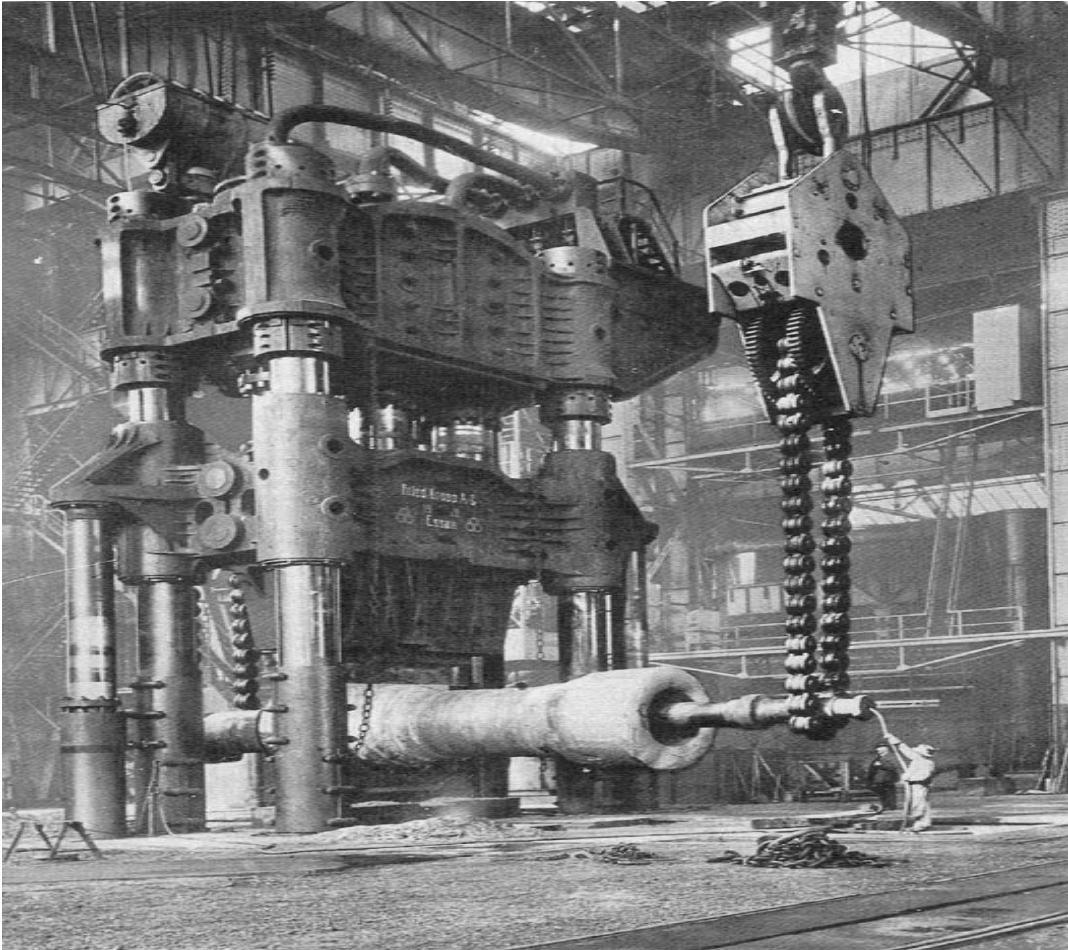


# Censuses Compared

A New Benchmark for British and German Manufacturing  
1935/1936



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# 1. Why are benchmark estimates important?

- Many comparisons rely on projections from 1990 prices
- Many competing intertemporal volume series for Germany (adjustments of existing Hoffmann series)
- New interpretations of U.S. growth during interwar period as well as on role of industrial policies in U.K.
- Existing UK/US and UK/Germany benchmarks: Rostas (1948) and Broadberry and Fremdling (1990)
- Based on comparison of physical quantities of output: method applied by Rostas

## 2. Sources, Data, and Methods

Sources: Official production censuses; focus on manufacturing

- Source **UK**: *Final report on the Fifth Census of Production, 1935*  
Level of Detail: **108** manufacturing industries
- Source **Germany**: *Die deutsche Industrie (1936, Archival records in Bundesarchiv Berlin)*  
Level of Detail: **284** manufacturing industries
- Source **US**: *Biennial Census of Manufactures, 1935*  
Level of Detail: **327** manufacturing industries
- Reclassification of all censuses into 12 branches and **95** common industries
- Censuses provide consistent information on labour input and related output
- Censuses give information on quantities and related values for many items

# Calculating comparative productivity levels from the British, American, and German censuses 1935/36

- comparing net output, or value added, by sector or industry
- value added information from detailed industry statistics is adjusted for sectoral price differentials between countries
- conversion: unit values or average prices were estimated by dividing production values by quantities of produced items
- coverage: between 40 and 45 percent, which implies that almost half of total output could be matched

# Calculation of conversion factors

- Unit values

$$uv_i = \frac{O_i}{Q_i}$$

- Unit value ratios

$$UVR_i^{BA} = \frac{uv_i^B}{uv_i^A}$$

- Purchasing power parities by sector

$$GO-PPP_j^{BA} = \sum_{i=1}^{I_j} W_{ij} UVR_{ij}^{BA}$$

**Table 1. Coverage Ratios and Matched Products, UK (1935),  
US (1935) and Germany (1936)**

	U.K.-U.S. Comparison			U.K.-Germany Comparison		
	Cov. U.K. %	Cov. U.S. %	Products Matched	Cov. U.K. %	Cov. Ger. %	Products Matched
<b>Textiles</b>	66	45	42	50	53	14
<b>Clothing</b>	38	36	20	28	37	5
<b>Iron and Steel</b>	43	38	26	40	45	30
<b>Engineering</b>	28	36	44	31	29	45
<b>Food, Drink &amp; Tobacco</b>	64	53	41	63	68	23
<b>Chemicals</b>	42	55	83	42	35	57
<b>Paper</b>	19	14	17	21	20	10
<b>Etc.</b>	.	.	.	.	.	.
<b>Total Manufacturing</b>	<b>45</b>	<b>40</b>	<b>365</b>	<b>42</b>	<b>43</b>	<b>229</b>

**Table 2. Purchasing Power Parities, U.K. and U.S. (1935), U.K. and Germany (1936)**

	PPP (\$/£) / Official 4.9			PPP (RM/£) / Official 12.3		
	Laspeyres	Paa-sche	Fisher	Laspeyres	Paa-sche	Fisher
<b>Textiles</b>	6.3	5.3	5.8	21.8	21.5	21.6
<b>Clothing Trades</b>	5.2	4.8	5.0	22.0	21.5	21.7
<b>Iron and Steel</b>	5.6	5.4	5.5	14.9	15.2	15.0
<b>Engineering</b>	4.2	3.6	3.9	17.8	17.3	17.6
<b>Food, Drink &amp; Tobacco</b>	6.3	5.6	5.9	24.3	24.5	24.4
<b>Chemicals</b>	4.8	3.2	3.9	17.2	16.3	16.7
<b>Paper</b>	3.8	3.4	3.6	14.8	14.1	14.5
<b>Etc.</b>	.	.	.	.	.	.
<b>Total Manufacturing</b>	<b>5.2</b>	<b>4.1</b>	<b>4.6</b>	<b>19.3</b>	<b>17.6</b>	<b>18.4</b>



**Table 3. The Structure of the Manufacturing Sector, UK (1935), US (1935) and Germany (1936)**

	Value Added in %			Employment in %		
	U.K.	U.S.	Germany	U.K.	U.S.	Germany
<b>Text, Leath,Cloth.</b>	21	17	17	32	27	23
<b>Iron, Steel, Metals</b>	12	13	18	12	14	18
<b>Engineering</b>	21	20	24	22	20	23
<b>Food, Drink &amp; Tobacco</b>	17	16	13	10	11	9
<b>Chemicals</b>	8	9	9	4	5	5
<b>Etc.</b>	.	.	.	.	.	.
<b>Total Manufacturing</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Table 4. Labour Productivity Levels UK and US (1935), Present estimate and Rostas's estimate**

	<b>US Labour Productivity (UK=100)</b>	
	<b>Present</b>	<b>Rostas</b>
<b>Textiles</b>	158	151
<b>Clothing</b>	<b>209</b>	<b>141</b>
<b>Iron and Steel</b>	184	170
<b>Engineering</b>	<b>265</b>	<b>270</b>
<b>Food, Drink &amp; Tobacco</b>	<b>145</b>	<b>176</b>
<b>Chemicals</b>	235	223
<b>Paper</b>	302	238
<b>Other</b>	...	...
<b>Total Manufacturing</b>	<b>218</b>	<b>205</b>

**Table 5. Value Added per Worker, UK/US (1935), UK(1935)/Germany (1936) and Value Added per Hour (UK/US 1935)**

	Value added per Worker (U.K.=100)		Value Added per Hour (U.K.=100)
	U.S.	Germany	U.S.
<b>Textile Trades</b>	158	97	204
<b>Clothing Trades</b>	209	94	291
<b>Iron and Steel</b>	184	133	229
<b>Engineering</b>	265	112	332
<b>Food, Drink &amp; Tobacco</b>	145	68	171
<b>Chemicals</b>	235	111	286
<b>Paper</b>	302	103	368
<b>Etc.</b>	.	.	.
<b>Total Manufacturing</b>	<b>218</b>	<b>105</b>	<b>272</b>

Figure 1. Weekly Hours Manufacturing 1929-38, UK, US, and Germany

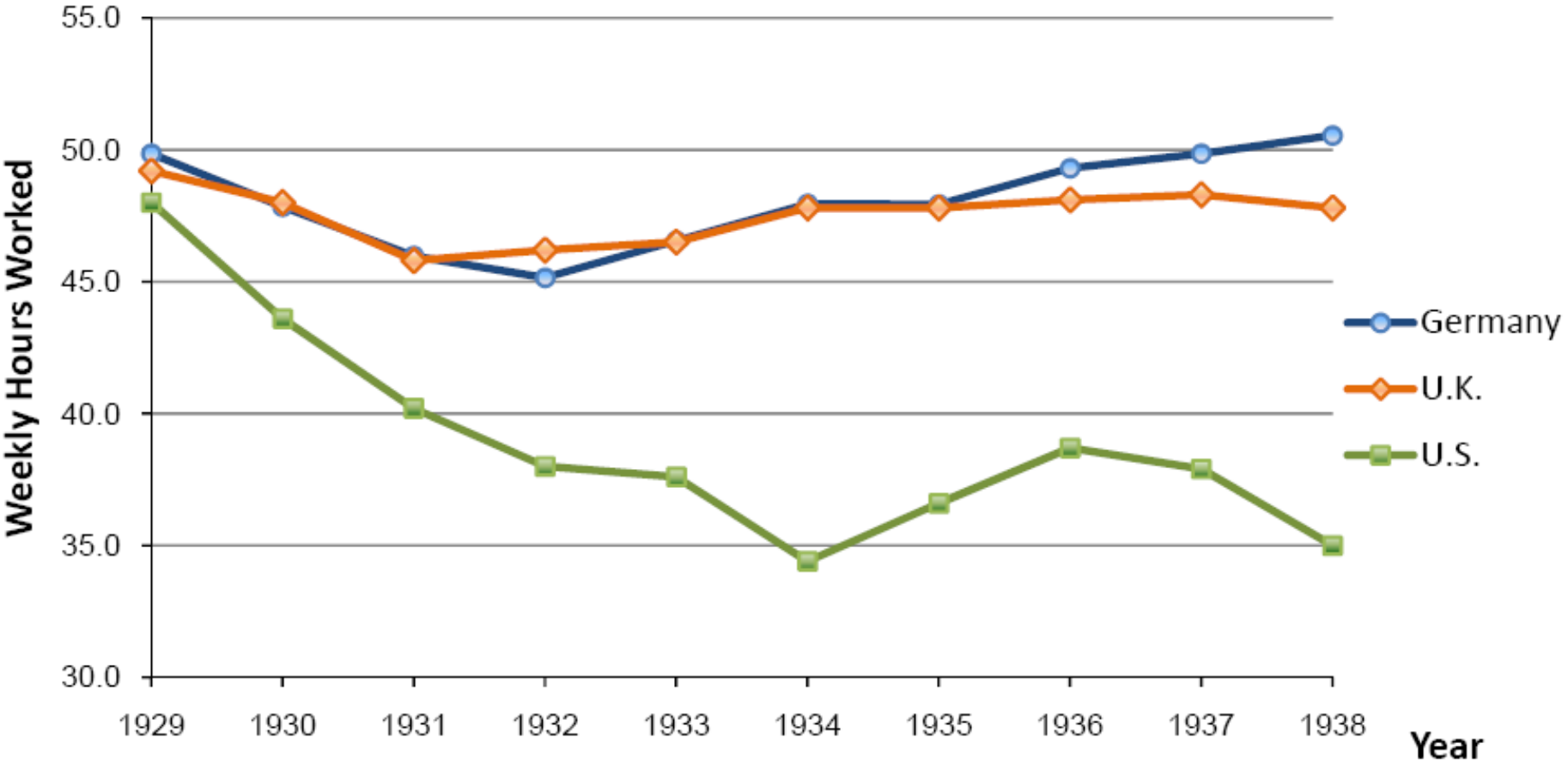


Figure 2. Comparative US/UK Productivity 1869-1989 (UK=100)

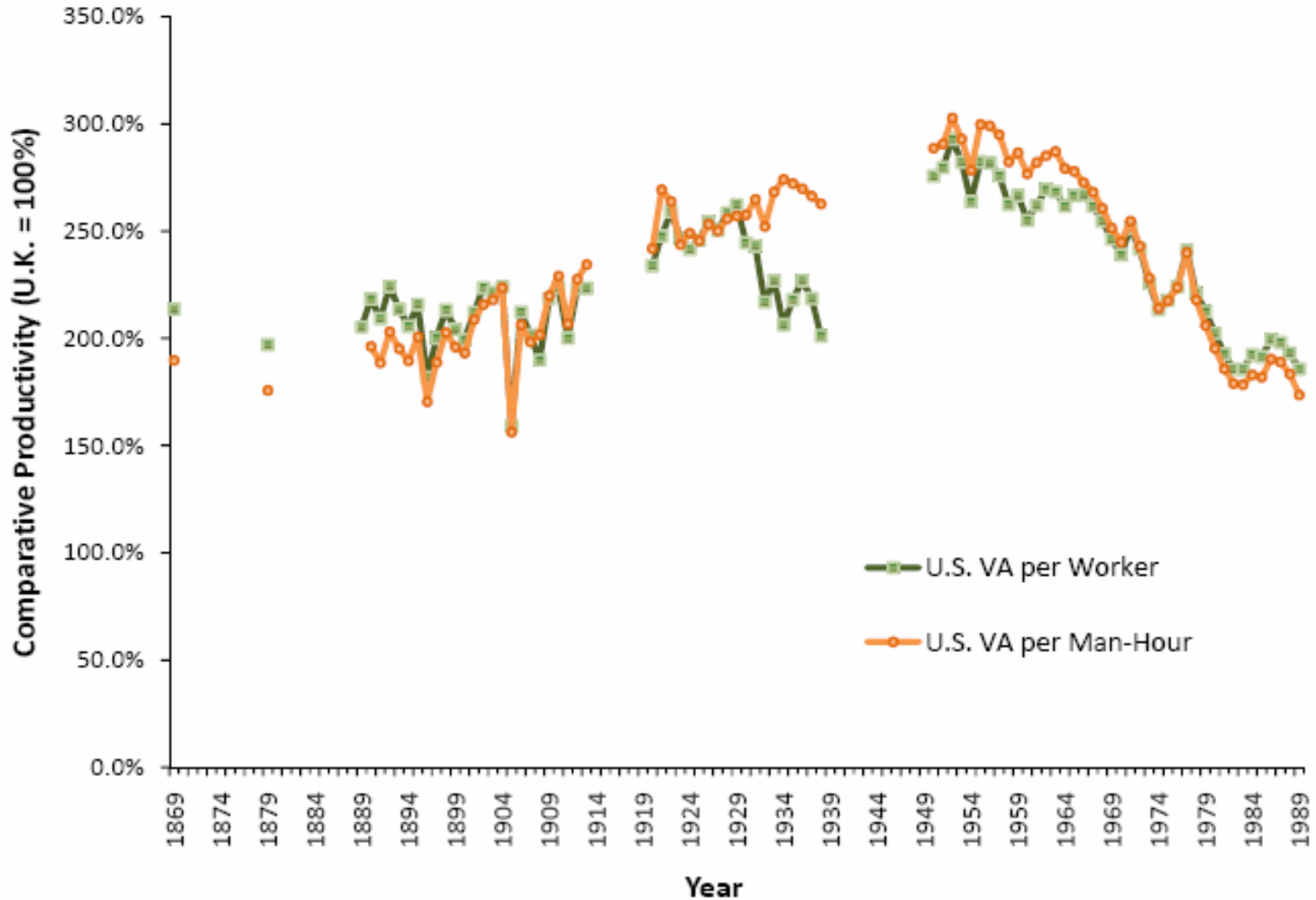


Table 6. **Shift-Share, UK and US (1935)**

	<b>Decomposition</b>		<b>Comparative Productivity</b>	
	Intra-Ind.	Structure	Intra-Ind.	Structure
<b>Textile</b>	1.01	-0.01	204	1
<b>Leather</b>	0.99	0.01	193	-1
<b>Clothing</b>	1.01	-0.01	290	2
<b>Iron and Steel</b>	1.01	-0.01	227	1
<b>Engineering</b>	1.01	-0.01	328	1
<b>Non-ferrous Metals</b>	1.03	-0.03	222	4
<b>Food, Drink &amp; Tobacco</b>	0.99	0.01	171	-1
<b>Chemicals</b>	1.02	-0.02	280	4
<b>Building Materials</b>	1.19	-0.19	218	28
<b>Timber</b>	1.00	0.00	387	-1
<b>Paper</b>	1.08	-0.08	346	20
<b>Miscellaneous</b>	1.04	-0.04	293	9
<b>Manufacturing</b>	<b>1.06</b>	<b>-0.06</b>	<b>261</b>	<b>11</b>
<i>Manufacturing</i>	<i>1.04</i>	<i>-0.04</i>	<i>266</i>	<i>7</i> <sup>14</sup>

# Explaining the 1935-productivity gap by OLS regression

- Based on Broadberry and Crafts (1992)
- Explanatory variables: capital installed (hp/worker), electrification rate, average wages, share of female workers, relative market size, three firm concentration ratio
- The general log-linearized specification is

$$\begin{aligned} \ln RELPROD_{mh} = & \beta_0 + \beta_1 \ln RELCAP_{mh} + \beta_2 \ln RELELEC \\ & + \beta_3 \ln RELWAGE_{mh} + \beta_4 \ln RELFEM + \beta_5 \ln RELSIZE \\ & + \beta_6 \ln 3CR \end{aligned}$$

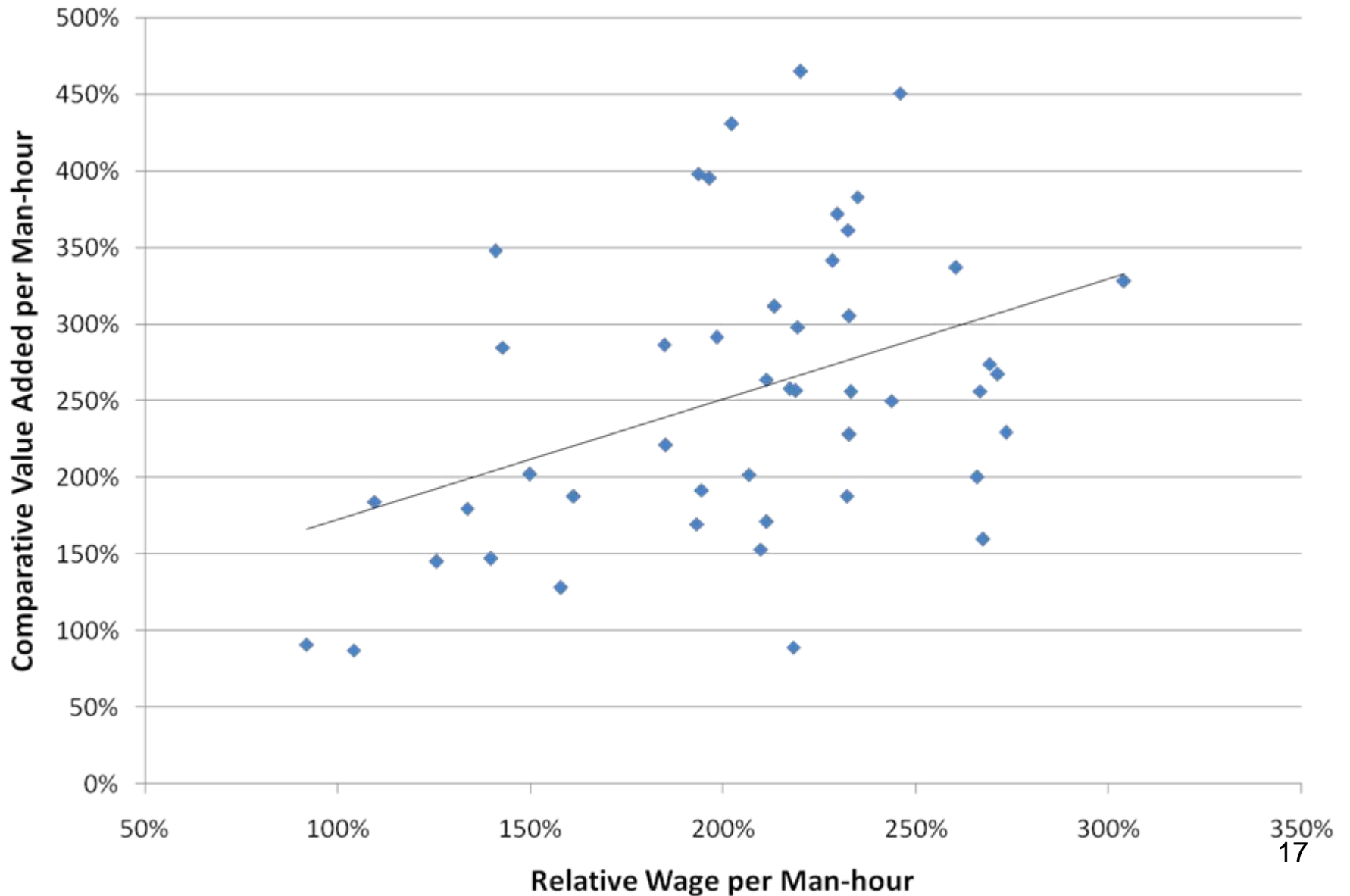
Table 7. **US-UK Comparative Productivity Regressions**

	<b>Equation 1</b>		<b>Equation 2</b>	
	<b>Coef.</b>	<b>SE</b>	<b>Coef.</b>	<b>SE</b>
<b>Intercept</b>	0.45	(0.12)	0.39	(0.10)
<b>lnRELCAPmh</b>	-0.05	(0.07)		
<b>lnRELELEC</b>	0.03	(0.13)		
<b>lnRELWAGEmh</b>	0.40	(0.10)	0.32	(0.11)
<b>lnRELFEM</b>	0.04	(0.08)		
<b>lnRELSIZE</b>	0.11	(0.03)	0.21	(0.05)
<b>ln3CR</b>	-0.06	(0.04)		
<b>adj. R2</b>		<b>0.205</b>		<b>0.338</b>
<b>SE</b>		<b>0.319</b>		<b>0.336</b>
<b>N</b>		<b>95</b>		<b>48</b>



# Figure 3. Relative Wage and Comparative Productivity U.S./U.K., 1935

*Partial Sample, manufacturing average wages (187%) productivity (272%)*



## Double deflation: adjusting for intermediate inputs (*JEH*, 2007, no.2)

- Double deflation adjusts for gains and losses due to relative price changes between input and output
- UK-Germany: 128 matches for intermediate inputs: coverage ratio of 35 % for total manufacturing
- Value added PPP:

$$VA-PPP_j^{BA(A)} = \frac{GO_j^A \times GO-PPP_j^{BA(A)} - II_j^A \times II-PPP_j^{BA(A)}}{GO_j^A - II_j^A}$$

**Table 8. Labour Productivity by Branch in Manufacturing - UK and Germany 1935-1936**

	<b>Value Added per Worker (Germany as percentage of UK)</b>	
	<b>Single Deflated</b>	<b>Double Deflated</b>
<b>Textiles</b>	97	76
<b>Iron and Steel</b>	133	175
<b>Engineering, Shipbuilding and Vehicle</b>	112	106
<b>Non-ferrous Metals</b>	133	104
<b>Food, Drink &amp; Tobacco</b>	68	78
<b>Chemicals</b>	111	126
<b>Paper, Printing and Stationery Trades</b>	103	141
<b>Timber Trades</b>	151	90
<b>Etc.</b>	.	.
<b>Total Manufacturing</b>	<b>105</b>	<b>107</b>

Table 9. Labour Productivity by Industry – UK and Germany  
1935-1936 (Germany as percentage of UK)

	Present Estimate	Broadberry/ Fremdling		Present Estimate	Broadberry/ Fremdling
Cotton spinning	77	100	Non-ferrous/zinc	104	85
Cotton weaving	73	69			
Rayon	106	109	Beet sugar	71	33
Jute	97	116	Margarine	78	52
Leather tanning and dressing	36	99	Brewing	94	62
			Tobacco	20	26
Boots and shoes	58	121	Soap	124	110
Blast furnaces, iron foundries and steelworks	175	116	Seed-crushing	128	50
Engineering	126	112	Rubber	117	112
Motor vehicles	98	141	Coke	108	174
			Cement	91	87

## 4. Conclusions

- **In 1935 the level of American productivity was 218 percent on a per worker basis, and 272 percent on a per man-hour basis (UK=100). The German level was about 105**
- **The aggregate outcome of the industry-of-origin studies is surprisingly resistant against different research strategies**
- **The advantages of the unit value approach become particularly evident when looking at cross-industry productivity differences**
- **Productivity per hour worked is a more accurate measure of technical advance than productivity per worker**
- **Double deflation reveals impact of input price distortions**

**Table 2. Gross Output, Value Added and Intermediate Input PPP per Branch in Manufacturing – UK and Germany 1935-1936**

*Official exchange rate RM/£ = 12.3*

	<b>Gross Output PPP (RM/£)</b>	<b>Intermediate Input PPP (RM/£)</b>	<b>Value Added PPP (RM/£)</b>
<b>Textiles</b>	21.6	18.7	27.5
<b>Iron and Steel</b>	15.0	17.9	11.5
<b>Engineering, Shipbuilding and Vehicle</b>	17.6	16.4	18.6
<b>Food, Drink &amp; Tobacco</b>	24.4	26.4	21.4
<b>Chemicals</b>	16.7	18.6	14.8
<b>Paper, Printing and Stationery Trades</b>	14.5	21.6	10.5
<b>Etc.</b>	.	.	.
<b>Total Manufacturing</b>	<b>18.4</b>	<b>18.9</b>	<b>17.9</b>

# Comparative Germany/UK labor productivity in manufacturing, Germany as % of UK, 1900-1938

