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Why growth rate differences persist

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Appendix A

Symbols

g_t	growth rate
h	industry
i_t	investment rate I_t/K_t
k_t	capital stock per efficiency unit of labour, $K_t/(A_tL_t)$
n_t	R&D productivity variable, e.g. $n_t = N_t/Y_t$
z_t	long run technology gap
A_t	average technology level
C_t	consumption
D	domestic country (technology follower)
F	foreign country (technology leader)
I_t	gross investment
K_t	capital stock
L_t	number of employees
N_t	research and development efforts
X_t	input variables in production (basic model)
Y_t	final goods production
Z_t	properties of technology system or innovation system (basic model)
α	coefficient of the growth rate of capital
δ	depreciation rate for capital
ω	weight of a country in leading-edge technology pool (macro model)
β	coefficient of growth rate of leader technology pool
λ_t	coefficient of change in technology gaps, or speed of diffusion
γ	coefficient of R&D variable in equation for speed of diffusion

ψ	constant term in equation for speed of diffusion
ϕ_t	arrival rate of innovations in domestic and foreign technology pools (macro model)
η_t	arrival rate of innovations in domestic technology pool and follower industry technology pool (GPT, industry model)
v_t	arrival rate of innovations in leader and follower industry technology pools (IPT, industry model)
σ	size of innovations in leader technology pool (macro model)
θ	size of innovations in domestic technology pool (GPT, industry model)
φ	size of innovations in leader industry technology pool (IPT, industry model)
Θ_t	interaction between IPTs and GPTs (industry model)
μ_t	coefficient of interaction term (industry model)
χ	empirical coefficient of interaction term (industry model)
Ω_t	technology gap between foreign and domestic technology pools (macro model)
Λ_t	technology gap between domestic technology pool and follower industry technology pool (GPT, industry model)
Π_t	technology gap between leader industry technology pool and follower industry technology pool (IPT, industry model)

Appendix B

Time series and data sources

B.1 Chapter 3

The data, sources and estimation methods for the time series estimates of labour productivity, capital intensity and joint factor productivity in Chapter 3 are described into detail by Albers et al. (1997). The current section summarizes the estimation methods and data sources.

Output and employment

United States *Total economy output* Maddison (1993, 1995a): GDP 1870-1990, and ten-year estimates back to 1820. The latter are interpolated with estimates from Feinstein (1972) for UK 1855-1870, or assuming linear trend in productivity between two interval years, using employment series. *Total economy employment* Van Ark (1996): 1950-1990. US Bureau of the Census (1975): 1900-1950 (civilian employment). Kendrick (1961): 1889-1900. Back to 1839: census years with 10 year intervals (US Bureau of the Census, 1975), interpolated with data on total population.¹ *Manufacturing output* Van Ark (1996): 1950-1990. Broadberry (1993) provides annual series 1889-1990, and a number of benchmark years before 1889 provided by Broadberry (1994b) to Albers et al. (1997). Broadberry's data were linked to the 1948 level as derived by Van Ark (1996). 1860-1888: based on an index for industrial production from US Bureau of the Census (1975). 1840-1859: five year benchmark estimates from Gallman (1960), interpolated. *Manufacturing employment* Van Ark (1996): 1950-1990. US Bureau of the Census (1975): 1900-1950 (civilian employment). Kendrick (1961): 1889-1900. Back to 1839: census years with 10 year intervals (US Bureau of the Cen-

¹Using annual hours worked instead of persons engaged do not greatly affect the comparative level estimates as annual hours per person were rather similar between the UK and the US, with exception of 1930s (hours worked fall in US) and since 1970 (hours worked fall in UK).

sus, 1975; Broadberry, 1993/1994b), interpolated assuming that employment moves with number of persons engaged in whole economy.

United Kingdom *Total economy output* Maddison (1993, 1995a): GDP 1870-1990, converted into constant 1990 US (Geary Khamis) dollars using the geometric average for GDP PPP at US and UK expenditure weights (data before 1950 linked to 1950 level), and before 1870 at 10 year intervals. 1855-1950: Feinstein (1972). 1840-1855: interpolation with data on population, and GDP per capita at interval years. *Total economy employment* Van Ark (1996): 1950-1990. linked to Maddison's estimates for key years, with intervals mostly interpolated with series from Feinstein (1972). *Manufacturing output* Van Ark (1996): value added 1950-1990, converted into 1990 US dollars using binary ICP Fisher PPPs for value added. 1869-1950 from Broadberry (1993) and 1855-1868 from Feinstein (1972) are linked to the absolute level in 1950. Data for period 1939-1947 are missing. Data before 1855 are interpolated with benchmark data provided by Broadberry (1994b). *Manufacturing employment* Van Ark (1996): 1950-1990. Before 1950, data at 10 year intervals from Broadberry (1993, 1994b) and Feinstein (1972) were used, assuming for 1855-1869 a parallel movement to total economy employment, and interpolation for 1840-1885. Data for 1939-1947 are missing.

Capital stock estimates

United States *1925-1990*: Non-residential structures and equipment stock estimates in 1987 US\$ from BEA wealth diskettes based on BEA (1993). Military equipment, residential structures and durable goods owned by consumers are excluded. Conversion to 1990 US\$ with 1987-1990 implicit deflators for capital stock from BEA; for total economy this is 1.120 for non-residential structures and 1.101 for machinery and equipment, for manufacturing 1.120 and 1.132 respectively. *1890-1924*: perpetual inventory estimates by cumulating investment data from BEA wealth diskettes, converted 1990 US\$. Application of rectangular scrapping patterns, same asset lives as applied by BEA for the later period. Missing data for some investment categories for early years filled by extrapolating investment series backward on the bases of the trend in investment for all other categories within the same main group. Estimates are linked to the 1925 stock estimates in 1990 US\$ as derived above. *1840-1889*: Total economy from perpetual inventory estimates from Gallman (1987, pp.249-250, 252-253), machinery and equipment as gross stock of 'manufactured producers' durables, service life of 17 years, retirement age of 17 years', structures is de gross stock of 'improvements (other than canals, railroads, farmm land clearing and improvements constructed with farm materials), service life of 50 years'. Asset lives most closely resemble the lives used for the post-1890 estimates. Estimates linked to 1890 level estimate derived above. Manufacturing data only at decadal intervals. Total net capital stock at current prices computed from data on value added and capital/value added ratios from Gallman (1960, p.56) and Gallman (1986, p.196). Subdivision by type of asset using Davis and Gallman (1978, p.29), conversion to values at constant prices using Gallman (1992, p.88). Estimates of net capital stock computed using linear depreciation, gross stocks from gross/net ratios derived from Gallman (1987, pp.249-250, 252-253). Annual figures obtained by logarithmic interpolation.

United Kingdom *1938-1990*: Perpetual inventory estimates applying rectangular scrapping. Investment data in 1990 pounds for 1985-1990 from CSO (1995), 1920-1984 underlying O'Mahony (1996) kindly provided by O'Mahony. Following Maddison (1995b), it is assumed that war damage, all in 1945, is equal to 3% of pre-war investment. Estimates converted from 1985 into 1990 prices with 1990-1985 price ratio of 1.385 for structures and 1.201 for equipment, from CSO (1995). Standardised asset lives from O'Mahony (1996) for 1985-1990, total economy 40 years for structures and 15 years for equipment, manufacturing 31 and 17 years respectively. For 1938-1955 asset lives total economy 65 years for structures, 26 years for equipment (CSO, 1985; Dean, 1964), manufacturing 75 and 27 years respectively (Hibbert, Griffin and Walker, 1977; Mayes and Young, 1994). It is assumed that the decline in asset lives between 1955 and 1985 had been proportional to the change in real GDP. *1921-1938*: From Feinstein (1972), trend in stock of structures ('other building and works'), and equipment ('plant and machinery' and 'vehicles, ships and aircraft') at constant 1938 prices, linked to the 1938 estimates derived above. *1840-1919*: Gross stocks by industry based on Feinstein (1988). He mainly applied the perpetual inventory method but also used census-based estimates. Annual data prior to 1851 obtained by logarithmic interpolation of decade averages given by Feinstein. For 1850-1920, data by type asset for manufacturing is only at decadal intervals. Linear interpolation of the ratio of structures to equipment is used to obtain annual estimates. Relative movements in capital stock levels of Feinstein (1988) linked to the 1920 estimate in constant 1990 pound sterling as derived above. The trends according to two different Feinstein estimates (1972, 1988) of the value of the non-residential capital stock in 1920 at current prices are linked.

Factor shares

In order to calculate joint factor productivity, factor shares of total labour compensation in GDP in current prices were estimated (including self-employed). For the period 1950-1990, the main data sources are OECD National Accounts Vol. II, and additional national account sources (see Groote and Van Ark, 1996). Data on factor shares in the period 1840-1950 for US total economy are from Kendrick (1961) at interval years (1898-1948), which are interpolated. Factor shares are assumed to remain constant for the period 1840-1898. Matthews, Feinstein and Odling Smee (1982) provide data for UK total economy at interval years (1856-1937), which are interpolated on the basis of the factor share of income from employment in total GDP from Feinstein (1972). Factor shares are assumed to be constant for 1840-1855. In manufacturing, factor shares are based on total economy and linked to the 1950 manufacturing share.

Table B.1: Gross domestic product (mln 1990 US\$) and employment, 1840-1990

	Gross domestic product				Persons employed			
	Total economy		Manufacturing		Total economy		Manufacturing	
	UK	US	UK	US	UK	US	UK	US
1840	49122	27604			10819	5750		482
1841	49984	28950	5247	1696	10854	5980	2320	528
1842	50862	30325	5333	1846	10890	6212	2411	578
1843	51754	31729	5065	2010	10925	6445	2506	632
1844	52662	33163	5357	2188	10960	6680	2604	691
1845	53586	34630	6031	2428	10995	6917	2707	754
1846	54526	36127	6380	2695	11031	7156	2813	822
1847	55481	37656	6347	2991	11066	7397	2923	896
1848	56453	39217	6755	3319	11101	7639	3038	975
1849	57442	40814	6840	3684	11137	7884	3157	1057
1850	58448	42475	6836	3934	11172	8136	3281	1081
1851	59966	44806	7126	4201	11159	8437	3410	1112
1852	61521	47210	7555	4487	11144	8738	3473	1143
1852	63116	49687	8188	4791	11130	9041	3537	1173
1854	64750	52241	8294	5117	11115	9344	3602	1202
1855	66425	54874	8108	5367	11100	9648	3668	1231
1856	65519	57589	8651	5630	11223	9954	3709	1260
1857	70773	60384	8947	5905	11242	10260	3715	1288
1858	70667	63263	8751	6194	10959	10566	3621	1315
1859	72952	66230	9199	6497	11591	10874	3830	1343
1860	75442	69287	9707	6786	11629	11183	3883	1412
1861	76210	71951	9694	6786	11462	11500	3843	1484
1862	77582	74666	9925	6407	11205	11819	3791	1559
1863	78156	77435	9973	7164	11552	12138	3861	1637
1864	81148	80257	10758	7543	12143	12459	3979	1718
1865	84154	83135	11484	7164	12284	12780	4008	1802
1866	86768	86067	11936	8678	12284	13103	4008	1889
1867	84731	89058	11246	9057	11783	13427	3907	1979
1868	87357	92105	11265	9435	11822	13752	3915	2072
1869	86940	95212	11098	10660	12092	14078	3969	2169
1870	92439	98418	12279	10660	12593	14411	4082	2231
1871	97413	103080	13367	11083	13242	14801	4200	2302
1872	97620	107224	13678	13199	13566	15192	4254	2374
1873	99900	112404	13958	12776	13720	15584	4278	2446
1874	101558	111886	14269	12353	13754	15977	4284	2520
1875	104045	117584	14082	11929	13788	16369	4290	2594
1876	105081	119138	14144	11929	13652	16765	4260	2669
1877	106118	122764	14424	12776	13566	17160	4242	2745
1878	106532	127944	14113	13622	13259	17556	4182	2821
1879	106118	144001	13336	15314	12320	17954	4010	2899
1880	111092	161095	15481	17747	13874	18359	4290	2998
1881	115030	166793	16072	19368	14143	18892	4397	3120
1882	118346	177153	17098	20584	14395	19428	4504	3245
1883	119175	181297	17222	20990	14482	19967	4546	3373
1884	119383	184922	16352	19774	13943	20510	4331	3505
1885	118761	185958	15605	19774	13912	21056	4325	3639
1886	120626	191656	15481	23828	13904	21606	4331	3776
1887	125393	200462	16942	25044	14321	22160	4504	3917
1888	130989	199426	18092	25854	14760	22717	4689	4061
1889	138036	211858	19429	27476	15238	23084	4891	4174

Table B.2: Gross domestic product (mln 1990 US\$) and employment, 1840-1990 (cont.)

	Gross domestic product				Persons employed			
	Total economy		Manufacturing		Total economy		Manufacturing	
	UK	US	UK	US	UK	US	UK	US
1890	138658	214966	19585	29578	15361	23842	5076	4348
1891	138658	224290	19740	30329	15267	24435	4933	4479
1892	135342	246045	18497	32881	14891	25181	4839	4752
1893	135342	234132	18465	29128	14851	25073	5016	4588
1894	144461	227398	19087	28227	15227	24578	4892	4359
1895	149021	254851	20300	33632	15724	25817	4992	4752
1896	155239	249671	22009	30629	16543	25948	5140	4654
1897	157311	273499	22134	33031	16798	26691	5217	4817
1898	164980	279197	23377	37686	17174	26920	5288	4948
1899	171820	304578	24310	41289	17617	28523	5377	5536
1900	170576	312866	24061	41589	17577	29269	5359	5754
1901	170576	348089	23999	46394	17596	30201	5353	6049
1902	174929	351715	24061	53300	17653	31008	5365	6583
1903	173063	368809	23470	53150	17756	31654	5395	6833
1904	174099	364147	23626	51349	17681	31894	5365	6441
1905	179281	391082	25678	58555	18021	32992	5466	7204
1906	185292	436148	26859	62459	18436	34608	5597	7585
1907	188815	442881	27605	63210	18587	35172	5639	7934
1908	181146	406622	25242	50598	17983	34137	5437	7106
1909	185292	456349	25553	65162	18153	35791	5484	7923
1910	191095	461011	25833	67714	18860	36413	5711	8283
1911	196691	476033	28040	64111	19332	36790	5854	8283
1912	199593	498306	29190	77023	19427	37930	5895	8653
1913	207261	517990	31087	80776	19823	38711	6069	8740
1914	209334	478105	28973	76723	20685	38003	5874	8435
1915	226122	491573	30465	89935	22593	37947	5444	8817
1916	231096	559429	28537	106901	23877	39699	5154	10397
1917	233169	545444	26424	106000	24978	39857	4905	11116
1918	234620	594653	25646	104799	25051	40214	4889	11334
1919	209127	599832	28662	91587	21437	40811	5705	10931
1920	196484	594135	31553	99094	18172	40868	6442	10909
1921	180525	580667	24559	80326	22314	38767	5063	8435
1922	189851	612782	28578	102247	22185	41288	5297	9231
1923	195862	693589	30603	115459	21648	43987	5436	10484
1924	203945	714826	33705	110204	21113	43645	5529	9830
1925	213894	731402	34749	122966	20710	45280	5565	10103
1926	206018	779057	33642	129422	20698	46368	5410	10321
1927	222599	786827	37186	130774	19634	46396	5750	10190
1928	225293	795633	37091	135278	19479	46657	5745	10223
1929	231925	844324	38610	150142	18936	47718	5829	10898
1930	230267	769215	36965	128522	18570	44726	5421	9721
1931	218453	710164	34433	108102	18112	40630	5057	8239
1932	220112	616408	34623	80776	18204	35906	5133	6964
1933	226537	603458	37186	94289	18595	35926	5329	7509
1934	241459	650078	40573	103748	19155	39191	5572	8708
1935	250786	699805	44244	124318	19507	41162	5708	9274
1936	262186	799259	48358	145337	20138	44511	6021	10048
1937	271305	833446	51301	155097	20819	47517	6325	11029
1938	274621	800295	49814	121465	20818	44732	6229	9525
1939	277316	864007		153896	21625	46534		10408

Table B.3: Gross domestic product (mln 1990 US\$) and employment, 1840-1990 (cont.)

	Gross domestic product				Persons employed			
	Total economy UK	Total economy US	Manufacturing UK	Manufacturing US	Total economy UK	Total economy US	Manufacturing UK	Manufacturing US
1940	305089	930828		178068	20634	48545		11367
1941	332862	1100211		237074	20435	51739		13699
1942	341152	1320357		296080	20535	55577		15922
1943	348614	1582978		357488	20039	56390		18124
1944	334934	1715583		349080	19543	55814		17775
1945	320219	1646690		295029	18949	54527		15857
1946	306332	1306889	52137	241128	20138	57270		15159
1947	301772	1287205	55149	267703	21427	60162		15901
1948	311306	1335896	60131	276562	21946	60763	7412	15966
1949	322913	1341076	63960	260496	22120	59978	7548	14833
1950	333276	1457624	68359	301936	22400	61413	7738	15639
1951	343225	1601107	71271	337884	22696	65017	7915	16866
1952	342603	1669482	68707	349393	22735	66158	7798	17174
1953	356075	1731641	72948	374813	22871	67126	7917	17998
1954	370583	1719727	77854	347443	23246	65459	8133	16774
1955	384055	1816591	82822	383905	23564	66877	8318	17327
1956	388822	1852850	82411	387355	23756	68365	8328	17674
1957	395040	1888592	84247	389522	23773	68577	8333	17577
1958	394211	1879268	83171	355537	23566	66863	8194	16234
1959	410170	1981830	88171	395987	23781	68317	8228	16967
1960	433798	2022233	95323	396775	24225	69195	8566	17088
1961	448099	2072996	95482	397648	24489	69090	8674	16636
1962	452659	2200422	95893	431450	24600	70374	8567	17199
1963	470069	2296768	99817	465617	24671	70930	8444	17320
1964	494940	2434553	107698	498456	24991	72290	8586	17614
1965	507790	2587360	111274	541871	25215	74289	8697	18398
1966	517531	2755189	113306	583365	25393	77540	8726	19579
1967	529138	2826672	114068	581784	25049	79129	8462	19811
1968	550693	2954097	121563	611613	24915	80943	8394	20154
1969	562093	3045781	126263	628753	24946	82985	8501	20574
1970	574943	3045781	127025	593732	24851	82607	8485	19713
1971	586342	3147826	126517	603918	24513	82278	8212	18860
1972	606654	3326014	129565	657533	24469	84095	7943	19328
1973	651422	3519224	140108	727863	25076	87391	7993	20405
1974	640437	3499023	138434	693104	25138	88794	8043	20387
1975	635670	3468461	128776	641443	24969	87257	7654	18658
1976	653080	3657010	131352	703649	24728	89371	7411	19375
1977	668210	3845558	133798	755718	24734	92358	7461	20113
1978	691631	4043948	134442	789707	24859	96772	7427	21000
1979	711114	4161014	134197	809601	25209	100332	7395	21530
1980	695362	4161014	122555	766063	25120	100850	7081	20800
1981	686449	4273418	115201	771405	24121	101731	6365	20699
1982	698263	4191575	115446	721443	23666	100516	6005	19308
1983	724586	4354742	118755	766404	23365	101595	5664	18934
1984	742617	4644817	123313	855298	23943	106054	5579	19888
1985	768525	4797624	126605	885764	24216	108330	5561	19700
1986	801687	4935409	128251	913273	24218	110093	5430	19465
1987	839823	5093396	134961	968747	24700	113061	5395	19511
1988	881690	5286606	144456	1019182	25505	116092	5476	19940
1989	900965	5419212	150933	1028783	26326	118634	5512	19990
1990	904488	5464795	150632	1024700	26881	120080	5494	19734

Table B.4: Non-residential structures and equipment (mln 1990 US\$), 1840-1990

	Non-residential structures				Machinery and equipment			
	Total economy		Manufacturing		Total economy		Manufacturing	
	UK	US	UK	US	UK	US	UK	US
1840	48001	25109	5799	1675	13468	2852	6946	857
1841	49424	27166	6006	1800	13783	3001	7195	920
1842	50889	29224	6221	1934	14105	3192	7452	987
1843	52397	31125	6444	2078	14434	3385	7718	1058
1844	53950	33079	6674	2233	14771	3583	7994	1135
1845	55549	35571	6913	2399	15116	3855	8280	1218
1846	57940	38574	6963	2578	15126	4176	8341	1307
1847	60434	41995	7014	2770	15136	4568	8402	1402
1848	63036	45355	7065	2976	15146	5071	8463	1504
1849	65750	48578	7117	3198	15157	5495	8525	1613
1850	68580	51799	7169	3436	15167	5877	8587	1731
1851	70109	55654	7450	3681	15728	6317	8931	1884
1852	71639	60251	7759	3944	16341	6775	9308	2050
1853	73107	65583	8097	4225	17056	7351	9721	2232
1854	74514	71541	8491	4527	17924	8024	10201	2429
1855	76044	77863	8856	4850	18741	8782	10648	2644
1856	77451	84693	9164	5197	19303	9693	11027	2877
1857	78858	92216	9415	5568	19865	10759	11337	3132
1858	80265	99358	9637	5965	20478	11701	11614	3409
1859	81917	105606	9916	6391	20988	12476	11959	3710
1860	83507	111850	10195	6847	21652	13317	12305	4038
1861	85404	117883	10394	7575	22367	14133	12715	4414
1862	87361	121942	10617	8381	23133	14215	13164	4824
1863	89503	124596	10862	9273	24154	14015	13651	5272
1864	91705	126910	11101	10260	25278	13907	14143	5761
1865	94213	129318	11336	11351	26401	14351	14640	6296
1866	96477	133508	11537	12559	27423	16860	15105	6881
1867	98496	139945	11707	13895	28240	20480	15539	7520
1868	100209	148943	11873	15373	29057	23915	15977	8219
1869	101922	160058	12060	17009	29772	26599	16455	8982
1870	103696	173578	12294	18818	30691	28810	17008	9816
1871	105776	186092	12605	18784	31712	31004	17557	10455
1872	107917	200652	12964	18750	32836	33775	18180	11135
1873	110242	217523	13268	18716	33806	37176	18734	11859
1874	112934	233265	13621	18682	34930	40038	19363	12631
1875	115625	248403	13995	18648	36104	42286	20032	13452
1876	118439	263230	14416	18615	37330	44635	20777	14328
1877	121192	277342	14858	18581	38606	47148	21561	15260
1878	123884	290969	15195	18547	39730	50046	22203	16252
1879	126393	304562	15529	18513	40802	54184	22847	17309
1880	128717	318503	15784	18480	41772	60020	23384	18435
1881	131042	334838	16105	19263	42794	67647	23753	19269
1882	133244	353335	16351	20080	43713	75832	24010	20140
1883	135447	372398	16574	20931	44683	82244	24229	21050
1884	137894	393506	16823	21818	45551	86405	24484	22002
1885	140096	415802	17048	22743	46164	89578	24701	22996
1886	142054	439742	17299	23708	46573	94930	24955	24036
1887	143950	467055	17526	24713	47185	103588	25171	25122
1888	145786	494479	17703	25760	47900	112993	25313	26258
1889	147682	521317	17881	26852	48922	121789	25454	27444

Table B.5: Non-residential structures and equipment (mln 1990 US\$), 1840-1990 (cont.)

	Non-residential structures				Machinery and equipment			
	Total economy		Manufacturing		Total economy		Manufacturing	
	UK	US	UK	US	UK	US	UK	US
1890	149701	555006	18059	27991	49892	130606	25595	28685
1891	151842	584584	18268	31518	51169	138602	25940	32299
1892	153984	613321	18476	35139	52445	146303	26286	36011
1893	156308	643212	18734	38759	53518	154127	26705	39721
1894	158694	668620	18992	42139	54692	159426	27125	43184
1895	161141	692858	19275	46256	55867	166395	27582	47403
1896	163711	721872	19583	51665	57092	174467	28076	52946
1897	166586	753046	19940	55928	58471	179436	28643	57315
1898	169829	781811	20348	59018	60310	184598	29285	60482
1899	173254	812465	20779	62089	62352	192484	29963	63629
1900	176742	843819	21261	64348	64548	202646	30716	65945
1901	180473	878993	21798	66832	67357	212810	31997	68490
1902	184450	926123	22320	71534	70472	225772	33289	73308
1903	188304	975276	22974	75834	73536	240619	34818	77715
1904	192036	1019881	23634	78501	76651	251636	36399	80448
1905	195339	1061407	24203	81401	79562	266315	37883	83421
1906	198643	1106397	24659	85458	82575	286533	39229	87578
1907	201274	1155935	25006	89730	85179	307099	40436	91956
1908	203537	1202922	25292	94054	87120	314656	41577	96387
1909	205740	1255878	25613	99031	89366	322903	42805	101487
1910	208064	1315043	25965	104118	91511	334777	44121	106701
1911	210328	1373053	26545	109950	93758	343630	45194	112677
1912	212653	1430665	27283	116622	96209	357079	46540	119515
1913	215406	1484222	28019	122189	98967	372595	47888	125219
1914	217975	1528596	29093	125499	102082	382362	49819	128612
1915	219627	1564899	30231	128398	104635	389926	51869	131583
1916	220728	1600802	31186	131979	105401	404795	53610	135253
1917	221646	1631980	32160	136374	104737	424580	55393	139757
1918	222747	1653227	33425	140328	106882	446109	57683	143809
1919	224338	1680973	34890	146105	111631	461072	60327	149730
1920	218415	1729269	35060	159316	111315	472995	60739	163268
1921	220456	1771432	35965	164394	111895	481750	60616	168471
1922	222206	1820780	36754	167825	113055	495351	60281	171988
1923	224247	1876770	37548	172732	113924	517479	59941	177017
1924	226289	1933200	38346	175380	115663	532256	59598	179731
1925	228913	1990564	39414	177683	117983	553662	59651	182091
1926	231246	2054680	40360	183180	119142	572253	59495	183155
1927	233287	2119456	41179	189153	120591	584767	59135	183582
1928	235328	2182566	42141	196521	123200	597095	58966	184561
1929	237953	2250467	43113	206006	125520	615787	58790	187633
1930	241452	2312840	44093	210020	127549	624386	58606	188596
1931	243785	2352657	44937	209545	129288	619582	58226	186498
1932	245535	2370218	45489	206338	129868	604563	57468	181746
1933	246993	2373759	46036	205419	129868	587965	56713	177898
1934	249034	2382639	47037	204468	131317	577032	56512	175652
1935	251659	2392351	47892	202324	133346	571821	56123	175410
1936	254575	2420943	49381	202118	136535	575286	56449	178042
1937	258074	2448235	51052	204652	139724	583804	56934	182722
1938	261282	2471006	52427	202791	143782	580544	57045	183371
1939	265447	2498155	54517	201106	149381	580507	60172	185280

Table B.6: Non-residential structures and equipment (mln 1990 US\$), 1840-1990 (cont.)

	Non-residential structures				Machinery and equipment			
	Total economy UK	US	Manufacturing UK	US	Total economy UK	US	Manufacturing UK	US
1940	268092	2521248	57816	202194	155732	588616	67212	190066
1941	269439	2556714	60610	209700	160881	610367	72135	196767
1942	269317	2590062	62722	208300	164728	644692	75322	201507
1943	268119	2588783	63947	203784	166789	698378	76779	204812
1944	266368	2582390	64519	200023	167100	738868	77238	213509
1945	256979	2578593	62757	199888	162947	776305	74932	227717
1946	256659	2590174	63171	208824	165008	761237	75226	245936
1947	258489	2603830	64465	214421	168575	794262	77011	270716
1948	260850	2631012	65579	215723	175325	833089	79201	292977
1949	264041	2663984	66815	214667	182332	874265	82441	305974
1950	268426	2708474	68161	214851	189680	926363	86276	319919
1951	272558	2761392	69368	219351	197137	981547	90655	338942
1952	276616	2818752	70662	224768	203809	1036162	94139	357557
1953	281816	2884958	72087	229192	210228	1091882	97658	375826
1954	287758	2959096	73753	232813	217944	1141413	101637	392780
1955	294693	3031535	76082	237561	226843	1199825	105565	408630
1956	302653	3115850	79014	247771	236514	1258484	110398	429664
1957	307988	3204959	81724	257221	241003	1312837	116157	449435
1958	316821	3293218	84342	262081	253018	1343822	121755	459541
1959	321271	3386922	86453	265017	264434	1383430	125430	468685
1960	327586	3487717	88685	272522	268134	1424656	131412	480191
1961	335330	3593504	92061	280650	280939	1459288	135769	489468
1962	342543	3705476	95482	287978	292872	1502587	141977	500946
1963	349577	3825295	97318	296237	296949	1553829	143150	513168
1964	360526	3962359	99283	306621	308355	1618241	139192	531142
1965	374230	4120449	101351	321073	330320	1703515	146104	557801
1966	388000	4287057	104272	341189	354549	1805876	155283	591179
1967	404101	4453786	105360	360444	372269	1903335	163640	621550
1968	421156	4624534	106897	378605	393033	2007941	174108	651097
1969	440912	4793244	109394	397459	398949	2123190	179350	682012
1970	462302	4954358	111677	415207	416243	2228537	188370	710579
1971	479878	5110389	112538	430427	432255	2329060	189609	734248
1972	497259	5259316	111124	442470	435386	2444802	195366	761324
1973	504332	5420434	107047	458018	436893	2592828	196241	793629
1974	529211	5578536	109717	477573	453147	2742472	203887	836681
1975	550183	5718509	111292	493931	465981	2851027	216736	870148
1976	565865	5854061	111009	511336	480196	2958931	214366	903084
1977	577835	5986472	110339	527393	474668	3094518	212350	941454
1978	587268	6142588	110406	551186	467819	3258473	206671	981320
1979	598795	6317696	110792	581326	484871	3423280	202649	1019588
1980	619758	6501539	113607	607328	497232	3564928	215389	1057897
1981	639819	6695720	115130	638833	529912	3696473	215164	1095777
1982	648211	6877994	114366	668758	509559	3785730	201560	1119612
1983	652962	7037391	106025	687470	486801	3876686	199967	1127739
1984	671868	7221784	100956	710977	496197	4003810	185833	1144238
1985	690679	7432886	100974	738885	479585	4144420	171648	1165551
1986	711695	7612872	101205	758789	493457	4278457	172434	1175943
1987	736455	7788342	101754	777728	507707	4404392	172639	1192206
1988	764545	7960583	102287	796694	527105	4545146	172522	1206016
1989	795636	8134950	102800	822244	554615	4696964	174877	1231934
1990	829471	8321195	103280	850926	577893	4835793	176672	1256869

Table B.7: Total assets (mln 1990 US\$) and joint factor productivity (US 1990=100), 1840-1990

	Total assets				Joint Factor Productivity			
	Total economy		Manufacturing		Total economy		Manufacturing	
	UK	US	UK	US	UK	US	UK	US
1840	61469	27961	12745	2533	27.76	40.17		
1841	63206	30167	13201	2720	27.87	39.86	13.59	20.61
1842	64993	32416	13673	2921	27.98	39.59	13.32	20.67
1843	66831	34510	14162	3137	28.10	39.47	12.19	20.73
1844	68721	36661	14669	3368	28.21	39.36	12.43	20.82
1845	70665	39426	15193	3617	28.32	39.03	13.49	21.32
1846	73066	42750	15304	3885	28.37	38.55	13.96	21.85
1847	75571	46563	15416	4172	28.42	37.97	13.58	22.40
1848	78182	50427	15528	4480	28.47	37.49	14.14	22.97
1849	80906	54073	15642	4811	28.51	37.17	14.01	23.63
1850	83747	57676	15756	5166	28.54	36.93	13.70	24.13
1851	85838	61971	16381	5565	29.01	36.98	13.73	24.54
1852	87980	67026	17068	5994	29.49	36.90	14.13	24.98
1853	90163	72933	17817	6457	29.97	36.71	14.84	25.44
1854	92438	79565	18692	6956	30.46	36.45	14.53	25.93
1855	94785	86645	19504	7494	30.95	36.21	13.77	25.96
1856	96754	94386	20191	8074	30.07	35.96	14.35	26.01
1857	98723	102974	20752	8699	32.17	35.66	14.61	26.07
1858	100742	111059	21252	9374	32.29	35.54	14.26	26.14
1859	102905	118082	21876	10101	32.00	35.63	14.39	26.22
1860	105159	125167	22500	10885	32.73	35.76	14.86	25.76
1861	107771	132016	23109	11989	32.97	35.71	14.69	24.00
1862	110494	136157	23781	13205	33.60	36.00	14.88	21.12
1863	113657	138610	24513	14545	32.86	36.49	14.58	22.02
1864	116983	140818	25245	16021	32.78	37.02	15.27	21.62
1865	120615	143669	25975	17647	33.31	37.47	15.99	19.15
1866	123900	150369	26643	19440	33.92	37.49	16.38	21.65
1867	126735	160425	27247	21415	33.54	37.19	15.41	21.09
1868	129265	172858	27850	23592	34.20	36.71	15.23	20.51
1869	131693	186656	28515	25991	33.34	36.20	14.72	21.64
1870	134387	202388	29302	28635	34.37	35.63	15.84	20.41
1871	137488	217096	30162	29239	34.91	35.64	16.76	20.66
1872	140753	234427	31144	29885	34.16	35.31	16.74	23.95
1873	144048	254699	32002	30576	34.38	35.17	16.78	22.57
1874	147863	273304	32984	31313	34.49	33.46	16.85	21.24
1875	151729	290689	34027	32101	34.87	33.75	16.33	19.96
1876	155769	307866	35193	32942	35.00	32.90	16.15	19.42
1877	159799	324489	36420	33840	35.07	32.69	16.19	20.24
1878	163614	341015	37398	34799	35.30	32.90	15.71	20.99
1879	167195	358746	38376	35823	36.29	35.76	14.92	22.95
1880	170490	378523	39168	36915	35.26	38.58	16.61	25.75
1881	173836	402486	39857	38532	35.81	38.25	16.89	26.97
1882	176957	429167	40361	40220	36.19	38.88	17.66	27.51
1883	180130	454643	40803	41981	36.04	38.19	17.61	26.94
1884	183445	479912	41307	43820	36.61	37.47	16.98	24.38
1885	186260	505380	41749	45739	36.23	36.29	16.12	23.42
1886	188627	534672	42254	47743	36.60	35.95	15.88	27.13
1887	191136	570643	42697	49835	37.21	36.02	16.98	27.41
1888	193686	607472	43016	52018	38.00	34.37	17.73	27.21
1889	196604	643107	43335	54297	39.08	35.29	18.61	27.95

Table B.8: Total assets (mln 1990 US\$) and joint factor productivity (US 1990=100), 1840-1990 (cont.)

	Total assets				Joint Factor Productivity			
	Total economy UK	Total economy US	Manufacturing UK	Manufacturing US	Total economy UK	Total economy US	Manufacturing UK	Manufacturing US
1890	199593	685612	43654	56675	38.82	34.18	18.37	28.85
1891	203011	723186	44208	63817	38.68	34.35	18.64	27.60
1892	206429	759624	44762	71151	38.06	36.26	17.51	27.59
1893	209826	797339	45440	78480	37.88	33.85	17.05	23.86
1894	213386	828046	46117	85323	39.56	32.68	17.69	22.91
1895	217008	859252	46857	93659	39.78	35.06	18.48	24.97
1896	220803	896339	47658	104611	39.96	33.61	19.59	21.90
1897	225057	932482	48583	113243	39.81	35.62	19.36	22.36
1898	230138	966409	49632	119501	40.83	35.62	20.09	24.54
1899	235607	1004949	50743	125717	41.49	36.98	20.48	24.70
1900	241290	1046464	51977	130293	40.81	36.77	20.04	23.97
1901	247830	1091803	53795	135322	40.32	39.46	19.62	25.57
1902	254922	1151895	55609	144842	40.78	38.36	19.30	27.20
1903	261840	1215895	57792	153550	39.75	38.82	18.39	25.88
1904	268687	1271517	60033	158950	39.65	37.42	18.18	25.44
1905	274901	1327722	62086	164822	39.99	38.69	19.24	26.83
1906	281218	1392930	63888	173035	40.40	41.13	19.60	27.22
1907	286453	1463034	65441	181687	40.65	40.50	19.81	26.29
1908	290657	1517578	66869	190442	39.48	37.19	18.20	21.91
1909	295106	1578781	68417	200518	39.90	39.95	18.12	25.96
1910	299576	1649820	70086	210818	40.01	39.20	17.75	25.74
1911	304086	1716683	71740	222627	40.35	39.54	18.81	23.78
1912	308862	1787744	73823	236136	40.55	39.96	19.22	27.17
1913	314373	1856817	75907	247408	41.32	40.39	19.89	27.75
1914	320057	1910958	78911	254111	40.41	37.18	18.43	26.56
1915	324262	1954824	82100	259980	41.16	37.88	19.71	30.08
1916	326129	2005596	84796	267231	40.55	41.56	18.67	32.23
1917	326383	2056560	87553	276131	39.78	39.99	17.43	30.34
1918	329629	2099337	91109	284137	39.80	42.98	16.60	29.30
1919	335969	2142044	95217	295835	38.77	42.62	16.82	25.67
1920	329730	2202264	95799	322584	40.68	41.67	17.37	26.75
1921	332351	2253183	96582	332865	32.79	41.52	15.18	24.69
1922	335261	2316130	97035	339812	34.49	41.79	17.24	29.61
1923	338171	2394249	97489	349748	35.98	44.99	18.19	30.74
1924	341952	2465457	97944	355111	37.90	45.97	19.81	30.22
1925	346896	2544226	99065	359774	40.05	45.45	20.25	33.01
1926	350388	2626933	99856	366336	38.45	47.10	19.81	34.06
1927	353879	2704224	100314	372735	42.86	46.97	21.17	34.41
1928	358529	2779661	101108	381082	43.41	46.78	21.04	35.19
1929	363472	2866254	101903	393639	45.29	48.37	21.66	37.14
1930	369001	2937226	102699	398616	45.28	45.26	21.44	33.76
1931	373073	2972238	103163	396043	43.49	43.92	20.66	31.30
1932	375403	2974781	102956	388084	43.59	40.91	20.62	25.98
1933	376861	2961724	102749	383317	44.17	40.11	21.73	29.20
1934	380351	2959671	103550	380120	46.01	41.12	23.07	29.61
1935	385005	2964172	104015	377734	47.03	43.00	24.79	34.31
1936	391110	2996230	105830	380160	47.89	46.74	26.14	38.19
1937	397798	3032039	107986	387374	48.21	46.70	26.76	38.32
1938	405064	3051550	109471	386163	48.49	46.31	26.02	32.71
1939	414828	3078663	114689	386386	47.37	48.68		39.35

Table B.9: Total assets (mln 1990 US\$) and joint factor productivity (US 1990=100), 1840-1990 (cont.)

	Total assets				Joint Factor Productivity			
	Total economy UK	Total economy US	Manufacturing UK	Manufacturing US	Total economy UK	Total economy US	Manufacturing UK	Manufacturing US
1940	423824	3109864	125028	392261	53.43	50.95		42.98
1941	430320	3167081	132746	406467	58.40	57.58		50.56
1942	434045	3234754	138045	409808	59.49	65.69		57.61
1943	434908	3287161	140727	408596	61.76	77.57		64.53
1944	433468	3321258	141757	413532	60.43	84.22		63.43
1945	419925	3354898	137689	427604	59.60	81.63		56.59
1946	421666	3351410	138398	454760	54.59	62.95		46.34
1947	427063	3398092	141476	485137	51.31	59.86		48.72
1948	436175	3464101	144779	508700	51.73	61.29	25.12	49.26
1949	446374	3538249	149256	520640	52.98	61.49	26.10	48.07
1950	458106	3634837	154437	534770	53.78	65.19	27.10	53.38
1951	469694	3742939	160023	558292	54.47	68.37	27.46	56.10
1952	480425	3854914	164801	582325	53.97	69.74	26.36	56.46
1953	492044	3976840	169744	605017	55.49	70.85	27.40	57.97
1954	505702	4100510	175390	625594	56.65	70.66	28.40	55.60
1955	521536	4231360	181647	646191	57.65	72.77	29.39	59.48
1956	539167	4374334	189411	677436	57.51	72.30	28.73	58.24
1957	548991	4517796	197881	706656	58.12	72.64	28.85	57.89
1958	569839	4637041	206096	721622	57.83	72.67	28.31	55.20
1959	585705	4770352	211883	733702	59.35	74.80	29.63	59.42
1960	595720	4912374	220097	752714	61.64	74.86	30.79	58.71
1961	616269	5052791	227830	770118	62.60	75.95	30.23	59.34
1962	635416	5208062	237458	788924	62.52	78.79	30.25	62.49
1963	646526	5379124	240468	809405	64.49	80.88	31.71	66.49
1964	668881	5580600	238475	837763	66.64	83.58	33.89	69.51
1965	704550	5823964	247456	878874	66.95	85.95	34.33	72.22
1966	742549	6092933	259555	932368	66.92	87.62	34.42	73.15
1967	776371	6357121	269000	981994	68.28	87.39	35.10	70.96
1968	814190	6632475	281005	1029702	70.43	88.65	37.18	72.47
1969	839862	6916434	288744	1079471	71.21	88.61	37.99	72.24
1970	878545	7182894	300047	1125786	72.16	87.73	37.91	69.00
1971	912133	7439450	302147	1164675	73.56	89.82	38.64	71.49
1972	932646	7704118	306490	1203794	75.71	92.45	40.44	75.75
1973	941225	8013262	303288	1251647	79.70	94.10	43.64	79.79
1974	982358	8321008	313604	1314255	77.24	91.41	42.58	75.01
1975	1016164	8569535	328028	1364079	76.37	90.75	40.90	73.28
1976	1046061	8812992	325375	1414420	78.45	93.29	42.91	77.44
1977	1052503	9080990	322689	1468847	80.11	95.02	43.55	80.11
1978	1055087	9401061	317077	1532506	82.57	95.77	44.09	80.19
1979	1083666	9740977	313442	1600915	83.39	95.07	44.27	79.78
1980	1116991	10066467	328996	1665224	81.02	93.67	41.48	76.71
1981	1169730	10392194	330294	1734610	81.26	94.60	42.54	76.76
1982	1157770	10663725	315926	1788371	84.04	92.69	45.08	75.05
1983	1139763	10914077	305992	1815209	88.41	94.86	48.89	80.58
1984	1168066	11225594	286789	1855215	88.42	97.44	52.09	86.27
1985	1170264	11577307	272622	1904436	90.74	98.19	54.22	89.29
1986	1205152	11891328	273639	1934733	93.78	99.01	55.87	92.43
1987	1244162	12192734	274393	1969934	95.95	99.56	59.04	97.37
1988	1291650	12505729	274809	2002710	97.39	100.68	62.47	100.41
1989	1350251	12831914	277677	2054179	96.10	100.84	64.78	100.35
1990	1407363	13156988	279952	2107795	94.00	100.00	64.70	100.00

Figure B.1: Total economy, 1840-1990

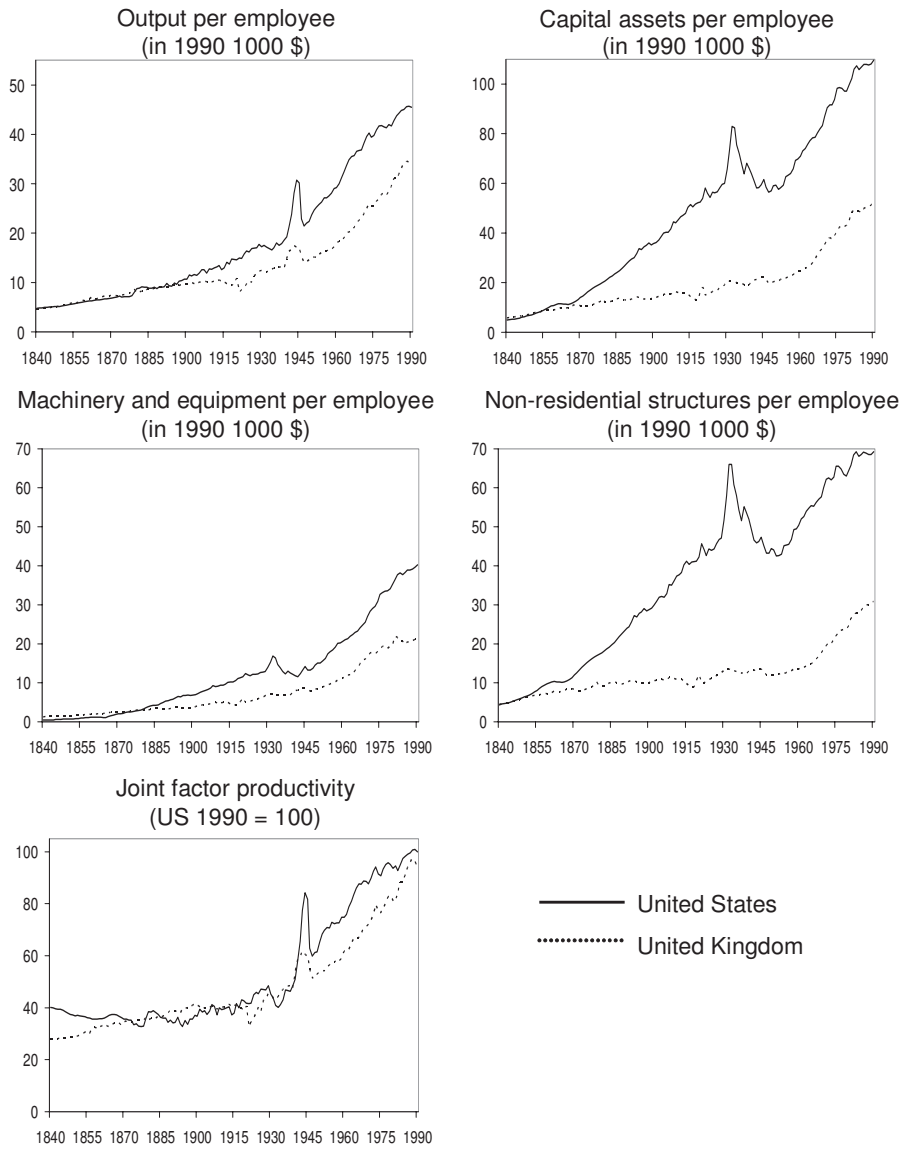
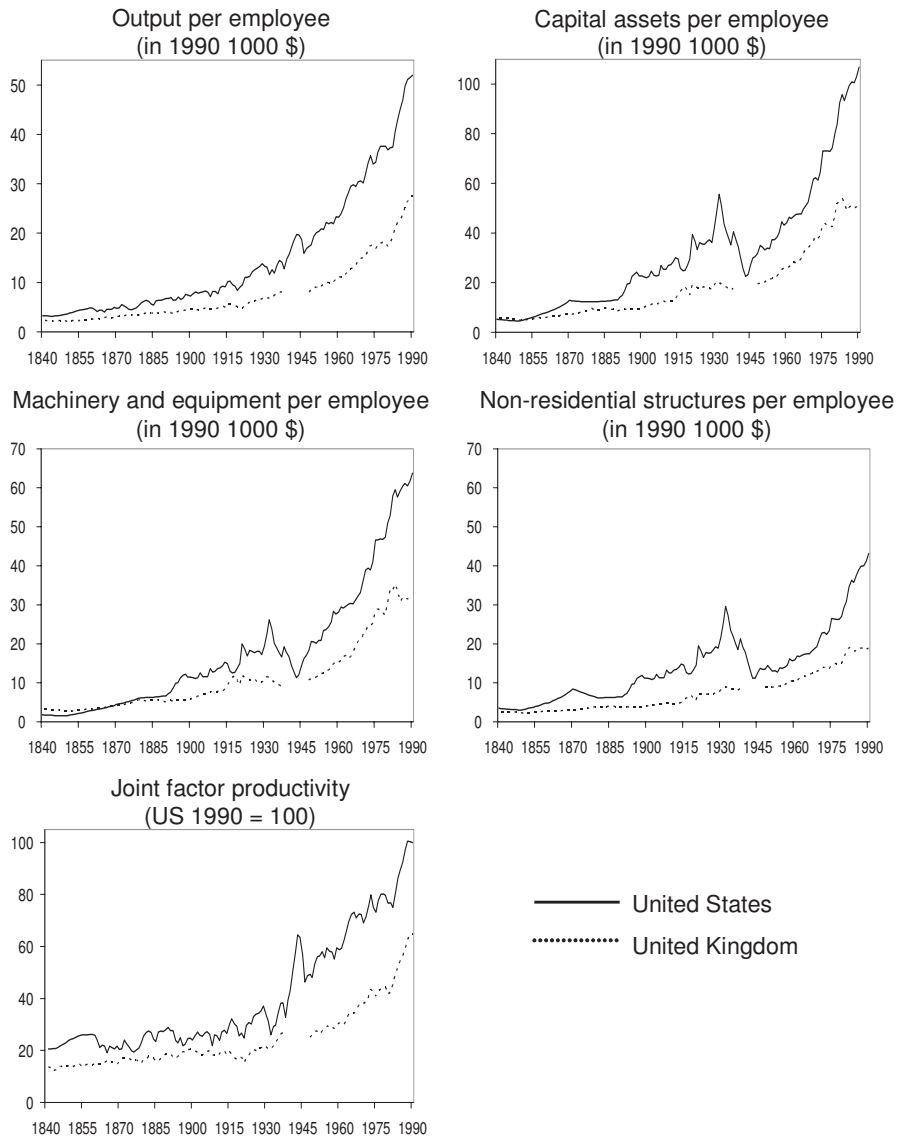


Figure B.2: Manufacturing, 1840-1990



B.2 Chapter 4

The current section lists, for France, Germany, the UK and the US, the underlying time series for the model variables in Chapter 4. These series are value added, capital services, total hours worked, stocks of the number of patent applications cumulated over 10 years, business enterprise R&D expenditures, and the number of researchers, scientists and engineers (RSE) in business enterprise.

The series cover the post-war period 1956-1996 for the market sector and the manufacturing sector. The series of value added and capital services were in the datasource presented as index numbers, with 1993=100. Other series are in levels.

Value added, capital services and total hours worked Labour productivity is measured as value added per hour worked, and capital intensity as capital services per hour worked. The underlying data are from O'Mahony (1999): Tables A (value added), B (number of employees in 1000s), C (average hours worked), E (capital services), and H (relative levels of value added and capital services per hour worked in 1993, UK = 100). The data are for the market sector and manufacturing sector. Compared to data for total economy (GDP), those for the market sector are preferred, because the reliability of the measurement of non-market output is lower and varies across countries (O'Mahony, 1999,p.4).

Value added is based on series of gross value added at constant prices, which are derived from national accounts of the countries' own statistical offices (O'Mahony, p.41).

Capital measures differ substantially across national statistical offices, so that O'Mahony constructed her own, internationally comparable capital data. The capital stock exist of structures and equipment assets. Assumptions were a common depreciation rate across countries and a geometric form for the depreciation function. "Capital input was then defined as the services of capital assets where the stocks of structures and equipment were weighed by their shares in the value of capital, which in turn is derived by multiplying stocks of both assets by their user costs" (O'Mahony, p.4).

Both value added and capital services series have been deflated and converted into 1993 PPPs (O'Mahony, p.3).

Average hours worked (O'Mahony, Table C) multiplied by the number of employees in 1000s (O'Mahony, Table B) give the total hours worked as presented in the current appendix. The numbers of persons engaged include all full time and part time employees and self-employed (O'Mahony, p.43). The various data sources for average hours worked are generally less comparable across countries than persons engaged do. Average annual hours worked is the product of average weekly hours and average weeks worked per year (O'Mahony, p.44).

In order to convert the current series on labour productivity and capital intensity into comparative levels (with US =100), the foregoing series are combined with data on comparative levels in 1993, provided by O'Mahony. These are summarized in Table B.10 below.

Patent applications Stocks of patent numbers cumulated over 10 years proxy the levels of technology. These patents are national applications, including applications by both residents and foreigners.

Table B.10: Comparative labour productivity and capital intensity (US=100), 1993

		market sector	manufacturing
value added per hour worked	France	94.1	81.9
	Germany	98.6	73.6
	UK	77.9	64.9
capital services per hour worked	France	110.2	110.7
	Germany	112.8	97.8
	US	84.9	69.8

Source: O'Mahony (1999), Table H, pp.184-185.

Application numbers of all countries from 1973 onwards: OECD (1991, Table 20) for 1973-1974; OECD (1995a, Table 20) for 1975-1987; OECD (1997a, Table 73) for 1988-1991; OECD (1999a) for 1992-1996. Before 1973 various sources:

- France: Institut National de la Propriété Industrielle for 1962-1972, WIPO (1983) for 1946-1961.
- Germany: Deutsches Patentamt for 1949-1972.
- UK and US: WIPO (1983) for 1946-1972.

R&D expenditures R&D effort is proxied by R&D expenditures divided by value added. The R&D series concern total business enterprise R&D expenditures. Total R&D (including public R&D) would not reveal the innovative effort of the private sector. The R&D time series in current national prices between 1956 and 1976 were largely from Verspagen (1996, updated series). Missing data for the UK for 1971-1974 were partly filled with ANBERD data from OECD (1995b), partly with assumptions on the development of R&D in the series. Data after 1976 are from OECD (1999b).

Data for manufacturing are collected from various sources. The period 1976-1996 is from OECD (1999b); 1973-1975 from OECD (1995b). Data before 1973 source from:

- France 1970-1972, Germany 1971-1972, US 1970-72: OECD (1984).
- France and Germany 1966-1969/1970: assumed that manufacturing R&D is 90% of total business enterprise R&D in current national prices.
- UK 1966-1969 en (with some manipulation) 1972: CSO, Annual Abstracts of Statistics, various issues 1970 to 1979. Assumed is that in 1970 and 1971 92% of total R&D is in manufacturing.
- US 1958-1970: Historical Statistics of the USA, US (1975), Series W144, p.966.

The R&D series are converted into constant prices with a Gross Domestic Product price index (1993=100). The index is composed (with some recalculations) from data from OECD (1966) for 1955-1960, OECD (1997b) for 1960-1993 and OECD (1998a) for 1994-1996. Special R&D price indices would be preferred, as "such special price indices indicate a higher rate of inflation for R&D than in the economy at

large" (OECD, 1984, p.309). So R&D growth rates calculated from time series based on GDP indices may appear too optimistic.

The R&D series were then converted into 1993 PPP dollars. The 1993 PPPs are market sector PPPs from O'Mahony (1999, Table 3.1, p.38), recalculated into national valuta per dollar. For the UK, this is £0.74627, for France *FFr* 7.74627, and for Germany *DM* 2.28358. These PPPs are also applied on the manufacturing R&D series, as no separate manufacturing PPPs were available.

In order to calculate comparative levels and log-levels of $R\&D/Y$, the value added for both the market sector and manufacturing in 1993 is calculated with data from Van Ark (1996, updated). The 1993=100 index of O'Mahony is then used to calculate the levels of value added before and after 1993. For convenience, $R\&D/Y$ is calculated as R&D expenditures in dollars per 1000 dollars value added for the market sector, and for manufacturing per 100 dollar value added.

Researchers, scientists and engineers The period 1976-1996 is largely from OECD (1999b), 1973-1975 is from OECD (1997c). For France and Germany there are some additions. OECD (2002b) provides 1996 data for France for both manufacturing and market sector. Germany 1994-1996 is guesstimated with data for total business enterprise in 1995 and 1996 for unified Germany. For the market economy, 1966-1972 is based on OECD (1984, nr.2), Graph 28, p.346. For manufacturing, no data before 1973 were available.

Table B.11: Real value added (1993=100), 1956-1996

	Market sector				Manufacturing			
	France	Germany	UK	US	France	Germany	UK	US
1956	28.8	31.1	42.8	34.6	26.5	32.4	48.6	40.7
1957	30.6	32.0	43.6	35.2	28.8	34.6	49.7	40.9
1958	31.4	33.1	43.4	34.8	29.8	36.5	51.7	37.1
1959	32.4	35.3	46.4	37.1	30.5	39.9	55.4	41.4
1960	35.0	38.6	49.8	37.8	33.6	45.2	60.7	41.4
1961	36.9	40.3	50.4	38.7	36.1	47.8	61.7	41.4
1962	39.5	42.2	51.1	40.8	38.8	50.0	62.7	45.0
1963	41.5	43.3	52.8	42.6	41.8	50.6	65.9	48.7
1964	44.6	46.5	56.8	44.9	45.6	55.4	71.9	52.2
1965	46.8	49.1	58.5	47.7	47.8	59.6	73.9	56.8
1966	49.4	50.3	59.2	50.4	52.3	60.1	75.2	61.3
1967	51.7	49.7	59.8	51.6	54.8	58.3	75.7	61.1
1968	53.7	52.8	63.0	53.8	57.8	64.4	81.0	64.3
1969	57.6	57.3	64.6	55.0	64.8	72.2	85.9	66.4
1970	61.0	60.4	65.7	54.7	69.6	75.7	88.2	62.1
1971	64.3	62.1	66.4	56.3	73.9	76.3	87.2	63.1
1972	66.9	64.6	68.6	59.5	77.4	78.6	89.3	69.1
1973	71.0	67.8	73.3	62.8	83.3	83.5	97.5	76.6
1974	74.2	67.2	71.4	62.0	84.8	83.1	95.8	72.8
1975	72.8	65.2	68.7	60.9	83.2	79.4	89.2	67.1
1976	75.0	69.2	70.0	64.3	88.1	85.7	90.9	73.7
1977	77.5	71.3	72.9	67.5	92.1	87.5	92.6	79.3
1978	79.6	73.4	75.9	71.0	94.3	89.0	93.2	82.6
1979	81.8	76.7	78.5	72.8	97.0	93.5	93.0	82.4
1980	83.2	77.1	75.2	71.9	96.4	91.4	85.0	77.0
1981	83.9	76.6	73.5	73.3	94.8	90.8	79.9	78.1
1982	85.9	75.4	75.6	71.3	95.7	87.5	80.1	74.1
1983	85.7	76.5	78.6	74.5	95.6	88.9	82.3	76.3
1984	86.3	78.8	81.3	80.1	94.5	91.5	85.5	82.6
1985	87.5	80.2	84.7	82.8	94.9	94.9	87.8	84.9
1986	90.1	82.0	87.9	85.4	94.9	95.8	88.9	86.9
1987	92.1	83.1	92.6	88.0	94.7	95.3	93.6	92.6
1988	96.2	86.5	97.1	93.0	100.2	98.2	100.2	99.0
1989	100.7	90.4	99.7	95.2	105.6	102.2	104.4	99.2
1990	102.6	96.4	100.7	95.4	107.6	108.0	103.8	98.7
1991	102.5	101.8	97.9	94.3	105.7	113.1	98.7	95.2
1992	102.9	103.3	97.3	96.6	104.0	109.7	98.5	96.4
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	102.3	101.9	105.2	106.4	105.3	102.0	104.8	109.0
1995	104.6	103.2	108.5	110.4	109.6	102.9	106.2	116.1
1996	105.9	103.6	111.6	114.8	111.9	102.7	106.9	120.6

Table B.12: Capital services (1993=100), 1956-1996

	Market sector				Manufacturing			
	France	Germany	UK	US	France	Germany	UK	US
1956	23.7	22.9	30.2	32.4	21.1	23.5	45.5	33.1
1957	25.0	24.4	31.8	33.4	23.0	25.6	48.1	34.4
1958	25.9	25.9	33.3	33.8	24.5	27.5	50.2	34.5
1959	26.8	27.6	34.9	34.5	25.7	29.5	52.0	34.6
1960	27.8	29.8	36.8	35.2	27.4	32.5	54.9	35.3
1961	29.2	32.1	38.8	35.9	29.7	35.7	58.9	35.8
1962	30.9	34.4	40.4	36.8	32.4	38.7	61.8	36.6
1963	32.7	36.4	41.9	37.8	35.2	40.9	63.4	37.6
1964	34.6	38.7	44.0	39.2	38.0	43.6	65.8	39.3
1965	36.5	41.0	46.4	41.2	40.7	47.0	69.3	42.1
1966	38.6	43.0	48.7	43.7	43.5	49.7	72.5	45.6
1967	40.8	44.3	51.1	45.7	46.1	50.9	75.1	48.4
1968	43.0	45.8	53.6	47.8	48.6	52.6	78.2	50.7
1969	45.6	48.2	56.0	50.0	51.8	56.2	81.8	53.1
1970	48.2	51.4	58.4	51.9	55.7	61.0	85.5	55.0
1971	50.9	54.6	60.4	53.5	59.6	65.1	87.9	56.1
1972	53.9	57.3	61.9	55.7	63.3	67.7	88.5	57.8
1973	57.3	59.4	64.0	59.2	67.4	69.1	90.2	59.9
1974	60.2	60.7	66.0	62.2	70.1	69.7	93.0	63.4
1975	62.1	61.8	67.3	63.6	70.9	69.8	94.0	65.2
1976	64.3	63.2	69.2	65.0	72.1	70.5	94.5	67.0
1977	66.4	64.7	71.1	67.3	73.5	71.4	95.4	69.5
1978	68.5	66.5	73.5	70.4	75.0	72.3	96.9	72.4
1979	70.9	68.8	75.8	73.8	76.3	74.1	98.9	75.5
1980	73.6	70.9	77.0	76.4	78.2	76.4	98.8	78.3
1981	75.9	72.5	77.1	78.8	79.2	77.6	95.9	81.3
1982	77.9	73.6	77.7	80.0	79.8	77.8	93.5	82.7
1983	79.4	74.8	78.4	81.2	80.2	77.4	91.6	82.2
1984	80.6	76.0	79.8	83.5	81.1	77.8	91.4	83.2
1985	82.3	77.8	81.6	86.3	82.8	79.3	92.2	85.0
1986	84.0	79.7	83.2	88.3	84.6	81.3	92.8	85.3
1987	86.0	81.8	85.3	90.0	86.9	83.7	94.0	86.7
1988	88.7	84.3	88.5	91.9	90.1	86.1	96.4	87.9
1989	91.5	87.3	92.6	94.2	93.7	89.2	99.8	90.9
1990	94.6	91.2	95.5	95.9	97.6	93.5	102.0	93.6
1991	97.4	95.8	97.2	96.8	100.5	98.1	101.8	95.6
1992	99.3	99.1	98.8	97.8	101.5	100.9	101.1	97.0
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	101.0	100.3	101.4	103.8	99.3	98.4	99.3	104.8
1995	102.8	100.9	103.1	107.6	99.5	97.8	99.5	110.7
1996	105.9	103.6	111.6	114.8	111.9	102.7	106.9	120.6

Table B.13: Total hours worked (mln), 1956-1996

	Market sector				Manufacturing			
	France	Germany	UK	US	France	Germany	UK	US
1956	32491	51202	44379	112589	10102	20003	17412	34518
1957	32719	51131	44003	111047	10440	20177	17408	33909
1958	32389	50500	42784	106601	10381	20039	16929	30952
1959	31988	49766	43197	109571	10123	19919	17129	33070
1960	32255	50102	43598	110262	10366	20085	17683	32949
1961	32361	50051	43375	108963	10491	20300	17660	32105
1962	32606	49251	43278	110920	10637	19884	17276	33551
1963	32784	48119	43296	111621	10771	19461	16997	33855
1964	33127	48546	43877	113247	10893	19497	17436	34551
1965	33049	48192	43338	116578	10702	19742	17430	36385
1966	33202	47354	42439	120083	10799	19278	17310	38842
1967	32944	44434	41277	120335	10640	17742	16555	38756
1968	32581	44177	40749	122001	10447	18084	16410	39209
1969	32736	44464	40891	125308	10753	18868	16496	39849
1970	32607	44476	39454	122750	10881	19188	16156	37299
1971	32351	43874	37826	121603	10954	18637	15268	35723
1972	32126	43132	37349	125003	10959	18109	14740	37205
1973	32091	42645	38464	130356	11094	18097	14946	39341
1974	31762	40964	37700	130213	11035	17308	14688	38537
1975	30468	38740	36284	125085	10470	15839	13674	34867
1976	29794	39014	35842	128570	10122	15906	13408	36543
1977	29606	38205	35997	133522	9996	15709	13461	38010
1978	29303	38028	36009	140205	9732	15480	13300	39737
1979	29091	38084	36068	144934	9546	15585	13036	40640
1980	28920	38250	35435	143348	9409	15537	12264	38887
1981	28195	37611	33211	144164	8992	15070	11013	38797
1982	26833	37086	32347	140558	8490	14622	10360	35620
1983	26317	36213	31971	142494	8271	14090	9903	35751
1984	25877	36103	32429	151085	8047	14037	9776	37968
1985	25217	35754	32738	154157	7767	13994	9683	37598
1986	25021	35957	32677	155033	7629	14110	9413	37080
1987	25102	35865	33201	159665	7480	14040	9431	37235
1988	25426	36198	34265	163432	7390	14001	9540	38279
1989	25609	36421	34639	167220	7376	14023	9432	38367
1990	25840	37233	34870	166603	7391	14138	9166	37496
1991	25700	37791	33140	163932	7284	14243	8268	36269
1992	25251	38277	31801	163052	7073	14103	7846	35680
1993	24362	36985	30933	166768	6686	12855	7515	36042
1994	24157	36387	31244	172109	6488	12210	7646	36756
1995	24448	35651	31985	177747	6514	11876	7897	37394
1996	24498	35049	32580	180910	6443	11339	7962	37253

Table B.14: Number of patent applications cumulated over 10 years, 1956-1996

	France	Germany	UK	US
1956	254966		349245	708252
1957	259710		354365	706881
1958	268558		363016	715607
1959	281432		374164	726504
1960	293078	569300	387392	738669
1961	307011	567287	403690	761395
1962	322876	568060	419735	783184
1963	339464	568141	434802	795017
1964	356927	573350	450035	805106
1965	375669	584955	467991	822233
1966	396108	598953	486732	835547
1967	415937	613446	505524	849413
1968	438145	624366	525242	865255
1969	448223	634381	544361	887962
1970	459060	643390	561554	911416
1971	468721	650958	575821	932749
1972	475888	658529	586915	946867
1973	480673	663721	595759	965077
1974	479020	662491	598905	980023
1975	471664	656116	596798	986408
1976	462068	650353	592888	1000227
1977	452705	643259	588021	1012994
1978	439641	639141	579777	1020748
1979	437400	637575	572322	1021262
1980	435198	638211	569858	1024305
1981	434417	639381	571136	1028249
1982	434683	643289	573576	1041185
1983	436769	650354	576471	1043420
1984	446329	662135	586157	1055305
1985	460652	677721	600166	1071096
1986	477947	693424	615721	1090893
1987	498707	712073	633998	1123413
1988	524250	735692	660215	1169092
1989	553353	760288	688844	1228237
1990	587191	788684	720179	1297352
1991	616003	816951	745431	1365179
1992	647260	844629	772458	1438902
1993	676846	870527	798866	1521959
1994	706474	899971	825929	1614791
1995	737945	933911	855560	1730160
1996	775288	979054	890910	1826661

Table B.15: Business enterprise R&D expenditures (mln 1993 PPP\$), 1956-1996

	Market sector				Manufacturing			
	France	Germany	UK	US	France	Germany	UK	US
1956	476	1705	3237	33796				
1957	599	2149	3677	37976				
1958	790	2262	4270	40942				40156
1959	1021	2712	4665	45353				44045
1960	1270	2651	4962	49323				47629
1961	1473	3646	5287	50249				49010
1962	2155	4075	5863	51587				50289
1963	2787	4577	6213	56277				54717
1964	3421	5146	6070	59318				57455
1965	4191	5979	6059	60503				58434
1966	4539	6434	6339	64337	4085	5791	5868	61782
1967	4961	7065	7393	65845	4465	6359	6847	63237
1968	5044	7583	7514	66575	4540	6824	6976	63882
1969	5490	8290	7597	66636	4941	7461	7051	63899
1970	5611	9634	7605	62199	4996	8671	6997	59300
1971	5922	10569	7424	59831	5460	9471	6830	57387
1972	6250	10666	7313	60735	5836	9509	6684	58632
1973	6282	10549	8078	62082	5858	9683	7365	59996
1974	6602	10677	8144	61392	6142	10002	7427	59332
1975	6706	11481	7564	59021	6225	10496	6875	57274
1976	6955	11908	8105	61959	6457	10960	7307	60020
1977	7120	12330	8365	64097	6623	11374	7518	62038
1978	7218	13908	8932	66546	6742	13004	8075	64091
1979	7651	15757	9888	70157	7115	14389	9084	67330
1980	8016	15991	9702	74705	7459	14905	9017	71658
1981	8560	16406	9612	79330	7932	15251	8994	76412
1982	9002	17216	9458	84534	8297	15993	8874	80972
1983	9107	17577	9285	90570	8426	16344	8698	85939
1984	9688	18145	9811	99826	8989	17029	9176	93280
1985	10358	20368	10330	108666	9599	19109	9537	100005
1986	10510	21038	11637	110520	9716	19848	9127	101150
1987	10973	22249	11805	112564	10173	21120	9507	102983
1988	11569	23019	12163	113992	10660	22070	9637	101640
1989	12475	23938	12541	114918	11484	22984	9997	99119
1990	13251	24109	12818	118615	12237	23159	10379	96138
1991	13546	23715	11760	122150	12476	22907	9378	92440
1992	13986	22957	11732	121470	12425	22141	9247	91964
1993	13837	22075	12152	117399	12269	21105	9529	90931
1994	13773	21500	12112	117210	12219	20689	9478	94386
1995	13657	21637	11914	124828	12062	20877	9391	98497
1996	13865	21733	11701	133662	12154	21037	9194	107655

Table B.16: Number of researchers, scientists, and engineers (FTE), 1964-1996

	Market sector				Manufacturing			
	France	Germany	UK	US	France	Germany	UK	US
1964	15000							
1965	17000			350000				
1966	19000			360000				
1967	20000	40000		370000				
1968	22000	43300	67000	380000				
1969	24000	46600	67500	385000				
1970	25000	50000	67000	375000				
1971	26000	53000	65000	360000				
1972	27000	56000	63000	350000				
1973	27961	59038	60075	360000	26043	56209	53939	345700
1974	28714	60062	60530	363300	26563	56882	54359	348500
1975	29433	61591	61655	364400	27004	58156	55389	350100
1976	30331	63535	63288	382800	27884	59998	56857	367900
1977	30952	66223	65423	404400	28554	62672	58758	389400
1978	31697	69997	67077	423900	29217	66542	61516	406800
1979	32489	73521	71302	450600	29751	70075	65160	430800
1980	33530	75562	74609	487800	30588	72124	69164	465600
1981	35095	77017	76780	509800	31819	73528	71762	482800
1982	37366	78812	78122	540900	33930	75059	72931	509700
1983	38269	81867	78933	584100	34832	77782	73358	534300
1984	41515	86988	79579	622500	37703	82633	73635	555700
1985	43863	93546	80900	671000	39757	88981	73900	595900
1986	45403	100734	87000	695800	40856	96117	75830	599400
1987	49157	107113	87000	708600	44018	102275	76210	606700
1988	51842	111218	89000	722492	45976	105645	78320	597272
1989	54352	113247	85100	743595	47525	108014	75200	590873
1990	57030	116588	83000	773424	49900	111605	72029	593762
1991	59594	118831	80000	779300	51768	114141	68659	576512
1992	64688	118254	82000	764700	54464	113565	65401	568200
1993	66455	114958	86200	768500	55822	110169	62400	594048
1994	66714	115696	85200	746100	55857	108754	62900	568984
1995	66618	116433	82825	832800	55744	108683	62831	630448
1996	68487	113753	79847	885700	57017	104653	61606	665600

B.3 Chapter 5

The time series used in Chapter 5 are value added, capital services, total hours worked, stocks of the number of grants cumulated over 10 years, and business enterprise R&d expenditures. The data were collected for twelve manufacturing branches and four aggregations of some of these branches. The industry classification is based on O'Mahony and de Boer (2002) and linked to the ISIC Rev.2 classification as used by the OECD until a few years ago (Table B.17).

Table B.17: Classification of manufacturing industries

Manufacturing branch	OECD ISIC rev.2
Chemicals and allied products	351 + 352 + 355 + 356
... Chemical products	351 + 352
... Rubber and plastics	355 + 356
Basic metals and metal products	37 + 381
... Basic metals	371 + 372
... Metal products	381
Total machinery and equipment	38 - 381
... Office equipment and machinery	382
... ... Machinery	382 - 3825
... ... Office equipment	3825
... Electrical and electronic equipment	383
... Optical equipment and instruments	385
... Motor vehicles	3843
... Other transport equipment	384 - 3843
Food, beverages and tobacco	31
Textiles, clothing and leather	32

The time series run from 1973 to 1993. A systematic collection of R&D data is lacking for the years before 1973. Furthermore, in the early 1990s, the third revision of the ISIC classification was carried out by the OECD. Besides, the unification of West-Germany and East-Germany also brought along its own data problems. The cost of linking of the series in ISIC Rev.2 to Rev.3, and those of West-Germany with unified Germany, is not offset by the benefit of longer time series of a few years more. After all, these data problems underline the importance of good data.

The series of value added and capital services are in index numbers, with 1996=100 for value added and 1993=100 for capital services. Other series are in levels.

Value added, capital services and total hours worked Labour productivity is measured as value added per hour worked, and capital intensity as capital services per hour worked. The underlying data are from O'Mahony (1999) for capital services and O'Mahony and De Boer (2002) for value added and hours worked. The data of O'Mahony and De Boer (2002) were downloaded from the NIESR site (www.niesr.ac.uk/research/nisec.htm).

Value added is based on series of gross value added at constant prices, which are derived from national accounts of the countries' own statistical offices (O'Mahony and De Boer, 2002).

As O'Mahony and De Boer (2002) do not provide capital series data for Germany before 1989, the capital series from O'Mahony (1999) were used. Capital measures differ substantially across national statistical offices, so that O'Mahony (1999) constructed internationally comparable capital data. The capital stock consist of structures and equipment assets. Assumptions were a common depreciation rate across countries and a geometric form for the depreciation function.

Both value added and capital services series have been deflated and converted into PPPs (1996 PPPs for value added, and 1993 PPPs for the capital series).

Average hours worked multiplied by the number of employees in 1000s give the total hours worked. The numbers of persons engaged include all full time and part time employees and self-employed. The various data sources for average hours worked are generally less comparable across countries than persons engaged do. Average annual hours worked is the product of average weekly hours and average weeks worked per year.

In order to convert the current series on labour productivity and capital intensity into comparative levels (with US=100), the foregoing series are combined with data on comparative levels in 1993 and 1996. These are summarized in Table B.18 below.

Table B.18: Comparative labour productivity (1996) and capital intensity (1993), UK=100

<i>Labour productivity, 1996</i>			
	France	Germany	US
Electronical/electric equipment	121.0	144.5	185.2
Office and computing equipment		124.2	
Chemical products	138.1	102.4	165.6
Rubber and plastics	110.8	100.9	132.1
Food, beverages and tobacco	179.6	115.5	146.7
Textiles, clothing and leather	103.6	93.4	141.2
<i>Capital intensity, 1993</i>			
	France	Germany	US
Electronical/electric equipment	158.8	154.9	197.3
Office and computing equipment		309.0	368.8
Chemical products	102.0	95.2	158.8
Rubber and plastics	132.2	127.0	109.0
Food, beverages and tobacco	190.4	238.5	118.8
Textiles, clothing and leather	154.0	104.4	126.4

Source: Labour productivity: O'Mahony and De Boer (2002); capital intensity: O'Mahony (1999).

US grants Stocks of patent numbers cumulated over 10 years proxy the levels of technology. These patents are grants assigned on the American market in various sectors of the economy. The data were provided by Verspagen (1996, updated).

R&D expenditures R&D effort is proxied by business R&D expenditures divided by value added. The R&D time series in current national prices were largely from the OECD ANBERD database (OECD, 1995b, 1997c, 1999b, 2000). Some missing data have been filled with assumptions on the development of R&D in the series.

The R&D series were converted into constant prices with a Gross Domestic Product price index (1996=100). The index is composed (with some recalculations) from data from OECD (1997b) for 1973-1993 and OECD (1998a) for 1994-1996.

The R&D series were then converted into 1996 PPP dollars. The 1996 GDP PPPs are from OECD (1999c). For the UK, this is £0.644, for France *FFr* 6.57, and for Germany *DM* 2.03.

In order to calculate comparative levels and log-levels of R&D intensity, the absolute level of value added for the UK in 1996 from OECD STAN (2002) is used together with the data of O'Mahony and De Boer (2002) (comparative levels of value added in 1996 and the time series for value added 1996=100).

Table B.19: Value added (1996=100), 1973-1993

	EE	OC	CH	RP	FO	TL
United States						
1973	18.5	2.7	55.2	33.6	74.8	79.1
1974	17.2	2.9	49.9	31.0	69.5	72.7
1975	15.9	3.0	48.7	28.1	67.2	74.6
1976	17.5	3.2	56.7	29.2	76.1	78.4
1977	20.9	4.0	62.6	34.0	82.9	78.0
1978	23.2	5.4	65.1	36.6	87.6	83.5
1979	24.8	6.8	62.6	38.9	89.4	84.9
1980	26.9	8.3	55.3	38.1	86.8	86.8
1981	28.0	9.7	59.6	42.0	85.4	89.7
1982	25.8	11.3	61.3	39.9	80.7	93.6
1983	27.2	14.0	65.4	43.8	87.2	90.8
1984	31.0	16.6	63.8	49.8	88.4	88.7
1985	32.2	17.5	64.4	53.7	86.8	92.0
1986	32.3	16.2	71.9	53.5	90.7	90.5
1987	35.2	18.8	79.1	59.7	94.8	94.9
1988	39.7	22.6	79.6	63.1	96.7	100.9
1989	43.3	23.6	80.2	69.4	98.1	94.1
1990	44.8	25.2	85.4	68.4	97.9	92.9
1991	47.5	25.6	84.1	70.6	97.4	92.3
1992	47.9	32.4	86.4	76.4	103.6	90.6
1993	55.5	39.3	85.9	82.9	103.3	92.8
United Kingdom						
1973	67.3	32.2	77.5	73.5	135.5	105.0
1974	68.2	34.3	77.8	71.0	128.6	101.0
1975	65.1	36.1	65.0	65.2	128.7	94.9
1976	66.5	30.6	73.1	73.0	129.3	99.4
1977	63.7	31.2	72.5	67.6	121.7	91.2
1978	67.2	33.9	71.3	66.6	125.5	92.1
1979	66.8	42.2	72.7	68.1	125.5	93.1
1980	66.1	38.9	62.8	61.0	107.4	92.8
1981	63.2	32.2	60.8	57.1	102.5	91.4
1982	67.0	39.3	59.3	56.4	97.8	89.8
1983	66.8	46.5	67.4	59.9	101.1	89.7
1984	72.1	54.1	73.3	61.9	106.5	82.0
1985	70.0	63.1	73.8	65.5	110.1	82.9
1986	69.1	63.5	78.3	69.7	111.2	85.7
1987	70.7	75.4	88.9	79.7	118.7	90.2
1988	76.9	92.2	93.3	83.2	117.3	90.4
1989	76.1	92.0	94.5	87.8	113.2	94.7
1990	73.2	90.5	88.6	89.6	111.3	97.5
1991	67.1	84.7	84.9	83.8	100.9	96.0
1992	74.0	67.6	87.8	86.0	101.4	97.7
1993	78.9	68.0	89.7	89.9	101.2	98.0

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.20: Value added (1996=100), 1973-1993 (cont.)

	EE	OC	CH	RP	FO	TL
France						
1973	32.5		46.9	72.2	141.6	84.7
1974	38.3		47.9	71.1	149.4	80.0
1975	40.0		43.8	65.1	143.7	88.2
1976	42.2		46.7	68.8	142.3	90.5
1977	45.6		50.0	70.0	143.2	92.4
1978	49.6		52.6	75.3	137.2	95.2
1979	52.8		57.4	77.7	139.2	96.6
1980	55.5		55.1	75.4	139.9	93.3
1981	56.2		56.7	69.7	137.4	92.0
1982	57.8		58.0	70.5	141.8	99.6
1983	59.0		62.1	72.5	141.5	92.4
1984	62.4		63.5	73.9	134.8	92.6
1985	64.0		64.9	74.8	131.4	96.0
1986	63.8		63.8	77.0	128.6	95.3
1987	65.2		66.6	81.4	120.9	90.2
1988	69.7		72.3	86.1	116.1	93.3
1989	74.5		78.7	90.5	117.8	99.4
1990	76.5		82.6	91.5	121.8	100.0
1991	79.1		82.2	89.7	115.0	101.5
1992	80.0		81.8	90.1	114.1	98.7
1993	79.0		84.5	83.4	105.7	102.5
Germany						
1973	59.4	19.8	61.0	60.6	193.1	100.4
1974	64.0	21.5	65.1	56.7	186.0	101.4
1975	60.2	20.6	56.9	51.3	182.7	98.9
1976	63.6	22.6	69.8	57.8	186.1	103.0
1977	67.9	26.6	72.7	59.6	183.1	102.1
1978	68.5	28.3	73.6	61.3	181.2	107.7
1979	72.7	30.8	80.7	68.0	181.2	111.8
1980	75.5	33.1	70.9	68.2	177.4	112.0
1981	76.3	36.2	72.8	67.0	167.5	112.2
1982	76.8	40.9	70.2	66.3	158.1	105.0
1983	77.7	44.9	79.4	70.7	155.0	106.3
1984	82.5	52.4	82.2	75.1	155.7	109.7
1985	89.0	60.7	83.2	79.5	157.9	109.4
1986	92.6	65.4	83.0	83.6	154.3	105.9
1987	96.5	72.0	82.2	86.6	152.2	101.0
1988	99.5	78.9	89.2	89.5	151.9	101.0
1989	107.6	81.6	92.0	94.4	154.0	100.5
1990	112.3	91.7	93.6	102.6	155.0	109.7
1991	117.6	132.4	96.2	106.4	152.1	113.8
1992	117.2	112.2	96.6	103.0	145.2	107.4
1993	107.0	96.5	93.8	98.4	131.1	106.3

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.21: Capital services (1993=100), 1973-1993

	EE	OC	CH	RP	FO	TL
United States						
1973	37.8		50.7	59.9	105.1	60.0
1974	41.2		54.7	64.1	107.2	61.9
1975	41.6		58.0	65.0	106.4	63.6
1976	42.4		61.3	66.6	106.1	65.4
1977	43.6		64.8	68.2	107.6	67.7
1978	46.3		68.4	71.3	108.4	69.6
1979	50.1		71.1	74.1	108.1	71.2
1980	55.3		73.4	74.8	107.8	72.9
1981	59.7		75.8	75.6	108.3	74.8
1982	64.8		77.2	75.9	106.2	77.1
1983	68.1		76.3	74.2	104.7	77.3
1984	74.7		75.8	76.3	104.8	77.6
1985	80.8		75.9	80.3	104.1	78.6
1986	83.8		75.5	81.8	101.8	78.9
1987	85.3		76.1	84.1	101.6	80.8
1988	87.8		78.3	86.2	101.6	82.5
1989	91.0		82.3	90.8	102.1	84.8
1990	94.8		85.3	94.1	102.3	87.2
1991	96.2		90.5	96.1	101.1	91.5
1992	96.5		95.4	98.3	100.0	95.5
1993	100.0		100.0	100.0	100.0	100.0
United Kingdom						
1973	59.0	33.4	87.7	94.4	151.4	79.8
1974	62.9	35.1	86.4	93.4	158.8	84.0
1975	64.5	36.1	87.1	89.9	156.7	85.2
1976	64.7	36.2	88.2	88.2	152.9	85.4
1977	66.0	37.6	89.2	88.1	148.9	87.4
1978	68.4	39.9	91.9	87.9	146.7	89.4
1979	71.3	42.5	94.2	87.6	144.5	91.1
1980	73.1	44.5	94.1	86.7	137.4	92.2
1981	73.7	44.3	91.1	83.4	129.0	91.4
1982	74.5	45.0	88.6	80.7	124.0	90.9
1983	75.6	48.0	86.9	78.8	119.7	90.2
1984	80.1	53.3	85.5	80.2	117.7	90.9
1985	83.9	63.4	86.3	81.7	116.8	92.3
1986	86.6	70.1	86.9	83.4	117.3	92.4
1987	88.9	75.4	88.1	87.3	118.6	92.6
1988	92.4	83.2	89.9	90.9	118.3	94.2
1989	98.7	89.9	93.3	95.9	115.7	96.0
1990	100.7	92.6	96.4	98.4	111.0	97.3
1991	99.7	95.7	98.9	98.0	106.4	98.2
1992	99.2	96.3	100.2	99.3	103.3	99.0
1993	100.0	100.0	100.0	100.0	100.0	100.0

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.22: Capital services (1993=100), 1973-1993 (cont.)

	EE	OC	CH	RP	FO	TL
France						
1973	39.8		59.1	62.2	109.1	76.5
1973	39.8		59.1	62.2	109.1	76.5
1974	43.2		61.2	65.0	109.2	77.6
1975	45.1		62.7	64.2	107.0	78.4
1976	47.7		64.3	64.4	106.5	79.0
1977	50.3		65.8	65.3	103.6	80.3
1978	53.5		67.8	65.7	101.6	81.6
1979	57.1		69.5	67.3	99.3	83.6
1980	60.1		71.1	68.7	98.5	85.2
1981	63.1		71.9	68.9	95.8	87.1
1982	66.1		71.9	68.6	95.7	88.5
1983	68.8		72.6	68.2	96.1	89.6
1984	72.0		73.5	68.1	96.8	92.6
1985	78.1		75.8	70.4	98.6	94.8
1986	84.0		78.1	73.2	99.2	95.5
1987	86.7		80.7	77.1	99.5	96.3
1988	89.8		84.2	82.9	102.2	97.6
1989	92.9		88.4	88.2	104.1	99.1
1990	98.9		92.8	94.6	106.2	99.9
1991	102.5		96.9	98.8	105.9	101.0
1992	102.9		99.4	100.1	103.4	101.5
1993	100.0		100.0	100.0	100.0	100.0
Germany						
1973	43.9	46.7	78.3	52.7	126.3	82.9
1974	46.0	50.3	80.6	52.8	122.9	82.7
1975	47.8	52.7	82.0	52.4	120.2	82.4
1976	49.1	54.6	82.8	53.1	118.6	82.9
1977	51.1	57.3	83.7	54.4	116.8	84.1
1978	53.0	59.6	83.6	55.7	115.0	84.6
1979	55.6	64.3	84.1	58.2	114.5	85.4
1980	58.8	68.7	85.0	61.0	113.0	86.2
1981	60.8	72.7	85.4	62.3	109.7	86.9
1982	61.5	75.1	84.9	62.6	106.7	86.5
1983	62.0	75.8	83.4	62.8	104.5	85.9
1984	64.4	78.0	82.9	64.6	103.1	85.4
1985	69.4	80.0	83.4	67.4	102.5	84.6
1986	75.1	81.7	84.9	71.0	102.1	84.0
1987	79.9	84.8	88.0	75.0	101.8	84.2
1988	83.6	89.1	90.5	79.0	101.8	85.1
1989	87.7	93.0	93.8	83.5	102.6	86.6
1990	93.2	98.5	97.2	90.0	104.3	89.6
1991	97.3	105.5	99.7	96.0	105.0	94.9
1992	100.5	108.5	101.2	100.0	103.6	98.9
1993	100.0	100.0	100.0	100.0	100.0	100.0

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.23: Hours worked (mln), 1973-1993

	EE	OC	CH	RP	FO	TL
United States						
1973	3216.2		1975.2	1465.3	3563.4	5229.9
1974	3173.7		1988.1	1428.7	3533.0	4843.7
1975	2707.8		1954.0	1199.5	3410.4	4357.8
1976	2862.3		2030.3	1323.4	3470.7	4715.8
1977	3047.1		2092.2	1467.8	3464.2	4673.2
1978	3271.1		2139.3	1544.4	3477.4	4719.6
1979	3431.7		2169.8	1591.8	3500.2	4555.5
1980	3360.4		2147.9	1456.6	3428.7	4387.5
1981	3380.2		2148.0	1489.0	3379.7	4311.4
1982	3165.4		2028.6	1346.9	3260.2	3798.7
1983	3299.9		2003.4	1458.2	3192.8	3983.3
1984	3635.9		2038.4	1661.4	3169.7	4054.0
1985	3570.9		2039.1	1615.9	3178.1	3736.9
1986	3465.7		1973.7	1644.6	3240.6	3747.7
1987	3387.8		1998.5	1724.3	3270.5	3857.6
1988	3403.5		2071.1	1760.3	3279.3	3807.1
1989	3344.3		2093.6	1794.4	3266.9	3819.6
1990	3245.0		2127.5	1802.6	3313.7	3650.6
1991	3069.4		2134.6	1750.3	3314.6	3573.8
1992	2975.9		2138.7	1802.4	3280.4	3582.4
1993	3019.5		2117.6	1875.7	3320.1	3568.7
United Kingdom						
1973	924.3	129.4	812.9	525.9	1474.3	1767.3
1974	945.2	127.1	818.5	520.9	1462.2	1671.9
1975	870.9	115.5	787.5	471.5	1381.5	1506.5
1976	830.5	109.3	788.1	476.1	1356.4	1460.8
1977	843.4	112.7	798.1	476.1	1353.2	1465.8
1978	849.5	105.8	800.2	468.6	1327.4	1417.0
1979	836.6	114.3	792.3	452.0	1318.9	1359.1
1980	813.9	118.8	750.8	417.0	1290.7	1215.8
1981	745.9	117.4	681.8	377.0	1205.7	1049.5
1982	693.3	120.8	647.3	358.9	1157.2	995.0
1983	675.3	124.7	609.2	357.9	1102.2	955.8
1984	674.4	129.4	610.9	369.9	1075.2	966.2
1985	664.7	136.1	596.8	370.3	1054.7	969.4
1986	637.4	127.0	580.8	368.4	1018.1	974.1
1987	631.5	127.0	571.5	389.5	1017.8	973.4
1988	630.0	130.0	570.7	413.9	1019.1	972.8
1989	621.9	127.2	570.0	416.7	1009.8	917.2
1990	598.7	120.3	553.1	418.6	983.5	880.0
1991	530.5	107.3	511.5	386.4	982.9	804.7
1992	483.2	88.8	497.8	376.0	928.3	770.7
1993	467.9	79.0	479.2	388.9	905.9	771.7

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.24: Hours worked (mln), 1973-1993 (cont.)

	EE	OC	CH	RP	FO	TL
France						
1973	565.8				1255.0	1597.6
1974	584.5				1235.7	1527.3
1975	564.9				1193.7	1441.0
1976	556.0		502.5	394.1	1155.7	1365.0
1977	557.0		502.2	396.0	1147.8	1315.5
1978	548.4		502.3	381.2	1141.2	1265.1
1979	543.1		495.3	374.2	1123.5	1222.1
1980	540.8		492.9	379.9	1109.8	1169.0
1981	524.5		477.1	363.8	1097.8	1070.1
1982	501.9		447.3	343.2	1056.9	1004.5
1983	492.5		431.9	330.9	1056.6	974.0
1984	490.8		430.9	325.7	1060.4	933.8
1985	479.2		425.9	313.1	1042.9	890.8
1986	483.6		423.9	313.8	1033.0	863.3
1987	474.5		419.0	317.9	1029.4	824.8
1988	470.3		417.9	324.3	1023.0	779.1
1989	471.4		418.9	334.5	1009.4	742.2
1990	477.2		418.7	343.4	994.1	714.8
1991	479.0		412.0	342.9	995.0	674.1
1992	462.3		403.6	334.3	984.5	637.2
1993	434.6		391.7	322.3	955.8	561.8
Germany						
1973	1496.1	190.4	1131.0	621.3	2013.6	1673.4
1974	1479.3	186.5	1160.9	580.2	1969.2	1498.6
1975	1310.5	153.0	1077.7	518.7	1876.4	1367.9
1976	1331.1	134.8	1069.0	554.3	1861.3	1340.3
1977	1312.9	134.6	1074.2	551.7	1834.5	1259.0
1978	1280.2	137.6	1054.8	540.5	1857.8	1227.9
1979	1294.4	133.4	1056.7	564.3	1846.2	1194.9
1980	1298.9	132.7	1036.4	586.8	1839.8	1168.4
1981	1265.7	128.5	1037.4	567.0	1815.0	1073.1
1982	1222.3	124.1	1034.9	564.1	1781.8	1008.5
1983	1190.8	128.9	1009.2	559.5	1738.5	950.1
1984	1200.8	145.7	1011.2	573.6	1697.8	932.5
1985	1235.2	149.8	1006.4	586.4	1654.1	895.5
1986	1269.0	155.7	1016.0	600.8	1622.7	867.9
1987	1301.0	158.5	1027.2	618.5	1618.0	841.6
1988	1290.7	169.4	1034.1	644.2	1586.3	814.6
1989	1316.9	163.4	1010.8	659.9	1567.9	774.4
1990	1325.5	164.8	1029.5	686.9	1583.6	736.0
1991	1303.5	195.7	1010.2	700.2	1624.8	694.7
1992	1261.9	180.6	1010.6	689.3	1593.2	644.4
1993	1164.9	126.9	952.2	636.2	1538.7	575.0

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.25: Number of US grants cumulated over 10 years, 1972-1993

	EE	OC	CH	RP	FO	TL	TOT
All countries							
1972	95590	11543	79624	18748	3474	3473	469092
1973	101280	12262	83415	19639	3640	3590	492455
1974	105591	12950	87752	20823	3816	3763	515784
1975	105744	13189	92125	21673	4080	3916	525143
1976	104806	13400	95297	22085	4333	4097	528692
1977	104692	13627	96765	22126	4456	4167	530281
1978	105381	14013	99629	22689	4477	4280	536768
1979	101714	14034	97968	22224	4370	4133	522981
1980	99533	14254	98838	22347	4413	4070	520407
1981	95431	13949	101064	22704	4326	4014	511425
1982	93786	13963	97774	22333	4211	3879	499142
1983	91395	14201	96854	22511	4198	3852	488668
1984	91491	14755	96001	22731	4103	3889	484985
1985	93795	15761	94598	22871	4016	3923	487705
1986	96199	16767	91316	22786	3849	3886	489574
1987	102974	18115	90501	23317	3821	3939	506085
1988	108249	19636	89435	23574	3911	3953	518045
1989	119244	22395	93819	25188	4309	4232	557082
1990	127257	24429	96277	26219	4511	4318	582228
1991	136575	26617	98729	27065	4651	4337	608742
1992	146200	29076	103441	28559	4834	4468	642643
1993	156602	32087	109007	29928	4965	4645	677975
United Kingdom							
1972	4658	459	3378	839	96	210	23159
1973	4859	472	3565	885	96	216	24111
1974	5016	485	3804	965	106	239	25200
1975	4955	480	4056	1029	132	254	25595
1976	4954	488	4327	1089	157	279	25941
1977	4900	500	4506	1113	169	277	25830
1978	4924	512	4765	1128	187	286	26066
1979	4644	492	4745	1097	193	268	25001
1980	4390	494	4879	1078	193	255	24466
1981	4038	458	5078	1074	195	247	23563
1982	3913	446	4936	1035	199	227	22661
1983	3703	437	4900	1021	205	223	21835
1984	3535	415	4858	981	205	212	21076
1985	3523	421	4778	938	188	207	20642
1986	3500	417	4498	880	170	192	20038
1987	3618	442	4349	850	162	189	20153
1988	3664	470	4223	828	158	169	19973
1989	3945	544	4366	871	178	171	20992
1990	4104	575	4417	878	188	168	21365
1991	4257	625	4461	864	183	158	21673
1992	4303	649	4568	864	189	156	21987
1993	4399	698	4741	871	188	161	22398

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles, TOT = all sectors.

Table B.26: Number of US grants cumulated over 10 years, 1972-1993 (cont.)

	EE	OC	CH	RP	FO	TL	TOT
France							
1972	2374	211	2230	434	20	75	11614
1973	2656	238	2421	468	22	79	12729
1974	2930	274	2694	535	27	89	14053
1975	3046	292	2969	587	34	93	14971
1976	3177	320	3315	619	43	105	15901
1977	3317	350	3523	637	54	114	16501
1978	3447	371	3756	676	60	118	17142
1979	3443	384	3785	665	62	118	17104
1980	3485	403	3901	673	72	127	17479
1981	3497	404	3984	708	82	130	17551
1982	3524	421	3922	686	92	134	17333
1983	3476	431	3921	698	102	136	17140
1984	3471	427	3817	678	101	129	16819
1985	3563	445	3767	649	106	137	16831
1986	3619	441	3566	645	106	131	16724
1987	3812	441	3515	654	109	133	17241
1988	3982	453	3461	658	112	138	17596
1989	4280	501	3629	710	129	151	18787
1990	4441	523	3735	745	138	149	19474
1991	4666	550	3874	743	140	148	20186
1992	4847	573	4096	780	145	153	21157
1993	5065	613	4355	821	151	153	22148
Germany							
1972	5189	724	7228	1271	86	300	32417
1973	5808	776	7787	1382	86	318	35341
1974	6353	834	8490	1514	95	350	38653
1975	6781	875	9295	1629	110	385	41324
1976	6951	909	10147	1737	131	438	43659
1977	7203	936	10754	1811	137	456	45539
1978	7520	965	11385	1946	148	487	47868
1979	7485	997	11469	1970	151	492	48085
1980	7575	1026	11818	2062	161	505	49434
1981	7579	1045	12345	2152	166	520	50348
1982	7704	1037	12214	2149	173	523	50387
1983	7623	1037	12259	2230	185	521	50494
1984	7660	1046	12218	2319	187	534	50854
1985	7835	1072	12042	2402	186	534	51599
1986	7968	1103	11565	2445	188	509	52146
1987	8460	1147	11407	2524	198	510	54216
1988	8920	1204	11391	2576	206	503	55618
1989	9631	1278	11976	2716	225	518	59031
1990	9953	1310	12345	2789	232	511	60763
1991	10226	1361	12514	2851	244	491	62079
1992	10376	1394	12908	3008	254	487	63873
1993	10560	1436	13311	3097	261	494	65298

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles, TOT = all sectors.

Table B.27: Business enterprise R&D expenditures (mln 1996 PPP\$), 1973-1993

	EE	OC	CH	RP	FO	TL
United States						
1973	15608.0	5518.0	6737.0	1356.0	857.0	204.0
1974	14703.0	6171.0	7189.0	1376.0	874.0	202.0
1975	13696.0	5956.0	7370.0	1253.0	899.0	188.0
1976	14200.0	6052.0	7599.0	1265.0	894.0	207.0
1977	13866.0	6254.0	7543.0	1157.0	978.0	196.0
1978	14256.0	6316.0	7844.0	1080.0	1034.0	195.0
1979	15743.0	6467.0	8125.0	1161.0	1062.0	203.0
1980	16852.0	7277.0	8515.0	1205.0	1139.0	211.0
1981	17200.0	7328.0	9365.0	1290.0	1062.0	193.0
1982	17154.0	8900.0	10371.0	1211.0	1224.0	214.0
1983	19063.0	9974.0	10802.0	1166.0	1243.0	226.0
1984	19788.0	11633.0	11385.0	1131.0	1554.0	261.0
1985	20032.0	13633.0	11854.0	938.0	1577.0	303.0
1986	20283.0	13260.0	11973.0	976.0	1741.0	334.0
1987	20778.0	12255.0	12632.0	796.0	1581.0	319.0
1988	17837.0	13186.0	13972.0	950.0	1552.0	328.0
1989	16112.0	14160.0	14601.0	1070.0	1543.0	315.0
1990	15531.0	13552.0	15404.0	1336.0	1639.0	344.0
1991	14964.0	12516.0	16340.0	1379.0	1424.0	316.0
1992	14526.0	12399.0	16723.0	1439.0	1507.0	299.0
1993	14129.0	9857.0	18545.0	1247.0	1424.0	337.0
United Kingdom						
1973	1969.6	310.6	1565.3	70.3	340.1	191.5
1974	1973.1	320.0	1639.8	67.4	365.2	211.8
1975	1867.6	354.9	1439.1	58.9	352.8	197.8
1976	2091.5	520.5	1431.7	58.2	387.2	193.3
1977	2280.5	630.8	1490.2	57.4	395.2	175.5
1978	2669.5	682.8	1589.0	60.6	397.7	151.4
1979	3379.5	663.6	1738.2	70.1	387.9	108.0
1980	3587.6	574.7	1693.7	71.5	342.6	69.1
1981	3717.4	550.8	1687.9	94.5	288.1	45.3
1982	3778.3	613.0	1717.9	71.6	248.8	38.9
1983	3694.3	714.9	1766.1	68.4	222.2	42.9
1984	3773.4	830.4	1935.0	59.2	285.2	53.4
1985	3825.4	896.2	2060.7	96.0	308.7	54.4
1986	3353.7	745.9	2210.3	77.8	303.7	55.9
1987	2930.0	757.3	2707.8	86.4	289.9	40.7
1988	2766.7	942.0	3074.9	78.6	252.4	42.6
1989	2344.4	1012.3	3265.0	83.5	362.6	34.6
1990	2480.7	901.8	3691.3	88.1	375.3	36.4
1991	2178.8	587.3	3423.3	62.9	352.0	41.3
1992	2091.6	439.6	3719.3	42.9	386.4	42.9
1993	2289.0	419.5	3995.7	111.5	318.0	73.3

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Table B.28: Business enterprise R&D expenditures (mln 1996 PPP\$), 1973-1993 (cont.)

	EE	OC	CH	RP	FO	TL
France						
1973	1624.6	474.1	1126.2	266.6	91.3	102.3
1974	1930.4	451.4	1156.9	267.5	108.9	113.4
1975	1984.2	455.6	1196.7	286.0	106.9	81.6
1976	2034.6	406.4	1204.1	287.4	106.5	75.2
1977	1996.1	440.2	1321.8	314.9	105.4	68.1
1978	2143.8	420.7	1383.9	297.8	121.5	70.9
1979	2199.1	460.2	1427.5	325.2	140.5	67.2
1980	2405.8	457.2	1472.1	341.3	141.9	56.8
1981	2605.4	488.0	1628.2	365.5	124.8	68.0
1982	2706.4	508.5	1685.9	369.4	126.8	67.9
1983	2832.4	483.5	1739.0	333.3	127.1	66.1
1984	3003.4	572.3	1955.1	325.6	161.9	72.2
1985	3148.1	637.6	2124.9	305.9	163.7	75.0
1986	3238.6	660.9	2208.1	299.3	187.7	76.2
1987	3580.4	641.4	2328.8	309.9	200.1	72.1
1988	3702.0	622.8	2424.4	341.7	231.5	68.7
1989	3958.9	591.7	2576.8	424.3	263.7	66.2
1990	4121.1	594.9	2725.9	386.2	288.2	59.8
1991	4213.8	588.6	2760.6	349.8	294.4	77.9
1992	4111.0	578.3	2829.0	347.8	289.8	82.2
1993	4064.8	550.6	2882.3	334.9	329.5	96.6
Germany						
1973	3343.8	189.3	3075.3	160.5	66.3	61.0
1974	3532.1	197.3	3333.7	139.8	74.4	59.5
1975	3737.9	226.2	3578.0	112.1	81.2	54.3
1976	3801.6	318.5	3796.3	123.8	96.2	40.1
1977	3856.2	399.3	3880.0	149.5	110.0	32.5
1978	4428.5	411.6	4015.1	204.2	128.8	70.4
1979	4738.5	427.5	4059.0	257.5	156.1	107.4
1980	4727.5	438.9	4204.6	281.8	192.9	105.8
1981	4686.1	461.6	4373.1	301.2	224.6	95.0
1982	4826.6	508.7	4537.2	337.4	239.1	99.3
1983	4955.3	535.6	4522.9	356.3	235.0	103.9
1984	5311.2	548.5	4584.6	359.3	232.9	105.9
1985	6189.4	614.4	5041.0	385.7	246.2	114.0
1986	6680.8	675.6	5204.6	394.3	238.6	113.0
1987	5090.0	786.5	5561.9	419.9	234.3	113.6
1988	7518.0	858.9	5824.4	425.8	222.8	109.0
1989	7602.6	932.3	6063.2	429.3	210.6	104.1
1990	7406.7	996.0	5928.9	400.3	202.5	106.7
1991	7281.4	1428.0	5827.7	383.3	199.7	157.9
1992	6821.2	1277.4	5381.6	378.9	180.5	150.4
1993	6479.3	1154.8	5036.8	379.2	165.1	145.3

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles.

Appendix C

Trend break test results

This appendix describes the trend break test and sequential ADF test used in Chapter 3. These tests were developed by Ben-David and Papell (1995). The appendix also presents the test results for the time series for the US and the UK in Chapter 3.

The sequential ADF test Ben-David and Papell (1995) applied a test for a structural break in time series which may contain a unit root. Such a test had been developed by Vogelsang (1994). However, in order to carry out the break test, first a ADF test had to be conducted, because the critical values used to reject the null hypothesis of ‘no structural break’ in the break test are larger for non-stationary series (so that the null will be less easily rejected) than for stationary ones. A complication is that in such an ADF test one has to account for the possibility of a structural break. Therefore Ben-David and Papell proposed to apply a sequential ADF test constructed by Zivot and Andrews (1992), before carrying out the trend break test.

In such a sequential ADF test, regressions on a time series $\{y_t\}$ (in log-levels) are repeatedly estimated for different potential break years $T_B = 2, \dots, T - 1$, with the number of T observations adjusted for first-differencing the logs of the levels of y_t and lag length k . Those regressions run as follows

$$\Delta y_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \alpha y_{t-1} + \sum_{j=1}^k c_j \Delta y_{t-j} + \varepsilon_t \quad (\text{C.1})$$

where Δy_t is the first difference of $\{y_t\}$ and t a trend variable. In estimation, the maximum lag length k is set by determining the last included lag that is significant. The test starts with a lag length of 8. If this appears not to be significant, then the next step is to estimate with $k = 7$. This procedure is repeated until all insignificant lags are excluded.

DU_t and DT_t are break dummies with values $DU_t = 1$ if $t > T_B$, zero otherwise and $DT_t = t - T_B$ if $t > T_B$, zero otherwise. These dummies make the difference with the conventional ADF test. Now we test the null hypothesis that there is no exogenous structural break and that the series are integrated (that is, $\theta = \gamma = 0$). The alternative hypothesis is that $\{y_t\}$ is trend-stationary with one break at an unknown time. The break year is chosen by selecting the year for which the Dickey Fuller t -statistic, i.e.,

the absolute value of the t -statistic for α , is maximized. If this DF -statistic is larger than the critical values as calculated by Zivot and Andrews (1992), then the null of a unit root is rejected. The critical values are displayed in Table C.1.

Table C.1: Critical values sequential ADF test and trend break test

significance level	Sequential ADF test	Trend break test	
	critical value for DF -statistic ^a	critical value for $SupF_t$ -statistic ^b	
		if series are stationary	if series have a unit root
1 %	5.57	19.90	30.44
2.5 %	5.30	17.26	27.76
5 %	5.08	15.44	25.27
10 %	4.82	13.62	22.60

^aSource: Zivot and Andrews (1992)
^bSource: Ben-David and Papell (1995)

The trend break test The trend break test of Ben-David and Papell (1995) is based on Vogelsang (1994). Here we use the same definitions for the variables as in the sequential ADF test. One estimates sequentially for each break year (with 1 per cent trimming, that is, for $0.01T < T_B < 0.99T$) the regressions

$$y_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \sum_{j=1}^k c_j y_{t-j} + \varepsilon_t \quad (C.2)$$

The null $\theta = \gamma = 0$ is now tested with help of the $SupF_t$ or Sup Wald statistic, being two times the standard F -statistic. We chose its maximum value across the estimations to determine the break year. The null of ‘no structural break’ is rejected if the $SupF_t$ -statistic is greater than the critical value. The critical values, however, depend on whether the series are stationary according to the sequential ADF test. In Table C.1, the critical values are presented.

Table C.2: Trend break test results, total economy 1840-1990

	Series	Sample period	Stat.	Trend break year	Sup F	No. of lags	Signif. level
UK/US	Y/L	1919-1990		1941	42,80	5	1
	K/L	1840-1990	Y	1921	15,31	2	1
		1840-1939	Y	1918	17,46	1	2,5
	MEQ/L	1919-1990		1932	38,60	8	1
		1919-1990		1932	23,22	2	10
	NRS/L	1946-1990	Y	1965	14,74	1	10
		1840-1939	Y	1865	16,34	1	5
	JFP	1946-1990		1965	27,12	1	5
		1840-1939	Y	1915	13,88	6	10
		1919-1990	Y	1941	30,52	1	1
		1946-1990	Y	1964	22,94	2	1
US	Y/L	1840-1990	Y	1940	17,18	2	5
		1904-1947	Y	1942	39,88	1	1
	K/L	1840-1913		1932	34,94	2	1
		1840-1939		1932	24,94	2	10
		1919-1990	Y	1933	57,98	1	1
	MEQ/L	1904-1947	Y	1929	35,02	2	1
		1840-1913		1865	30,16	4	2,5
		1919-1990	Y	1931	43,44	6	1
	NRS/L	1904-1947		1933	22,68	1	10
		1840-1990		1932	34,90	2	1
		1919-1990		1933	57,22	1	1
	JFP	1904-1947	Y	1929	37,40	2	1
		1840-1990	Y	1938	27,34	2	1
		1919-1990	Y	1940	24,20	2	1
			1904-1947		1941	25,92	1
UK	Y/L	1840-1939		1924	28,86	5	2,5
		1919-1990		1945	23,28	7	10
	K/L	1840-1990		1945	22,88	2	10
		1840-1990		1945	28,26	2	2,5
	NRS/L	1919-1990	Y	1945	29,10	2	1
		1919-1990	Y	1945	26,62	2	1
	JFP	1919-1990	Y	1945	26,62	2	1

Y/L = production per employee; K/L = capital assets per employee, MEQ/L = machinery and equipment per employee; NRS/L = non-residential structures per employee; JFP = joint factor productivity.

Stat. = Stationary series (test results from the sequential ADF tests, see Table C.4).

Table C.3: Trend break test results, manufacturing 1840-1990

	Series	Sample period	Stat.	Trend break year	Sup F	No.of lags	Signif. level
UK/US	Y/L	1904-1947		'38-'45	41,82	1	1
	K/L	1919-1990		1932	25,84	5	5
		1904-1947		'38-'45	31,26	2	1
	MEQ/L	1919-1990		1932	24,76	1	10
		1904-1947		'38-'45	35,74	2	1
	NRS/L	1904-1947		'38-'45	28,28	2	2,5
		1946-1990		1966	26,06	3	5
	JFP	1904-1947		'38-'45	54,58	1	1
US	Y/L	1840-1990	Y	1919	39,16	4	2,5
		1840-1913	Y	1860	13,62	4	10
	K/L	1919-1990	Y	1938	38,16	2	1
		1904-1947	Y	1929	18,04	2	2,5
	MEQ/L	1919-1990	Y	1938	33,08	2	1
	NRS/L	1919-1990	Y	1943	30,92	1	1
		1904-1947	Y	1929	21,84	2	1
	JFP	1919-1990	Y	1932	16,20	2	5
UK	Y/L	1840-1913	Y	1869	15,12	1	10
		1904-1947		'40-'45	56,88	1	1
	K/L	1840-1913	Y	1886	27,36	2	1
		1904-1947		'40-'45	56,04	1	1
		1946-1990		1982	34,18	2	1
	MEQ/L	1840-1913	Y	1886	24,68	2	1
		1904-1947		'40-'45	87,82	1	1
		1946-1990		1983	27,20	2	5
	NRS/L	1840-1913	Y	1886	29,86	2	1
		1904-1947		'40-'45	27,72	1	2,5
		1946-1990		1980	32,88	2	1
	JFP	1840-1939	Y	1915	24,38	1	1
		1904-1947		'40-'45	86,88	1	1
	1946-1990	Y	1979	22,24	2	1	

Y/L = production per employee; K/L = capital assets per employee, MEQ/L = machinery and equipment per employee; NRS/L = non-residential structures per employee; JFP = joint factor productivity.

Stat. = Stationary series (test results from the sequential ADF tests, see Table C.5).

Table C.4: Sequential ADF test results, total economy 1840-1990

	Series	Sample period	T_B	DF	No.of lags	Signif. level
UK/US	Y/L	1919-1990	1961	4,75	5	
	K/L	1840-1990	1913	5,06	2	10
		1840-1939	1921	4,96	1	10
		1919-1990	1938	4,43	2	
	MEQ/L	1919-1990	1938	4,25	2	
		1946-1990	1965	4,94	1	10
	NRS/L	1840-1939	1913	5,22	1	5
		1946-1990	1959	3,90	1	
	JFP	1840-1939	1893	4,85	6	10
		1919-1990	1941	4,98	1	10
1946-1990		1969	4,87	1	10	
US	Y/L	1840-1990	1940	6,78	2	1
		1904-1947	1936	5,09	2	5
	K/L	1840-1913	1886	3,11	1	
		1840-1939	1892	4,23	5	
		1919-1990	1938	4,99	1	10
	MEQ/L	1904-1947	1930	5,77	2	1
		1840-1913	1885	3,99	2	
		1919-1990	1932	5,45	2	2,5
	NRS/L	1904-1947	1935	4,27	1	
		1840-1990	1932	4,76	7	
		1919-1990	1938	4,76	1	
	JFP	1904-1947	1930	5,68	2	1
		1840-1990	1938	5,81	2	1
		1919-1990	1940	5,85	2	1
		1904-1947	1942	4,35	8	
UK	Y/L	1840-1939	1913	3,40	6	
		1919-1990	1945	4,72	7	
	K/L	1840-1990	1945	4,50	2	
		1840-1990	1945	4,77	2	
	NRS/L	1919-1990	1964	3,49	2	
		1919-1990	1945	6,28	2	

Y/L = production per employee; K/L = capital assets per employee, MEQ/L = machinery and equipment per employee; NRS/L = non-residential structures per employee; JFP = joint factor productivity.

DF = Dickey Fuller t -statistic, maximum absolute value over the years. T_B = year for which Dickey Fuller t -statistic is maximized.

Only those results are presented which are needed for the trend break tests (see Table C.2).

Table C.5: Sequential ADF test results, manufacturing 1840-1990

	Series	Sample period	T_B	DF	No.of lags	Signif. level
UK/US	Y/L	1904-1947	1931	3,87	1	
	K/L	1919-1990	1965	3,53	1	
		1904-1947	1914	4,60	2	
	MEQ/L	1919-1990	1965	4,18	1	
		1904-1947	1914	4,73	2	
	NRS/L	1904-1947	1914	4,43	2	
		1946-1990	1969	3,71	1	
JFP	1904-1947	1929	3,33	1		
US	Y/L	1840-1990	1916	6,19	4	1
		1840-1913	1860	5,01	4	10
	K/L	1919-1990	1938	6,16	2	1
		1904-1947	1929	4,86	2	10
	MEQ/L	1919-1990	1938	6,36	2	1
	NRS/L	1919-1990	1938	4,96	1	10
		1904-1947	1929	4,84	2	10
	JFP	1919-1990	1938	5,90	1	2,5
UK	Y/L	1840-1913	1869	5,64	1	1
		1904-1947	1915	3,82	1	
	K/L	1840-1913	1886	5,44	2	2,5
		1904-1947	1921	3,66	1	
		1946-1990	1982	4,61	2	
	MEQ/L	1840-1913	1886	5,11	2	5
		1904-1947	1921	3,58	1	
		1946-1990	1979	4,69	1	
	NRS/L	1840-1913	1886	5,69	1	1
		1904-1947	1918	3,83	1	
		1946-1990	1980	4,53	3	
	JFP	1840-1939	1915	5,75	1	1
		1904-1947	1916	3,41	1	
1946-1990		1947	4,85	6	10	

Y/L = production per employee; K/L = capital assets per employee, MEQ/L = machinery and equipment per employee; NRS/L = non-residential structures per employee; JFP = joint factor productivity.

DF = Dickey Fuller t -statistic, maximum absolute value over the years. T_B = year for which Dickey Fuller t -statistic is maximized.

Only those results are presented which are needed for the trend break tests (see Table C.2).

Appendix D

Alternative estimation results

Table D.1: WLS and WTSLs estimation results productivity growth function with AR(1) terms, 1966-1996 (*t*-values between brackets)

$$\Delta \ln y_t^j = (1 - \alpha) \Delta \ln A_t^j + \alpha [\Delta \ln(K/L)_{t-1}^j + \Delta \ln A_{t-1}^j] + u_t$$

$$u_t = \rho u_{t-1} + \varepsilon_t$$

	WLS estimation		WTSLs estimation					
	market sector	manufacturing	market sector	manufacturing	market sector	manufacturing		
<i>$\hat{\alpha}$ (common), impact capital intensity growth</i>								
	0.27	0.44	-0.10			0.32		
	(3.00)	(5.69)	(-1.08)			(3.79)		
<i>$\hat{\alpha}$ (country specific), impact capital intensity growth</i>								
France	0.37	0.54	-0.26			0.13		
	(1.98)	(2.65)	(-1.15)			(0.49)		
Germany	-0.07	0.43	-0.32			0.29		
	(-0.46)	(3.29)	(-2.24)			(2.07)		
UK	0.34	0.42	0.21			0.38		
	(2.45)	(2.14)	(1.50)			(2.21)		
<i>$\hat{\rho}$, autocorrelation coefficient</i>								
France	0.82	0.80	0.68	0.69	0.87	0.89	0.69	0.73
	(7.42)	(7.14)	(5.22)	(5.23)	(9.17)	(8.59)	(5.28)	(5.66)
Germany	0.67	0.85	0.44	0.45	0.85	0.89	0.48	0.49
	(4.94)	(9.33)	(2.76)	(2.77)	(9.74)	(11.89)	(3.07)	(3.17)
UK	0.50	0.50	0.37	0.37	0.62	0.50	0.41	0.38
	(3.10)	(3.09)	(2.14)	(2.14)	(4.46)	(3.04)	(2.41)	(2.21)
<i>Observations</i>	93	93	93	93	93	93	93	93
<i>Mean dependent variable</i>								
France	3.60	3.60	4.38	4.38	3.60	3.60	4.38	4.38
Germany	3.43	3.43	3.54	3.54	3.43	3.43	3.54	3.54
UK	3.01	3.01	3.72	3.72	3.01	3.01	3.72	3.72
<i>Standard error regression</i>								
France	2.03	2.02	2.64	2.64	2.20	2.33	2.70	2.81
Germany	1.88	1.80	2.56	2.56	1.80	1.86	2.58	2.60
UK	2.18	2.17	2.27	2.27	2.49	2.20	2.30	2.28
<i>Durbin Watson</i>								
France	2.42	2.41	1.99	2.00	2.44	2.44	2.00	2.04
Germany	2.00	2.04	2.05	2.05	2.04	2.08	2.09	2.10
UK	2.04	2.08	1.96	1.96	1.89	2.01	1.96	1.95

Instrumental variables for the WTSLs estimation are the capital growth variable and a constant. The WLS and WTSLs estimated values of the autocorrelation coefficients $\hat{\rho}$ were all significantly below 1 according to the Wald coefficient test.

Table D.2: WTSLs estimation results productivity growth function, 1956-1996 and 1973-1996 (*t*-values between brackets)

$$\Delta \ln y_t^j = (1 - \alpha)\Delta \ln A_t^j + \alpha [\Delta \ln(K/L)_{t-1}^j + \Delta \ln A_{t-1}^j] + u_t$$

	1956-1996		1973-1996	
	market sector	manufacturing	market sector	manufacturing
$\hat{\alpha}$ (<i>common</i>), <i>impact capital intensity growth</i>	0.30 (5.31)	0.38 (7.23)	0.29 (3.10)	0.40 (4.74)
<i>Observations</i>	105	105	72	72
<i>Mean dependent variable</i>				
France	3.81	4.62	3.05	3.75
Germany	3.71	3.85	2.83	3.06
UK	3.09	3.85	2.60	3.31
<i>Standard error regression</i>				
France	3.12	3.42	3.64	4.03
Germany	2.54	2.91	2.47	3.01
UK	2.44	2.33	2.63	2.62
<i>Durbin Watson</i>				
France	0.41	0.62	0.36	0.61
Germany	0.59	1.14	0.67	1.02
UK	0.99	1.24	0.89	1.17

Instrumental variables are the growth of capital intensity and a constant.

Table D.3: WLS estimation results technology growth function, 1956-1996 and 1973-1996 (*t*-values between brackets)

$$\Delta \ln A_t^j = - \left(\psi^j + \gamma^j [n_t^j] \right) \left(\ln A_{t-1}^j - \ln \hat{A}_{t-1} - z^j \right) + \beta \Delta \ln \hat{A}_t + u_t$$

$$u_t = \rho u_{t-1} + \varepsilon_t$$

$$n_t^j = \ln(R\&D/Y)_t^j$$

	market sector		manufacturing
	1956-1996	1973-1996	1973-1996
$\hat{\beta}$, impact US technology growth	0.29 (4.15)	0.23 (2.68)	0.17 (2.43)
\hat{z} , long run gap with US technology			
France	-0.45 (-1.83)	-0.46 (-4.13)	-0.56 (-10.43)
Germany	-0.26 (-2.23)	-0.40 (-11.24)	-0.32 (-10.80)
UK	-0.48 (-3.55)	-0.55 (-8.50)	-0.53 (-11.33)
$\hat{\gamma}$ (common), impact R&D intensity on speed of diffusion	12.75 (1.59)	42.17 (3.22)	49.80 (4.20)
$\hat{\psi}$, impact constant on speed of diffusion	-30.22 (-1.42)	-111.20 (-3.18)	-82.53 (-4.13)
$\hat{\rho}$, autocorrelation coefficient			
France	0.88 (22.08)	0.68 (5.25)	0.53 (3.51)
Germany	0.90 (10.88)	0.85 (7.22)	0.50 (3.43)
UK	0.97 (21.32)	0.95 (12.97)	1.07 (19.14)
Observations	113	72	72
Mean dependent variable			
France	2.80	2.03	2.02
Germany	1.56	1.65	1.65
UK	2.36	1.74	1.74
Standard error regression			
France	0.85	0.77	0.78
Germany	0.49	0.45	0.39
UK	0.50	0.61	0.60
Durbin Watson			
France	2.03	1.62	1.78
Germany	0.89	0.93	1.71
UK	0.88	0.87	1.00

The estimated values of the autocorrelation coefficients $\hat{\rho}$ were all significantly below 1 according to the Wald coefficient test.

Table D.4: WLS estimation results technology function with alternative proxies for R&D effort n , market sector, 1966-1996 (t -values between brackets)

$$\Delta \ln A_t^j = - \left(\psi^j + \gamma^j [n_t^j] \right) \left(\ln A_{t-1}^j - \ln \hat{A}_{t-1} - z^j \right) + \beta \Delta \ln \hat{A}_t + u_t$$

$$u_t = \rho u_{t-1} + \varepsilon_t$$

$$n_t^j = \Delta \ln(R\&D/Y)_t^j \qquad n_t^j = \ln(RSE/H)_t^j$$

$\hat{\beta}$, impact US technology growth	0.30 (3.50)	0.18 (2.10)
\hat{z} , long run gap with US technology		
France	-0.81 (-5.43)	-0.38 (-1.71)
Germany	-0.44 (-7.53)	-0.26 (-2.25)
UK	-0.51 (-8.63)	-0.44 (-3.67)
$\hat{\gamma}$ (common), impact R&D intensity on speed of diffusion	0.24 (1.33)	15.70 (2.47)
$\hat{\psi}$, impact constant on speed of diffusion	9.23 (2.61)	-116.65 (-2.45)
$\hat{\rho}$, autocorrelation coefficient		
France	0.93 (16.28)	0.86 (24.09)
Germany	0.92 (15.41)	0.78 (10.31)
UK	0.93 (17.63)	0.91 (18.04)
Observations	93	90
Mean dependent variable		
France	2.34	2.34
Germany	1.66	1.61
UK	2.08	2.01
Standard error regression		
France	0.96	0.93
Germany	0.49	0.40
UK	0.52	0.54
Durbin Watson		
France	1.65	2.08
Germany	1.05	1.06
UK	0.85	0.91

According to the Wald coefficient test, the null that the estimated values of the autocorrelation coefficients $\hat{\rho}$ were all significantly below 1 could not be rejected for the estimation with the growth rate of R&D intensity, but it was rejected for the estimation with the log-level of RSE intensity.

Table D.5: WLS estimation productivity growth function with AR(1) terms, 1973-1993 (*t*-values between brackets)

$$\Delta \ln y_t^{hD} = (1 - \alpha)\Delta \ln A_t^{hD} + \alpha \left[\Delta \ln(K/L)_t^{hD} + \Delta \ln A_t^{hD} \right] + u_t$$

$$u_t = \rho u_{t-1} + \varepsilon_t$$

	EE	OC	CH	RP	FO	TL
<i>$\hat{\alpha}$ (common), impact capital intensity growth</i>						
	0.16 (1.83)	0.60 (4.08)	0.57 (3.45)	0.37 (3.47)	0.34 (2.88)	0.42 (6.92)
<i>$\hat{\rho}$, autocorrelation coefficient</i>						
France	0.66 (3.48)		0.36 (1.47)	0.51 (2.07)	0.64 (3.57)	0.53 (2.91)
Germany	0.37 (1.42)	0.01 (0.05)	-0.21 (-1.05)	0.34 (1.74)	0.59 (3.37)	0.59 (3.24)
UK	0.45 (2.22)	0.28 (1.29)	0.41 (1.89)	0.47 (2.37)	0.59 (3.98)	0.58 (3.15)
Observations	54	36	51	51	54	54
<i>Mean dependent variable</i>						
France	5.24		4.82	1.80	2.07	3.53
Germany	3.85	9.62	3.47	2.48	1.50	2.97
UK	4.52	5.62	2.71	2.85	2.53	2.38
<i>Standard error regression</i>						
France	2.65		5.09	5.38	8.49	2.87
Germany	2.79	7.41	6.42	3.48	4.89	3.20
UK	7.49	12.55	6.92	5.62	6.42	6.13
<i>Durbin Watson</i>						
France	1.78		1.93	1.55	2.31	2.35
Germany	1.96	1.88	1.75	2.29	2.27	2.58
UK	2.16	1.55	1.65	2.12	2.10	2.21

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles. Estimations for office and computing do not include data for France. These are covered in the French data for electronic equipment.

Table D.6: WTSLS estimation productivity growth function with AR(1) terms, 1973-1993 (*t*-values between brackets)

$$\Delta \ln y_t^{hD} = (1 - \alpha)\Delta \ln A_t^{hD} + \alpha \left[\Delta \ln(K/L)_t^{hD} + \Delta \ln A_t^{hD} \right] + u_t$$

$$u_t = \rho u_{t-1} + \varepsilon_t$$

	EE	OC	CH	RP	FO	TL
<i>$\hat{\alpha}$ (common), impact capital intensity growth</i>						
	0.17 (1.20)	0.62 (0.79)	0.56 (2.20)	-0.24 (-1.56)	-1.03 (-3.39)	0.40 (3.15)
<i>$\hat{\rho}$, autocorrelation coefficient</i>						
France	0.66 (3.19)		0.36 (1.47)	0.27 (1.26)	-0.14 (-0.62)	0.52 (2.89)
Germany	0.34 (1.33)	1.06 (1.79)	-0.21 (-1.08)	-0.34 (-1.67)	-0.19 (-0.89)	0.58 (3.23)
UK	0.45 (2.20)	0.82 (1.90)	0.40 (1.87)	0.45 (2.42)	0.25 (1.24)	0.59 (3.17)
<i>Observations</i>	54	36	51	51	54	54
<i>Mean dependent variable</i>						
France	5.24		4.82	1.80	2.07	3.53
Germany	3.85	9.20	3.47	2.48	1.50	2.97
UK	4.52	5.62	2.71	2.85	2.53	2.38
<i>Standard error regression</i>						
France	2.66		5.10	7.37	11.59	2.90
Germany	2.80	10.38	6.42	3.62	8.44	3.23
UK	7.47	14.50	6.92	6.78	11.50	6.06
<i>Durbin Watson</i>						
France	1.78		1.93	1.87	2.05	2.35
Germany	1.95	3.20	1.74	2.24	2.20	2.57
UK	2.16	2.08	1.64	1.92	1.65	2.20

EE = electronic equipment, OC = office and computing, CH = chemicals, RP = rubber and plastics, FO = food, TL = textiles. Estimations for office and computing do not include data for France. These are covered in the French data for electronic equipment.
