Machine Building: A New Benchmark before World War I

Research Memorandum GD-94a

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Abstract:
The figure most commonly used as benchmark for the output of machinery before WW I is based on an estimate by the Association of German Machinery Producers (VDMA). It estimated that all German firms together had sold machines worth 2,800 million Marks in 1913. Using a recently detected detailed report, filed in the Federal Archives in Berlin-Lichterfelde, on the internal statistics of VDMA results in alternative figures for the benchmark year 1913. Besides the original figure of VDMA two different new benchmark figures are presented here, namely 2,700 m. M (VDMA modified) and 2,600 m. M (according to Rech). The two new benchmark figures for 1913, in combination with a new production index, yield two time series for German machinery output between 1909 and 1918.

1 This research was supported by grants from the Netherlands Organisation for Scientific Research (NWO), Deutsches Institut für Wirtschaftsforschung (DIW) and Wissenschaftszentrum Berlin (WZB).
1. Introduction

It has been a problem how to link time series of machinery output for the inter-war years to a benchmark before World War I (Ritschl, 2004). The figure most commonly used as benchmark for the output of machinery before WW I is based on an estimate by the Association of German Machinery Producers (Verein Deutscher Maschinenbau-Anstalten, VDMA). VDMA estimated that all German firms had sold machines worth 2800 million Marks in 1913 (Denkschrift, 1926: 82). This figure was calculated by applying the known export share, based on enquiries among the members of the Association, to the official value of German exports of machines in that year. For compiling the statistics of sales and export the Association asked the members to apply the same classification as the German tariff system of 1902 (Rech, 1920: 807). Specifically, the internal statistics of VDMA revealed an export quota of 30.9 percent. It was assumed, however, that the firms, which did not report, were smaller on average and exported less of their production. Thus for the entire industry, a lower share between roughly 26 and 27 percent was taken. A recalculation based on the export figure of 738.441 million Marks (Denkschrift, 1926: 168) yields between 2,840 and 2,735 M of sales or on average 2,788. Rounded up it thus comes to the value of 2,800 million Marks.

Using a detailed report on the internal statistics of VDMA results in alternative figures for the benchmark year 1913. Applying firstly the same estimation procedure as VDMA and secondly an alternative approach, these statistics even allow an estimation of German output of machinery for the entire period between 1909 and 1918. In the exercise described below, the value of output for 1913 is estimated in such a way that it is consistent with the time series reported for the period 1909 to 1918. For 1913, two different benchmark values are obtained, both deviating from the hitherto accepted figure.

2. 1909-1918

The figures (Table M1) are based on enquiries among the members of VDMA. For internal information among members, Rech had compiled a survey of machinery statistics covering ten years (Rech, 1920, ‘Zehn Jahre Maschinenstatistik’ Zwanglose Mitteilungen für die Mitarbeiter des Vereines deutscher Maschinenbau-Anstalten, 20, 805-816, to be found at the Federal Archive BA R 8099/69). At the time of the reference period, VDMA neither comprised all machinery producers nor did all members report on a regular basis. In his compilation, Rech distinguished among four groups: I 28 firms reporting during the entire time span 1909-1918; II 55 firms 1909-1913; III 49 firms 1913-1918 and IV 104 firms reporting at least for one year (Rech, 1920: 809). In 1919/20, the reports did not deliver adequate data. The figure of 2800 million Marks is obviously based on the reported export

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2 This enquiry was initiated in 1907 in order to overcome the shortcomings of the official statistics. At that time, new negotiations for foreign trade treaties were taking place. Rech (1920: 806).

3 According to Rech (1920: 807), in 1918 VDMA covered about 75 to 80 percent of all employment of this industry. Measured by employment figures, only 20 percent of the members had reported in that year, though.
quota of group IV. The information on this group, however, is not suitable for constructing a consistent time series. For this purpose it is decided to rely on the groups II and III instead.

2.1 VDMA procedure
Step 1: The export quotas (31.4 and 32.7) for 1913 are corrected by a factor of 0.858 (26.5 divided by 30.9). Based on the exports of 1913 (738.441 m. M), sales amounted to 2,740.936 and 2,631.969 m. M, on average thus 2686.452. Rounded up to 2700, export is less than 4 % below the 2,800 m. M used as benchmark in the literature.
Step 2: For both groups a production (sales) index is calculated with 1913 equalling 100. Thus an index number series is derived for the period 1909 to 1918.
Step 3: By using the estimated average production (2,686.452) for 1913, a time series is obtained of German machinery output in current prices between 1909 and 1918 (Table M2). Alternative calculations based on the export quotas for each single year yield figures that do not correlate with the changing yearly sales figures of the reports. This in turn indicates the weakness of this specific estimation procedure.

2.2 An alternative approach
It is, however, possible to estimate the production based on average sales or output per employee. According to VDMA (Denkschrift, 1926: 102) the entire industry employed between 500,000 and 600,000 people in 1913. Multiplied by the average production reported for group IV, output would have amounted to 2,985 or 3,582 m. M. Both figures, however, are significantly higher than the two estimated benchmark numbers put forward above. They are thus not acceptable. Based on Rech’s detailed account, the following alternative opens up.
In 1918, all member firms employed 518,769 people.4 According to Rech’s judgement, this was between 75 and 80 percent of total employment of this industry (Rech, 1920: 807). Member firms comprised 518,769 employees and thus in 1918, the entire machine building industry had between 648,461 and 691,692 people on its payroll. The increase within the stable group III is used to extrapolate backward employment for 1913 (423,029 and 451,231 people).5 Multiplied by the average production reported for group IV, output amounted to 2,525 or 2,694 m. M, or 2,610 on average.

In conclusion, there are three different benchmark figures available, namely 2,800 m. M (VDMA original), 2,700 m. M (VDMA modified) and 2,600 m. M (according to Rech). The two new benchmark figures for 1913, in combination with the production index yield two time series for German machinery output between 1909 and 1918. Both series can be linked to the commonly accepted data of machinery output for the inter-war years and they can even further be based on the statistics of VDMA.

4 Due to increased war efforts (‘Hindenburgprogramm’), armament production and thus employment in machinery grew from 1916 onwards. According to Rech (1920: 814), this production line combined with growing numbers of female workers led to declining labour productivity measured in output per ton. At the same time, prices increased especially from 1917 onwards. Both effects do not allow a backward extrapolation based on sales figures.
5 The figures, however, are below the 476457 drawn by VDMA from the workplace census of 1907, see Denkschrift (1926: 102). In any case, the delimitation of the workplace census did not match what VDMA considered to be machinery production proper.
Literature/Source


Ritschl, Albrecht (2004), 'Spurious growth in German output data, 1913-1938’, European Review of Economic History, 8, 201-223

VDMA (1926), Denkschrift über die Maschinenindustrie der Welt, Berlin-Charlottenburg: Karl Lange
Table M1. *Statistics of German machine building industry, 1909-1918*

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Firms</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1909</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>1910</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>1911</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>1912</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>1913</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>1914</td>
<td>28</td>
<td>49</td>
</tr>
<tr>
<td>1915</td>
<td>28</td>
<td>49</td>
</tr>
<tr>
<td>1916</td>
<td>28</td>
<td>49</td>
</tr>
<tr>
<td>1917</td>
<td>28</td>
<td>49</td>
</tr>
<tr>
<td>1918</td>
<td>28</td>
<td>49</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales (1,000 M)</th>
<th>Share of Exports (%)</th>
<th>Price per Tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>1909</td>
<td>94,958</td>
<td>238,661</td>
<td>270,404</td>
</tr>
<tr>
<td>1910</td>
<td>93,796</td>
<td>222,256</td>
<td>285,804</td>
</tr>
<tr>
<td>1911</td>
<td>111,384</td>
<td>241,170</td>
<td>333,132</td>
</tr>
<tr>
<td>1912</td>
<td>121,708</td>
<td>288,328</td>
<td>425,166</td>
</tr>
<tr>
<td>1913</td>
<td>156,489</td>
<td>358,321</td>
<td>283,586</td>
</tr>
<tr>
<td>1914</td>
<td>127,193</td>
<td>228,153</td>
<td>376,855</td>
</tr>
<tr>
<td>1915</td>
<td>98,024</td>
<td>160,715</td>
<td>212,881</td>
</tr>
<tr>
<td>1916</td>
<td>102,637</td>
<td>206,468</td>
<td>266,173</td>
</tr>
<tr>
<td>1917</td>
<td>168,003</td>
<td>311,430</td>
<td>394,433</td>
</tr>
<tr>
<td>1918</td>
<td>253,793</td>
<td>475,564</td>
<td>580,493</td>
</tr>
</tbody>
</table>

*Note(s):* Price: 1913 weighted average.

*Source(s):* Rech (1920: 809-13).
### Table M2. Estimated production of the German machine building industry, 1909-1918 (current prices)

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (1,000 M)</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VDMA mod.</td>
<td>Rech</td>
</tr>
<tr>
<td>1909</td>
<td>1,789,321</td>
<td>1,738,178</td>
</tr>
<tr>
<td>1910</td>
<td>1,666,328</td>
<td>1,618,699</td>
</tr>
<tr>
<td>1911</td>
<td>1,808,132</td>
<td>1,756,451</td>
</tr>
<tr>
<td>1912</td>
<td>2,161,691</td>
<td>2,099,904</td>
</tr>
<tr>
<td>1913</td>
<td>2,686,452</td>
<td>2,609,666</td>
</tr>
<tr>
<td>1914</td>
<td>2,161,327</td>
<td>2,099,551</td>
</tr>
<tr>
<td>1915</td>
<td>1,522,477</td>
<td>1,478,960</td>
</tr>
<tr>
<td>1916</td>
<td>1,955,902</td>
<td>1,899,997</td>
</tr>
<tr>
<td>1917</td>
<td>2,950,223</td>
<td>2,865,897</td>
</tr>
<tr>
<td>1918</td>
<td>4,505,089</td>
<td>4,376,320</td>
</tr>
</tbody>
</table>

*Note(s):* See text for calculation method.
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