworking	144,931	183,307	18,696	32,647	8,332	7,175
Musical instruments and toys	26,407	38,870	12,807	17,087	1,005	1,981
Paper processing	67,903	63,340	38,365	35,350	2,575	2,151
Printing industry	93,601	125,834	33,790	41,399	10,482	6,106
Synthetic-material processing	12,116	31,396	3,077	12,128	401	995
Leather making	33,305	34,716	5,495	7,256	576	515
Leather processing	35,112	30,503	10,007	15,352	1,242	1,370
Footwear industry	89,759	90,134	29,172	45,292	2,610	1,837
Textiles	508,436	582,577	262,353	335,739	10,377	11,025
Clothing industry	195,771	216,049	121,182	148,642	21,157	11,728
Flouring mills	16,028	16,683	2,324	2,449	1,822	900
Oil pressing and margarine industry	15,992	14,521	2,687	3,299	623	326
Sugar industry	8,295	14,594	788	1,465	95	82
Brewing and malting	40,558	43,756	5,354	5,413	1,896	1,202
Other food industry and tobacco	350,905	274,292	159,662	136,817	39,621	25,361
All industries	**4,766,439**	**5,177,826**	**1,072,016**	**1,321,542**	**163,220**	**131,950**

Source: Figures for 1950 are drawn from *StBRD*, vol. 45/2 (1952), pp. 4-18; for 1939, figures are determined by aggregating provincial data obtained from *StDR*, vol. 568 (1942-44). For both years, I have adjusted figures to the above system of industrial classification.

Industries of declining employment – metallurgy, shipbuilding, crude-oil and paper processing, flouring mills and oil pressing as well as tobacco – were all concentrated in large cities with heavily destroyed residential areas. On the other hand, most branches in the investment and consumption goods sectors were traditionally characterised by a surprisingly large number of small and medium-sized firms and, thus, a more balanced pattern of regional settlement.

Employment expansion, in almost all branches, relied on increasing female participation. Just by eyeballing the figures, one should already suspect a strong positive correlation between the two variables – a point which I will return to later in this section. Especially large was the growth of female employment in electrical engineering, synthetic-material processing and most consumption goods industries. In mining, women were employed for the first time in notable numbers, although their share in the workforce remained very small. Finally, at fist glance, the results of my calculations seem to support the traditional historiography, which strongly accentuated the successes that the rationalisation drive Albert Speer had achieved by concentrating production capacity in sizeable plants while closing down numerous small firms. Hence, employment expansion went hand in hand with a sharp decline in the total number of industrial plants. At a more disaggregated level, however, the figures clearly speak against this argument. In branches critical to the war effort – the steel industry, machine tools, motor vehicles, shipbuilding, electrical engineering and synthetic-material processing – the number of plants actually increased quite significantly. The data presented in the above two tables also enabled me to calculate levels of capital intensity which will be analysed in detail below.

Finally, using 1939 employment data made it necessary to establish figures for net industrial production in West Germany for the same year, in order to produce productivity estimates in Section IV. As mentioned above, the Federal Statistical Office computed output indexes for 1936 and 1938, but also published figures for net national product in constant prices and adjusted for territorial changes for the years between 1924 and 1939.[51] Based on the assumption that neither the growth rate of the industrial sector relative to the rest of the economy nor that of individual branches relative to one another changed significantly between 1936-38 and 1939, I estimated output for 1939 with the following extrapolation, where NIP_i refers to net industrial production in a given branch and *NNP* denotes net national product.

$$NIP_i^{39} = \left[\left(\sqrt{\frac{NIP_i^{38}}{NIP_i^{36}}} - 1 \right) \times \left(\frac{NNP_{39}/NNP_{38} - 1}{\sqrt{NNP_{38}/NNP_{36}} - 1} \right) + 1 \right] \times NIP_i^{38}$$

[51] *IndBRD*, Sonderveröffentlichung, 8 (1956), p. 17; Statistisches Bundesamt (1972), pp. 260-61.

The assumptions underlying this approach do introduce some distortions, but they are nonetheless reasonable. First, the German economy was dominated by industrial production to an extent that the share of industry in national income could not increase substantially over the course of just one year. Second, the growth performance of individual branches relative to one another was strongly influenced by the objectives of the Four Year Plan, which the Nazi government had already put into force in 1936 to prepare the economy for war.

To test the alternative hypotheses proposed by Jánossy (and his advocates) and myself, the relative contributions of capital and labour to output expansion have to be measured first. In an ideal economy characterised by a homogenous production function and perfect factor mobility, one should expect a perfect correlation between the growth of factor inputs and output expansion. At the onset of post-war recovery, such conditions can not prevail as severe bottlenecks impose great limitations on the potential to increasing production. According to the reconstruction thesis, the major supply-side constraint to growth after a war-induced disruption of economic activity must be a serious shortage of capital, since the accumulation of human-resource endowments is expected to have remained largely unaffected. My alternative hypothesis arguing for the existence of regional labour scarcity, induced by war-time destruction in urban housing, suggests a more important role for labour-supply constraints. To test these contrasting propositions we first need to determine how well the expansion of industrial machinery and employment correlate with the growth of net industrial production.

Table 3: *Correlations explaining the growth of net industrial production 1939-50*

	Correlation Coefficient	Significance Level	N
ΔINDPROD & ΔCAPSTOCK	0.212	.214	36
ΔINDPROD & ΔEMPLOY	0.592	.000	36

The growth of industrial employment clearly made a much larger contribution to output expansion than the growth of the stock of machinery and equipment, which failed to produce a statistically significant impact. Correlation coefficients, of course, do not provide a clear indication of the line of causality and, therefore, a strong correlation between ΔEMPLOY and ΔINDPROD may well reflect reverse causation inasmuch as the faster growth in a particular industry would lead to more robust employment expansion as well. This problem, however, is not relevant to the questions investigated in this paper, since neither the reconstruction thesis as formulated by Jánossy nor my alternative hypothesis consider incentives for growth; both of

them only attempt to explain the growth potential of an economy or one of its sectors. The decline of industrial production could have been induced by different factors, but according to my results, labour was undoubtedly the most crucial supply-side bottleneck of post-war recovery in West German industry.

On the other hand, we shall remember that the overall demographic expansion experienced across the war went hand in hand with a gender-balance distortion, which should have found a reflection in labour-market developments as well. According to my calculations, increasing female participation accounted for no less than 60.7 per cent of aggregate employment growth in West German industry between 1939 and 1950.[52] In the face of vigorous capital-stock expansion, female participation had to increase rapidly in order for industrial employment to increase sufficiently to alleviate the severe labour shortage prevailing in major industrial agglomerations.

This macro-level phenomenon, however, is only partially confirmed by the weak correlation coefficient of 0.314 between the two variables, not even significant at the 5 percent level. Although the coefficient becomes slightly larger, if we exclude the two coal-mining branches, which employed hardly any women prior to the 1950s, it still demonstrates that increasing female participation was no sufficient remedy for the war-induced dislocation of labour supplies. The regional settlement pattern of different branches must also have influenced their capacity to expand employment. According to data I drew from the 1950 non-agricultural workplace census, big industry – concentrated in the heavily destroyed urban agglomerations – saw its employment actually decline in the face of substantial labour-force expansion at the macro level. In ferrous metallurgy and the metal processing industries, which embraced most of the traditional locomotive branches of the German economy beyond chemicals, the stability of total employment disguised a 21.1 percent decline in large and a corresponding 31.3 percent increase in small and medium-sized plants.[53]

Interestingly, we do not find a significant negative correlation between increasing female participation in industrial employment and labour-productivity growth. This result indicates that female workers were not significantly less efficient than their male colleagues, suggesting that the substantial gender wage gap in the early 1950s was, at least partially, the consequence of gender based labour-market segmentation. The only alternative explanation is that women, on average, were earning less than men due to lower qualification levels, which temporarily failed to affect their relative productivity performance as young and middle-aged

[52] See Table 2.
[53] Own calculations based on data from *StBRD*, vol. 47.1 (1956), pp. 98-99.

male labourers were often out of employment for long years and, therefore, lost much of their working skills acquired through previous vocational training. Following this argument, firms could expect rapid productivity improvements on the part of their qualified male employees once they were successfully reintegrated into the industrial workforce. In any case, the persistence of a large skill premium demonstrates that skilled labour was in short supply and, therefore, employers were forced to pay higher wages to male workers who had absolved vocational training in previous years. It certainly signifies no labour surplus that even at moderate levels of capacity utilisation and despite the increasing female participation rate, real gross hourly earnings in West German industry jumped almost 12 per cent in 1950 – the peak year for unemployment during the economic miracle.[54]

As for the relationship between the growth of capital intensity and labour productivity, the assumptions of Jánossy also find little support in the historical evidence. Whereas aggregate labour productivity in West German industry plummeted by 21.3 per cent, average capital intensity as measured by the gross value of machinery and equipment per employee increased by 8.8 per cent between 1939 and 1950. Furthermore, it is difficult to comprehend how a relative shortage of capital would serve as an impediment in the way of increasing productivity in an industrial sector, where average levels of capacity utilisation remained below 80 per cent in 1950.[55] Under such conditions, firms would have certainly reacted to a genuine labour surplus by firing employees, especially since the West German labour market only started to become more heavily regulated from 1951 onwards and unemployment was practically nonexistent in industrial cities. It is a more realistic explanation that the war-induced dislocation of labour reserves and/or the scarcity of skilled workers did not allow certain industries, those operating large-scale plants in the major cities in particular, to achieve normal levels of capacity utilisation. To explore the dynamics behind the productivity meltdown that plagued West German industry after World War II, I use growth-accounting techniques and shift-share analysis in the next section of this paper.

IV. Structural shifts and productivity growth in West German industry

The growth-accounting exercise that provides the analytical framework of this section is based on the standard neoclassical Cobb-Douglas production function. The growth of TFP is computed as the proportion of labour-productivity growth unexplained by capital deepening.

[54] Bundesministerium für den Marshallplan (1953), p. 206.
[55] Krengel (1960), p. 81.

$$\frac{\Delta A}{A_t} = \frac{\Delta(Y/L)}{(Y/L)_t} - \alpha \frac{\Delta(K/L)}{(K/L)_t}$$

Comparable levels of labour productivity and capital intensity for 1939 and 1950 can be determined for each of the industrial branches represented in my dataset from the figures on net industrial production, total employment and capital stock (structures as well as machinery and equipment) that I presented in the previous section of this chapter. The only missing variable we need to compute in order to apply the following formula is a set of relative factor shares for capital and labour respectively for 1939. To make factor inputs comparable, they have to be expressed in value terms. For labour, it can be achieved simply by calculating the annual wage bill in a particular branch. To determine the value of capital inputs, we need to account for the rental price paid on fixed assets and for the cost of capital depreciation in the particular year.

The published records of the 1936 work-book census, which I have already referred to in Section III, report both total employment and the aggregate wage bill in each industrial sub-branch represented in the survey.[56] This allowed me to compute average annual wages for the branches listed in my dataset. Based on the index numbers presented on actual weekly standard wages in the 1939/40 statistical yearbook, we can determine the rate at which average wages increased between 1936 and 1939.[57] Since the level of disaggregation in the later source did not quite suffice to match that of my dataset, I had to assume identical rates of growth in annual earnings within the mining sector, in the leather producing and processing industries and finally in the different textile branches. The 1939 wage bill in individual industries is then calculated as the product of total employment and the annual wage per employee. The later represents an average for Germany according to her 1937 borders, and industrial earnings had been traditionally higher in the western part of the country. However, during the interwar period and especially under the Nazi regime, government policies successfully narrowed regional wage differentials in order to avoid low cost competition.[58] As a consequence, the East-West wage gap is believed to have practically disappeared by the late 1930s.[59]

In Appendix 1, I reported estimates for gross industrial fixed capital in millions of 1962 DM. To convert the 1939 figures into 1939 RM prices, I relied on the price indexes constructed by Baumgart and Krengel to deflate investments in fixed assets in individual branches.[60] Based on data derived from the same source, I also computed the rate of capital depreciation in 1950

[56] Reichsministerium für Wehrwirtschaftliche Planung (1939), pp. 44-55.
[57] *Statistisches Jahrbuch* 1939/40, p. 348.
[58] Bry (1960), p. 109.
[59] Sleifer (1999), p. 11.
[60] Baumgart and Krengel (1970), pp. 62-65.

for structures and equipment separately for each branch represented in my dataset.[61] Since no comparable figures are available for the interwar period at any similar level of disaggregation, I had to apply the same rates to 1939 as well. It may be a controversial assumption, since the age composition of the available stock of machinery and equipment became significantly more advantageous over the period under investigation. However, during the 1950s, when changes of similar magnitude took place, depreciation rates appear to have remained remarkably stable. The cost of capital depreciation in 1939 is then calculated (separately for structures and equipment) as the product of the branch-specific depreciation rate and the gross value of the capital stock in 1939 prices.

When measuring the rental cost of capital, we need to remember that, under the stringent capital-market regulations instituted by the Nazi regime, industrial enterprises were largely forced to rely on equity financing. Hence, market rates of return or standard interest rates on long-term bank credit do not constitute appropriate benchmarks. The best available proxy for the rate of interest paid on fixed capital is, therefore, the average rate of dividends issued to shareholders on equity capital in industrial corporations. Mark Spoerer investigated the development of equity yields in German industry over the period 1925-41 and estimated average yield rates for over 30 different branches, mostly corresponding to the level of disaggregation attained in my dataset. His figures for 1939 can be multiplied by the value of the capital stock to account for rental costs on fixed assets.[62] The total value of capital input in 1939 is then computed by adding up the later and the estimated cost of depreciation in the same year.

Once I had converted the value of labour and capital inputs into 1939 prices, I was able to determine the respective factor shares for the industrial branches represented in my dataset. The results of my calculations, together with branch-specific growth rates of TFP, are presented in Appendix 2. A growth-accounting expert would quickly note that capital shares appear slightly low, especially in ferrous metallurgy. For the industrial sector as a whole, factor shares are approximately 32.5 per cent for capital and 67.3% for labour respectively. However, it must be emphasised that in the late 1930s several factors acted to depress capital intensity in German industry, at least when measured in valued inputs.

First, while prices of capital goods stagnated during the 1930s and remained well below 1929 levels, average weekly wages were raised by more than 15 per cent between 1935 and 1939 alone.[63] Although the later phenomenon owed much to the parallel increase in average weekly working hours, my dataset measures labour input in the number of employees and not

[61] Ibid, pp. 78-80, 96-98.
[62] Spoerer (1996), p. 179.
[63] Bumgart und Krengel (1970), pp. 62-63; *Statistisches Jahrbuch* 1939/40, p. 348.

annual working hours and, therefore, capital intensity is also specified as capital per man year worked. Second, government efforts to contain working wages were precisely aimed at expanding employment, and hence industrial production in Germany could remain relatively labour intensive. Especially so, as several branches of top priority under the Nazis – coal mining and the extraction of mineral ores, the engineering industries and construction materials – still operated predominantly with labour and skill-intensive technologies. Finally, sluggish investment in the interwar period, particularly during the Great Depression, implied that in 1938-39 full employment could still only be attained at low levels of capital intensity.

Juts by looking at aggregate numbers it becomes clear that capital intensity was not the driving force behind the productivity meltdown that characterised the immediate post-war years, contrary to the assumptions of the reconstruction thesis. For West German industry as a whole, the capital-labour ratio even increased by 2.8% between 1939 and 1950, while net industrial production per employee plummeted by more than 21%. Hence, we can observe an even slightly greater decline in TFP than in labour productivity. At the more disaggregated level, the contrast is even sharper. In several branches of heavy industry, ferrous metallurgy and shipbuilding in particular, labour productivity deteriorated despite a massive increase in capital intensity. Severely hit by post-war dislocation and – in some cases – by stringent output restrictions under Allied occupation, large-scale urban industry was unable to exploit its production capacities. Therefore, most of the branches that made colossal investments in fixed assets during the war, suffered a substantial decline in capital productivity in the late 1940s.

From the 1950s onwards, the DIW has produced estimates for average utilisation rates in the industrial branches represented in my datasets.[64] The correlation of the figures reported for 1950 with the growth rates of TFP that I computed yields a coefficient of 0.52 significant at the five percent level. It demonstrates that the overall efficiency of factor use deteriorated to a large extent because of falling levels of capacity utilisation, which in turn resulted – as previously explained – from the dislocation of labour reserves due to wartime destruction in urban housing. In West German industry as a whole, between 1939 and 1950, the share of plants with over 200 workers in total employment declined from 61.8 to 53.8 per cent.[65] Whereas the expansion of the capital stock during the war took place primarily in urban industry, the growth of the labour force in the second half 1940s concentrated exclusively in small towns and rural areas. As a consequence, in several branches, rising levels of capital intensity could not generate improvements in labour productivity.

[64] Mertens (1964), p. 196.
[65] Own calculation based on data from *StBRD*, vol. 47.1 (1956), pp. 98-100.

A sharp fall in TFP despite increasing capital intensity over the period 1939-50 implied the potential for an economic miracle in subsequent years. Simply recovering to pre-war standards of the overall efficiency of factor use would have resulted in remarkable growth rates of labour productivity and TFP during the 1950s. Efforts to eliminate, or at least mitigate, the distortions the Nazi regime imposed upon factor markets, coupled with the liberalisation of international trade and capital controls, provided an opportunity to raise productive efficiency to levels unattainable under the conditions of the late 1930s. Not surprisingly, the industries that suffered the deepest recessions in both gross value-added and productivity after 1945, non-ferrous metallurgy, machine tools, shipbuilding as well as musical instruments, toys and jewellery, were among the most dynamically expanding branches of the early 1950s.[66]

On the other hand, several industries – the extraction of crude oil and natural gas, petrochemicals and synthetic-material processing – were still in their infancy before the war and, therefore, benefited from a string of sweeping technological innovations during the 1940s, especially after the adaptation of superior American production methods became possible. The spread of standardised mass production proved particularly influential in the manufacturing of motor vehicles, which constituted one of the only branches of heavy industry capable of delivering a higher output in 1950 than what it generated in 1939. Finally, the clothing industry, which was deprived of resources in the late 1930s as its produce was deemed unessential for war preparations, found it comparatively easy to expand both output and labour productivity after 1948, despite a decline in capital intensity. This finding strongly suggests that manufacturers of consumption goods were not allocated sufficient labour and – due to stringent import restrictions – often natural resources to reach full capacity utilisation prior to the war. In conclusion, the higher priority a particular branch of industry enjoyed in the German war economy, the more exposed it subsequently became to wartime destruction and particularly post-war dislocation.

Since the average size of industrial plants differed greatly across branches, they may well have been affected very differently by factor misallocation as well, due to different levels of concentration in the major urban agglomerations. Therefore, it is important to investigate whether and to what extent structural change within the industrial sector accounted for the overall decline of labour productivity. Shift-share analysis has been specifically developed to distinguish between sector- (or region) specific and inter-sectoral (or inter-regional) effects in accounting for aggregate growth patterns. The specific formula I employ here is taken from a

[66] *IndBRD*, Sonderveröffentlichungen, 8 (1956), p. 17.

comparative study of Jaap Sleifer on East and West German industry in 1936.[67] The important differences are that I present a temporal, not a regional, comparison and my calculations are based on a significantly more disaggregated database.

$$LP^t - LP^0 = \sum_{i=1}^{n}\left(LP_i^t - LP_i^0\right)\times\frac{1}{2}\left(S_i^t + S_i^0\right) + \sum_{i=1}^{n}\left(S_i^t - S_i^0\right)\times\frac{1}{2}\left(LP_i^t + LP_i^0\right)$$

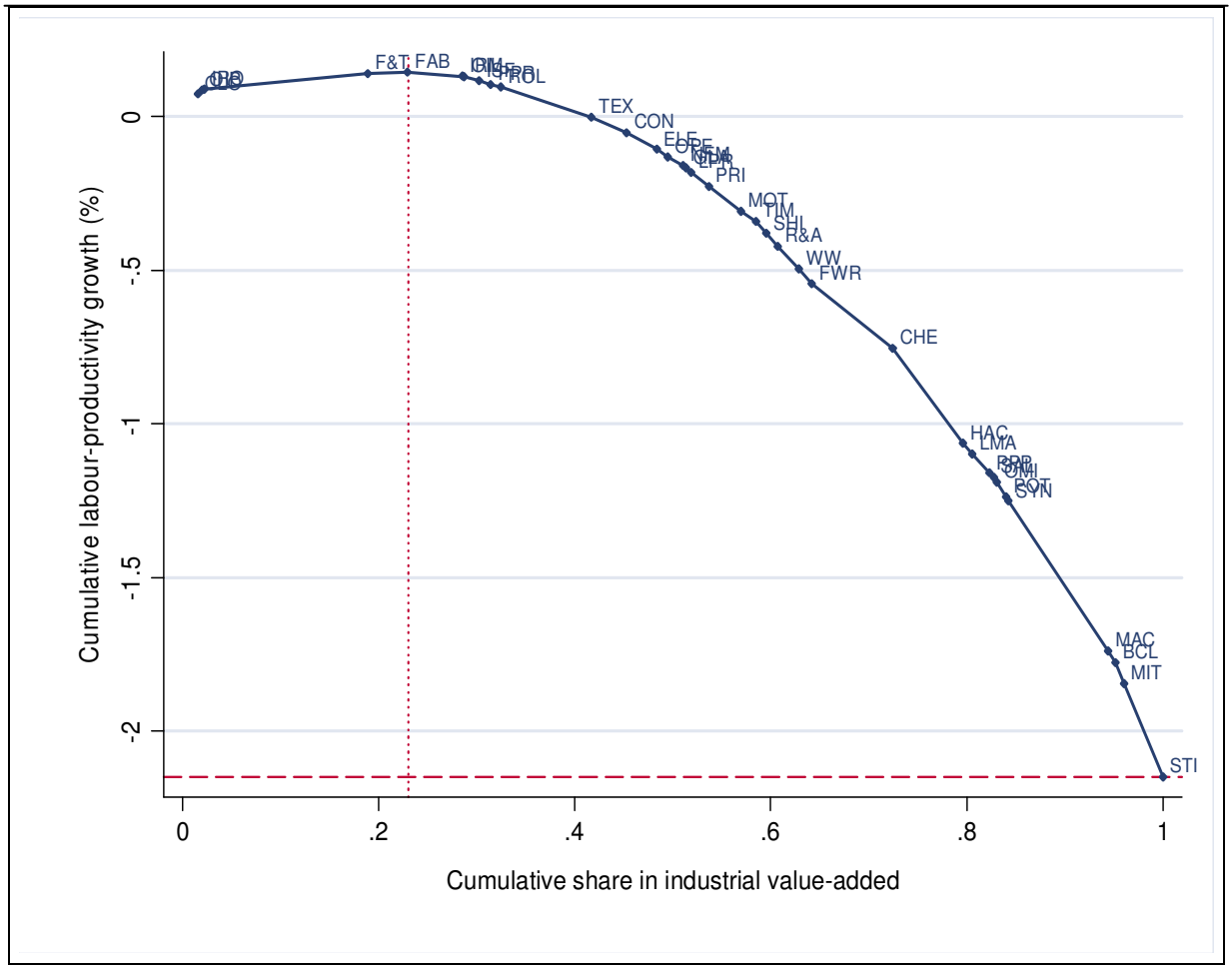
The equation, in which the term S_i represents the share of a particular branch in total employment, breaks down the growth of aggregate labour productivity (*LP*) into two components: an intra-sector effect which accounts for productivity improvements within individual branches as if their respective employment shares had not changed, and a shift effect which measures the contribution of structural change under the assumption of constant branch-specific levels of labour productivity. According to my calculations, shifts in employment across branches accounted for a mere 3.1% of the overall decline in industrial labour productivity between 1939 and 1950. This result does not necessarily imply that there were no major changes in the branch structure of industrial employment with a substantial impact on aggregate productivity performance, but indicates that these changes balanced out. The employment figures of Table 2 on page 16 demonstrate that among the most highly productive branches, chemicals, the timber industry as well as pulp and paper production and the steel industry, managed to increase their shares in total employment, whereas the food industry suffered substantial contraction. A further factor explaining the relatively small contribution of structural shifts to the overall productivity performance of West German industry is that labour productivity declined in almost all branches, although at different rates. It means that the dislocating effects of wartime destruction in urban infrastructure made a significant, albeit not uniform, impact on the development of practically all industries.

Sleifer presented a very useful method to visualise the productivity performance of industrial branches in a comparative framework.[68] He applied a variant of the sunset-sunrise diagrams of Jorgenson *et al.*, which were used by Harberger to account for the contribution of individual branches to overall improvements in TFP.[69] In the version developed by Sleifer, the cumulative share in industrial value-added is presented on the *x*-axis, while the cumulative rate of growth in labour productivity, instead of TFP, is measured on the *y*-axis. The branches with the most dynamic productivity performance are closest to the origin and, therefore, the diagram

[67] Sleifer (1999), pp. 8-9.
[68] Sleifer (2006), pp. 107-115.
[69] Jorgenson *et al.* (1987); Harberger (1998).

presents a convex curve. Figure 2 demonstrates a relatively smooth distribution of the productivity decline we can observe over the period under investigation. Improvements in labour productivity were only achieved in the clothing industry, food and tobacco, crude-oil processing, fabricated metal products and the extraction of iron ore. All other braches contributed to the overall deterioration of industrial productivity. Machine tools, the steel industry and the production of musical instruments, toys and jewellery exhibited the most disappointing performance. In all three cases, the highest value-added items of the pre-war product mix were missing in 1950. Whereas the manufacturing of tanks and artillery equipment has been shut down after the 1945, the impoverished society of post-war Germany had understandably little demand for expensive jewels.[70]

Figure 2: *Harberger-diagram for labour-productivity growth in West Germany industry*



[70] The branch 'musical instruments, toys and jewellery' also incorporated the manufacturing of sport and hunting guns and, therefore, was responsible for the production of smaller firearms during the years of rearmament in the late 1930s. These products also became illegal in West Germany after the war.

The bulk of the deterioration in aggregate labour productivity took place within the boundaries of individual branches. It is not surprising after all, since most of them incorporated both large and medium-size plants or small workshops and, therefore, exhibited a diverse settlement pattern. As the degree of the wartime destruction of accommodation facilities and thereby the extent of war-induced factor dislocation differed primarily between urban agglomerations and the more remote rural areas of the country, the conditions of factor accumulation and productivity growth varied foremost not between branches, but production sites in general settled in large and medium-sized cities on the one hand and small towns as well as villages on the other. I have already discussed the sweeping changes in the distribution of employment according to plant size. However, no data is available to make a distinction between factor endowments and productivity levels at different production scales within the individual branches constituting my dataset. Consequently, the nature and impact of post-war dislocation in West German industry needs further investigation at the regional level, following a geographic rather than a sectoral approach – which I undertake in another research paper.

Finally, we have to discuss an alternative explanation in brief. Since my model defines labour productivity as net industrial production per employee, one could suspect that the apparent trans-war productivity meltdown might be the sheer reflection of declining average working hours. The historical evidence, however, does not support this view. Albeit still averaging only 42.4 hours in 1948, the mean length of the working week in West German industry already stood at peak levels by 1950, not to be reached again ever except for the 1955 boom.[71] It is also presumable that in 1939 average working hours were still below the desired equilibrium due to the concentration of efforts under the Nazi regime to boost employment rather than labour input in hours.[72] Therefore, despite the increasing female share in industrial employment, average working hours, if anything, must have increased between 1939 and 1950. It also implies that, if measured correctly as net industrial production per man hour worked, labour productivity perhaps declined even more then suggested by my calculations.

V. Conclusions

At the onset of the economic miracle, West German industry and large-scale urban industry in particular did not suffer from a relative shortage of capital but rather from regional labour scarcity that prevented firms from fully exploiting their available production capacities. The

[71] Schudlich (1987), pp. 158-67.
[72] DIW (1954), p. 60.

remarkable overall population growth and the ensuing expansion of labour reserves disguised serious distortions in human-capital accumulation, through the diminution of effective working skills, while the available production capacities were significantly augmented in both quantitative and qualitative terms. Furthermore, the war-induced dislocation of labour reserves entailed a regional mismatch between the complementary factors of production. Hence, the decline in average labour productivity was also greatly enhanced by the reallocation of employment from large to small and medium-sized plants. Therefore, contrary to the reconstruction thesis, wartime destruction and especially post-war dislocation made a far greater impact on the size, composition and allocation of the labour force than on the growth of the capital stock in West German industry.

This novel finding also enables us to reformulate the reconstruction thesis. The collapse of output levels following a major crisis does indeed reflect a serious mismatch between complementary factors of production, what Jánossy termed structural incongruence. This discrepancy, however, does not necessarily result from a shortage of fixed capital, machinery in particular; it can also be the consequence of relative labour scarcity. In this case, the sharp decline in labour productivity does not result from lower levels of capital intensity but from the war-induced dislocation of labour reserves and/or the deterioration of effective labour qualifications. This argument implies that the severity of a crisis does not only affect actual output at the onset of recovery but also the human-capital determined productive potential. In other words, wartime destruction and dislocation do not simply determine the deviation from the long-run potential growth path specific to a particular economy; they may also alter the shape of that growth path itself.

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APPENDIX 1

Table 1: *Estimates of gross capital stock in West German industry for the period 1939-50: machinery and equipment (million DM in 1962 prices)*

Industrial Branches	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**	**1946**	**1947**	**1948**	**1949**	**1950**
Hard coal	5,914	6,415	7,005	7,598	8,170	8,393	8,077	7,620	7,472	7,337	7,297	7,450
Brown coal and lignite	933	982	1,042	1,103	1,164	1,179	1,104	1,036	1,027	1,022	1,047	1,121
Iron ore	125	133	143	154	165	173	171	161	159	158	161	172
Rock and potassium salt	630	660	688	717	741	739	692	648	641	634	642	659
Crude oil and natural gas	473	511	556	600	638	656	631	590	583	573	583	614
Other mining	57	59	61	63	66	66	62	59	61	63	70	79
Construction materials	1,518	1,634	1,767	1,883	1,973	1,979	1,876	1,744	1,695	1,663	1,671	1,728
Iron making	3,625	3,977	4,410	4,879	5,364	5,692	5,624	5,030	4,607	4,365	4,222	4,194
Iron and steel foundries	927	1,004	1,095	1,192	1,293	1,358	1,323	1,229	1,179	1,143	1,119	1,123
Rolling mills	468	512	565	623	683	723	714	643	586	559	543	544
Non-ferrous metallurgy	1,741	1,881	2,035	2,197	2,360	2,467	2,415	2,234	2,115	2,040	1,993	1,970
Chemical industry	8,084	8,965	9,965	11,026	12,091	12,828	12,652	11,700	11,120	10,734	10,492	10,405
Crude-oil processing	1,273	1,377	1,504	1,652	1,801	1,904	1,870	1,767	1,729	1,694	1,674	1,670
Rubber and asbestos processing	528	563	607	655	704	742	721	686	683	685	698	732
Timber industry	316	315	315	312	308	296	263	259	278	305	366	473
Pulp and paper production	984	1,015	1,042	1,061	1,075	1067	1,002	942	928	918	933	981
Steel industry	378	403	433	465	503	530	519	482	464	453	456	479
Machine tools	3,191	3,383	3,619	3,894	4,248	4,531	4,537	4,092	3,761	3,606	3,613	3,760
Motor vehicles	1,703	1,824	1,973	2,145	2,367	2,540	2,534	2,324	2,190	2,105	2,077	2,123
Shipbuilding	480	527	581	641	714	773	783	707	651	623	613	617
Electrical engineering	1,782	1,895	2,041	2,205	2,411	2,570	2,559	2,281	2,098	2,045	2,097	2,252
Optical and precision engineering	312	341	374	394	435	467	465	414	374	353	345	353
Fabricated metal products	1,089	1,142	1,207	1,278	1,359	1,413	1,371	1,245	1,172	1,134	1,143	1,201
Pottery industry	170	179	184	189	195	195	176	162	161	163	177	197
Glass industry	206	214	221	225	233	233	218	202	201	203	213	237
Woodworking	360	366	369	368	369	362	326	295	301	328	397	491
Musical instruments and toys	66	65	64	63	62	59	52	51	52	52	52	54
Paper processing	180	185	189	191	189	184	169	157	158	164	179	202
Printing industry	682	688	688	682	670	648	592	541	525	519	539	593
Synthetic-material processing	83	87	93	99	107	114	111	105	102	103	107	117
Leather making	191	198	202	204	210	209	192	178	179	179	189	203
Leather processing	62	64	66	67	69	68	61	57	57	57	60	67
Footwear industry	250	257	267	277	290	297	278	257	253	247	254	269
Textiles	3,525	3,617	3,691	3,748	3,776	3,748	3,529	3,272	3,188	3,146	3,237	3,476
Clothing industry	176	172	170	170	172	172	159	146	149	155	176	220
Flouring mills	762	771	783	795	811	819	779	735	730	735	756	802
Oil pressing and margarine industry	457	468	482	501	517	534	514	483	474	467	473	480
Sugar industry	407	412	421	435	450	465	447	420	413	411	431	465
Brewing and malting	1,477	1,517	1,542	1,557	1,561	1,531	1,423	1,319	1,282	1,262	1,281	1,334
Other food industry and tobacco	2,878	2,876	2,885	2,902	2,932	2,915	2,711	2,530	2,546	2,624	2,921	3,386
All industries	**48,467**	**51,657**	**55,344**	**59,210**	**63,243**	**65,639**	**63,699**	**58,804**	**56,342**	**55,030**	**55,297**	**57,293**

Table 2: *Estimates of gross capital stock in West German industry for the period 1939-50: structures (million DM in 1962 prices)*

Industrial Branches	**1939**	**1940**	**1941**	**1942**	**1943**	**1944**	**1945**	**1946**	**1947**	**1948**	**1949**	**1950**
Hard coal	3,664	3,853	4,072	4,282	4,467	4,487	4,115	3,784	3,736	3,692	3,681	3,711
Brown coal and lignite	463	483	507	529	549	549	493	451	449	451	463	485
Iron ore	137	145	155	166	176	180	169	154	153	152	152	153
Rock and potassium salt	512	519	525	530	533	521	469	429	424	420	419	421
Crude oil and natural gas	220	232	247	261	273	275	252	231	230	232	237	245
Other mining	23	24	25	26	26	26	24	21	21	20	24	27
Construction materials	925	961	1,002	1,038	1,063	1,051	947	861	854	852	890	941
Iron making	1,765	1,847	1,948	2,052	2,151	2,189	2,028	1,832	1,785	1,746	1,764	1,812
Iron and steel foundries	619	649	684	720	754	766	706	646	634	626	630	644
Rolling mills	351	369	390	411	432	442	410	373	363	358	358	363
Non-ferrous metallurgy	809	858	911	964	1,012	1,032	959	875	850	828	825	825
Chemical industry	5,236	5,673	6,165	6,661	7,116	7,352	6,880	6,295	6,150	6,022	6,001	6,018
Crude-oil processing	591	624	665	709	750	769	711	654	646	640	654	668
Rubber and asbestos processing	283	299	319	339	358	366	335	310	310	313	332	354
Timber industry	248	246	244	242	239	228	190	174	183	195	243	304
Pulp and paper production	416	424	431	436	437	427	380	345	341	342	364	399
Steel industry	280	297	317	337	358	368	341	313	311	311	323	342
Machine tools	3,138	3,250	3,387	3,538	3,713	3,800	3,545	3,225	3,137	3,068	3,113	3,203
Motor vehicles	1,514	1,600	1,701	1,810	1,934	2,009	1,888	1,726	1,689	1,655	1,667	1,708
Shipbuilding	571	633	703	775	855	910	872	795	772	750	738	732
Electrical engineering	1,365	1,458	1,571	1,691	1,825	1,904	1,784	1,611	1,576	1,562	1,632	1,732
Optical and precision engineering	301	321	342	365	387	399	373	339	329	319	320	328
Fabricated metal products	999	1,026	1,059	1,092	1,126	1,132	1,034	942	928	918	945	992
Pottery industry	213	216	217	219	220	216	190	170	169	172	185	198
Glass industry	273	277	281	283	285	281	252	230	227	225	233	248
Woodworking	453	458	462	463	463	450	391	349	350	365	421	486
Musical instruments and toys	214	211	207	203	200	192	170	156	152	151	150	150
Paper processing	112	115	118	119	119	116	101	92	95	99	112	127
Printing industry	936	932	924	915	901	871	773	702	692	683	698	732
Synthetic-material processing	65	67	71	75	80	83	75	68	68	69	73	82
Leather making	169	170	170	170	170	165	145	133	134	135	145	157
Leather processing	102	104	105	105	106	104	92	83	81	81	85	90
Footwear industry	157	160	164	168	172	173	153	140	142	140	150	165
Textiles	2,459	2,471	2,476	2,475	2,464	2,400	2,133	1,924	1,895	1,892	2,003	2,199
Clothing industry	342	339	338	338	339	333	297	267	268	270	288	318
Flouring mills	432	435	439	443	447	443	400	362	358	356	364	380
Oil pressing and margarine industry	421	426	431	438	443	441	402	369	363	358	360	360
Sugar industry	245	248	253	259	265	267	242	220	216	215	224	236
Brewing and malting	1,253	1,274	1,286	1,292	1,292	1,262	1,133	1,032	1,011	996	1,002	1,019
Other food industry and tobacco	2,264	2,256	2,253	2,250	2,249	2,199	1,952	1,765	1,757	1,770	1,897	2,066
All industries	**34,541**	**35,951**	**37,567**	**39,191**	**40,748**	**41,176**	**37,805**	**34,449**	**33,849**	**33,448**	**34,163**	**35,420**

APPENDIX 2

Table 1: *Estimated rates of factor accumulation and productivity growth in West German industry in 1939-50 (%)*

Industrial Branches	Output	Labour	Output per unit of labour	Capital	Output per unit of capital	Capital per unit of labour	Capital share	TFP
Hard coal	-22.72	25.96	-38.65	16.53	-33.68	-7.49	31.2	-36.33
Brown coal and lignite	-18.36	54.03	-47.00	15.04	-29.04	-25.31	42.8	-36.11
Iron ore	-17.32	-23.03	7.42	24.05	-33.34	61.16	22.0	-6.03
Rock and potassium salt	-11.71	54.35	-42.80	-5.43	-6.64	-38.73	60.0	-19.56
Crude oil and natural gas	86.53	100.85	-7.13	23.95	50.48	-38.28	80.7	23.88
Other mining	-34.83	14.37	-43.02	32.50	-50.82	15.85	18.0	-45.87
Construction materials	-10.61	1.65	-12.07	9.25	-18.18	7.48	22.0	-13.71
Iron making	-35.99	-34.35	-2.50	11.43	-42.56	69.74	38.0	-29.00
Iron and steel foundries	-24.78	-18.37	-7.85	14.29	-34.19	40.02	31.0	-20.26
Rolling mills	-32.02	-25.25	-9.06	10.74	-38.62	48.15	34.0	-25.43
Non-ferrous metallurgy	-22.18	-4.64	-18.40	9.61	-29.01	14.94	41.5	-24.68
Chemical industry	-4.69	41.10	-32.45	23.30	-22.70	-12.62	57.2	-25.26
Crude-oil processing	11.96	-15.20	32.03	25.43	-10.74	47.91	70.5	-1.99
Rubber and asbestos processing	-10.01	22.34	-26.44	38.06	-34.82	12.86	22.0	-29.27
Timber industry	-7.10	25.41	-25.92	4.30	-10.93	-16.83	43.1	-18.68
Pulp and paper production	-21.62	33.88	-41.45	19.81	-34.58	-10.51	30.0	-38.30
Steel industry	-59.68	34.68	-70.06	24.77	-67.68	-7.36	22.0	-68.44
Machine tools	-32.05	26.80	-46.41	10.02	-38.24	-13.24	28.3	-42.71
Motor vehicles	-2.01	31.40	-25.43	19.09	-17.71	-9.37	31.6	-22.43
Shipbuilding	-61.45	-47.99	-25.88	28.35	-69.97	146.77	22.0	-58.17
Electrical engineering	37.74	66.95	-17.50	26.60	8.80	-24.17	25.9	-11.21
Optical and precision engineering	-10.95	8.02	-17.56	11.09	-19.84	2.85	18.0	-18.07
Fabricated metal products	-22.06	-22.70	0.82	5.03	-25.79	35.87	21.0	-6.71
Pottery industry	-31.52	22.95	-44.30	3.13	-33.60	-16.12	16.8	-41.56
Glass industry	42.39	76.38	-19.27	1.25	40.63	-42.59	29.2	-6.92
Woodworking	-8.82	26.48	-27.91	20.17	-24.13	-4.99	14.8	-27.16
Musical instruments and toys	-54.43	47.20	-69.04	-27.14	-37.45	-50.50	20.5	-58.43
Paper processing	-14.84	-6.72	-8.70	12.67	-24.42	20.79	11.0	-10.99
Printing industry	1.74	34.44	-24.32	-18.11	24.23	-39.09	22.0	-15.73
Synthetic-material processing	41.54	159.13	-45.38	34.46	5.27	-48.11	27.9	-31.91
Leather making	-36.01	4.24	-38.61	0.00	-36.01	-4.06	22.9	-37.68
Leather processing	-33.37	-13.13	-23.30	-4.27	-30.39	10.20	13.2	-24.62
Footwear industry	-29.66	0.42	-29.95	6.63	-34.03	6.19	12.4	-30.69
Textiles	2.44	14.58	-10.60	-5.16	8.02	-17.23	29.5	-5.60
Clothing industry	49.01	10.36	35.02	3.86	43.47	-5.89	9.0	35.55
Food industry and tobacco	-7.73	-11.83	4.64	-0.47	-7.29	12.88	39.1	-0.38
All industries	**-14.49**	**8.63**	**-21.28**	**11.69**	**-23.44**	**2.82**	**32.5**	**-22.19**

Table 2: *Estimated annual rates of factor accumulation and productivity growth in West German industry in 1939-50 (%)*

Industrial Branches	Output	Labour	Output per unit of labour	Capital	Output per unit of capital	Capital per unit of labour	Capital share	TFP
Hard coal	-2.32	2.12	-4.34	1.40	-3.66	-0.71	31.2	-4.02
Brown coal and lignite	-1.83	4.00	-5.61	1.28	-3.07	-2.62	42.8	-3.99
Iron ore	-1.71	-2.35	0.65	1.98	-3.62	4.43	22.0	-0.56
Rock and potassium salt	-1.13	4.02	-4.95	-0.51	-0.62	-4.36	60.0	-1.96
Crude oil and natural gas	5.83	6.54	-0.67	1.97	3.79	-4.29	80.7	1.97
Other mining	-3.82	1.23	-4.98	2.59	-6.25	1.35	18.0	-5.43
Construction materials	-1.01	0.15	-1.16	0.81	-1.81	0.66	22.0	-1.33
Iron making	-3.98	-3.75	-0.23	0.99	-4.92	4.93	38.0	-3.07
Iron and steel foundries	-2.56	-1.83	-0.74	1.22	-3.73	3.11	31.0	-2.04
Rolling mills	-3.45	-2.61	-0.86	0.93	-4.34	3.64	34.0	-2.63
Non-ferrous metallurgy	-2.25	-0.43	-1.83	0.84	-3.07	1.27	41.5	-2.54
Chemical industry	-0.44	3.18	-3.50	1.92	-2.31	-1.22	57.2	-2.61
Crude-oil processing	1.03	-1.49	2.56	2.08	-1.03	3.62	70.5	-0.18
Rubber and asbestos processing	-0.95	1.85	-2.75	2.98	-3.82	1.11	22.0	-3.10
Timber industry	-0.67	2.08	-2.69	0.38	-1.05	-1.66	43.1	-1.86
Pulp and paper production	-2.19	2.69	-4.75	1.66	-3.78	-1.00	30.0	-4.30
Steel industry	-7.93	2.74	-10.38	2.03	-9.76	-0.69	22.0	-9.95
Machine tools	-3.45	2.18	-5.51	0.87	-4.29	-1.28	28.3	-4.94
Motor vehicles	-0.18	2.51	-2.63	1.60	-1.76	-0.89	31.6	-2.28
Shipbuilding	-8.30	-5.77	-2.69	2.30	-10.36	8.56	22.0	-7.62
Electrical engineering	2.95	4.77	-1.73	2.17	0.77	-2.48	25.9	-1.08
Optical and precision engineering	-1.05	0.70	-1.74	0.96	-1.99	0.26	18.0	-1.80
Fabricated metal products	-2.24	-2.31	0.07	0.45	-2.68	2.83	21.0	-0.63
Pottery industry	-3.38	1.90	-5.18	0.28	-3.65	-1.58	16.8	-4.77
Glass industry	3.26	5.29	-1.93	0.11	3.15	-4.92	29.2	-0.65
Woodworking	-0.84	2.16	-2.93	1.68	-2.48	-0.46	14.8	-2.84
Musical instruments and toys	-6.90	3.58	-10.11	-2.84	-4.18	-6.19	20.5	-7.67
Paper processing	-1.45	-0.63	-0.82	1.09	-2.51	1.73	11.0	-1.05
Printing industry	0.16	2.73	-2.50	-1.80	1.99	-4.41	22.0	-1.54
Synthetic-material processing	3.21	9.04	-5.35	2.73	0.47	-5.79	27.9	-3.43
Leather making	-3.98	0.38	-4.34	0.00	-3.98	-0.38	22.9	-4.21
Leather processing	-3.62	-1.27	-2.38	-0.40	-3.24	0.89	13.2	-2.54
Footwear industry	-3.15	0.04	-3.18	0.59	-3.71	0.55	12.4	-3.28
Textiles	0.22	1.25	-1.01	-0.48	0.70	-1.70	29.5	-0.52
Clothing industry	3.69	0.90	2.77	0.34	3.34	-0.55	9.0	2.80
Food industry and tobacco	-0.73	-1.14	0.41	-0.04	-0.69	1.11	39.1	-0.03
All industries	**-1.41**	**0.76**	**-2.15**	**1.01**	**-2.40**	**0.25**	**32.5**	**-2.25**