Table 8b. **World GDP, 20 Countries and Regional Totals, 1-2001 AD**
(million 1990 international Geary-Khamis dollars)

	1	*1000*	*1500*	*1600*	*1700*	*1820*	*1870*	*1913*	*1950*	*1973*	*2001*
Austria			1 414	2 093	2 483	4 104	8 419	23 451	25 702	85 227	164 851
Belgium			1 225	1 561	2 288	4 529	13 716	32 347	47 190	118 516	214 655
Denmark			443	569	727	1 471	3 782	11 670	29 654	70 032	123 978
Finland			136	215	255	913	1 999	6 389	17 051	51 724	105 298
France			10 912	15 559	19 539	35 468	72 100	144 489	220 492	683 965	1 258 297
Germany			8 256	12 656	13 650	26 819	72 149	237 332	265 354	944 755	1 536 743
Italy			11 550	14 410	14 630	22 535	41 814	95 487	164 957	582 713	1 101 366
Netherlands			723	2 072	4 047	4 288	9 952	24 955	60 642	175 791	347 136
Norway			192	304	450	1 071	2 485	6 119	17 838	44 544	110 683
Sweden			382	626	1 231	3 098	6 927	17 403	47 269	109 794	182 492
Switzerland			411	750	1 068	2 165	5 581	16 483	42 545	117 251	162 150
United Kingdom			2 815	6 007	10 709	36 232	100 180	224 618	347 850	675 941	1 202 074
12 Country Total			**38 459**	**56 822**	**71 077**	**142 693**	**339 104**	**840 743**	**1 286 544**	**3 660 253**	**6 509 723**
Portugal			606	814	1 638	3 043	4 219	7 467	17 615	63 397	143 234
Spain			4 495	7 029	7 481	12 299	19 556	41 653	61 429	266 896	627 733
Other			602	975	1 106	2 110	4 712	12 478	30 600	105 910	269 582
Total Western Europe	**11 115**	**10 165**	**44 162**	**65 640**	**81 302**	**160 145**	**367 591**	**902 341**	**1 396 188**	**4 096 456**	**7 550 272**
Eastern Europe	**1 900**	**2 600**	**6 696**	**9 289**	**11 393**	**24 906**	**50 163**	**134 793**	**185 023**	**550 756**	**728 792**
Former USSR	**1 560**	**2 840**	**8 458**	**11 426**	**16 196**	**37 678**	**83 646**	**232 351**	**510 243**	**1 513 070**	**1 343 230**
United States			800	600	527	12 548	98 374	517 383	1 455 916	3 536 622	7 965 795
Other Western Offshoots			320	320	306	951	13 129	65 558	179 574	521 667	1 190 472
Total Western Offshoots	**468**	**784**	**1 120**	**920**	**833**	**13 499**	**111 493**	**582 941**	**1 635 490**	**4 058 289**	**9 156 267**
Mexico			3 188	1 134	2 558	5 000	6 214	25 921	67 368	279 302	722 198
Other Latin America			4 100	2 629	3 788	10 024	21 305	93 950	348 539	1 109 727	2 364 808
Total Latin America	**2 240**	**4 560**	**7 288**	**3 763**	**6 346**	**15 024**	**27 519**	**119 871**	**415 907**	**1 389 029**	**3 087 006**
Japan	**1 200**	**3 188**	**7 700**	**9 620**	**15 390**	**20 739**	**25 393**	**71 653**	**160 966**	**1 242 932**	**2 624 523**
China	26 820	26 550	61 800	96 000	82 800	228 600	189 740	241 344	239 903	740 048	4 569 790
India	33 750	33 750	60 500	74 250	90 750	111 417	134 882	204 242	222 222	494 832	2 003 193
Other Asia	16 470	18 630	31 301	36 725	40 567	52 177	76 994	163 109	363 646	1 388 124	4 908 218
Total Asia (excluding Japan)	**77 040**	**78 930**	**153 601**	**206 975**	**214 117**	**392 194**	**401 616**	**608 695**	**822 771**	**2 623 004**	**11 481 201**
Africa	**7 096**	**13 720**	**19 283**	**23 349**	**25 692**	**31 161**	**45 234**	**79 486**	**203 131**	**549 993**	**1 222 577**
World	**102 619**	**116 787**	**248 308**	**330 982**	**371 269**	**695 346**	**1 112 655**	**2 732 131**	**5 329 719**	**16 023 529**	**37 193 868**

Table 8b. **Rate of Growth of World GDP, 20 Countries and Regional Totals, 1-2001 AD**
(annual average compound growth rates)

	1-1000	*1000-1500*	*1500-1820*	*1820-70*	*1870-1913*	*1913-50*	*1950-73*	*1973-2001*
Austria			0.33	1.45	2.41	0.25	5.35	2.38
Belgium			0.41	2.24	2.02	1.03	4.08	2.14
Denmark			0.38	1.91	2.66	2.55	3.81	2.06
Finland			0.60	1.58	2.74	2.69	4.94	2.57
France			0.37	1.43	1.63	1.15	5.05	2.20
Germany			0.37	2.00	2.81	0.30	5.68	1.75
Italy			0.21	1.24	1.94	1.49	5.64	2.30
Netherlands			0.56	1.70	2.16	2.43	4.74	2.46
Norway			0.54	1.70	2.12	2.93	4.06	3.30
Sweden			0.66	1.62	2.17	2.74	3.73	1.83
Switzerland			0.52	1.91	2.55	2.60	4.51	1.16
United Kingdom			0.80	2.05	1.90	1.19	2.93	2.08
12 Country Average			**0.41**	**1.75**	**2.13**	**1.16**	**4.65**	**2.08**
Portugal			0.51	0.66	1.34	2.35	5.73	2.95
Spain			0.32	0.93	1.77	1.06	6.60	3.10
Other			0.39	1.62	2.29	2.45	5.55	3.39
Total Western Europe	**-0.01**	**0.29**	**0.40**	**1.68**	**2.11**	**1.19**	**4.79**	**2.21**
Eastern Europe	**0.03**	**0.19**	**0.41**	**1.41**	**2.33**	**0.86**	**4.86**	**1.01**
Former USSR	**0.06**	**0.22**	**0.47**	**1.61**	**2.40**	**2.15**	**4.84**	**-0.42**
United States			0.86	4.20	3.94	2.84	3.93	2.94
Other Western Offshoots			0.34	5.39	3.81	2.76	4.75	2.99
Total Western Offshoots	**0.05**	**0.07**	**0.78**	**4.31**	**3.92**	**2.83**	**4.03**	**2.95**
Mexico			0.14	0.44	3.38	2.62	6.38	3.45
Other Latin America			0.28	1.52	3.51	3.61	5.16	2.74
Total Latin America	**0.07**	**0.09**	**0.23**	**1.22**	**3.48**	**3.42**	**5.38**	**2.89**
Japan	**0.10**	**0.18**	**0.31**	**0.41**	**2.44**	**2.21**	**9.29**	**2.71**
China	0.00	0.17	0.41	-0.37	0.56	-0.02	5.02	6.72
India	0.00	0.12	0.19	0.38	0.97	0.23	3.54	5.12
Other Asia	0.01	0.10	0.16	0.78	1.76	2.19	6.00	4.61
Total Asia (excl. Japan)	**0.00**	**0.13**	**0.29**	**0.05**	**0.97**	**0.82**	**5.17**	**5.41**
Africa	**0.07**	**0.07**	**0.15**	**0.75**	**1.32**	**2.57**	**4.43**	**2.89**
World	**0.01**	**0.15**	**0.32**	**0.93**	**2.11**	**1.82**	**4.90**	**3.05**

Table 8b. **Share of World GDP, 20 Countries and Regional Totals, 1-2001 AD**
(per cent of world total)

	1	*1000*	*1500*	*1600*	*1700*	*1820*	*1870*	*1913*	*1950*	*1973*	*2001*
Austria			0.6	0.6	0.7	0.6	0.8	0.9	0.5	0.5	0.4
Belgium			0.5	0.5	0.6	0.7	1.2	1.2	0.9	0.7	0.6
Denmark			0.2	0.2	0.2	0.2	0.3	0.4	0.6	0.4	0.3
Finland			0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3
France			4.4	4.7	5.3	5.1	6.5	5.3	4.1	4.3	3.4
Germany			3.3	3.8	3.7	3.9	6.5	8.7	5.0	5.9	4.1
Italy			4.7	4.4	3.9	3.2	3.8	3.5	3.1	3.6	3.0
Netherlands			0.3	0.6	1.1	0.6	0.9	0.9	1.1	1.1	0.9
Norway			0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3
Sweden			0.2	0.2	0.3	0.4	0.6	0.6	0.9	0.7	0.5
Switzerland			0.2	0.2	0.3	0.3	0.5	0.6	0.8	0.7	0.4
United Kingdom			1.1	1.8	2.9	5.2	9.0	8.2	6.5	4.2	3.2
12 Country total			**15.5**	**17.2**	**19.1**	**20.5**	**30.5**	**30.8**	**24.1**	**22.8**	**17.5**
Portugal			0.2	0.2	0.4	0.4	0.4	0.3	0.3	0.4	0.4
Spain			1.8	2.1	2.0	1.8	1.8	1.5	1.2	1.7	1.7
Other			0.2	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7
Total Western Europe	**10.8**	**8.7**	**17.8**	**19.8**	**21.9**	**23.0**	**33.0**	**33.0**	**26.2**	**25.6**	**20.3**
Eastern Europe	**1.9**	**2.2**	**2.7**	**2.8**	**3.1**	**3.6**	**4.5**	**4.9**	**3.5**	**3.4**	**2.0**
Former USSR	**1.5**	**2.4**	**3.4**	**3.5**	**4.4**	**5.4**	**7.5**	**8.5**	**9.6**	**9.4**	**3.6**
United States			0.3	0.2	0.1	1.8	8.8	18.9	27.3	22.1	21.4
Other Western Offshoots			0.1	0.1	0.1	0.1	1.2	2.4	3.4	3.3	3.2
Total Western Offshoots	**0.5**	**0.7**	**0.5**	**0.3**	**0.2**	**1.9**	**10.0**	**21.3**	**30.7**	**25.3**	**24.6**
Mexico			1.3	0.3	0.7	0.7	0.6	0.9	1.3	1.7	1.9
Other Latin America			1.7	0.8	1.0	1.4	1.9	3.4	6.5	6.9	6.4
Total Latin America	**2.2**	**3.9**	**2.9**	**1.1**	**1.7**	**2.2**	**2.5**	**4.4**	**7.8**	**8.7**	**8.3**
Japan	**1.2**	**2.7**	**3.1**	**2.9**	**4.1**	**3.0**	**2.3**	**2.6**	**3.0**	**7.8**	**7.1**
China	26.1	22.7	24.9	29.0	22.3	32.9	17.1	8.8	4.5	4.6	12.3
India	32.9	28.9	24.4	22.4	24.4	16.0	12.1	7.5	4.2	3.1	5.4
Other Asia	16.0	16.0	12.6	11.1	10.9	7.5	6.9	6.0	6.8	8.7	13.2
Total Asia (excl. Japan)	**75.1**	**67.6**	**61.9**	**62.5**	**57.7**	**56.4**	**36.1**	**22.3**	**15.4**	**16.4**	**30.9**
Africa	**6.9**	**11.7**	**7.8**	**7.1**	**6.9**	**4.5**	**4.1**	**2.9**	**3.8**	**3.4**	**3.3**
World	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Table 8c. **World Per Capita GDP, 20 Countries and Regional Averages, 1-2001 AD**
(1990 international Geary-Khamis dollars)

	1	*1000*	*1500*	*1600*	*1700*	*1820*	*1870*	*1913*	*1950*	*1973*	*2001*
Austria			707	837	993	1 218	1 863	3 465	3 706	11 235	20 225
Belgium			875	976	1 144	1 319	2 692	4 220	5 462	12 170	20 924
Denmark			738	875	1 039	1 274	2 003	3 912	6 943	13 945	23 160
Finland			453	538	638	781	1 140	2 111	4 253	11 085	20 344
France			727	841	910	1 135	1 876	3 485	5 271	13 114	21 092
Germany			688	791	910	1 077	1 839	3 648	3 881	11 966	18 677
Italy			1 100	1 100	1 100	1 117	1 499	2 564	3 502	10 634	19 040
Netherlands			761	1 381	2 130	1 838	2 757	4 049	5 996	13 082	21 722
Norway			640	760	900	1 104	1 432	2 501	5 463	11 246	24 580
Sweden			695	824	977	1 198	1 662	3 096	6 739	13 493	20 562
Switzerland			632	750	890	1 090	2 102	4 266	9 064	18 204	22 264
United Kingdom			714	974	1 250	1 706	3 190	4 921	6 939	12 025	20 127
12 Country Average			**798**	**908**	**1 033**	**1 245**	**2 088**	**3 688**	**5 018**	**12 156**	**20 024**
Portugal			606	740	819	923	975	1 250	2 086	7 063	14 229
Spain			661	853	853	1 008	1 207	2 056	2 189	7 661	15 659
Other			472	525	584	711	1 027	1 840	2 538	7 614	15 989
West European average	**450**	**400**	**771**	**890**	**998**	**1 204**	**1 960**	**3 458**	**4 579**	**11 416**	**19 256**
Eastern Europe	**400**	**400**	**496**	**548**	**606**	**683**	**937**	**1 695**	**2 111**	**4 988**	**6 027**
Former USSR	**400**	**400**	**499**	**552**	**610**	**688**	**943**	**1 488**	**2 841**	**6 059**	**4 626**
United States			400	400	527	1 257	2 445	5 301	9 561	16 689	27 948
Other Western Offshoots			400	400	408	761	2 245	4 752	7 425	13 399	21 718
Average Western Offshoots	**400**	**400**	**400**	**400**	**476**	**1 202**	**2 419**	**5 233**	**9 268**	**16 179**	**26 943**
Mexico			425	454	568	759	674	1 732	2 365	4 845	7 089
Other Latin America			410	431	502	663	683	1 424	2 536	4 426	5 508
Latin American Average	**400**	**400**	**416**	**438**	**527**	**692**	**681**	**1 481**	**2 506**	**4 504**	**5 811**
Japan	**400**	**425**	**500**	**520**	**570**	**669**	**737**	**1 387**	**1 921**	**11 434**	**20 683**
China	**450**	450	600	600	600	600	530	552	439	839	3 583
India	**450**	450	550	550	550	533	533	673	619	853	1 957
Other Asia	**450**	450	565	565	565	584	643	882	926	2 049	3 998
Asian average (excl. Japan)	**450**	**450**	**572**	**575**	**571**	**577**	**550**	**658**	**634**	**1 226**	**3 256**
Africa	**430**	**425**	**414**	**422**	**421**	**420**	**500**	**637**	**894**	**1 410**	**1 489**
World	**445**	**436**	**566**	**595**	**615**	**667**	**875**	**1 525**	**2 111**	**4 091**	**6 049**

Table 8b. **Rate of Growth of World Per Capita GDP, 20 Countries and Regional Averages, 1-2001 AD**
(annual average compound growth rates)

	1-1000	*1000-1500*	*1500-1820*	*1820-70*	*1870-1913*	*1913-50*	*1950-73*	*1973-2001*
Austria			0.17	0.85	1.45	0.18	4.94	2.12
Belgium			0.13	1.44	1.05	0.70	3.54	1.95
Denmark			0.17	0.91	1.57	1.56	3.08	1.83
Finland			0.17	0.76	1.44	1.91	4.25	2.19
France			0.14	1.01	1.45	1.12	4.04	1.71
Germany			0.14	1.08	1.61	0.17	5.02	1.60
Italy			0.00	0.59	1.26	0.85	4.95	2.10
Netherlands			0.28	0.81	0.90	1.07	3.45	1.83
Norway			0.17	0.52	1.30	2.13	3.19	2.83
Sweden			0.17	0.66	1.46	2.12	3.06	1.52
Switzerland			0.17	1.32	1.66	2.06	3.08	0.72
United Kingdom			0.27	1.26	1.01	0.93	2.42	1.86
12 Country Average			**0.14**	**1.04**	**1.33**	**0.84**	**3.92**	**1.80**
Portugal			0.13	0.11	0.58	1.39	5.45	2.53
Spain			0.13	0.36	1.25	0.17	5.60	2.59
Other			0.13	0.74	1.37	0.87	4.89	2.68
Total Western Europe	**-0.01**	**0.13**	**0.14**	**0.98**	**1.33**	**0.76**	**4.05**	**1.88**
Eastern Europe	**0.00**	**0.04**	**0.10**	**0.63**	**1.39**	**0.60**	**3.81**	**0.68**
Former USSR	**0.00**	**0.04**	**0.10**	**0.63**	**1.06**	**1.76**	**3.35**	**-0.96**
United States			0.36	1.34	1.82	1.61	2.45	1.86
Other Western Offshoots			0.20	2.19	1.76	1.21	2.60	1.74
Total Western Offshoots	**0.00**	**0.00**	**0.34**	**1.41**	**1.81**	**1.56**	**2.45**	**1.84**
Mexico			0.18	-0.24	2.22	0.85	3.17	1.37
Other Latin America			0.15	0.06	1.72	1.57	2.45	0.78
Total Latin America	**0.00**	**0.01**	**0.16**	**-0.03**	**1.82**	**1.43**	**2.58**	**0.91**
Japan	**0.01**	**0.03**	**0.09**	**0.19**	**1.48**	**0.88**	**8.06**	**2.14**
China	**0.00**	0.06	0.00	-0.25	0.10	-0.62	2.86	5.32
India	**0.00**	0.04	-0.01	0.00	0.54	-0.22	1.40	3.01
Other Asia	**0.00**	0.05	0.01	0.19	0.74	0.13	3.51	2.42
Total Asia (excl. Japan)	**0.00**	**0.05**	**0.00**	**-0.10**	**0.42**	**-0.10**	**2.91**	**3.55**
Africa	**0.00**	**-0.01**	**0.00**	**0.35**	**0.57**	**0.92**	**2.00**	**0.19**
World	**0.00**	**0.05**	**0.05**	**0.54**	**1.30**	**0.88**	**2.92**	**1.41**

Table 8a. **World Population, 20 Countries and Regional Totals, 1-2001 AD**

(000)

	1	*1000*	*1500*	*1600*	*1700*	*1820*	*1870*	*1913*	*1950*	*1973*	*2001*
Austria	500	700	2 000	2 500	2 500	3 369	4 520	6 767	6 935	7 586	8 151
Belgium	300	400	1 400	1 600	2 000	3 434	5 096	7 666	8 639	9 738	10 259
Denmark	180	360	600	650	700	1 155	1 888	2 983	4 271	5 022	5 353
Finland	20	40	300	400	400	1 169	1 754	3 027	4 009	4 666	5 176
France	5 000	6 500	15 000	18 500	21 471	31 250	38 440	41 463	41 829	52 157	59 658
Germany	3 000	3 500	12 000	16 000	15 000	24 905	39 231	65 058	68 375	78 950	82 281
Italy	7 000	5 000	10 500	13 100	13 300	20 176	27 888	37 248	47 105	54 797	57 845
Netherlands	200	300	950	1 500	1 900	2 333	3 610	6 164	10 114	13 438	15 981
Norway	100	200	300	400	500	970	1 735	2 447	3 265	3 961	4 503
Sweden	200	400	550	760	1 260	2 585	4 169	5 621	7 014	8 137	8 875
Switzerland	300	300	650	1 000	1 200	1 986	2 655	3 864	4 694	6 441	7 283
United Kingdom	800	2 000	3 942	6 170	8 565	21 239	31 400	45 649	50 127	56 210	59 723
12 Country Total	**17 600**	**19 700**	**48 192**	**62 580**	**68 796**	**114 571**	**162 386**	**227 957**	**256 377**	**301 103**	**325 088**
Portugal	500	600	1 000	1 100	2 000	3 297	4 327	5 972	8 443	8 976	10 066
Spain	4 500	4 000	6 800	8 240	8 770	12 203	16 201	20 263	28 063	34 837	40 087
Other	2 100	1 113	1 276	1 858	1 894	2 969	4 590	6 783	12 058	13 909	16 860
Total Western Europe	**24 700**	**25 413**	**57 268**	**73 778**	**81 460**	**133 040**	**187 504**	**260 975**	**304 941**	**358 825**	**392 101**
Eastern Europe	**4 750**	**6 500**	**13 500**	**16 950**	**18 800**	**36 457**	**53 557**	**79 530**	**87 637**	**110 418**	**120 912**
Former USSR	**3 900**	**7 100**	**16 950**	**20 700**	**26 550**	**54 765**	**88 672**	**156 192**	**179 571**	**249 712**	**290 349**
United States	680	1 300	2 000	1 500	1 000	9 981	40 241	97 606	152 271	211 909	285 024
Other Western Offshoots	490	660	800	800	750	1 250	5 847	13 795	24 186	38 932	54 815
Total Western Offshoots	**1 170**	**1 960**	**2 800**	**2 300**	**1 750**	**11 231**	**46 088**	**111 401**	**176 457**	**250 841**	**339 839**
Mexico	2 200	4 500	7 500	2 500	4 500	6 587	9 219	14 970	28 485	57 643	101 879
Other Latin America	3 400	6 900	10 000	6 100	7 550	15 118	31 180	65 965	137 453	250 756	429 334
Total Latin America	**5 600**	**11 400**	**17 500**	**8 600**	**12 050**	**21 705**	**40 399**	**80 935**	**165 938**	**308 399**	**531 213**
Japan	**3 000**	**7 500**	**15 400**	**18 500**	**27 000**	**31 000**	**34 437**	**51 672**	**83 805**	**108 707**	**126 892**
China	59 600	59 000	103 000	160 000	138 000	381 000	358 000	437 140	546 815	881 940	1 275 392
India	75 000	75 000	110 000	135 000	165 000	209 000	253 000	303 700	359 000	580 000	1 023 590
Other Asia	36 600	41 400	55 400	65 000	71 800	89 400	119 792	184 849	392 827	677 613	1 227 630
Total Asia (excluding Japan)	**171 200**	**175 400**	**268 400**	**360 000**	**374 800**	**679 400**	**730 792**	**925 689**	**1 298 642**	**2 139 553**	**3 526 612**
Africa	**16 500**	**32 300**	**46 610**	**55 320**	**61 080**	**74 236**	**90 466**	**124 697**	**227 333**	**390 034**	**821 088**
World	**230 820**	**267 573**	**438 428**	**556 148**	**603 490**	**1 041 834**	**1 271 915**	**1 791 091**	**2 524 324**	**3 916 489**	**6 149 006**

Table 8a. **Rate of Growth of World Population, 20 Countries and Regional Totals, 1-2001 AD**
(annual average coumpound growth rates)

	1-1000	*1000-1500*	*1500-1820*	*1820-70*	*1870-1913*	*1913-50*	*1950-73*	*1973-2001*
Austria	0.03	0.21	0.16	0.59	0.94	0.07	0.39	0.26
Belgium	0.03	0.25	0.28	0.79	0.95	0.32	0.52	0.19
Denmark	0.07	0.10	0.20	0.99	1.07	0.97	0.71	0.23
Finland	0.07	0.40	0.43	0.81	1.28	0.76	0.66	0.37
France	0.03	0.17	0.23	0.42	0.18	0.02	0.96	0.48
Germany	0.02	0.25	0.23	0.91	1.18	0.13	0.63	0.15
Italy	-0.03	0.15	0.20	0.65	0.68	0.64	0.66	0.19
Netherlands	0.04	0.23	0.28	0.88	1.25	1.35	1.24	0.62
Norway	0.07	0.08	0.37	1.17	0.80	0.78	0.84	0.46
Sweden	0.07	0.06	0.48	0.96	0.70	0.60	0.65	0.31
Switzerland	0.00	0.15	0.35	0.58	0.88	0.53	1.39	0.44
United Kingdom	0.09	0.14	0.53	0.79	0.87	0.25	0.50	0.22
12 Country average	0.01	**0.18**	**0.27**	**0.70**	**0.79**	**0.32**	**0.70**	**0.27**
Portugal	0.02	0.10	0.37	0.55	0.75	0.94	0.27	0.41
Spain	-0.01	0.11	0.18	0.57	0.52	0.88	0.94	0.50
Other	-0.06	0.03	0.26	0.88	0.91	1.57	0.62	0.69
Total Western Europe	**0.00**	**0.16**	**0.26**	**0.69**	**0.77**	**0.42**	**0.71**	**0.32**
Eastern Europe	**0.03**	**0.15**	**0.31**	**0.77**	**0.92**	**0.26**	**1.01**	**0.32**
Former USSR	**0.06**	**0.17**	**0.37**	**0.97**	**1.33**	**0.38**	**1.44**	**0.54**
United States	0.06	0.09	0.50	2.83	2.08	1.21	1.45	1.06
Other Western Offshoots	0.03	0.04	0.14	3.13	2.02	1.53	2.09	1.23
Total Western Offshoots	**0.05**	**0.07**	**0.44**	**2.86**	**2.07**	**1.25**	**1.54**	**1.09**
Mexico	**0.07**	**0.10**	-0.04	0.67	1.13	1.75	3.11	2.05
Other Latin America	0.07	0.07	0.13	1.46	1.76	2.00	2.65	1.94
Total Latin America	**0.07**	**0.09**	**0.07**	**1.25**	**1.63**	**1.96**	**2.73**	**1.96**
Japan	**0.09**	**0.14**	**0.22**	**0.21**	**0.95**	**1.32**	**1.14**	**0.55**
China	0.00	0.11	0.41	-0.12	0.47	0.61	2.10	1.33
India	0.00	0.08	0.20	0.38	0.43	0.45	2.11	2.05
Other Asia	0.01	0.06	0.15	0.59	1.01	2.06	2.40	2.15
Total Asia (excl. Japan)	**0.00**	**0.09**	**0.29**	**0.15**	**0.55**	**0.92**	**2.19**	**1.80**
Africa	**0.07**	**0.07**	**0.15**	**0.40**	**0.75**	**1.64**	**2.37**	**2.69**
World	**0.01**	**0.10**	**0.27**	**0.40**	**0.80**	**0.93**	**1.93**	**1.62**

Table 8a. **Share of World Population, 20 Countries and Regional Totals, 1-2001 AD**
(per cent of world total)

	1	*1000*	*1500*	*1600*	*1700*	*1820*	*1870*	*1913*	*1950*	*1973*	*2001*
Austria	0.2	0.3	0.5	0.4	0.4	0.3	0.4	0.4	0.3	0.2	0.1
Belgium	0.1	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.2	0.2
Denmark	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1
Finland	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1
France	2.2	2.4	3.4	3.3	3.6	3.0	3.0	2.3	1.7	1.3	1.0
Germany	1.3	1.3	2.7	2.9	2.5	2.4	3.1	3.6	2.7	2.0	1.3
Italy	3.0	1.9	2.4	2.4	2.2	1.9	2.2	2.1	1.9	1.4	0.9
Netherlands	0.1	0.1	0.2	0.3	0.3	0.2	0.3	0.3	0.4	0.3	0.3
Norway	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sweden	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.2	0.1
Switzerland	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1
United Kingdom	0.3	0.7	0.9	1.1	1.4	2.0	2.5	2.5	2.0	1.4	1.0
12 Country total	**7.6**	**7.4**	**11.0**	**11.3**	**11.4**	**11.0**	**12.8**	**12.7**	**10.2**	**7.7**	**5.3**
Portugal	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2
Spain	1.9	1.5	1.6	1.5	1.5	1.2	1.3	1.1	1.1	0.9	0.7
Other	0.9	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.4	0.3
Total Western Europe	**10.7**	**9.5**	**13.1**	**13.3**	**13.5**	**12.8**	**14.7**	**14.6**	**12.1**	**9.2**	**6.4**
Eastern Europe	**2.1**	**2.4**	**3.1**	**3.0**	**3.1**	**3.5**	**4.2**	**4.4**	**3.5**	**2.8**	**2.0**
Former USSR	**1.7**	**2.7**	**3.9**	**3.7**	**4.4**	**5.3**	**7.0**	**8.7**	**7.1**	**6.4**	**4.7**
United States	0.3	0.5	0.5	0.3	0.2	1.0	3.2	5.4	6.0	5.4	4.6
Other Western Offshoots	0.2	0.2	0.2	0.1	0.1	0.1	0.5	0.8	1.0	1.0	0.9
Total Western Offshoots	**0.5**	**0.7**	**0.6**	**0.4**	**0.3**	**1.1**	**3.6**	**6.2**	**7.0**	**6.4**	**5.5**
Mexico			1.7	0.4	0.7	0.6	0.7	0.8	1.1	1.5	1.7
Other Latin America			2.3	1.1	1.3	1.5	2.5	3.7	5.4	6.4	7.0
Total Latin America	**2.4**	**4.3**	**4.0**	**1.5**	**2.0**	**2.1**	**3.2**	**4.5**	**6.6**	**7.9**	**8.6**
Japan	**1.3**	**2.8**	**3.5**	**3.3**	**4.5**	**3.0**	**2.7**	**2.9**	**3.3**	**2.8**	**2.1**
China	25.8	22.1	23.5	28.8	22.9	36.6	28.1	24.4	21.7	22.5	20.7
India	32.5	28.0	25.1	24.3	27.3	20.1	19.9	17.0	14.2	14.8	16.6
Other Asia	15.9	15.5	12.6	11.7	11.9	8.6	9.4	10.3	15.6	17.3	20.0
Total Asia (excl. Japan)	**74.2**	**65.6**	**61.2**	**64.7**	**62.1**	**65.2**	**57.5**	**51.7**	**51.4**	**54.6**	**57.4**
Africa	**7.1**	**12.1**	**10.6**	**9.9**	**10.1**	**7.1**	**7.1**	**7.0**	**9.0**	**10.0**	**13.4**
World	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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Is US economic growth over?

Is US economic growth over? Faltering innovation confronts the six

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Global growth is slowing – especially in advanced-technology economies. This column argues that regardless of cyclical trends, long term economic growth may grind to a halt. Two and a half centuries of rising per-capita incomes could well turn out to be a unique episode in human history.

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It is time to raise basic questions about the process of economic growth, especially the assumption – nearly universal since Solow's seminal contributions of the 1950s (Solow 1953) – that economic growth is a continuous process that will persist forever.

- There was virtually no growth before 1750;
- There is no guarantee that growth will continue indefinitely.

This column introduces my CEPR Policy Insight [1], which argues in detail that the rapid progress made over the past 250 years could well turn out to be a unique episode in human history (Gordon 2012).

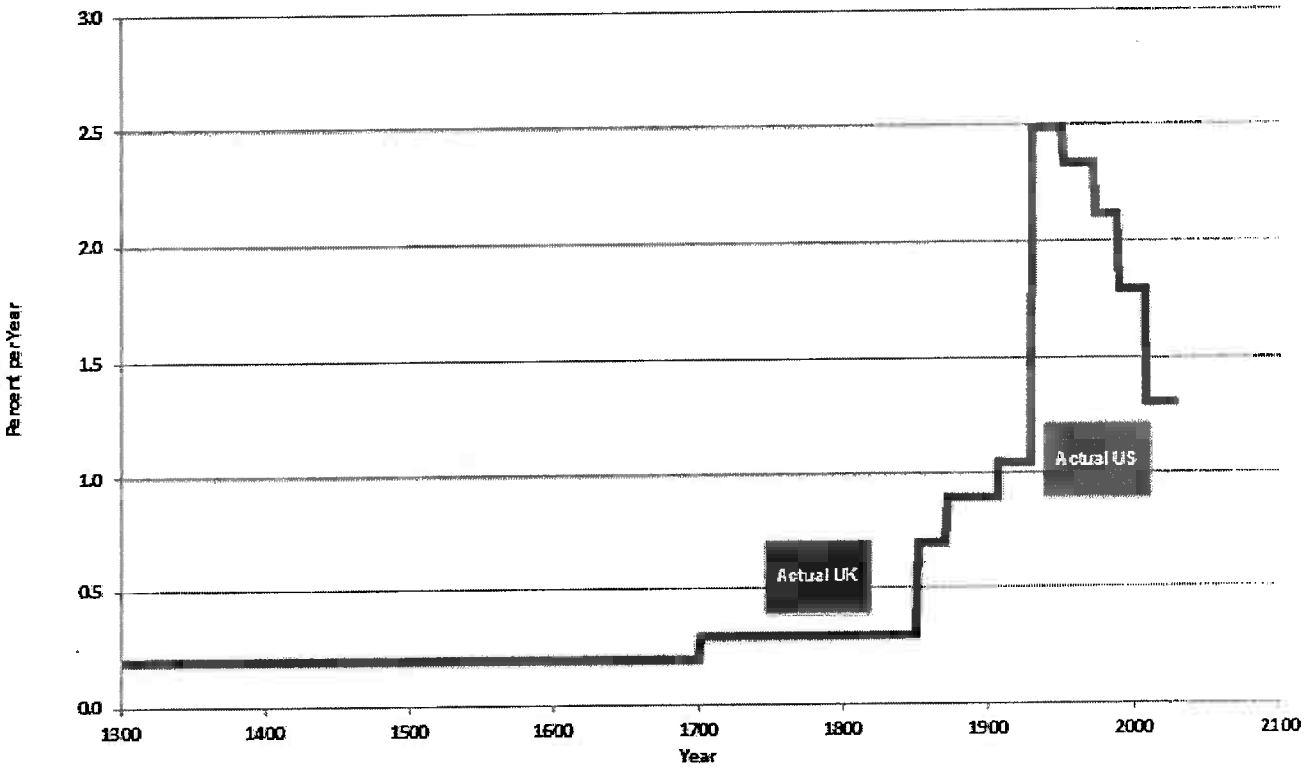
The data I use only concern the US and view the future from 2007 while pretending that the financial crisis did not happen. The focus is on per-capita real GDP growth in the frontier country since 1300, the UK until 1906 and the US afterwards. Growth in the frontier economy gradually accelerated after 1750, reached a peak in the middle of the 20th century, and it has been slowing since. The paper is about 'how much further could the frontier growth rate decline?'

Growth: The long view

Figure 1 takes the history of economic growth back to the year 1300. Clearly there was almost no growth through 1700, then a gradually accelerating rate of growth. The blue line in Figure 1 represents growth in the frontier country – the US after 1906 and Britain before because 1906 seems to be the consensus of modern growth data for the cutover.

The key point is the big peak in US growth between 1928 and 1950, the years that span the Great Depression and WWII. Leaving aside the debate about what could have caused a concentration of economic growth in a period dislocated by depression and war, the remaining conclusion of Figure 1 is that growth has steadily declined in each interval plotted since 1950.

Figure 1. Growth in real GDP per capita, 1300-2100



The paper is deliberately provocative and suggests not just that economic growth was a one-time thing centred on 1750-2050, but also that because there was no growth before 1750, there might conceivably be no growth after 2050 or 2100. The process of innovation may be battering its head against the wall of diminishing returns. Indeed, this is already evident in much of the innovation sector.

To taunt critics Figure 2 superimposes on the actual growth record a green line that starts at zero growth in 1300, peaks in the middle of the 20th century, and then floats down to 0.2% by 2100. Figure 3 translates the growth rates into levels.

- Before 1800, it took centuries to double income per capita;
- Between 1929 and 1957, US incomes doubled in only 28 years;
- Between 1957 and 1988, doubling took 31 years.
- The pessimistic view adopted here suggests that it may take almost a century for income per capita to double between 2007 and 2100.

Figure 2. Growth in real GDP per capita, with actual and hypothetical paths

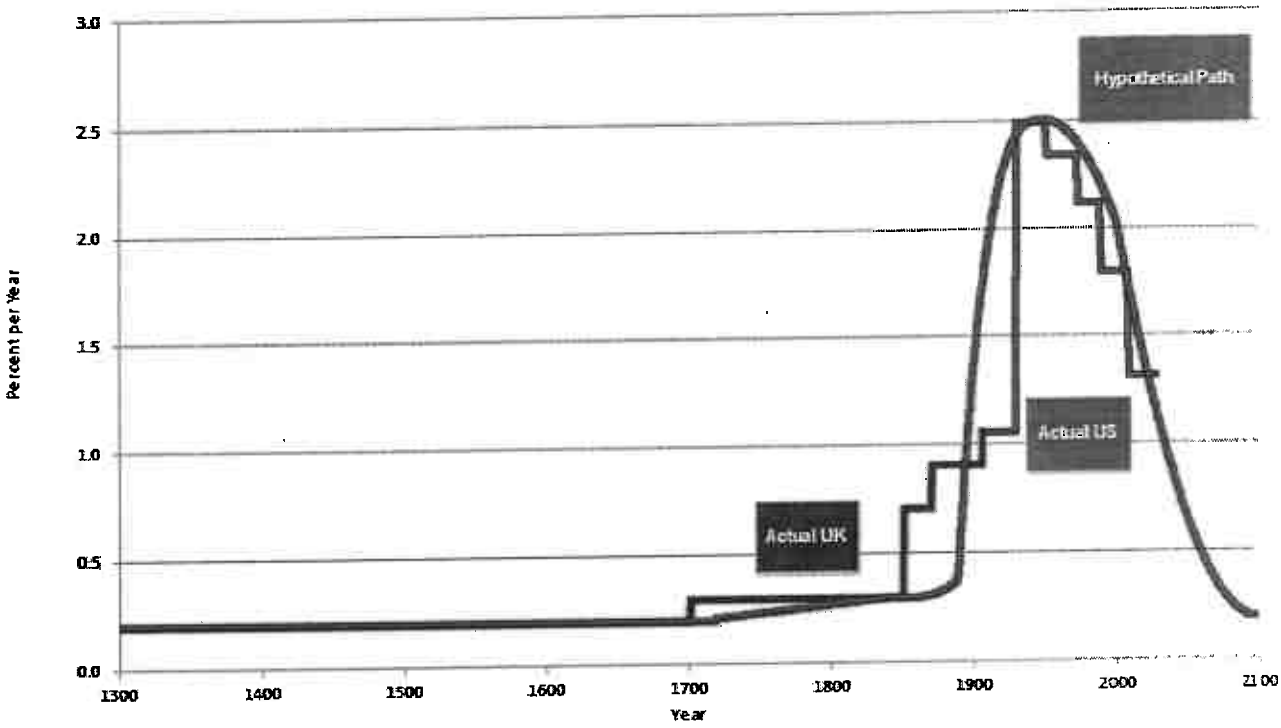
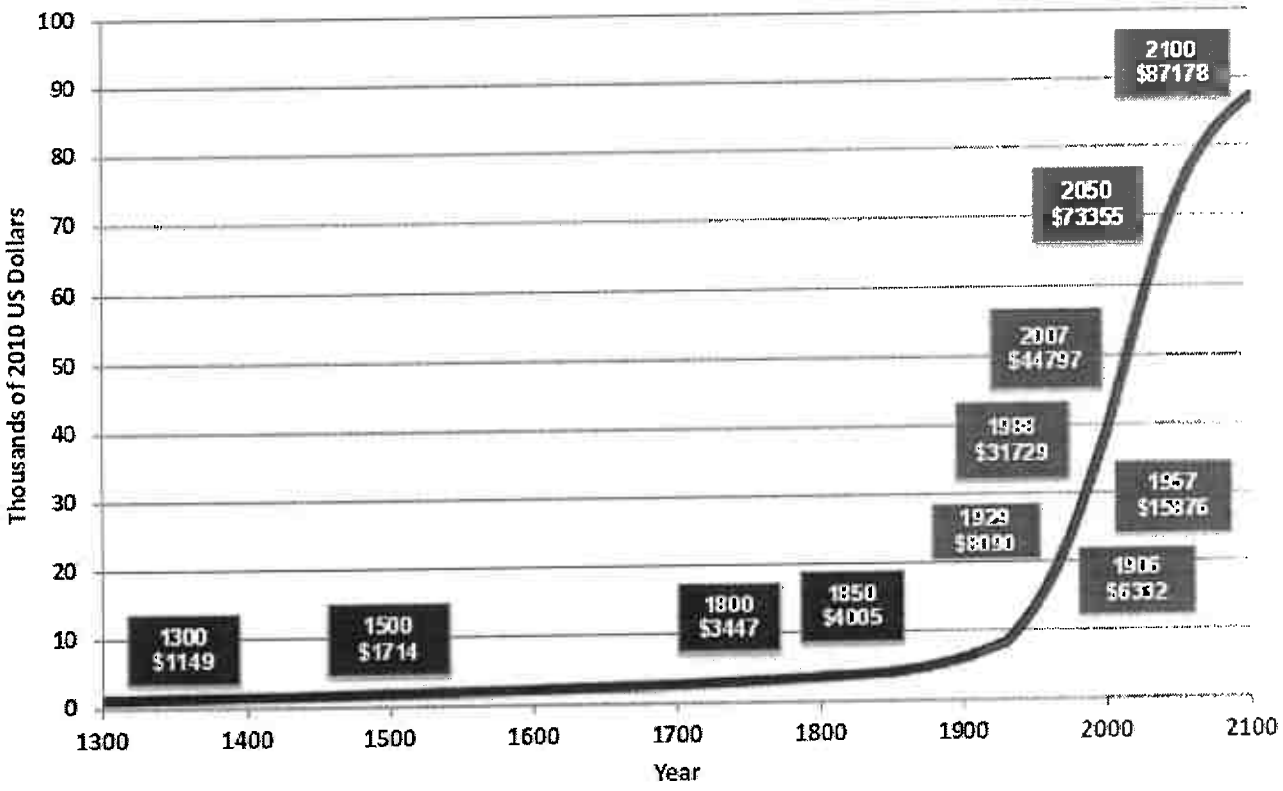


Figure 3. Actual and hypothetical levels of GDP per capita, 1300-2100



Phases of growth

The analysis in my paper links periods of slow and rapid growth to the timing of the three industrial revolutions:

- IR #1 (steam, railroads) from 1750 to 1830;
- IR #2 (electricity, internal combustion engine, running water, indoor toilets,

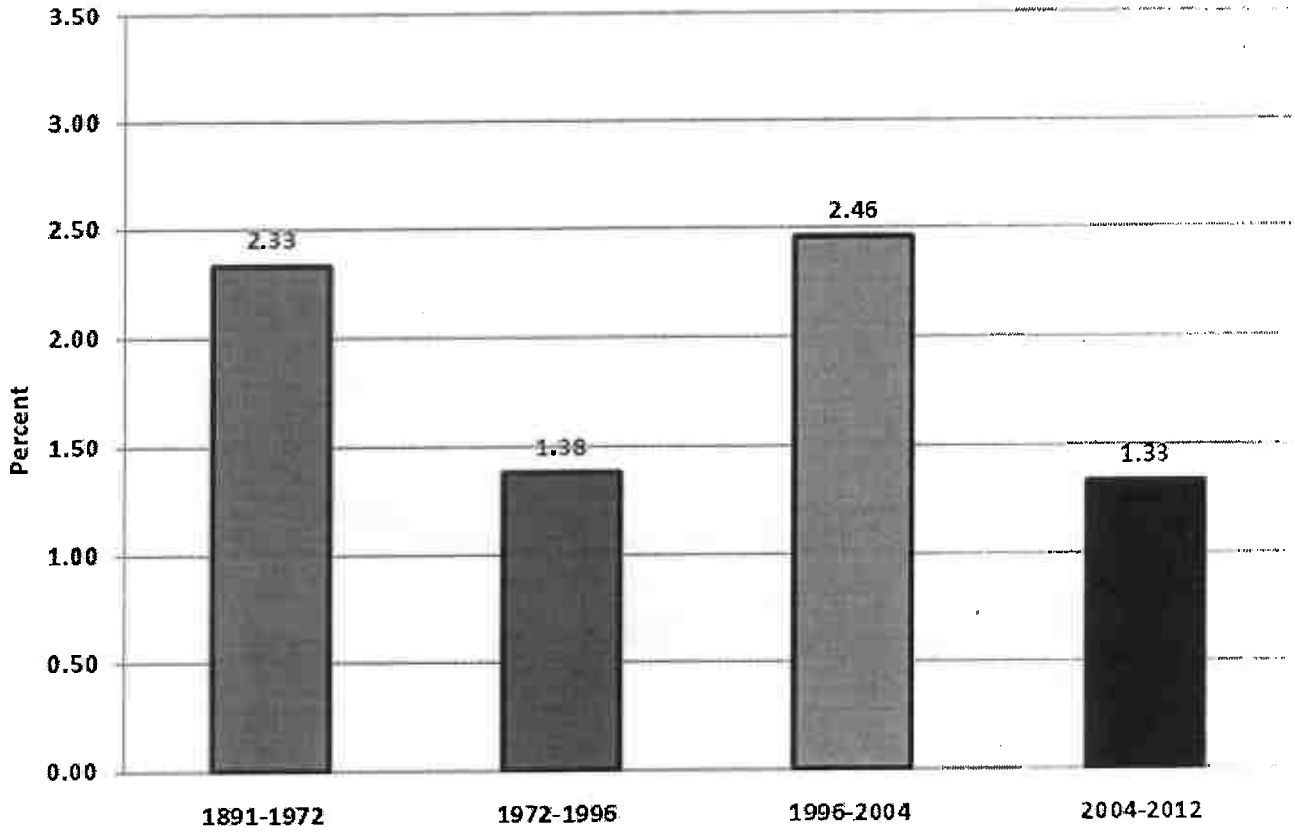
communications, entertainment, chemicals, petroleum) from 1870 to 1900; and
- IR #3 (computers, the web, mobile phones) from 1960 to present.

It provides evidence that IR #2 was more important than the others and was largely responsible for 80 years of relatively rapid productivity growth between 1890 and 1972.

Once the spin-off inventions from IR #2 (airplanes, air conditioning, interstate highways) had run their course, productivity growth during 1972-96 was much slower than before. In contrast, IR #3 created only a short-lived growth revival between 1996 and 2004. Many of the original and spin-off inventions of IR #2 could happen only once – urbanisation, transportation speed, the freedom of women from the drudgery of carrying tons of water per year, and the role of central heating and air conditioning in achieving a year-round constant temperature.

Figure 4 translates the abstraction about the three industrial revolutions into the data on US growth in labour productivity over selected intervals in the postwar era.

Figure 4. Average growth rates of US labour productivity over selected intervals, 1891-2012



- The ongoing benefits of IR #2 maintained rapid productivity growth through 1972.

Then diminishing returns set in – air conditioning was here and the interstate highways had been largely completed. The US entered the "dismal age" of slow productivity growth between 1972 and 1996. After being the mysterious 'Missing in Action' component of growth, computers and their brethren the internet and world wide web, pushed the growth of productivity in Figure 4 upwards, but only for the eight years 1996-2004.

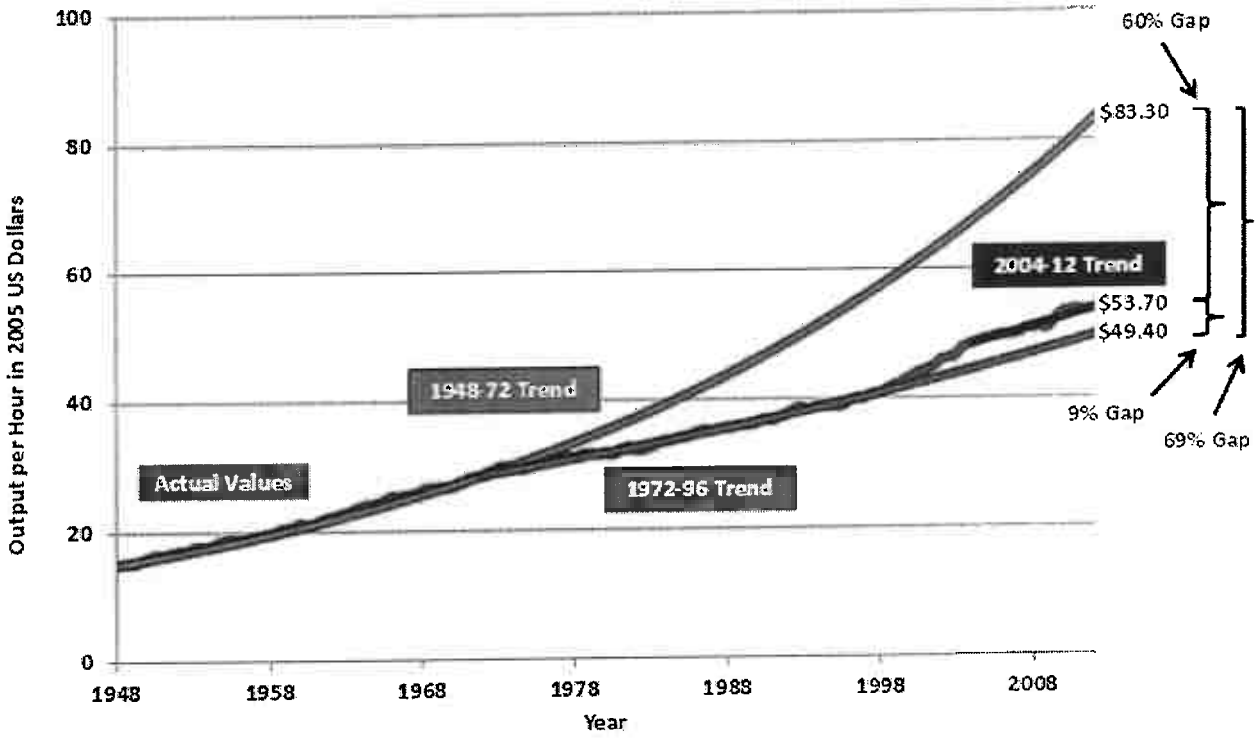
- IR #3 appears to have lasted only eight years, compared to the conjectural 100 years for IR #2.
- Since 2004 productivity growth has been almost as slow as in the previous dismal period of 1972-96.

Inventions are not all created equal

The paper explains this history by a simple proposition. The great inventions of IR #2 were just more important than anything that has happened since. The speed of transportation was increased from that of the 'hoof and sail' to the Boeing 707. The temperature of a room was wildly variable in the 19th century but by now is a uniform 70 degrees year round. The transition from rural to urban in the US could only happen once. Only once could electricity be invented and create rapid transit, machine tools, consumer appliances, and the entire electricity-dependent set of entertainment devices from the radio to the TV to the internet and its multiple spin-offs such as the iPod, iPhone, and iPad.

The loss of the impetus of IR #2 inventions makes a big difference in the future of human wellbeing. Figure 5 shows that if the 1948-72 productivity trend had continued, the level of productivity would have been 69% above what would have occurred if the 1972-96 trend had continued. The actual outcome shown in Figure 5 is that the benefits of actual productivity from the IR #3 internet revolution only closed 9% of the 69% gap created by the end of the IR #2 inventions.

Figure 5. US labour productivity from 1948 to 2012, with trend growth rates over selected intervals

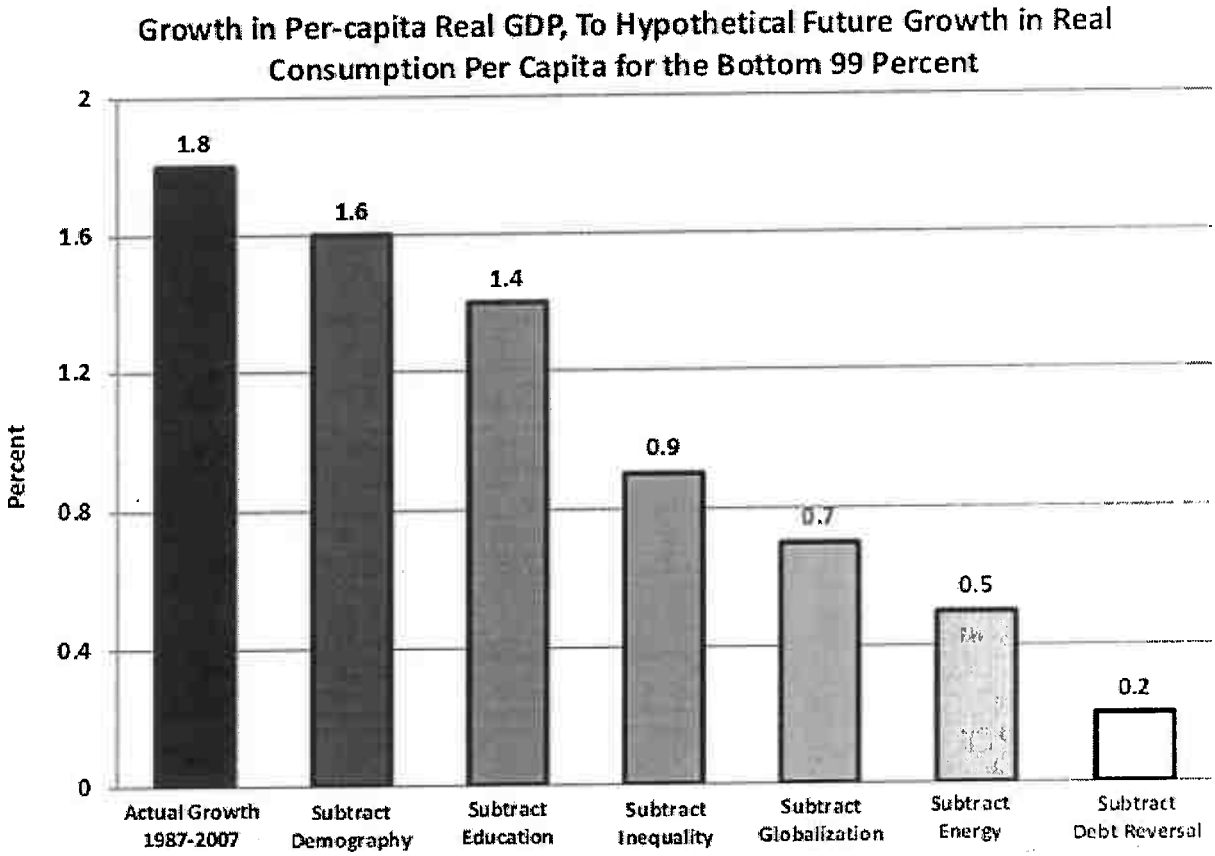


Even if innovation were to continue into the future at the rate of the two decades before 2007, the US faces six headwinds that are in the process of dragging long-term growth to half or less of the 1.9% annual rate experienced between 1860 and 2007. These include demography, education, inequality, globalisation, energy/environment, and the overhang of consumer and government debt. A provocative 'exercise in subtraction' suggests that future growth in consumption per capita for the bottom 99% of the income distribution could fall below 0.5% per year for an extended period of decades.

The exercise in subtraction is shown in Figure 6, but this is just a suggestion. All the numbers could be altered, but the big point is that each of these subtractions is a number, whether 0.05 or 0.1, or 0.2, that reduces the future growth of consumption per capita for the bottom 99% of US

households.

Figure 6. Exercise in subtraction: Components of growth, from 1987 to 2007



Concluding remarks

This paper is deliberately provocative. The numbers in the 'exercise in subtraction' have been chosen to reduce growth to that of the UK for 1300-1700. The outcome may turn out to be much better than that. But the point of this article is that it is likely to be much worse than any epoch of US growth since the civil war.

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The next productivity revolution: The 'industrial internet'

Marco Annunziata, 7 December 2012

Today's technological innovation is regarded by many as all about social media and entertainment, with no impact on economic growth. This column argues that such scepticism is premature. A closer look at selected industries suggests that the 'industrial internet' – a network that binds together intelligent machines, software analytics and people – through accelerated adoption of sensors and software analytics, will have a powerful impact on productivity and growth.

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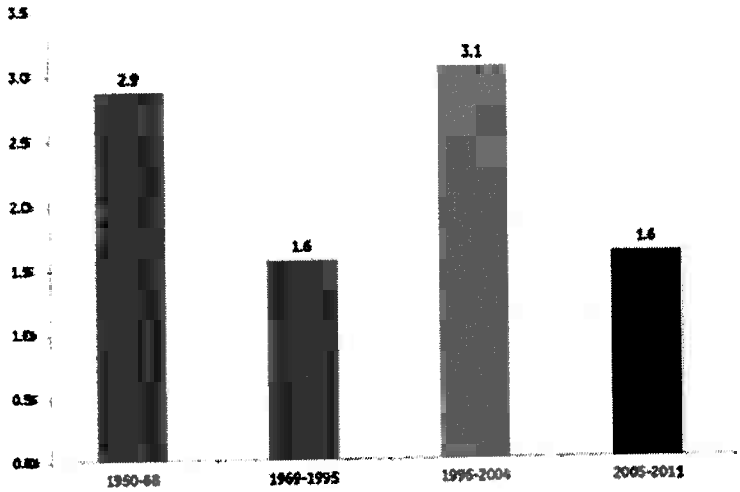
The largest advanced economies are struggling with weak growth prospects and daunting fiscal challenges. Looking at the macroeconomic equation, there is no easy way out. Looking at the microeconomic level, however, suggests that it is innovation that might come to the rescue.

Game over for productivity growth?

US labour productivity surged to an annual average of 3.1% between 1996 and 2004, nearly double the rate of the previous quarter-century; empirical evidence suggests that the Information and Communication Technology (ICT) revolution was an important driver of this productivity boost, which benefited both manufacturing and services (see for example Stiroh 2001 and Bosworth and Triplett 2003, 2007). Then it fizzled out. The deep 2008-09 recession and subsequent weak recovery, as well as the dramatic reduction in employment levels, make it hard to draw any meaningful conclusions from the swings in productivity growth rates of the last few years (labour productivity growth accelerated sharply in 2009-10 and then collapsed in 2011) – but overall, labour productivity has averaged a meagre 1.6% since 2005.

Figure 1. The US productivity decline and rebound



The sceptics argue that technology has exhausted its growth-enhancing potential, that innovation is now mostly about social media, entertainment and silly games, with no ability to boost living standards. In a recent provocative piece, Robert Gordon (2012) has argued that the recent waves of technological innovations are simply not as transformative as those of the industrial revolution, and Martin Wolf of the *Financial Times* commented: "Today's information age is full of sound and

Marco Annunziata
Chief Economist and Executive Director of Global Market Insight, General Electric Co.

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fury signifying little."

The next wave of innovation

This scepticism might be premature. In a recent report (Annunziata and Evans 2012), my co-author Peter Evans and I have looked at the productivity-enhancing potential of the 'industrial internet', a network that binds together intelligent machines, software analytics and people. The declining cost of instrumentation is beginning to enable a much wider use of sensors in machines ranging from jet engines to power generation turbines to medical devices. Software analytics can then leverage the enormous amount of data generated in order to optimise the performance of individual machines, fleets and networks. This means, for example, having a better insight in the performance of a jet engine and being able to anticipate mechanical failures so that maintenance can be performed in a pre-emptive way, minimising the delays that occur when the problem emerges shortly before take-off. It means being able to track the exact location of medical devices in a hospital and whether they are in use or idle, so that patient admissions and medical procedures can be scheduled more efficiently, yielding better health outcomes to more patients at lower cost.

The potential benefits are sizeable. Just a 1% gain in fuel efficiency over fifteen years would yield $30 billion in savings in aviation and $66 billion in the power generation industry, while a 1% efficiency gain would yield $63 billion in the healthcare industry and $27 billion in the rail industry. Our study focuses on the sectors where General Electric has a strong presence, because those are the sectors we know best and where we are seeing these gains materialise. But the industrial internet has the potential to impact a much wider range of industries, as well as services.

The industrial internet's impact on economic growth

As the industrial internet spreads, it could have a major impact on economic growth. Forecasting productivity is an extremely difficult exercise. But looking at the potential efficiency gains in individual industries, we feel it is not unreasonable to posit that the impact of the industrial internet might be comparable to the first wave of the internet revolution. In the US, if the industrial internet could accelerate annual labor productivity growth by 1-1.5 percentage points, bringing it back to its previous peaks, it could give a crucial boost to US economic growth. And the benefits would not be limited to the US. In fact emerging markets , where investment is likely to increase at a fast pace in the coming years, have the opportunity to become early adopters of the new technologies. Given EM's greater share in the world economy, this would quickly amplify the impact on the global economy.

Turning point

The technologies underlying the industrial internet have been in the making for some time. Why get excited about it now? The cost of instrumentation is declining, making a wider use of sensors economically viable, and is matched by the impact of cloud computing, which allows us to gather and analyse much larger amounts of data at lower cost. This creates a cost-deflation trend comparable to that which spurred rapid adoption of ICT equipment in the second half of the 1990s.

The mobile revolution will compound this effect, making information sharing and decentralised optimisation easier and more affordable. Industrial internet technologies is set to accelerate.

Enabling conditions

Reaping the full benefits of the industrial internet will require a set of key enablers and catalysts:

- Investment to rapidly incorporate the new technologies into the capital stock.
- Strengthening cyber security to manage the new vulnerabilities of a more internet-heavy industrial system.
- Development of a strong talent pool, which will include new professional roles combining mechanical, industrial and software engineering expertise.

More jobs?

The last point is especially important. Every wave of innovation raises a concern that higher productivity will simply mean fewer jobs. In today's context of high unemployment, this concern is especially acute. As in the past, technological innovation will make some jobs redundant. But it will create new ones and, if the impact on global growth is as strong as we believe, it will certainly create more jobs overall. But the education system will need to ensure that the supply of skills matches the evolving demand.

Conclusion

Pryce, 7 December 2012

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The industrial revolution unfolded in waves over a very long period of time. The internet revolution is following a similar pattern, and we think the next, most powerful and disruptive wave is arriving now. The efficiency gains that are coming within reach in individual industrial sectors suggest that the potential impact of the industrial internet on productivity and GDP growth is substantial. In 1987, Robert Solow famously quipped: "you can see the computer age everywhere but in the productivity statistics". Ten years later, productivity growth surged. Today's widespread scepticism might prove similarly premature.

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THE UNBOUND ECONOMY

Rethinking the Growth Imperative

Kenneth Rogoff

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Rethinking the Growth Imperative

CAMBRIDGE – Modern macroeconomics often seems to treat rapid and stable economic growth as the be-all and end-all of policy. That message is echoed in political debates, central-bank boardrooms, and front-page headlines. But does it really make sense to take growth as the main social objective in perpetuity, as economics textbooks implicitly assume?

Certainly, many critiques of standard economic statistics have argued for broader measures of national welfare, such as life expectancy at birth, literacy, etc. Such appraisals include the United Nations Human Development Report, and, more recently, the French-sponsored Commission on the Measurement of Economic Performance and Social Progress, led by the economists Joseph Stiglitz, Amartya Sen, and Jean-Paul Fitoussi.

But there might be a problem even deeper than statistical narrowness: the failure of modern growth theory to emphasize adequately that people are fundamentally social creatures. They evaluate their welfare based on what they see around them, not just on some absolute standard.

The economist Richard Easterlin famously observed that surveys of "happiness" show surprisingly little evolution in the decades after World War II, despite significant trend income growth. Needless to say, Easterlin's result seems less plausible for very poor countries, where rapidly rising incomes often allow societies to enjoy large life improvements, which presumably strongly correlate with any reasonable measure of overall well-being.

In advanced economies, however, benchmarking behavior is almost surely an important factor in how people assess their own well-being. If so, generalized income growth might well raise such assessments at a much slower pace than one might expect from looking at how a rise in an individual's income *relative to others* affects her welfare. And, on a related note, benchmarking behavior may well imply a different calculus of the tradeoffs between growth and other economic challenges, such as environmental degradation, than conventional growth models suggest.

To be fair, a small but significant literature recognizes that individuals draw heavily on historical or social benchmarks in their economic choices and thinking. Unfortunately, these models tend to be difficult to manipulate, estimate, or interpret. As a result, they tend to be employed mainly in very specialized contexts, such as efforts to explain the so-called "equity premium puzzle" (the empirical observation that over long periods, equities yield a higher return than bonds).

There is a certain absurdity to the obsession with maximizing long-term average income growth in perpetuity, to the neglect of other risks and considerations. Consider a simple thought experiment. Imagine that *per capita* national income (or some broader measure of welfare) is set to rise by 1% per year over the next couple of centuries. This is roughly the trend *per capita* growth rate in the advanced world in recent years. With annual income growth of 1%, a generation born 70 years from now will enjoy roughly double today's average income. Over two centuries, income will grow eight-fold.

Now suppose that we lived in a much faster-growing economy, with *per capita* income rising at 2% annually. In that case, *per capita* income would double after only 35 years, and an eight-fold increase would take only a century.

Finally, ask yourself how much you really care if it takes 100, 200, or even 1,000 years for welfare to increase eight-fold. Wouldn't it make more sense to worry about the long-term sustainability and durability of global growth? Wouldn't it make more sense to worry whether conflict or global warming might produce a catastrophe that derails society for centuries or more?

Even if one thinks narrowly about one's own descendants, presumably one hopes that they will be thriving in, and making a positive contribution to, their future society. Assuming that they are significantly better off than one's own generation, how important is their absolute level of income?

Perhaps a deeper rationale underlying the growth imperative in many countries stems from concerns about national prestige and national security. In his influential 1989 book *The Rise and Fall of the Great Powers*, the historian Paul Kennedy concluded that, over the long run, a country's wealth and productive power, relative to that of its contemporaries, is the essential determinant of its global status.

Kennedy focused particularly on military power, but, in today's world, successful economies enjoy status along many dimensions, and policymakers everywhere are legitimately concerned about national economic ranking. An economic race for global power is certainly an understandable rationale for focusing on long-term growth, but if such competition is really a central justification for this focus, then we need to re-examine standard macroeconomic models, which ignore this issue entirely.

Of course, in the real world, countries rightly consider long-term growth to be integral to their national security and global status. Highly indebted countries, a group that nowadays includes most of the advanced economies, need growth to help them to dig themselves out. But, as a long-term proposition, the case for focusing on trend growth is not as encompassing as many policymakers and economic theorists would have one believe.

In a period of great economic uncertainty, it may seem inappropriate to question the growth imperative. But, then again, perhaps a crisis is exactly the occasion to rethink the longer-term goals of global economic policy.

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Degrowth: solving the impasse by magical thinking

Branko Milanovic

Jun 27 ♡ 13 💬 22

world GDP more or less as now one must (A) "freeze" today's global income distributions so that some 10-15% of the world population continue to live below the absolute poverty line, and one-half of the world population below $PPP 7 dollars per day (which is, by the way, significantly below Western *poverty* lines). This is however unacceptable to the poor people, to the poor countries, and even to degrowers themselves.

Thus they must try something else: introduce a different distribution (B) where everybody who is above the current mean world income ($PPP 16 per day) is driven down to this mean, and the poor countries and people are, at least for a while, allowed to continue growing until they too achieve the level of $PPP 16 per day. But the problem with that approach is that one would have to engage in a massive reduction of incomes for all those who make more than $PPP 16 which is practically all of the Western population. Only 14% of the population in Western countries live at the level of income less than the global mean. This is probably the most important statistic that one should keep in mind. Degrowers thus need to convince 86% of the population living in rich countries that their incomes are too high and need to be reduced. They would have to preside over economic depressions for about a decade, and then let the new real income stay at that level indefinitely. (Even that would not quite solve the problem because in the meantime, many poor countries would have reached the level of $PPP 16 per day and they too would have to be prevented from growing further.) It is quite obvious that such a proposition is a political suicide. Thus degrowers do not wish to spell it out.

They are brought to an impasse. They cannot condemn to perpetual poverty people in developing countries who are just seeing the glimpses of a better life, nor can they reasonably argue that incomes of 9 out of 10 Westerners ought to be reduced.

The way out of the impasse is to engage in semi-magical and then outright magical thinking.

Semi-magical thinking (that is, thinking where the objective—however laudable- is not linked with any tools of achieving it) is to argue that GDP is not a correct measure of welfare, or that better outcomes in certain dimensions can be achieved by countries or peoples with a lower GDP (or lower incomes). Both propositions are correct.

GDP does leave out non-commercialized activities that are welfare-enhancing. It is, like every other measure, imperfect and one-dimensional. But if it is imperfect at the edges while fairly accurate overall. Richer countries are countries that are generally better-off in

almost all metrics, from education, life expectancy, child mortality to women's employment etc. Not only that: richer people are also on average healthier, better educated, and happier. Income indeed buys you health and happiness. (It does not guarantee that you are a better person; but that's a different topic.) The metric of income or GDP is strongly associated with positive outcomes, whether we compare countries to each other, or people (within a country) to each other. This is something so obvious that it is bizarre that one needs to restate it: people migrate from Morocco to France because France is a richer country and they will be better-off there. American Blacks are worse off than American Whites in all dimensions, not least in terms of their income. This is the background to the Black Lives Matter movement that wants to make Blacks better off and equal in income and health to Whites.

Since this fails, the next approach taken by degrowers consists in pulling out individual cases of countries the have performed exceptionally well on some metrics (like Cuba on health) and those that have performed exceptionally badly (like US on life expectancy) and to argue that a certain desirable outcome can be achieved with much less money. It is indeed true that some countries or some people, despite their lack of income, have achieved excellent things while others have used their income inefficiently or wastefully. But it does not follow from such individual examples that they overturn the regularities described In the previous paragraph. What degrowers do is to first metaphorically run a regression of a desirable outcome on GDP or income, and when they observe that the two are closely correlated, forget about the regression, pull out an outlier, and claim that the outlier shows that the relationship does not exist.

That is clearly wrong too. So the next stage in semi-magical thinking consists in trying to convince people that they are wrongly pursing the Golden Calf of wealth and that much more modest lives would be better, or at least are feasible. To that effect they use baskets of goods and services that allow "modest" standard of living and satisfy all basic needs. But they fail to show us how such "modest needs" are to be implemented: how will people be obliged to consume only so much and not more? In war situations, this is done through rationing. Indeed, one could ration the number of square meters of textile that each household may be able to buy, introduce meat and gasoline coupons and so forth. It has been done many times. But degrowers know that a wartime economy in the peacetime would not be politically acceptable, so they just do the basket calculation, show that it is compatible with "planetary boundaries", and leave it at that. How we are going to have that basket accepted by people, or implemented despite their will, is not something they desire

to be disturbed with.

After this comes direct magical or religious thinking. Its first component, in an asceticism reminiscent of the early Christendom, is to point out to the vanity of all material acquisitions. People indeed can live happy lives with much less "stuff". That is true for some special people like Christian or Buddhist monks. For example, Simeon the Stylite, an early Christian monk is reputed to have lived several decades on a top of a pillar. But this is not true for the remaining 99.99% of the people who are not attracted by monastic lives. And it certainly is not true today when capitalism, and thus both the relentless search for profit and the value system that places wealth on the pedestal, is more dominant than ever (see Chapter 5 of "Capitalism, Alone"). Had degrowers preached material abstinence in 13th century Europe or 10th century Byzantium it might have had more appeal. Commercial society, capitalism, numerical abilities were far less developed than today. But now, the relevance of moral preaching of abstinence is close to zero.

When all arguments and quasi-arguments are exhausted, magical thinkers move into the realm of rhetoric. Thinking is now replaced by phrase-mongering: "thriving", "flourishing" and "self-fulfilling" lives are possible and they are just around the corner. Everybody can be happier with much less. We can just cultivate our own gardens. If you string all the desirable words together, "no exploitation, "living wage", "ethical business", "self-sufficiency", "fair price" they will somehow take the life of their own and the Elysian fields will open up in front of us. For all and forever.

La mano visible

Por **Jesús Fernández-Villaverde**

El futuro demográfico de la humanidad: los retos económicos

Habrá consecuencias positivas y negativas del cambio poblacional, y cuáles de estas predominen dependerá de la habilidad para diseñar políticas que gestionen la transición

Foto: iStock.

Por **Jesús Fernández-Villaverde**

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Hace unas semanas esbocé el inusitado **futuro demográfico** de la humanidad. Con bastante probabilidad, entre 2050 y 2060 nuestra especie alcanzará un **pico de población cercano a los 9.500 millones**, para comenzar a caer a partir de ese momento. Apunté, también, algunos de los mecanismos que pueden hacer que esta predicción sea incorrecta (evolución de la mortalidad, cambios en los pesos relativos de los grupos sociales, políticas de los gobiernos, etc.). Sin ir más lejos, a los pocos días de publicar mi entrada, **China anunció una nueva regulación muy restrictiva del aborto** para incrementar su fertilidad.

Pero asumiendo que el futuro se parezca, de manera razonable, a las tendencias demográficas que observamos desde nuestra atalaya de 2021, merece la pena dedicarle unos párrafos a **pensar sobre las consecuencias de este cambio poblacional**. Como casi siempre ocurre, habrá consecuencias positivas y negativas, y cuáles de estas predominen dependerá, en parte, de nuestra habilidad para diseñar **políticas que gestionen la transición correctamente**.

En esta entrada me centraré en las **consecuencias económicas más directas**. En la tercera y última entrada de esta mini-serie (prevista para dentro de unas semanas) repasaré las consecuencias sociales sobre la estructura de la familia, la distribución de la población en el territorio y la **vivienda**.

Tormenta perfecta: petróleo, luz, gas y carbón ponen en jaque la economía mundial

Carlos Sánchez

La principal consecuencia positiva que a todos nos viene a la cabeza es una **menor presión sobre los recursos naturales**. Una población más reducida, o con un crecimiento más lento, facilita descarbonizar la economía mundial y conservar las áreas de riqueza biológica menos afectadas por la actividad humana. Esta consecuencia refuerza otra **transformación clave de la economía mundial**: cada vez el **producto interior bruto** de las economías avanzadas "pesa" menos y, por tanto, requiere menos recursos naturales para generarse.

Pensemos en un **sencillo ejemplo**: en estos momentos tengo 1.833 libros en mi Kindle. Cada estante de mi despacho puede albergar, de media, unos 40 libros (unos más grandes, otros más pequeños). Es decir, necesitaría unas 46 estanterías para almacenar los libros de mi Kindle en formato físico, ocupando mi despacho entero y buena parte de otro. Desde que empecé a leer y comprar libros, siendo niño, hasta 2010, que me pasé al **libro electrónico**, acumulé y acumulé "peso" en papel. Desde 2010 hasta hoy, el "peso" de mi papel se estabilizó, primero, para comenzar a caer, después. En 2020 compré solo 14 libros en papel, pero regalé más de 14 libros de los que ya tenía (muchos los re-compré en versión electrónica para tenerlos siempre a mano y las copias físicas se las di a mis estudiantes). Es decir, que mi colección de libros, siendo mucho más amplia a 1 de enero de 2021 que a 1 de enero de 2020, "pesaba" mucho menos. Esta observación se aplica a casi todas mis posesiones: ni me acuerdo de la última vez que me compré un CD o un DVD. **El conjunto de todos mis bienes "pesa" menos hoy que hace cinco años**.

> Las economías menos desarrolladas todavía necesitan más recursos para crecer y llegar al nivel de riqueza de los países líderes

El crecimiento económico moderno no usa, en general, más recursos per cápita. Sí somos cada vez mejores en recombinar ideas de maneras increíblemente creativas para **generar mucho más valor añadido**. Por eso, el Reino Unido fue capaz de emitir menos CO2 en 2019 (antes de la pandemia) que en 1890, a pesar de tener un producto interior bruto, en valor real, 13 veces mayor. Por su parte, **Estados Unidos consumió un 2% menos de petróleo en 2019** que en 1978, cuando su producto interior bruto fue, en valor real, tres veces más grande (y eso que en **Estados Unidos** no se han preocupado en exceso en ahorrar energía).

El punto débil del argumento anterior es que se centra en las economías más avanzadas: **las economías menos desarrolladas todavía necesitan más recursos** para crecer y llegar al nivel de riqueza de los países líderes. Pero en cuanto estas economías vayan estabilizándose en tamaño total como consecuencia de la caída de la población, incluso un **mayor uso de recursos per cápita** será compatible con unos consumos mundiales de recursos estables o en decrecimiento.

Las **consecuencias negativas de la caída de la población mundial** son mas complejas. La más importante es que tenemos que acostumbrarnos a que el producto interior bruto crezca a tasas menores y adaptar nuestras sociedades a esa realidad. Históricamente, **la productividad del trabajo ha crecido de media un 2% anual**. Si la población activa se incrementa a un 1% anual (como lo hacía durante los años 60 del siglo pasado en muchas economías avanzadas), en una situación normal del ciclo económico, la economía crecerá un 3% (un 2% de la productividad más un 1% de la población). Cuando la economía se acelera por encima de la situación normal (por efectos de shocks de demanda o de oferta), crece a un 4% o 5%, mientras que **cuando se ralentiza crece a un 1% o 2%**, pero fluctuando siempre alrededor del 3%.

Buenas noticias de la OCDE y el BdE para la economía, pero los retos no desaparecen

Valor Añadido

Ahora, imaginémonos una situación donde **la población activa cae a un 1% anual**. Incluso si la productividad del trabajo sigue creciendo a un 2% (volveré a ello en un momento), la economía crecerá de media un 1% (un 2% de la productividad menos un 1% de caída de la población), **no un 3% como lo hacía antes**. Cuando la economía se acelere por encima de la media, crecerá a un 2% o 3% y cuando se ralentice, a un -1% o 0%.

Esto es exactamente lo que ha pasado con **Japón**. Desde fuera, **su economía parece atascada desde mediados de los 90** del siglo pasado. Pero si la observamos en términos de su producto interior bruto dividido por adultos en edad de trabajar (entre 16 y 65 años), una medida de los trabajadores potenciales de la economía independientemente de si están ocupados o no, **Japón ha crecido casi a igual velocidad que Estados Unidos** y más deprisa que Alemania. Los ríos de tinta escritos sobre los orígenes de los "males económicos" de Japón durante las últimas décadas son, básicamente, inútiles. **Ni es culpa del Banco de Japón, ni de China, ni de nadie**. Japón crece a la velocidad que uno se esperaría teniendo en consideración su evolución demográfica.

Nigeria, la bomba demográfica que acecha a Europa: "Debo salir como sea de este país"

Carlos Barragán. Lagos

¿Y qué importa que la economía crezca al 1% en vez del 3% en términos totales, si **en términos de adulto por edad de trabajar seguimos creciendo a igual velocidad**? ¿No nos debe preocupar la renta per cápita en vez de la renta total? Sí y no. Sí, porque la medida relevante de renta para evaluar el bienestar de una sociedad es per cápita. Pero no, porque **la renta per cápita no lo es todo**. La capacidad de pagar nuestra deuda pública, por ejemplo, depende de la renta total, no de la renta per cápita.

Imaginémonos un país que tenga una razón de deuda pública sobre **producto interior bruto del 100%**. Si la economía de ese país crece al 3%, la deuda pública se estabiliza como porcentaje del producto interior bruto si el déficit de las administraciones públicas es el 3% (añadimos 3 puntos más de deuda en el numerador, pero el denominador también crece 3 puntos). En cambio, **si la economía crece al 1%, necesitamos llevar el déficit de las administraciones públicas al 1%** para estabilizar la deuda, un esfuerzo fiscal más considerable.

> ¿Seguirá creciendo la productividad del trabajo un 2% aunque caiga la población? Hay razones para dudarlo

Algo similar ocurre con muchas obligaciones del Estado, como las pensiones y la sanidad pública. Estas prestaciones sociales son mucho más onerosas de mantener cuando, junto a la caída de la población en edad de trabajar, nos encontramos con una **prolongación de la esperanza de vida**. Mientras los costes sociales suben rápidamente, la economía se queda detrás. Cambios como **retrasar la edad de jubilación**, ayudan, pero no modifican significativamente el escenario básico. Trabajando más años podremos ralentizar la caída de la población activa, pero no frenarla.

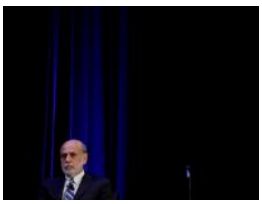
De hecho, los argumentos de los párrafos anteriores pueden ser demasiado optimistas. ¿**Seguirá creciendo la productividad del trabajo un 2% aunque caiga la población**? Hay razones para dudarlo. Antes resaltaba que el crecimiento económico se basa en **recombinar nuevas ideas**.

Desempleo juvenil: un drama en tres actos

Carlos Sánchez

¿Qué entendemos aquí por ideas? Cualquier **creación de la menta humana** que nos permite transformar un recurso en un bien o servicio. Por ejemplo, una idea hace muchos siglos fue emplear el silicio para fabricar hormigón. Más recientemente, se nos ocurrió emplear el silicio para los transistores (como los que usted está empleando para leer estas líneas). Hace solo dos semanas, ha habido avances importantes en el **uso del silicio para fabricar mejores baterías para los coches eléctricos**. Pero también son ideas los nuevos teoremas en matemáticas (claves, por ejemplo, para que su tarjeta de crédito funcione en internet) o el **desarrollo de nuevas formas de negocio**. Fundar Amazon o la invención de la contabilidad de costes fueron igual de innovación que un nuevo proceso químico.

¿Y quién crea estas ideas? Las personas: las ideas son fruto del esfuerzo en investigación y de la creatividad. Por tanto, y como primera aproximación, el flujo de ideas en una sociedad depende de la cantidad de personas pensando. Es prácticamente seguro que una sociedad con 200 millones de personas desarrollará más ideas innovadoras que una sociedad con 2 millones, siempre y cuando las instituciones económicas sean similares. **Suiza produce más ideas que Nigeria** porque tiene mejores instituciones, pero Suiza produce **menos ideas innovadoras que Estados Unidos** porque tiene menos habitantes. Poblaciones más reducidas, sobre todo en los países del mundo con mejores instituciones de innovación (Estados Unidos, Este de Asia, Europa Occidental), van a ser poblaciones con menos ideas innovadoras.



Bernanke: "Ahora sabemos más del efecto del estrés de los mercados en la economía"

Óscar Giménez. Bilbao

Y este fenómeno puede ser particularmente acuciante si nos fijamos que la evidencia sugiere que, según vamos acumulando conocimiento, **cada vez es más difícil crear nuevas ideas**. **La humanidad nunca tendrá un nuevo Galileo Galilei**, un Isaac Newton o un Charles Darwin. Las ideas fundacionales en física, matemáticas o biología que estos científicos desarrollaron no pueden ser "re-inventadas". Incluso la teoría de la relatividad o la mecánica cuántica de la física del siglo XX, con toda su novedad y dramáticas consecuencias, fueron **más refinamientos de estructuras cognitivas** ya existentes que rupturas radicales, como lo fue la invención del método experimental o el desarrollo del cálculo infinitesimal. Es probable que a Newton no le faltara razón cuando argumentó que pudo ver más allá porque se encaramó a hombros de gigantes, pero cada vez hay más nubes que nos impiden tener una visión nítida, incluso desde ahí arriba.

Yo lo noto mucho en mi quehacer diario. Justo el próximo lunes comienzo a dar un curso de doctorado de control óptimo. Este es el campo de las matemáticas aplicadas que analiza cómo controlar un sistema dinámico para alcanzar los mejores resultados posibles a lo largo del tiempo. Por ejemplo, en economía es la teoría aplicada a estudiar para gestionar una cartera de inversiones a lo largo del tiempo de cara a maximizar su rendimiento dado un nivel de riesgo. Cuando yo era estudiante, a finales de los 90 del siglo pasado, calculo que se necesitaban unos 12 meses para especializarse en el campo (una vez acabados los cursos de doctorado básicos) y estar listo para empezar a escribir una tesis innovadora a nivel mundial. Hoy, estimo que **se necesitan al menos 24 meses**. La cantidad de cosas que hemos aprendido sobre control óptimo en las dos últimas décadas es espectacular. Pero esto también quiere decir que tener nuevas ideas en este campo es más complejo que nunca y uno tiene que aprender muchas más cosas. Los padres de esta especialización, **Richard Bellman** y **Lev Pontriaguin**, lo tenían mucho más fácil: **estaba todo por descubrir**. Esto no quita ápice alguno de valor a sus logros (ambos fueron grandes genios), pero sí que pone en perspectiva los méritos de la generación actual de jóvenes investigadores.

Durante los últimos tres siglos la humanidad ha estado participando en una carrera en la que, por un lado, cada vez es más difícil tener nuevas ideas, pero en la que, por el otro, cada vez somos más personas dedicándonos a la investigación. Estos das fuerzas se han compensado y el resultado de la carrera, hasta ahora, es que hemos podido desarrollar nuevas tecnologías y avances científicos que nos han regalado ese **2% de crecimiento medio** de la productividad del trabajo anual al que me refería antes durante muchas décadas. Pero, con una población en caída, empezaremos a perder la carrera. **Cada vez será más difícil incrementar el número total de investigadores** (que, recuerdo, incluye también a los innovadores en el mundo de los negocios). Mucha gente no tiene interés o capacidad para investigar y cada investigador adicional es una persona menos trabajando en la **producción de bienes y servicios**. Como sociedad no nos podemos dedicar todos a innovar. Alguien tendrá que emplear esa innovación en producir cosas que nos gusten.

Es decir, que una reducción de la población humana también puede ser una **población mucho menos dinámica** desde el punto de vista de innovación. Muchos economistas argumentan que los efectos ya **se notan en la creación de nuevas empresas** y en el **mal comportamiento de la productividad desde 2008**.

> ¿Cómo vamos a pagar el estado del bienestar y nuestro nivel de deuda pública con tasa cero de crecimiento medio?

Pero, en consecuencia, la productividad del trabajo solo crecerá, pongamos una cifra redonda para simplificar, **un 1% al año**. Con una caída de la población en edad de trabajar del 1%, la "nueva normalidad" será un crecimiento del 0% del producto interior bruto. ¿Cómo vamos a pagar el estado del bienestar y nuestro nivel de deuda pública con **tasa cero de crecimiento medio**? A mí no me salen las cuentas de ninguna manera.

A menudo me encuentro con el argumento de que la automatización nos sacará las castañas del fuego: **si tenemos suficientes robots** y desarrollamos sistemas de inteligencia artificial, **podremos seguir creciendo sin problema**. Mi respuesta es siempre que esa era la idea detrás de la estrategia económica de la Unión Soviética y que ni funcionó en el siglo XX ni funcionará ahora.

Opinión

Europa desarrolla musculo estratégico: el plan de industrialización de la UE

Miguel Otero

En 1928 Stalin se embarcó en un **programa de industrialización acelerada** basada en unas tasas de inversión altísimas. La idea era acumular suficiente capital físico para, en unas décadas, poder producir suficientes bienes de consumo y alcanzar el comunismo. Tan arraigada estaba la creencia en el bloque socialista de que el camino al crecimiento económico pasaba siempre por la acumulación de capital físico, que cuando Gorbachov llegó al poder en 1985 su primera ronda de reformas se centró en una **"aceleración" de la tasa de inversión de la Unión Soviética**, que había caído como consecuencia de las malas cosechas de 1979-1981 y el colapso del precio del petróleo en 1983.

El problema de esta estrategia de inversión del estalinismo clásico es que la acumulación de capital físico esta **sujeta a rendimientos marginales decrecientes**. Construir el primer alto horno en **Magnitogorsk** en 1932 tiene unos rendimientos altísimos: pasamos de no producir nada de acero a producir acero que tiene un valor marginal muy alto. El segundo alto horno en los años 50 tiene un rendimiento mucho más bajo. El último alto horno, finalizado en 1987, no vale para casi nada. Piénselo

Jesús Fernández-Villaverde
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absoluto. Crecemos porque tenemos más y mejores ideas. Acumulamos capital pa producir esas ideas, no al revés. Gran Bretaña, y luego el resto de Occidente, lideraı la revolución industrial y el crecimiento económico moderno porque fueron las primeras sociedades que, **cerca de 1650**, empezaron a tener **estructuras institucionales** que incentivaron la producción sistemática y constante de nuevas ideas. En resumen: con una población más pequeña en 2100, es probable que tengamos menos ideas innovadoras y con ellas, **menos crecimiento de la productividad**.

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¿Puedo estar equivocado? Sí. Por ejemplo, los avances en aprendizaje profundo de los últimos años puede que faciliten el desarrollo de nuevas ideas incluso con menos investigadores. Hace diez años no hubiera aventurado que hoy tendríamos **redes neuronales profundas** que pueden predecir el plegamiento de proteínas. Y volviendo al ejemplo del control óptimo que mencionaba antes, las redes neuronales profundas permiten **solucionar problemas** que eran imposibles incluso hace dos años. Otra posibilidad es que las nuevas tecnologías no estén sujetas a los mismos rendimientos marginales decrecientes que las tecnologías de siglos pasados. Por ejemplo, **los datos son bienes no rivales**: emplear los datos en una línea de negocio de una empresa no limita sus usos en otra línea de negocio. En comparación, emplear una máquina en una línea sí que imposibilita su uso en otra actividad de la empresa.

Moderamos los comentarios de nuestra comunidad para asegurar una discusión sana y constructiva.

Enviar

JORDI FRANCH PAREL...
2021-10-10 22:26:29

¿Pero serán estos cambios **lo suficientemente poderosos para derrotar el efecto de la caída de la población** en la creación de nuevas ideas? Yo, siguiendo a **Robert Gordon** , tiendo a ser pesimista y creo que estos cambios no serán suficientes, pero nada me gustaría más que estar equivocado.

Sabemos que Japón está en crisis desde 1990. Y que las políticas ultraexpansivas aplicadas, tanto fiscal como monetariamente, no son la solución sino parte importante del problema. Pero el autor asegura que "Los ríos de tinta escritos sobre los orígenes de los "males económicos" de Japón durante las últimas décadas son, básicamente, inútiles. Ni es culpa del Banco de Japón, ni de China, ni de nadie." Una lástima que de tan altos vuelos se olviden principios básicos como el equilibrio presupuestario o el control monetario. Todo un monumento a la soberbia y la deificación de la razón.

Concluyo aquí. Me quedan en el tintero algunas ideas, como los **efectos de la demografía sobre los tipos de interés** mundiales, a los que volveré en entradas futuras que tengo pensadas sobre los retos de la política monetaria durante la próxima década. Como expliqué al principio de esta, mi siguiente entrada se centrará en las **consecuencias del futuro demográfico de la humanidad** en aspectos de la vida como la familia o la vivienda.

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ALBERTO_CASAS
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Estoy sorprendido por el nivel intelectual de este artículo, nada común en nuestros medios periodísticos. ¡Felicidades, señor Fernández-VIllaverde!

Particularmente me ha gustado que ponga sobre la mesa (algunas de) las muchas incertidumbres inherentes a estos análisis. Lejos de quitarle interés al artículo, le aportan rigor y lo enriquecen, ya que es sumamente interesante reflexionar sobre ellas.

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