Why the U.S. became the economic superpower in the 20th century*

A Case Study in Endogenous Growth Theory

Isaac Ehrlich

State University of New York at Buffalo and NBER
Hong Kong Institute of Monetary Research

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Preliminaries

- The human capital revolution came at the heels of another revolution: the neo-classical growth model.
- It first questioned the growth accounting of the CGM that missed weighting the labor input by quality attributes, but
- Soon developed into a new paradigm viewing HC to equal to physical capital as a means of production.
- Most applications in labor economics studied income distrib. & wage differentials which CGM could not handle.
- Several other turning points expanded the scope of HC as an asset & focused on the sources & consequences of its production and accumulation. Health, fertility, family formation, aging
- More HC theory went back to its original objective: better understanding of the dynamics of econ. growth. It is this new direction of HCT which I'll try to illustrate.

Defining human capital*

"human capital" is an intangible asset, best thought of as a stock of embodied and disembodied knowledge, comprising education, information health, entrepreneurship, and productive and innovative skills, that is formed through investments in schooling, job training, and health, as well as through research and development projects and informal knowledge transfers.

* Isaac Ehrlich and Kevin Murphy "Why Does Human Capital Need a Journal?", *Journal of Human Capital* , Vol. 1, Winter 2007; http://ssrn.com/abstract=1130937

1. Prologue

- What drives wealth accumulation across nations?

  A. Smith: free markets & trade induce specialization, hence wealth creation. In dynamic context query separable into 2: to explain variation in income **level (Y)** v. **long-term growth rate (g)**
  g is critical due to force of compounding: If g=7% income doubles in 10 yrs; If g=1% in 70 yrs.

- The Neo-Classical growth model (NCGM)

  Explains economy's **agg. output level** as a product of agg. labor & capital & their productivity.
  In this approach, equilibrium **per-capita real income level, which is** more relevant as a personal welfare index, depends on economy's K/L ratio and technology level, which drive productivity.

- But what explains continuous productivity growth (new phenomenon, 2 centuries old)?

  By NCGM: Tech. advances are key. But what guarantees advances? Accidental discoveries?
  I. Newton's apple & gravity; L. Pasteur & vaccination (accidental injection of old serum to chicks);
  Paul Ehrlich & magic bullet = stochastic shocks, but what guarantees continuous accidents?

- Endogenous growth theory (EGT)

  Generally identifies technology w/ **Human Capital, or knowledge**. Difference? HC can grow via **investments** individuals, families, firms & government make in schooling, OJT & research.
  HC, or Knowledge formation thus becomes an **endogenous** variable.

- How well can EGT explain comparative econ. growth & dev. across nations?

- **Taking the US v. UK (E-5) as a case study:***
  Lagging UK in 19th century, US replaced it as economic superpower in 20th, not just by real GDP ($13 trillion), but by GDPPC as well. See ***T-A.*** (Italy, Spain not even in picture).

- **How did the takeover happen**?
  Technically: via higher long-term growth rate. **Over 131** yrs (1871-2004):
  Real GDP growth rate per annum g(Y): US=3.3%; UK=1.91%
  Real per-capita GDP growth rate: g(y): US=1.87%; UK= 1.419% See **Figs. 1 and 2.**

  What accounts for US's, practically constant, higher long-term g-rate?
  Economies of Scale in production, as Alfred Marshall thought? Natural resources? Population?
  Thesis: by EGT, all traces to investment in human capital, or knowledge formation. Secret?

- **Human-capital has two dimensions:**
  a. Labor-augmenting **skill**, leading to higher output level (**embodied HC**)
  b. Creative knowledge leading to **innovation** & productivity growth (**disembodied HC**):
  Ideas flowing from the human brain wind up as product & process innovation.
  Hence special role to **Tertiary Education**.
  These are complementary dimensions, making human capital "engine of growth".

- Before elaborating on the thesis, let's see if the thesis has any legs to stand on empirically.

T-A Real (PPP) GDP Per-Capita: Country Comparison

Rank	Country	Per Capita GDP	Estimate Year
1	Luxembourg	58,900	2004
2	United States	40,100	2004
3	Jersey	40,000	2003
3	Norway	40,000	2004
5	Bermuda	36,000	2003
6	San Marino	34,600	2001
7	Switzerland	33,800	2004
8	Cayman Islands	32,300	2004
9	Denmark	32,200	2004
10	Iceland	31,900	2004
10	Ireland	31,900	2004
12	Canada	31,500	2004

Rank	Country	Per Capita GDP	Estimate Year
13	Austria	31,300	2004
14	Belgium	30,600	2004
15	United Kingdom	29,600	2004
16	Netherlands	29,500	2004
17	Japan	29,400	2004
18	Finland	29,000	2004
19	France	28,700	2004
19	Germany	28,700	2004
19	Hong Kong	28,700	2003
22	Sweden	28,400	2004
23	Aruba	28,000	2002
24	Singapore	27,800	2004
25	Monaco	27,000	2000

Source: http://www.cia.gov/cia/publications/factbook;
http://www.worldfactsandfigures.com/gdp_country_desc.php

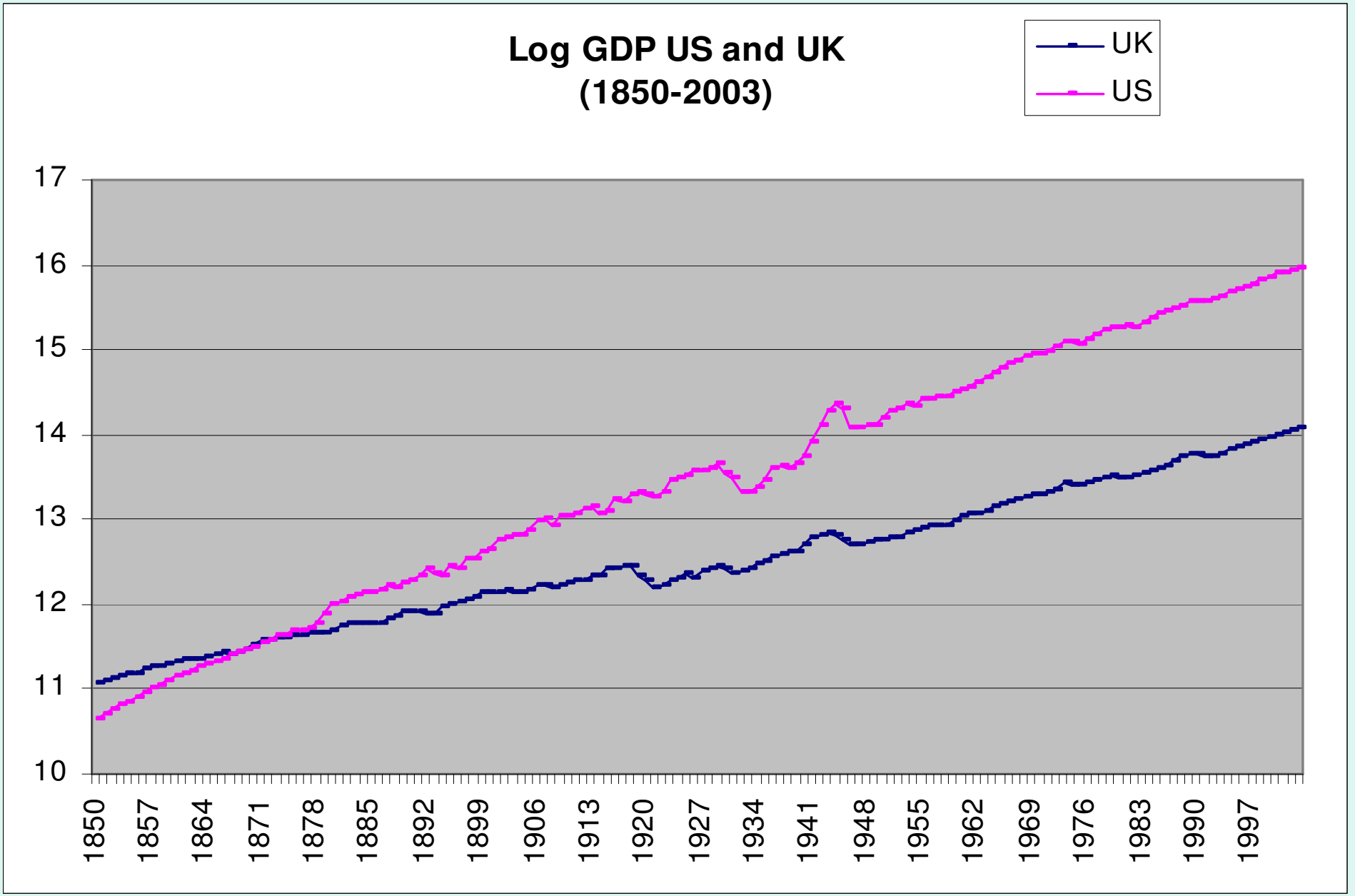


Figure 1

Notes: GDP data are in real (PPP) 1990 Geary-Khamis million dollars. Data for 1851-1859 and 1861-1869 are imputed.

Source: "The World Economy: Historical Statistics" by Angus Maddison (2003)

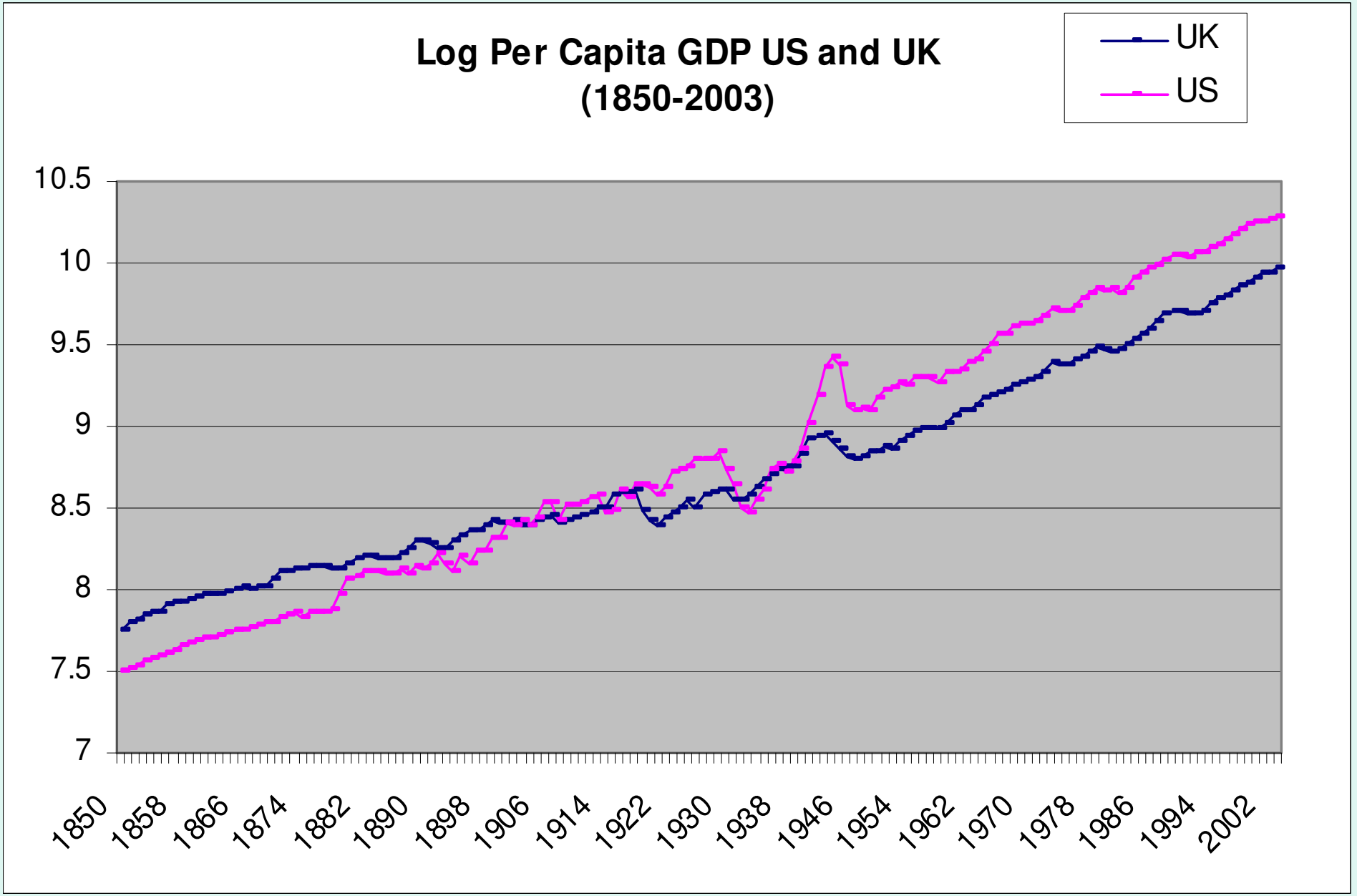


Figure 2

Notes: Per Capita GDP data are in real (PPP) 1990 Geary-Khamis dollars. Data for 1851-1859 and 1861-1869 are imputed.

Source: "The World Economy: Historical Statistics" by Angus Maddison (2003)

2. The Evidence: Does the Thesis Have "Legs" to Stand On?

- We first need a good proxy for HC. We try an **imperfect** one: Schooling. We then examine a number of different bodies of raw data to "test" the thesis.

A. Evolution of Educational Attainments US v. Europe. See *T-1.*

Highlights (from Angus Maddison, 91):

a. In 1913, average schooling attainment (ASA) in US was 6.93, behind Germany (6.94) and UK (7.28). Japan is lowest (5.10). Even then, the US already had highest average higher education attainments (AHA), (0.2), followed by Netherlands (0.11), and France (0.10).

b. In 1989, US emerges as leader at all schooling levels. ASA in US = 13.39, ahead of Japan (11.66), France (11.61) and UK (11.28). Germany = 9.58. ATA in US = 1.67, ahead of France (1.32); other 4 substantially lower. Note: Japan's ASA is last in 1913, but in second place in 1989.

c. No comparable recent data are available for same population groups & countries. We thus switch to OECD data for more recent years.

Table 1: *Average years of Formal Educational Experience of the Population Aged 15-64 in 1913 and 1989*

1913

Country	Total (Rank)	Primary (Rank)	Secondary (Rank)	Higher (Rank)
France	6.18 (4)	4.31 (5)	1.77 (4)	0.10 (3)
Germany	6.94 (2)	3.50 (6)	3.35 (1)	0.09 (4)
Japan	5.10 (6)	4.50 (4)	0.56 (6)	0.04 (6)
Netherlands	6.05 (5)	5.30 (1)	0.64 (5)	0.11 (2)
United Kingdom	7.28 (1)	5.30 (1)	1.90 (2)	0.08 (5)
United States	6.93 (3)	4.90 (3)	1.83 (3)	0.20 (1)

1989

Country	Total (Rank)	Primary (Rank)	Secondary (Rank)	Higher (Rank)
France	11.61 (3)	5.00 (5)	5.29 (2)	1.32 (2)
Germany	9.58 (6)	4.00 (6)	5.20 (3)	0.38 (6)
Japan	11.66 (2)	6.00 (1)	4.95 (4)	0.71 (3)
Netherlands	10.51 (5)	6.00 (1)	3.82 (6)	0.69 (4)
United Kingdom	11.28 (4)	6.00 (1)	4.75 (5)	0.53 (5)
United States	13.39 (1)	6.00 (1)	5.72 (1)	1.67 (1)

Sources: Maddison (1991, p.64)

B. Recent Evidence from OECD's "*Education at a Glance*", 1998

T-2: % of the population that has attained at least tertiary Type-A or upper High School education by age group 1998 and 2003

Highlights:

- Rapid changes from 1998 to 2003 indicative of trend post WW-II
- US has top attainments in both categories in age-group 25-64 in both years with decisive edge over E-5 (UK, Germany, France, Italy, Spain) and 29 OECD countries including smaller countries & Tigers.
- Breakdown by age cohorts, however, tells a dynamic story:
  - US advantage is greatest in 55-64 & lowest in 25-34 age group.
  - While advantage over E-5 is maintained, some EU countries show edge over US in the 25-34 age categories in 2002:
  - e.g., Norway in Tertiary type-A & Korea, Japan and Norway in Upper HS
- So we have evidence of convergence across countries, young age groups, and years.

Table 2: Percentage of the population that has attained at least tertiary Type-A and Upper Secondary Education by age group (1998 and 2003)

Country	1998					2003				
	25-64	25-34	35-44	45-54	55-64	25-64	25-34	35-44	45-54	55-64
	At Least Tertiary Education Type-A									
France	11	15	10	10	6	14	22	13	11	10
Germany	14	14	16	15	10	14	14	15	15	12
Italy	9	9	11	9	5	10	12	11	10	7
Norway	24	27	25	22	17	29	37	30	25	20
Spain	14	21	16	11	6	18	26	19	14	9
United Kingdom	15	17	17	15	11	19	24	19	18	14
United States	**27**	27	26	29	22	**29**	30	29	30	27
29 OECD Countries Mean	14	16	15	13	9	16	20	17	15	12
	At Least Upper Secondary Education									
France	61	75	63	56	41	65	80	69	59	48
Germany	84	88	87	84	76	83	85	86	84	78
Italy	41	55	50	35	19	44	60	50	39	24
Japan	80	93	91	77	57	84	94	94	82	65
Spain	33	53	38	23	12	43	60	48	33	19
United Kingdom	60	63	62	58	53	65	71	65	64	57
United States	**86**	88	88	87	80	**88**	87	88	89	85
29 OECD Countries Mean	61	72	65	57	44	66	75	70	62	51

Source: Education at a Glance 2000, p.36 (Table A2.2b) and p.35 (Table A2.2)
http://www.oecd.org/dataoecd/22/35/35282639.xls (Table A.1.3a and A.1.2a)

T-3 ***Annual expenditures on educational institutions per student (US dollars converted using PPP) by levels of education based on full-time equivalents***

Highlights:

- In % of GDP spent on both public and private institutions, in 1990, 1995, and 2000, the US is still at the top. – 7.2% over UK and E-5, although in 2002, Iceland is ahead at 7.4 (Table 5 in text). Numbers influenced by student populations. More relevant: See **Table 3**.

- In 2002, US spending per student at all levels of secondary education was $9098, while the OECD countries' ave. was $6992. But US already ranks behind Switzerland ($11900), and Norway ($10154) (Luxembourg @ $15195, is not a comparable country).

- In tertiary educational spending (both type A and B) per student, the US ($20545) is second only to Switzerland ($23714). Just Sweden ($15715) and Denmark ($15183) have spending levels above $15000. (Fr v. UK: $9276 v. $11,822)

Table 3: ***Annual expenditures on educational institutions per student (US dollars converted using PPP) by levels of education based on full-time equivalents (2002)***

Country	Primary	All secondary	Tertiary-type A	All tertiary
United States	**8049**	9098	**NA**	20545
United Kingdom	5150	6505	Na	11822
France	5033	8472	9132	9276
Germany	4537	7025	11860	10999
Italy	7231	7568	8649	8636
Spain	4592	6010	8074	8020
Austria	7015	8887	12701	12448
Belgium	5665	8272	Na	12019
Denmark	7727	8003	Na	15183
Finland	5087	7121	11833	11768
Netherlands	5558	6823	13163	13101
Norway	7508	10154	Na	13739
Sweden	7143	7400	Na	15715
Switzerland	7776	**11900**	25524	**23714**
Japan	6117	6952	11984	11716
Korea	3553	5882	7630	6047
OECD Mean	5273	6992	~	13343

Source: http://www.oecd.org/dataoecd/2/12/35286348.xls (Table B1.1)

Some Caveats

- The US Advantage remains significant in tertiary type-A institutions; In Type B (vocational) – not as much
- Schooling attainments have institutional upper limit (Ph.D.), becoming a less effective proxy in highly developed economies. Investment in knowledge at firm level via general OJT, specific R&D likely to become more important in more developed economies. US may hold sizeable advantage in this supplementary HC measure.
- Schooling length & expenditure are but input measures of HC. Product measures are more mixed:
- Distribution of math literacy scores of 15-yr old is below OECD ave., but in the mid-range of the E-5 at higher percentiles (no UK data) (see **T-4**). At Tertiary level, in contrast, US academic institutions are at the top and attract more int'l students and faculty.

Table 4: ***Average combined mathematics literacy scores of 15-year-old students by percentiles (2003)***

Country	5th	10th	25th	75th	90th	95th	90th–10th difference
United States	323	357	418	550	607	638	251
France	352	389	449	575	628	656	239
Germany	324	363	432	578	632	662	269
Italy	307	342	400	530	589	623	247
Spain	335	369	426	546	597	626	229
Austria	353	384	439	571	626	658	242
Belgium	334	381	456	611	664	693	284
Denmark	361	396	453	578	632	662	236
Finland	406	438	488	603	652	680	214
Netherlands	385	415	471	608	657	684	241
Norway	343	376	433	560	614	645	238
Sweden	353	387	446	576	631	662	243
Switzerland	359	396	461	595	652	684	256
Japan	361	402	467	605	660	690	258
Korea	388	423	479	606	659	690	236
OECD Average	332	369	432	570	628	660	259

Source: http://nces.ed.gov/programs/coe/2006/section2/table.asp?tableID=464

3. How Did it Happen?

A. **The massive high school movement** of 1915-1940

In 1910, school participation @ (5-19) is similar for US & Europe. By 1930 US is decades ahead. US advantage widens until 1950. In Europe apprenticeship is more popular. (Reasons discussed later.)

B. **Tertiary education**: Justin Morrill's (Vermont) acts 1862-90.

- Morrill's Land Grant Act (1862): 30K Acres Federal Land, or income from lands, allotted per each State senator and representative. Emphasis put on agriculture & mechanical + military arts. Additional Acts made higher Ed more accessible in US v. Europe:
- 1887: Hatch Act: funding for research station
- 1890: 2nd Morrill Act: Endowments to Land Grants for colleges & universities if they met no-discrimination standards.
- 1914: Smith-Lever: extension services to inform people. Home econ.

- **Growth:**

  In 1961: 68 institutions located in the 50 States & Puerto Rico: e.g. Iowa, Mich, Ohio, Penn, St.; UC, Maryland, Florida, Purdue; Cornell (Not SUNY). See Map

  - accounted for <5% of enrolments, but
  - 48% of organized research exp
  - 40% of doctorates conferred
  - 33% of current-account income
  - 28% of value of plant assets

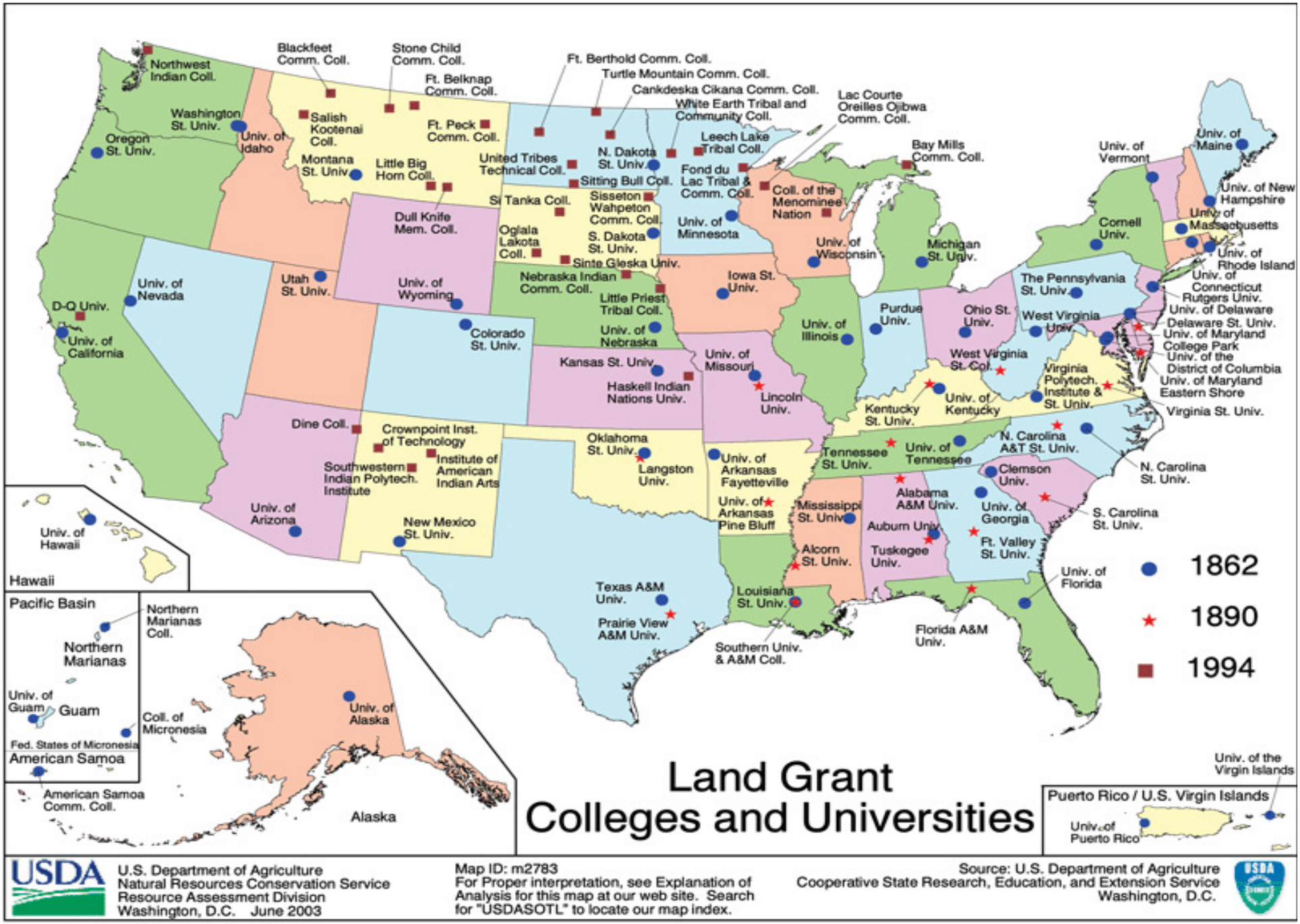
- **Recently** (2005): 105 LGCU + 29 tribal (since 1994)

C. The GI Bill of 1944

supplemented by tuition assistance supports in many states & federal Pell Grants, it provoked **massive Higher-Ed** movement. Aided by knock-on effect of HS revolution.

D. Immigration policy & brain drain

- In US's relatively open economy HC could also be imported, not home grown
- US became magnet to scientists, skilled workers 1st from Europe, then Asia
- In science & engineering, share of doctorates awarded int'l students: 23% in 1966, 39% in 2000. Post docs in residence: 37% in 1982, 59% in 2002
- >1/3 of US Nobel laureates foreign born.



Source: http://www.nrcs.usda.gov/technical/land/meta/m2786.html

4. **Why Did it Happen?** (Whence the Divergence?)

- **Education template:**
  Focus on formal (general) training prompted by US dev. as a large, open-trade area, need for mobile LF, & changes in manufacturing, telecommunications, large-scale farming & retailing. Faster dev. Rel' to Europe.

- **Feedback wealth effects:**
  coming from US's income growth, which reduces financing costs – credit constraints.

- **Institutional policies (esp. Re: higher education):**
  US educational system more democratic, secular, gender neutral. In Europe – more rigid, elitist. Less access to universities. In Europe public subsidies of higher-ed began in (60s-70s). In France college enrolments expanded in 80s.

- **Immigration policy: more open relative to Europe.**
  Esp. in late 19th, early 20th, and in aftermath of break of WW-II allowed importing skilled labor & scientific & entrepreneurial capacity.

- **The political/economic system:**
  US had a freer economy, larger free-trade area, less regulated labor markets, protection of property rights offering greater **ROR** to educational investments.
  Rel' free-market system, public educational support has 2 links with growth:
  - **a. Raising econ Performance of human capital;**
  - **b. Enhancing incentives to accumulate it.**

5. Why is Human Capital so critical to Growth

A. The endogenous growth hypothesis:

Human capital, or knowledge, is the only reproducible asset not subject to diminishing returns **(John Maurice Clark)**. More knowledge breeds new **net** knowledge as it also enhances productivity of learning & innovating. Thus:

- a. Knowledge accumulated by current generation can be transferred to, and aid in, knowledge formation in the next. Moreover, interaction between parents' and children's generations is a sine-qua-non for **growth**. Why? Without such link each generation would attain constant knowledge level.

- b. Since generations overlap, continuous HC accumulation is feasible via investments. This is why self-sustaining productivity growth is an **endogenous process**, coming from controllable internal forces.

- c. Warning: growth is not automatic. Whether economy stays stagnant or achieves self-sustaining growth depends on **motivation and incentives** of individuals, families, firms, and governments to invest in education which, in turn, depends on economy's ability to reward such investments.

Model

(1) $q = B(T)f(K/L)$; $T \equiv H$;
In steady state $k=K/L$ is constant, given parameters

(2) $H_{t+1} = Ah_t (H^e+H_t)$; Ehrlich & Kim (06) also allow intra-gen. spillover effects

if $Ah<1$, no human capital accumulation

- Objective function: parent Max lifetime U w.r.t. {n, h}:

(3) $U = [1/(1-\sigma)][C_{1,t}^{1-\sigma}-1]+\delta\ [1/(1-\sigma)]\{[C_{2,t+1}^{1-\sigma}-1] + [C_{3,t+1}^{1-\sigma}-1]\}$ 3 components:

$C_{1,t}= (H^e+H_t)[1-vn_t-\theta h_t n_t]-w_t H_t$ =consumption @ period 1=adulthood
$C_{2,t+1}= n_t\, w_{t+1} H_{t+1}$ = consumption @ period 2 = old age
$C^i_{3,t+1} \equiv B(n^i_t)^{\beta}(H^e+H^i_{t+1})^{\alpha}$ = altruistic benefits @ 2;
$[1/(1-\sigma)] > \beta > \alpha = 1$.

v^i, h^i = fraction of i's income of spent on raising, educating each child;
θ^i = i's unit cost of financing educational investment per child.
w^i= parental compensation rate per H^i; endogenized in **App B.**
Note: altruism + old age support = joint motivating forces to assure interior solutions in $\{n^i, h^i, E^i\}$ at all stages of development.
Savings added in **App. C**; "earnings" may thus stand for income.

Self-sustaining growth

Human capital intergenerational PF:

$$H_{t+1} = Ah_t (H^e + H_t). \qquad (1)$$

Plot: slope = $dH_{t+1}/dH_t = Ah$, Intercept: Ah_tH^e

For a stagnant steady state we need:

$$H_t = Ah (H^e + H_t), \text{ or} \qquad (2)$$

$$Ah^* = H_t^* /(H^e + H_t^*) < 1 \qquad (3)$$

with

$$H^* = Ah^*H^e / (1-Ah^*).$$

∵ As long as Ah <1 we are stuck in a Malthusian Trap

- Condition for growth steady state: $Ah \geqq 1$
- h* is a current generation control variable

Motivating factors include:

- Strong family unit strengthening intergenerational links
- Competitive markets rewarding knowledge & productivity
- Rule of Law. Protection of (intellectual) property rights.
- Public subsidization of investment in education to internalize 2 types of externalities: a. imperfections in the capital market for education financing; b. knowledge spillover effects.
- All these contribute to high **ROR** on (higher) Ed investments.

By this analysis the US lead among developed countries ultimately stems from the relatively high ROR for educational attainments it offers through its relatively free market and free-trade policies. This also explains the US power to attract immigrants and benefit from their "brain power".

B. Why is higher education especially important?

a. Researchers and skilled workers generate:

- product innovation: new & better products & services: financial, IT, health-improving and life extending;
- process innovation: more cost-efficient methods of producing existing products. This enhances productivity **growth.**

c. Those w/ higher education also perform a leadership role in society by transferring knowledge to others.

- Knowledge spillover effects are another externality that calls for government special attention to higher education.

6. Evidence linking education and productivity growth

A. Evidence from growth accounting

Ascribing changes in output to changes in inputs after weighting labor employment by educational attainments. Expansion in educational index explains ≈ ¼ of productivity growth, but still leaves a large unexplained "residual".

B. Evidence from rates of return to education

"Mincer regressions" establish strong link between individual schooling, experience & earnings, permitting estimation of RORs to schooling – upward of 10% per annum in US (exceeding real RORs in financial markets). Notable: stable ROR over 40-80; improved RORs for blacks. Jump in RORs in 90 (13%). See **Table 5**

C. Linking investment in human capital to growth

By endog. growth paradigm **growth rates** of per-capita GDP, g(y), in a growth-equilibrium regime should be systematically related to investment in education, which can be inferred from **growth rates** of schooling attainments over time, g(H). We estimate relation from int'l data panel of developing @ developed economies:

(3) $\text{Log}[1+g(y)]^* = \alpha + \beta \log[1+g(H)]^*$. See **Fig. 3**

Variants of this regression explain 30-36% (adj. R^2) of the variation in g(y).

Table 5: *Estimated Coefficient from Mincer Log Earnings Regression for Men*

		Whites		Blacks	
		Coefficient	Std. Error	Coefficient	Std. Error
1940	Intercept	4.4771	0.0096	4.6711	0.0298
	Education	**0.125**	0.0007	**0.0871**	0.0022
	Experience	0.0904	0.0005	0.0646	0.0018
	Experience-Squared	-0.0013	0	-0.0009	0
1960	Intercept	5.6478	0.0066	5.4107	0.022
	Education	**0.1152**	0.0005	**0.1034**	0.0016
	Experience	0.1156	0.0003	0.1035	0.0011
	Experience-Squared	-0.0018	0	-0.0016	0
1990	Intercept	6.8912	0.0034	6.3474	0.0144
	Education	**0.1292**	0.0002	**0.1524**	0.0011
	Experience	0.1301	0.0001	0.1109	0.0006
	Experience-Squared	-0.0023	0	-0.0017	0

Source: Heckman et al. (2003)

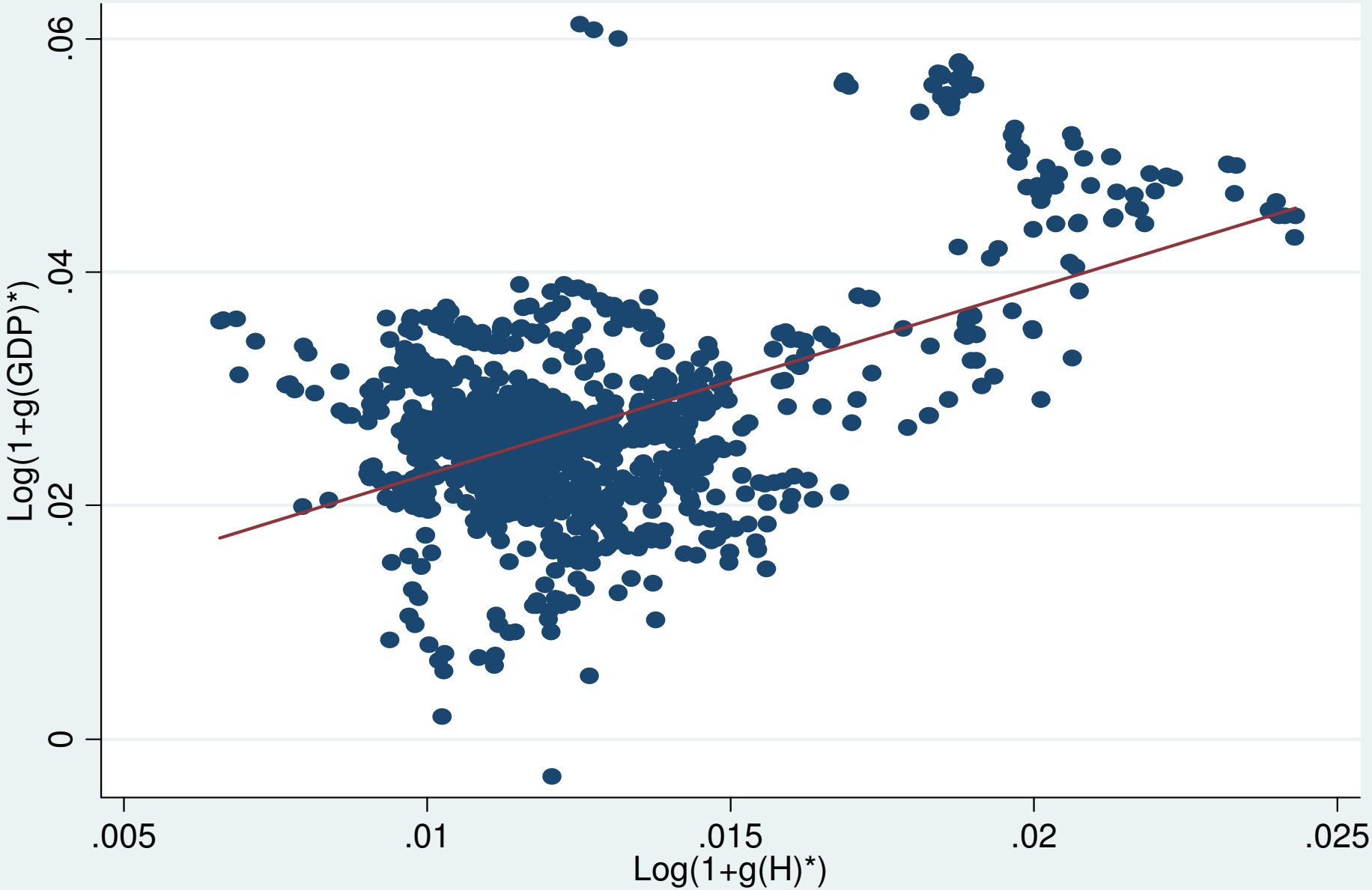


Figure 3: ***Correlating Predicted Growth Rates in Per Capita GDP and Average School Years of the Adult Population (based on Ehrlich and Kim, 2005)***

7. Epilogue: Can the US retain its advantage

- Circumstantial evidence supports thesis that "HC", esp. upper-second'y & tertiary edu., despite imperfection has been secret weapon in the US overtaking of UK & E-5. What's next?

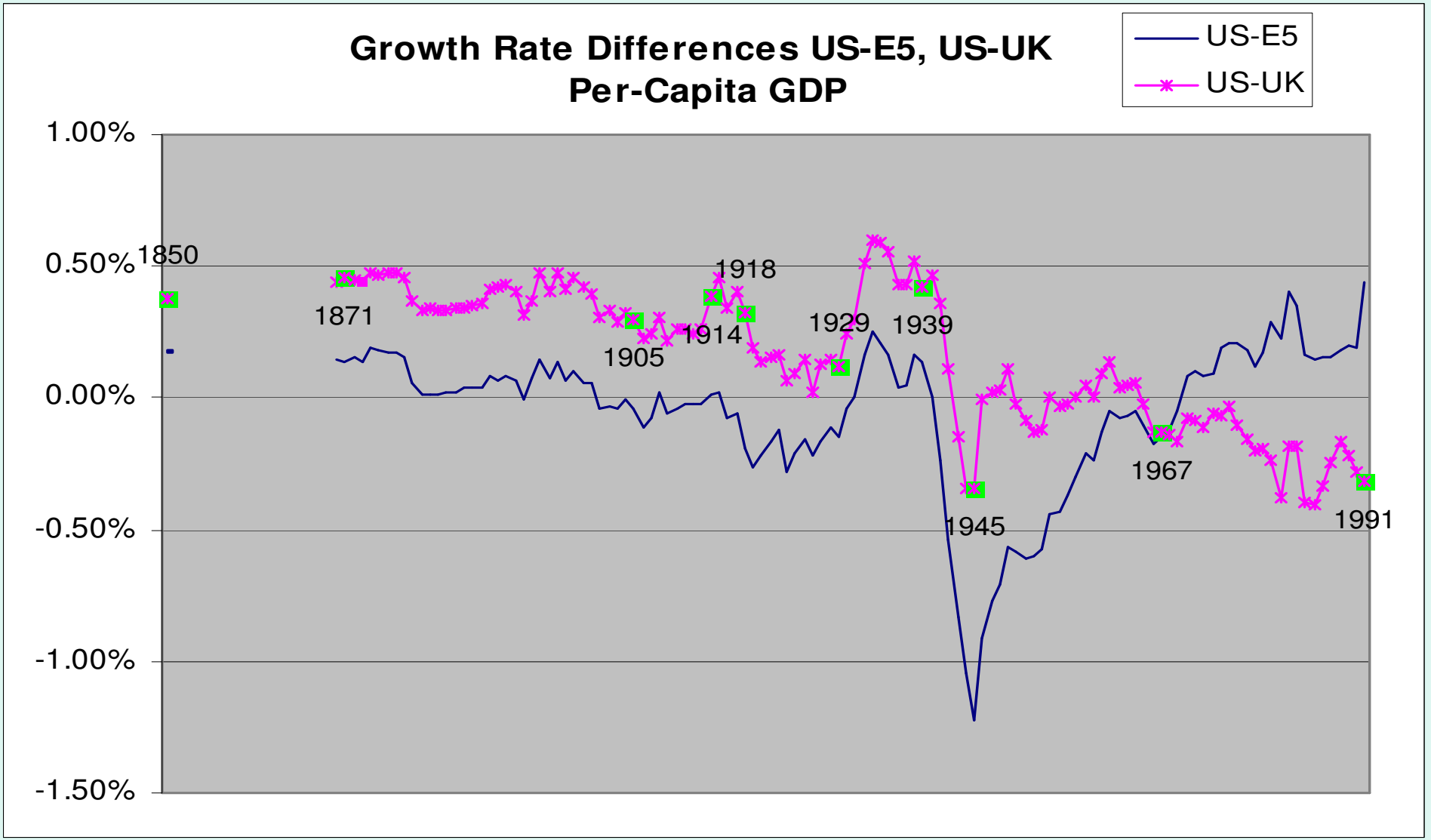
- Based on T-2 & 3, educational attainment gaps are closing. Even over 98-03: In HS attainments: E-5 rise from 64.9% to 68.2% of US
  In Tertiary type-A : E-5 rise from 46.7% to 51.7% of US
  UK rises from 55.6% to 65.5% of US

- But schooling is not perfect HC proxy: it has upper limit & we need to account for firm R&D as well, esp. in developed countries.

- Indeed, evolving LT GDPPC g-rate gaps are more mixed. As starting reference yrs shift from 1850-03 to 91-03, US's edge on E-5, despite cycles, hold & is even up, but the UK converges – see **Fig. 4A.**
- Same for evolving GDP g-rate, except the US gap here is a full percent higher because of a higher pop. growth – see **Fig. 4B.**

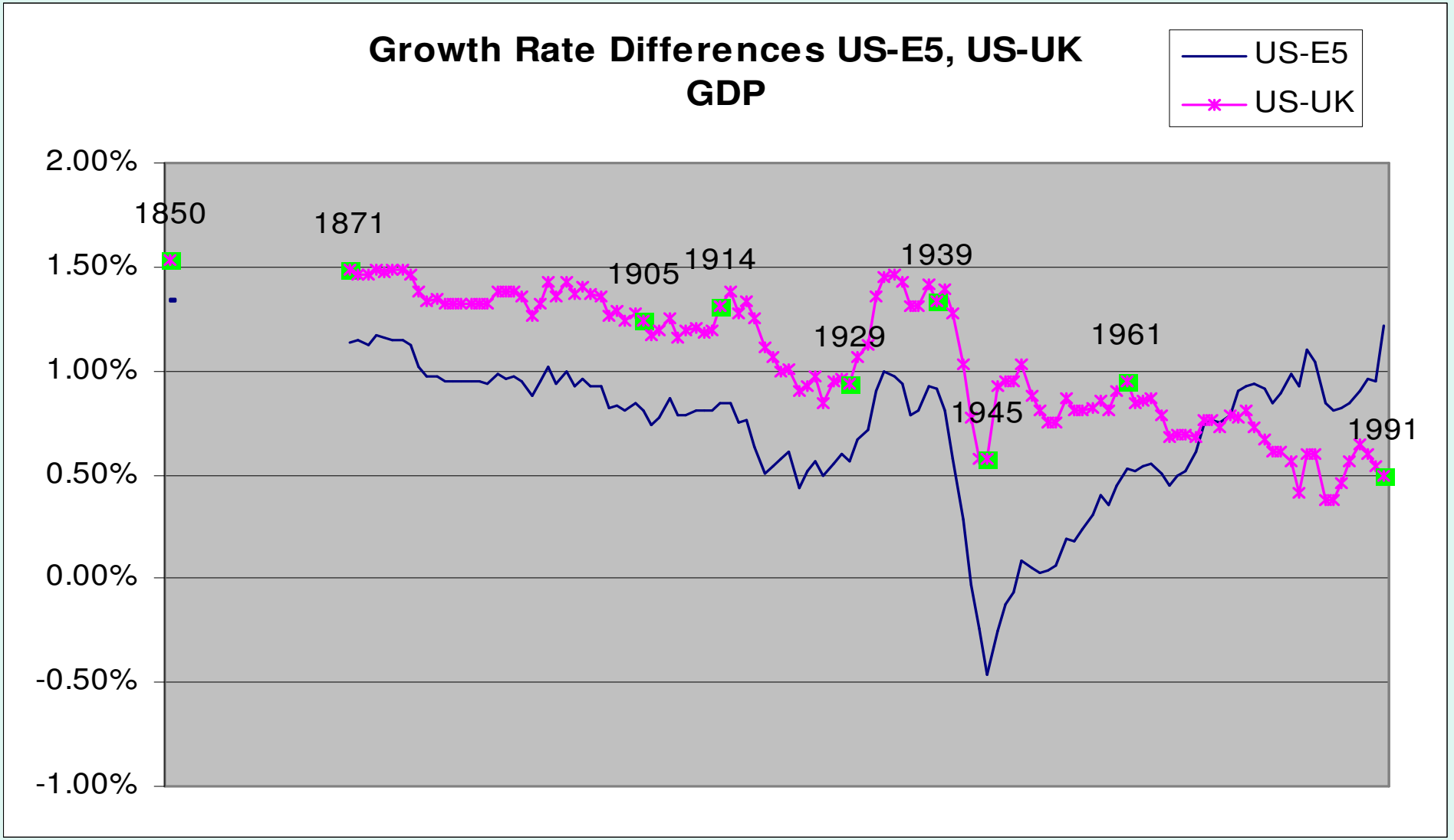
- Even over 98-03 these data indicate a positive correlation between g(y) and esp. tertiary attainments, at least across UK and Germany.

Figure 4-A: Deviations in Long-Term Per-Capita GDP Growth Rates Per Annum over the period 1850-2003 between the US and E5, and US and UK



Notes: Chart shows Percentage differences measured at progressively later starting dates from 1850-2003 up to 1991-2003.
GDP data are in real (PPP) 1990 Geary-Khamis dollars. Source: Maddison (2003)
* E5 includes: France, Germany, Italy, Spain, and United Kingdom

Figure 4-B: Deviations in Long-Term GDP Growth Rates Per Annum over the period 1850-2003 between the US and E5, and US and UK

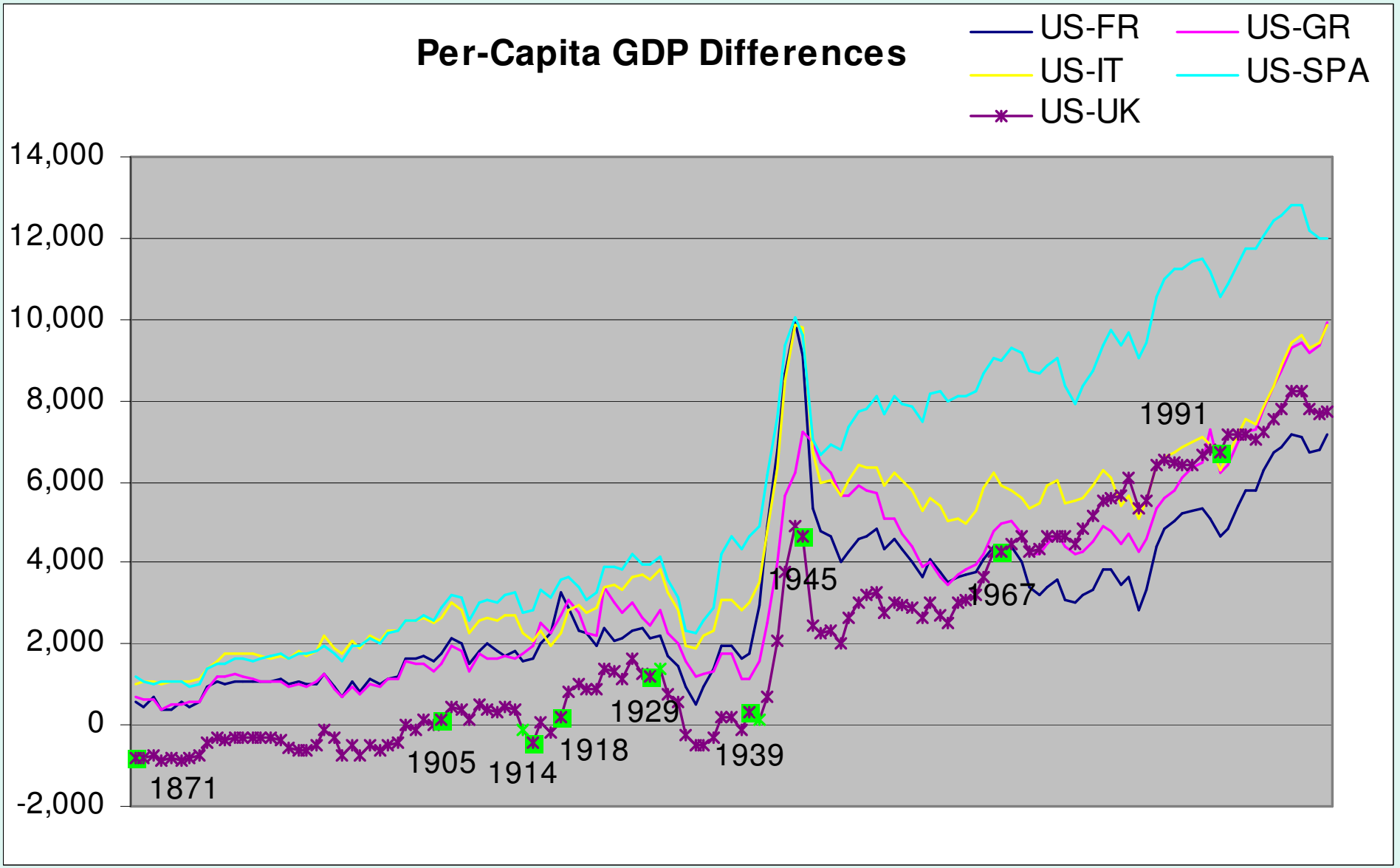


Notes: Chart shows Percentage differences measured at progressively later starting dates from 1850-2003 up to 1991-2003.
GDP data are in real (PPP) 1990 Geary-Khamis dollars. Source: Maddison (2003)
* E5 includes: France, Germany, Italy, Spain, and United Kingdom

Epilogue

- Other forces may be at work in explaining trends in g-rates, but US educational advantage provides powerful explanation.
- Will US lose its advantage? First answer: absolute GDPPC will continue to grow even if growth rates converge – see **Fig. 5**.
- Future developments depend on comparative trends in underlying causes that created the US long-term advantage – the high reward the US system provides to HC, domestically produced or imported.
- They also depend on Gov. support of education generally and Higher-Ed specifically, to internalizes externalities.
- Important issue, however, is not whether the US advantage is maintained. World welfare best served if all countries competed on HC formation to sustain economic growth and equitable income distribution.

Figure 5: Annual Per Capita GDP Differences between the US and Major European Countries 1871-2003 (1990 Geary Khamis $)



Source: Maddison (2003)