Trade, Growth and Disparity Among Nations
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A. Introduction

The pluses and minuses of openness between countries have been a source of heated debate for much of the 20th century—with domestic trade policies lying in the balance. The century began with movement towards relative openness that eventually reverted to the erection of massive trade barriers during the inter-war period. The current trend towards greater openness began in the 1940s with the end of World War II.

This trend received a major boost from two complementary factors. The first important factor is the continuous decline in transportation costs—the natural barriers to trade—throughout the century. The second factor is the change in trade-related policies: those that affected regional trade and those that affected trade at the global level.

How has this increased openness affected the incomes levels of the trading countries? In a world marked by huge—and increasing—income disparity among countries, has trade been a source of the divergence, or is it a source of income convergence? Is this a question of a zero-sum game, where movement toward freer trade can only benefit some of the countries at the expense of others, or can freer trade benefit all of the countries concerned?

The focus of this paper is on exactly these questions. It begins in section B with the overall—non-trade-related—picture of income disparity between countries. Once this benchmark is illustrated, the emphasis then shifts towards a number of the more important instances of trade liberalization (in sections C and D) during the post-war period and examines how income disparity among the liberalizing countries compares with these benchmarks. The general relationship between trade and income disparity is analyzed in section E, while section F provides evidence on the long-run growth behaviour of countries that liberalized trade. Section G provides some explanations for the outcomes and section H concludes.

B. Income disparity among countries

How big are the income gaps between countries and how have these gaps been changing over time? The goal of this section is to provide some evidence on this question—evidence which will serve as the backdrop for the remainder of this paper.

One of the most important data improvements made during the past couple of decades has been the increasing availability and usage of purchasing power parities (PPPs) instead of official exchange rates for comparison of national products and incomes. Since PPPs are based on cross-country price comparisons of representative baskets

of goods and services, they are less prone to exchange rate distortions. Hence, they provide much more reliable cross-country output comparisons than do official exchange rates.

The determination of purchasing power parities for a large number of countries over a span of several decades began with the seminal work of Heston, Kravis, Lipsey and Summers in the 1970s. This work evolved over several rounds and culminated with the most recent data set made available in 1995 by Summers and Heston which begins in 1950 for a number of countries and ends in 1992. In all, the dataset includes annual observations for 152 countries, though not all of the countries have data for all of the years.

Table 1 draws on this most recent Summers and Heston (1995) dataset and includes the 1985 per capita output of all 152 countries in US dollars. The conversion of GDPs in the table is via both PPPs and official exchange rates so that it may be possible to compare the degree of discrepancy that can exist between the two measures.

As the PPP conversions indicate, the average American in 1985 made over 30% more than the average German, 40% more than the average Japanese, nearly 50% more than the average citizen of the United Kingdom, and 5,500% more than the average Ethiopian. While PPP's are much more accurate, the official exchange rates commonly used to convert national incomes into dollars paint an even grimmer picture.

These gaps nearly defy the imagination. As the growth rates between 1960 and 1992 indicate, several of these income gaps are much smaller today than they once were, while many of the other gaps have grown substantially. Overall, have these gaps been falling or rising between countries over time? From the table, the pattern is not very easy to discern.

Figure 1 displays the relationship between the initial income levels and subsequent growth rates of 113 non-communist countries.[2] On the horizontal axis are the real per capita income levels of the countries in 1960 relative to the US, which was the wealthiest country at the time. The vertical axis measures the average annual growth rates of each country from 1960 to 1985. Dividing the graph into four quadrants are two lines that depict the average world income level in 1960 (which was just under 30% of the US level) and the annual growth rate of the average world income level over the subsequent 25 year span (which was just above 2%). Convergence requires that all countries be located in either the top left quadrant, or the bottom right.

The convergence curve represents the locus of all points that the countries would have had to have been on

2   Data source: Summers and Heston (1988).

Table 1: GDP per capita in 1985, from wealthiest to poorest in US dollars
Using purchasing power parities (Summers and Heston data) and also official exchange rates (World Bank data)

#	Country	Summers and Heston Data — GDP Per Cap	Summers and Heston Data — Ratio of USA to Country	Avg ROG 60-92	World Bank Data — GDP Per Cap	World Bank Data — Ratio of USA to Country
1	United Arab E.	19648	0.84		17188	0.98
2	Qatar	16986	0.98		16786	1.00
3	United States	16570	1.00	1.88%	16841	1.00
4	Canada	15589	1.06	2.57%	13804	1.22
5	Switzerland	14864	1.11	1.65%	14339	1.17
6	Norway	14144	1.17	3.23%	14009	1.20
7	Australia	13583	1.22	1.95%	10646	1.58
8	Sweden	13451	1.23	1.93%	12062	1.39
9	Luxembourg	13175	1.26	2.38%	9414	1.78
10	Denmark	13114	1.26		12527	1.34
11	Kuwait	12969	1.28		11350	1.48
12	Germany, West	12535	1.32	2.32%	7971	2.11
13	Bahamas	12404	1.34	2.55%	10003	1.68
14	Iceland	12209	1.36	2.96%	11996	1.40
15	France	12206	1.36	2.76%	9482	1.77
16	Finland	12051	1.37	2.59%	10928	1.54
17	Japan	11771	1.41	5.23%	11124	1.51
18	Netherlands	11539	1.44	2.47%	8837	1.90
19	New Zealand	11443	1.45	1.12%	6863	2.45
20	Belgium	11285	1.47	2.84%	8099	2.07
21	United Kingdom	11237	1.47	1.97%	8073	2.08
22	Austria	11131	1.49	2.93%	8627	1.95
23	Italy	10808	1.53	3.26%	7429	2.26
24	Hong Kong	10599	1.56	6.42%	6142	2.73
25	Trinidad & Tobago	9701	1.71		6359	2.64
26	Bahrain	9547	1.74		8717	1.93
27	Germany, East	9337	1.77			
28	Oman	9199	1.80		7922	2.12
29	Singapore	8616	1.92	6.56%	7125	2.36
30	Saudi Arabia	8313	1.99		7002	2.40
31	Israel	8310	1.99	3.31%	6103	2.75
32	Spain	7536	2.20	3.64%	4299	3.90
33	Ireland	7275	2.28	3.39%	5314	3.16
34	Puerto Rico	7120	2.33		6008	2.79
35	U.S.S.R	7049	2.35			
36	Cyprus	6486	2.55	4.83%	3633	4.62
37	Venezuela	6225	2.66	0.35%	3629	4.63
38	Greece	6224	2.66		3366	4.99
39	Barbados	6131	2.70		4750	3.53
40	Mexico	5621	2.95	2.50%	2468	6.80
41	Taiwan	5449	3.04			
42	Argentina	5324	3.11		2925	5.74
43	Malta	5321	3.11		2959	5.67
44	Hungary	5278	3.14		1935	8.67
45	Yugoslavia	5172	3.20			
46	Portugal	5070	3.27		2043	8.22
47	Bulgaria	4773	3.47		1964	8.55
48	Iraq	4249	3.90		2886	5.82
49	Syria	4240	3.91		1585	10.59
50	Mauritius	4226	3.92	2.43%	1055	15.91
51	Korea	4217	3.93		2277	7.37
52	Poland	4177	3.97	4.47%	1908	8.80
53	Malaysia	4146	4.00	2.23%	1990	8.44
54	Gabon	4072	4.07	0.70%	3674	4.57
55	Iran	4043	4.10	2.46%	3877	4.33
56	Brazil	4017	4.12	0.84%	1645	10.21
57	Uruguay	3969	4.17		1569	10.70
58	Czechoslovakia	3920	4.23		2668	6.29
59	Jordan	3561	4.65		1888	8.89
60	Panama	3499	4.74	2.37%	2270	7.40
61	Chile	3467	4.78	1.66%	1358	12.36
62	St.Kitts&Nevis	3447	4.81		1825	9.20
63	Suriname	3396	4.88		2387	7.03
64	South Africa	3322	4.99	1.06%	1644	10.21
65	Fiji	3281	5.05		1637	10.29
66	Costa Rica	3184	5.20	1.68%	1485	11.31
67	Seychelles	3183	5.21		2590	6.48
68	Reunion	3093	5.36			
69	Turkey	3077	5.39	2.70%	1049	16.00
70	Algeria	2988	5.55	1.44%	2682	6.26
71	Colombia	2968	5.58	2.20%	1184	14.18
72	Ecuador	2913	5.69	2.99%	1303	12.88
73	Tunisia	2758	6.01	3.26%	1140	14.72
74	Congo	2697	6.14	2.18%	1115	15.05
75	Namibia	2604	6.36	1.38%	1037	16.19
76	Peru	2565	6.46	0.11%	830	20.21
77	Dominica	2563	6.47		1350	12.44
78	Belize	2529	6.55		1258	13.34
79	Thailand	2463	6.73	4.57%	723	23.23
80	St. Vincent	2411	6.87		1103	15.22
81	Botswana	2337	7.09		1057	15.88
82	Jamaica	2215	7.48	2.00%	893	18.80
83	St. Lucia	2211	7.49		1589	10.56
84	Swaziland	2198	7.54	0.95%	548	30.64
85	Dominican Rep.	2111	7.85	1.94%	700	23.99
86	Guatemala	2090	7.93	1.78%	1221	13.75
87	Paraguay	2072	8.00		856	19.60
88	Sri Lanka	2045	8.10		384	43.74
89	Romania	1995	8.31	3.11%		
90	Morocco	1956	8.47	2.65%	583	28.78
91	Egypt	1953	8.48		746	22.51
92	Tonga	1929	8.59		646	25.99
93	Grenada	1873	8.85		1231	13.63
94	Mongolia	1858	8.92		1323	12.69
95	El Salvador	1831	9.05	0.86%	857	19.60
96	Vanuatu	1829	9.06		916	18.32
97	Nicaragua	1794	9.25	1.27%	831	20.20
98	Bolivia	1754	9.45		469	35.81
99	Western Samoa	1726	9.60		558	30.09
100	Indonesia	1651	10.04	3.80%	536	31.34
101	Soloman Islands	1638	10.12		584	28.73
102	Papua N. Guinea	1619	10.23	0.82%	701	23.96
103	Yemen, N.	1574	10.53	-0.04%	644	26.07
104	Ivory Coast	1545	10.72	1.26%	562	29.88
105	Philippines	1542	10.75	1.49%	817	20.54
106	Cameroon	1487	11.14	0.90%	830	20.22
107	Honduras	1387	11.95		659	25.48
108	Laos	1340	12.37		581	28.92
109	Guyana	1265	13.10	2.56%	324	51.84
110	Pakistan	1262	13.13	3.07%	372	45.11
111	China	1262	13.13	0.51%	543	30.89
112	Zimbabwe	1216	13.63	1.45%	160	105.14
113	Bangladesh	1163	14.25		404	41.51
114	Senegal	1137	14.57		259	64.90
115	Djibouti	1108	14.95	1.72%	973	17.25
116	Benin	1062	15.60	2.66%	329	50.97
117	Nigeria	1052	15.75	1.62%	280	59.93
118	Cape Verde	1050	15.78	3.54%	160	104.92
119	India	975	16.99		150	112.08
120	Lesotho	936	17.70		343	49.00
121	Nepal	911	18.19			
122	Haiti	905	18.31	0.22%	360	46.65
123	Sierra Leone	853	19.43		498	33.71
124	Liberia	824	20.11	1.03%	395	42.48
125	Mauritania	808	20.51	0.21%	337	49.79
126	Zambia	794	20.87		303	55.42
127	Kenya	792	20.92	1.10%	357	47.03
128	Ghana	791	20.95		469	35.80
129	Sudan	776	21.35		288	58.33
130	Rwanda	769	21.55	-2.08%	286	58.65
131	Madagascar	769	21.55	-1.50%	285	58.94
132	Gambia	749	22.12	0.88%	246	68.19
133	Mozambique	712	23.27		150	111.68
134	Guinea	711	23.31			
135	Angola	672	24.66			
136	Bhutan	653	25.38			
137	Somalia	650	25.49	0.73%	131	128.06
138	Guinea Bissau	643	25.77	-0.09%	178	94.31
139	Comoros	637	26.01	1.16%	290	57.91
140	Togo	630	26.30	-0.98%	251	66.89
141	Central Afr.Rep	599	27.66		268	62.75
142	Myanmar	559	29.64	-0.28%		
143	Niger	540	30.69		183	91.87
144	Uganda	532	31.15	-0.37%	219	76.49
145	Mali	527	31.44	0.84%	172	97.34
146	Burundi	518	31.99	0.37%	168	99.71
147	Malawi	495	33.47		242	69.34
148	Burkino Faso	473	35.03		157	106.66
149	Tanzania	442	37.49		326	51.45
150	Zaire	409	40.51	-1.91%	227	73.90
151	Chad				145	115.83
152	Ethiopia	299	55.42		110	152.31

Avg ROG 60-92 = average annual rate of growth, 1960-92.

Figure 1: Growth vs. real per capita incomes, 113 countries
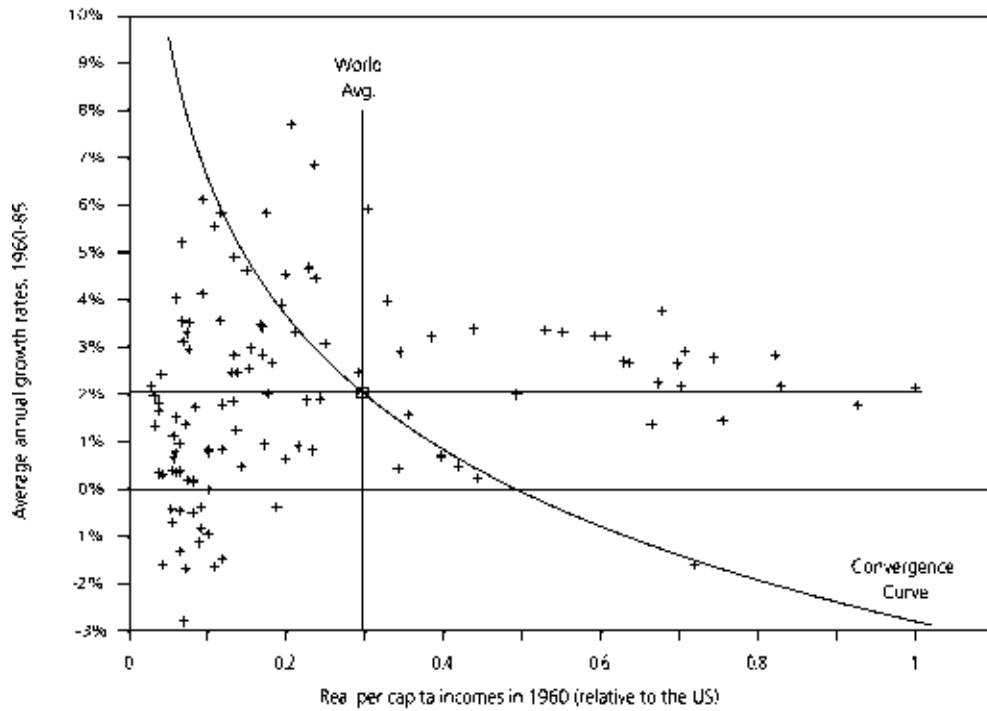
Source. Ben-David, Dan (1994), "Income Disparity Among Countries and the Effects of Freer Trade," in *Economic Growth and the Structure of Long Run Development*, Luigi L. Pasinetti and Robert M. Solow (eds.), London: Macmillan, 45-64.

Figure 2: Disparity within three income groups: 1960-85
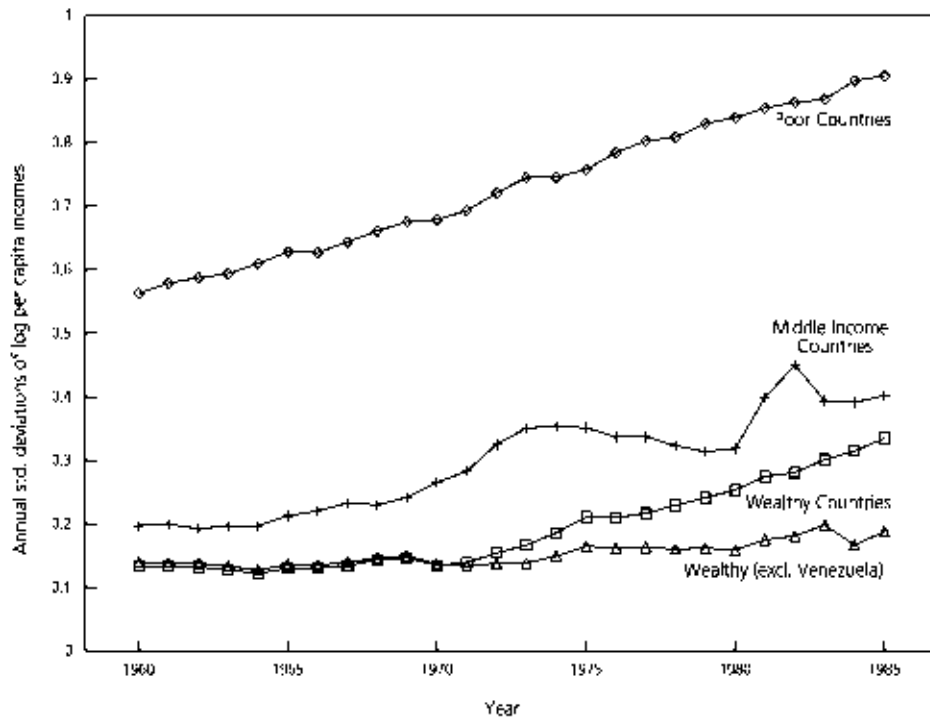
Source. Ben-David, Dan (1995), "Convergence Clubs and Diverging Economies," Foerder Institute working paper 40-95.

Figure 3: Disparity within five income groups: 1960-85
By Quintiles of 1960 US per capita income
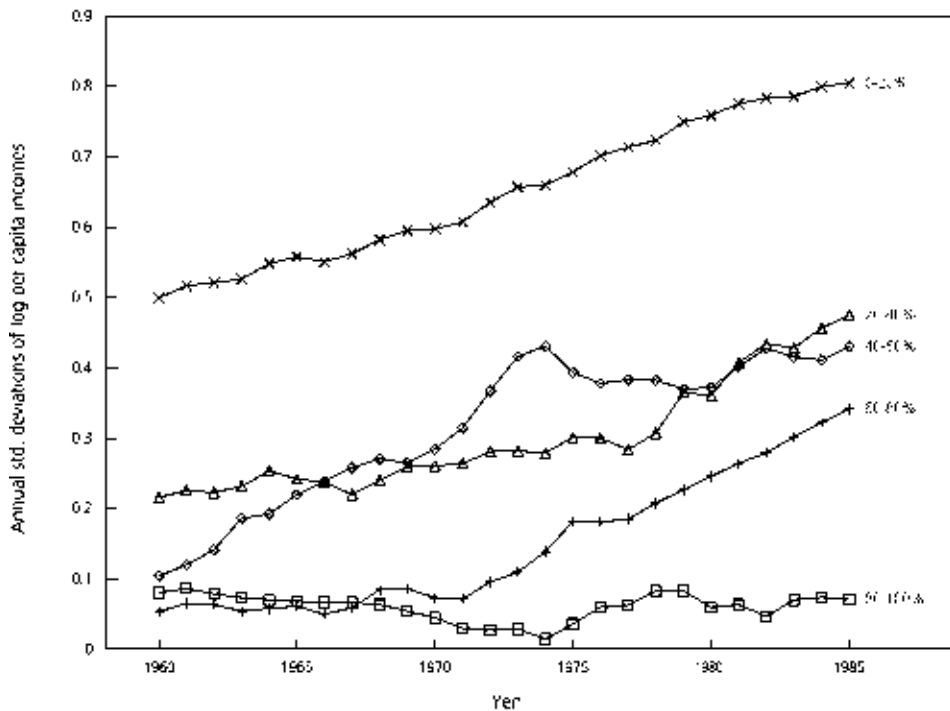
Source: Ben-David, Dan (1995), "Convergence Clubs and Diverging Economies," Foerder Institute working paper 40-95

to reach the world average level of income in 1985.[3] As is clear from the graph, the countries of the world are nowhere near alignment along the convergence curve. Instead, they are arrayed in a mean-preserving wedge.

Rather than looking at the world as a whole, it is possible to divide it up into three income groups using the cutoff point of 60% of the 1960 US income to distinguish between wealthy and middle income countries and 25% of the US income as the dividing point between middle income and poor countries. Given this delineation, the poor group includes 82 countries, the middle income group 15 countries, and the wealthy group 16 countries.

Figure 2 displays the annual income gaps within each of the groups between 1960 and 1985 using the standard deviation of the income logs as the measure of intra-group income disparity. As the figure shows, the poorest group of countries had the largest (relative) income gap in 1960 and it diverged steadily over time. The group of middle-income countries exhibited the second-largest income gap and it too diverged over time. The group of wealthy countries exhibited the smallest income gap in 1960. As was the case within the other two income

groups, this gap grew over time. In contrast with the two poorer groups, one of the main reasons for the divergence among the wealthier countries is one country, Venezuela, a country that was among the wealthiest in 1960 that experienced negative average growth over the next two-and-a-half decades. Exclusion of this outlier country yields weaker divergence evidence, if any still exists. In any event, none of the three groups exhibits any sign of a reduction in the degree of income disparity.

Rather than divide the world into three income groups using the admittedly subjective criteria above, it is possible to regroup the countries into five different groups according to quintiles based on the 1960 US per capita income. The poorest quintile (0-20% of the 1960 US per capita income) includes 72 countries, the second (20-40%) 18 countries, the third (40-60%) seven countries, the fourth (60-80%) 12 countries, and the fifth (80-100%) four countries. Figure 3 depicts the behavior of the income gaps over time. As in the earlier division of the world into three groups, the poorest countries exhibit the largest income gap in 1960 while the second poorest group exhibits the second largest income gap that year. In

3   The equation for this curve is $ROG_i^{60-85} = 100 \left[\left(\frac{y_a^{85}}{y_i^{60}} \right)^{\frac{1}{25}} - 1 \right]$, where ROG_i^{60-85} represents the rate that country i would

have had to have grown by between 1960 and 1985 to have reached the world's average income level by 1985. The variable y_i^{60} is the

level of the country's real per capita income in 1960, and the variable y_a^{85} is the world's average income level in 1985.

general, all of the groups but the wealthiest diverged through 1985. The wealthiest group, which contained just four countries did not diverge, but did not exactly converge either.

Figures 2 and 3 suggest that if any conclusion at all might be reached at this point, it is that the world appears to have been characterized by an increase in income disparity among countries. The visual impression is confirmed by statistical analysis, detailed in Box 1. Essentially, what the statistical analysis is doing is to estimate the rate of convergence or divergence of incomes within a group of countries, where ϕ is the estimated convergence coefficient. If ϕ is larger than one, incomes are diverging, and if smaller than one, incomes are converging.

The results are presented in Table 2. The first regression on all 113 countries in the sample between 1960 and 1985 is presented in the first line of the table. Note that the estimated ϕ is significantly greater than one, confirming that per capita incomes are diverging in the world as a whole.[4] The rate of divergence over the 25 year period is such that the world-wide income gap will be doubled in one and a half centuries (or 146 years to be exact), as detailed in the last column.

Division of the world in half according to 1960 per capita incomes yields 57 countries in the "wealthier" half (country one to 57) and 56 countries in the "poorer" half (country 58 to 113). The top half exhibits neither significant convergence nor significant divergence while the bottom half diverged over time. A division of the world into three equally sized groups yields a significant outcome, divergence, only for the middle group. Continuing to divide the world into increasingly smaller ranges of countries begins to yield a pattern. As the size of the country ranges falls, we see increasing evidence of

convergence at the bottom end, and divergence elsewhere.

Moving to the bottom of the table, the countries are divided into eight ranges containing 14 countries each (with exception of the first range that contains 15 countries). All of the estimated convergence coefficients are greater than one (most of these significantly so) with the exception of the poorest range of countries, as detailed in Figure 4. That is, it is only the poorest group of countries that exhibit income convergence among its members. Even with the exclusion of the outlier country, Venezuela, from the top range, there is very little support for the determination of convergence among the wealthy countries (from here on, Venezuela will be excluded from the sample).

Are these results, however, really indicative of who is converging and who is not? What is the likelihood of finding convergence within a group of, say, six countries, if this group is randomly selected from each range? Or, put differently, what is the percentage of sub-unity ϕ's (i.e. convergence) groups within each income group?

It is possible to create 3003 different possible groupings of six countries from each income range of 14 countries. The rate of convergence or divergence within each group of six countries is estimated using the methodology described in Box 1. The resultant estimated ϕ's for each of the groups is plotted in Figure 5. The horizontal axis lists the ϕ's and the vertical axis lists the cumulative distribution of the estimated ϕ's. For example, in the case of countries 30 through 43 in range 3 (curve "3rd 14" in the figure), the smallest ϕ in any of the 3003 groups was no less than 0.95 and the highest ϕ was greater than 1.06. The curve crosses the vertical line (dividing both sides of the graph at ϕ=1) at a height of approximately 0.05 indicating that roughly 5% of the estimated ϕ's were less than one (i.e. convergence groups) while 95% of the groups exhibited divergence.

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[4]   The degree of statistical significance is given by the "t-statistic" in column 4. The higher the absolute value, the more confidence (significance) can be attributed to the estimated coefficient. While the cutoff point between significance and insignificance is somewhat arbitrary (it depends on the number of observations and whether the significance is measured at the 1% level, the 5% level, or the 10% level), a t-statistic above two (in absolute terms) may be thought of as statistically "significant".

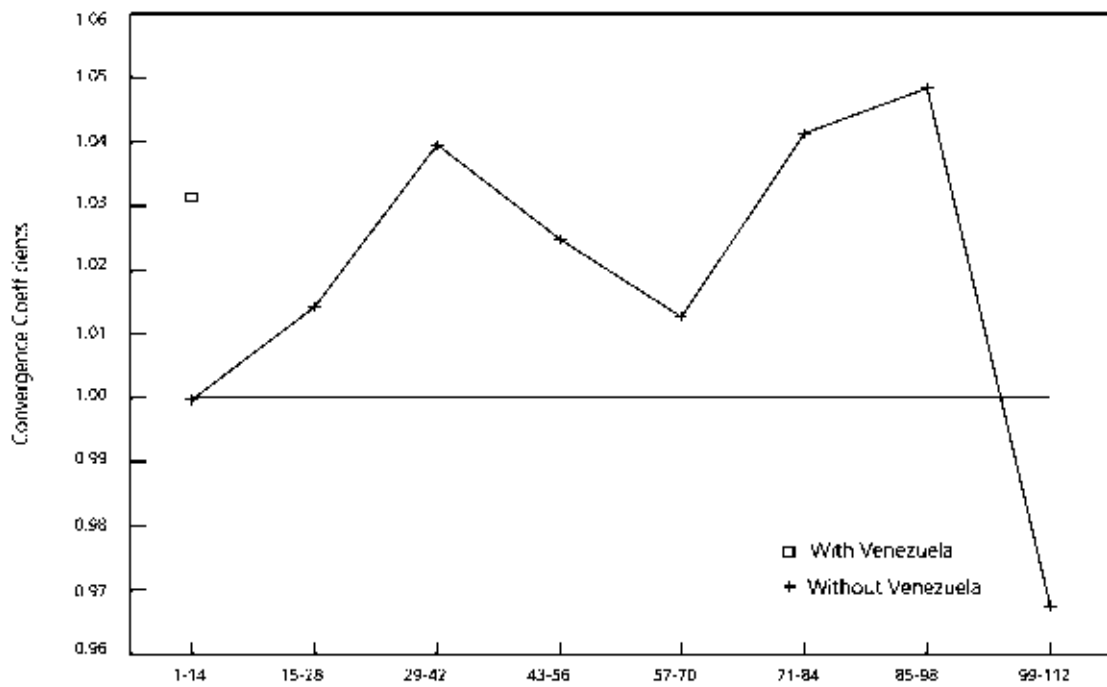## Table 2: Convergence coefficients by range

Country range First	Last	$\hat{\phi}$	t-statistic (H_0: ϕ=1)	k	NOBS	$\bar{R}^2$	Half/double * life
1	113	1.00476 (1.00533)	4.06 (4.49)	3	2373	0.997	146
1	57	0.99803 (0.99882)	-0.74 (-0.43)	2	1197	0.992	-352
58	113	1.00898	2.73	3	1176	0.990	78
1	38	0.99745 (0.99758)	-0.60 (-0.56)	2	798	0.986	-272
39	76	1.02230	4.76	1	798	0.986	31
77	113	1.00216	0.37	3	777	0.978	321
1	29	1.00882 (1.00769)	1.49 (1.28)	2	609	0.981	79
30	57	1.01945	2.61	4	588	0.978	36
58	85	1.02138	3.72	1	588	0.984	33
86	113	1.00343	0.47	4	588	0.976	202
1	123	1.00548 (1.00490)	0.90 (0.82)	4	483	0.986	127
24	45	1.01952	1.96	2	462	0.964	36
46	67	1.01174	1.16	2	462	0.967	59
68	89	1.02618	3.60	1	462	0.981	27
90	111	1.01079	1.45	0	462	0.976	65
1	19	1.01059 (0.99404)	1.16 (-0.66)	4	399	0.976	66
20	37	1.00582	0.58	2	378	0.967	119
38	55	1.04945	5.29	0	378	0.971	14
56	73	1.00374	0.43	1	378	0.976	186
74	91	1.04071	4.29	4	378	0.984	17
92	109	1.00504	0.54	0	378	0.968	138
1	17	1.02667 (0.99243)	2.89 (-0.65)	1	357	0.975	26
18	33	0.99958	-0.04	2	336	0.966	-1650
34	49	1.04586	5.16	0	336	0.976	16
50	65	1.01113	1.16	1	336	0.975	63
66	81	1.04030	6.17	0	336	0.987	18
82	97	1.03173	3.04	1	336	0.973	22
98	113	0.99183	-0.85	0	336	0.969	-85
1	15	1.03140 (0.99960)	3.21 (-0.03)	1	315	0.976	22
16	29	1.01433	1.29	2	294	0.970	49
30	43	1.03960	2.72	4	294	0.968	18
44	57	1.02484	1.69	4	294	0.965	28
58	71	1.01274	1.26	4	294	0.984	55
72	85	1.04138	3.20	4	294	0.973	17
86	99	1.04841	4.43	0	294	0.969	15
100	113	0.96751	-2.60	1	294	0.955	-21

The parentheses denote values without Venezuela.

* The half-lives are denoted by negative numbers.

Source: Ben-David, Dan (1995), "Convergence Clubs and Diverging Economies," Foerder Institute working paper 40-95.

Figure 4: Convergence coefficients by income range
Fourteen countries per range, eight ranges

Source: Ben-David, Dan (1995), "Convergence Clubs and Diverging Economies,"
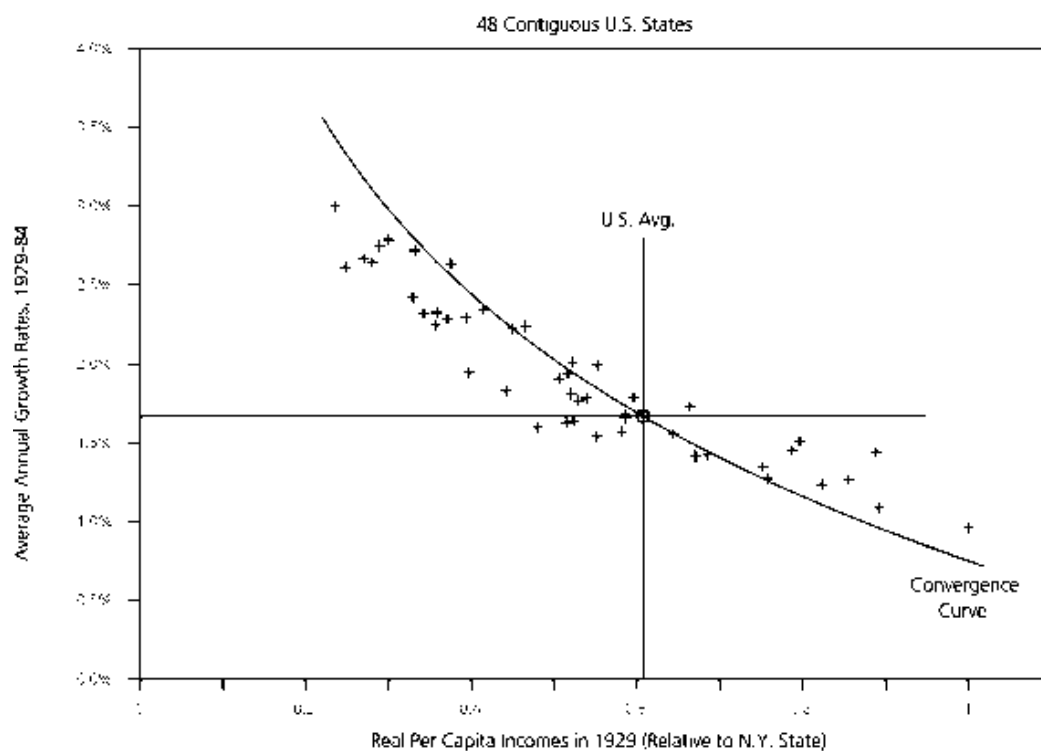Foerder Institute working paper 40-95.

Figure 5: Distribution of convergence coefficients
All 3003 Possible Draws of Groups of 6 From Each Range of 14 Countries
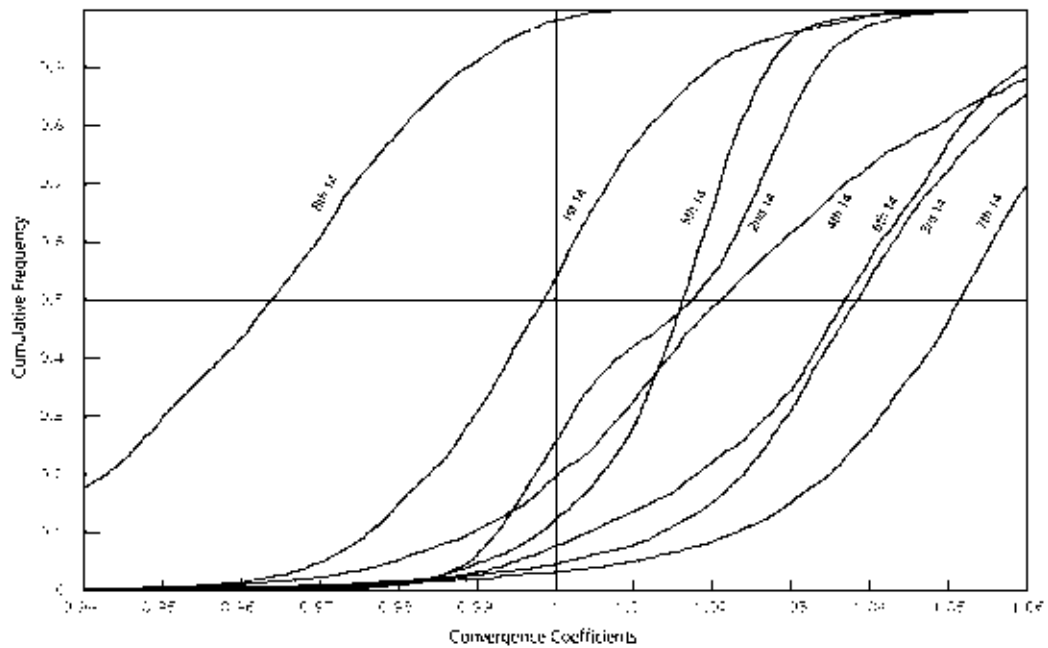
Source: Ben-David, Dan (1995), "Convergence Clubs and Diverging Economies," Foerder Institute working paper 40-95.

Figure 6: Growth vs. real per capita incomes

Source: Ben-David, Dan (1994), "Income Disparity Among Countries and the Effects of Freer Trade," in *Economic Growth and the Structure of Long Run Development*, Luigi L. Pasinetti and Robert M. Solow (eds.), London: Macmillan, 45-64.

The most evidence of convergence is among the poorest countries with nearly all of the groups in the range exhibiting convergence. With the exception of the wealthiest range of countries, there is non-convergence or divergence in over three quarters of the other randomly-created groups. And among the wealthiest countries, one is just as likely to find $\phi>1$ as they are of finding $\phi<1$.

Although the two ranges at both ends of the income spectrum exhibit the highest incidence of convergence, the nature of the convergence is different in each of them. While convergence at the top end of the spectrum is of the catching-up variety—where the poorer group members catch-up with the wealthier group members— the convergence at the bottom end of the income spectrum is one of negative growth by the initially better-off members of the poorest range, i.e. this is a downward convergence. Convergence at both ends of the income spectrum with divergence in between is also shown, using different methodology, in Quah (1993 and 1996).

The focus in the remainder of this paper will be on isolating one of the possible sources of the catch-up convergence. In particular, from among the wealthier countries within the top two ranges, are there any identifying characteristics that tie the converging groups together and sets them apart from the remaining groups? One possibility is that international trade may be one of the main threads connecting the convergers from the non-convergers.

What kind of a role might trade barriers play in yielding the non-convergence between countries—and what kind of an effect might their removal produce? Or more generally, how does one go about identifying trade's effect on income differentials between countries?

One might want, for example, to compare the behavior of income differentials between US states to income differentials between countries. In this kind of an example, the US could represent a proxy for an integrated world economy with free trade and mobility of factors (both capital and labor).

As Figure 6 indicates, there has been substantial convergence within the US. Nearly all of the states are in the upper-left or lower-right quadrants—an indication that the below-average states (in terms of initial income levels) grew at faster than average rates while above average states grew at below average rates.[5] This state-wide income convergence stands in stark contrast to the non-convergence observed in the world (Figure 1).

The question is whether it is the relatively free flow of goods between states that is the primary force behind this convergence outcome, or whether there might be other explanations as well. These would include the relatively unrestricted flows of factors—both capital and labor—

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5   The convergence, while extensive, is nonetheless incomplete insomuch as the below-average states are still a bit below the convergence curve while the above average states are a bit above it.

between states and regions of the US as well as the existence of a central government.

How might it be possible to isolate trade's contribution to the US convergence? The answer is that, without data on trade between states, this contribution is very hard to pin down. Trade data does, however, exist for countries.

In this regard, the European Economic Community (or EEC) provides a very useful arena for isolating the effects of trade on incomes. This is due to the fact that the EEC represents a fixed group of countries that formally integrated most of their trade policies. While the EEC exhibited significantly increased trade during its evolutionary period, (we'll look at these changes in the volume of trade in just a moment) there have been a considerable number of studies pointing out that the early years of the Community were not distinguished by significant improvements in factor flows—both capital and labor—among countries. Hence, the primary changes that occurred during the formative years of the EEC were in commodity flows rather than in factor flows.

How does the relationship between growth rates and initial income levels compare between the six founding members of the EEC and the 107 remaining countries of the sample? Correlation coefficients ranging from -1.0 (for a perfect negative correlation) and 1.0 (for a perfect positive correlation) —where 0 indicates no correlation at all—may be used to compare these relationships between the two sets of countries. For the 107 non-EEC countries of the world, the correlation coefficient between their 1960 per capita incomes and their 1960-85 growth rates is 0.13, which indicates a slight positive correlation. By comparison, the correlation coefficient for the EEC is -0.88, indicating a strong negative relationship between initial incomes and subsequent growth rates.

C. Trade liberalization's impact on trade

Before going into a more direct analysis of the relationship between trade reform and income convergence, it is useful to examine whether the trade reforms discussed below had any sort of an impact on the actual trade of the reforming countries. Such an examination is the focus of this section.

Post-war trade liberalization between the countries that would later form the EEC began in earnest with the implementation of the Marshall Plan in 1947. As a part of the Plan's conditions, the United States required recipient countries to begin liberalizing their trade. These steps led primarily towards a movement from discriminatory quotas towards non-discriminatory quotas and to a partial easing of some existing quotas.

That same year, 1947, saw the creation of the Benelux Union by Belgium, the Netherlands and Luxembourg. The Union's provisions for allowing unrestricted movement of goods and services, as well as the implementation of a common external policy, broke new ground and gave a hint of things to come. In the early 1950s, the Benelux countries were joined by France, Germany and Italy in a series of treaties that eventually culminated in the signing of the Treaties of Rome and the creation of the European Economic Community in 1957. Nearly all remaining internal barriers to trade within the EEC were eliminated

Figure 7: Intra-EEC imports as a percentage of total imports
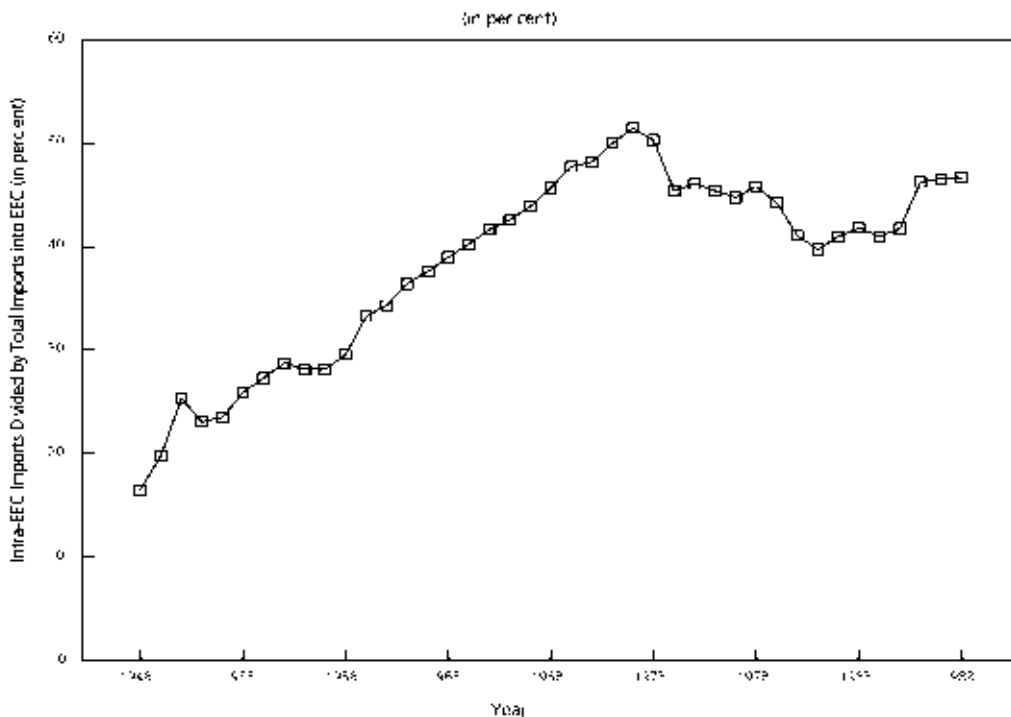
Source: Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics*, 108, 653-79.

Figure 8: Ratio of intra-EEC trade to EEC GDP
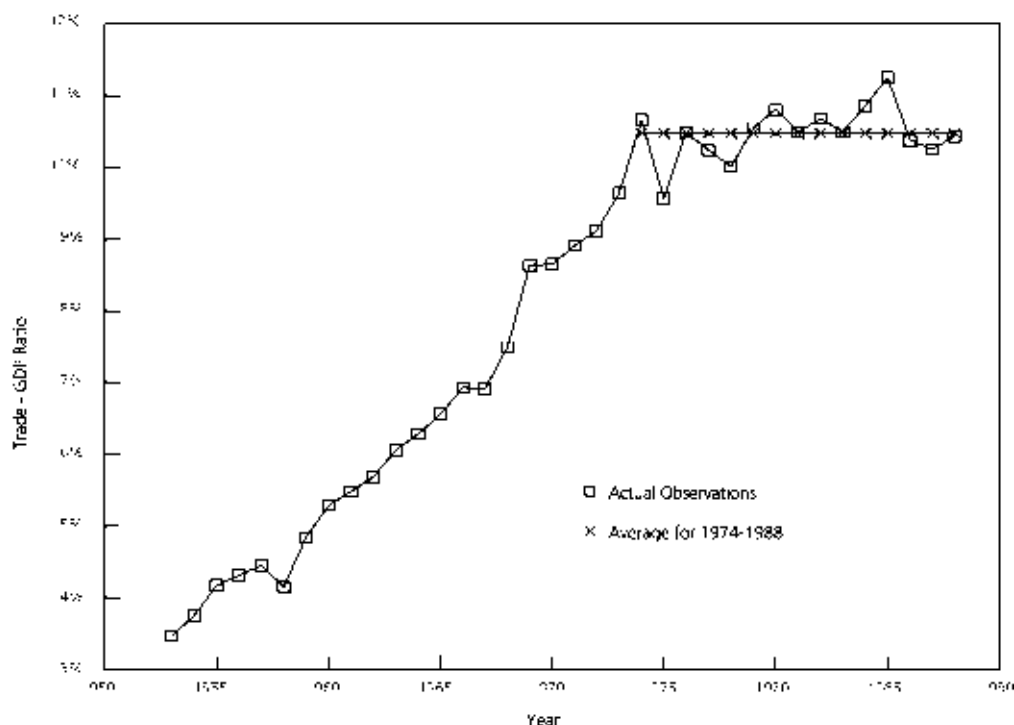
Source: Ben-David, Dan and Ayal Kimhi (2000), "Trade and the Rate of Income Convergence," CEPR Discussion Paper 2390.

by 1968. Thus, the relevant period for analysis of EEC liberalization includes the decade preceding and the decade following the formal creation of the Community in the late 1950s.

What kind of an impact did this integration have on intra-Community trade? As Figure 7 indicates, the proportion of imports by the EEC countries from each other (i.e. total intra-EEC trade) to total imports by the EEC countries from other, non-EEC, countries was roughly 15% in 1948. This proportion rose steadily throughout the liberalization period until leveling off in the late 1960s and early 1970s at about three times the 1948 ratio.

Figure 8 shows how this increase in intra-EEC trade compared with output growth in the Community. The intra-EEC trade-output ratio grew from about 3½% in the early 1950s along a relatively monotonous path until the 1970s when it reached a plateau of just over 10% of GDP.

A similar pattern emerged when the EEC was enlarged from six to nine countries in 1973 (upper panel of Figure 9). The ratio of imports into the six from the three to EEC six output was fairly constant until the enlargement was implemented. The ratio then began to rise to over double its pre-enlargement level.

While different EEC trade liberalization periods coincided with different periods of trade increases, it is important to note that not all EEC trade exhibited this kind of behavior. For example, the United States did not enjoy the unlimited access to EEC markets that the Community members enjoyed, and as the bottom panel

of Figure 9 indicates, EEC imports from the US grew at the same rate as EEC output throughout the entire period.

In short, in the instances that EEC trade was liberalized, the impact on the affected trade volumes is readily apparent. Different instances of trade liberalization coincided with different instances of increases in trade-output ratios. In lieu of such trade reforms, trade-output ratios tended to remain unchanged.
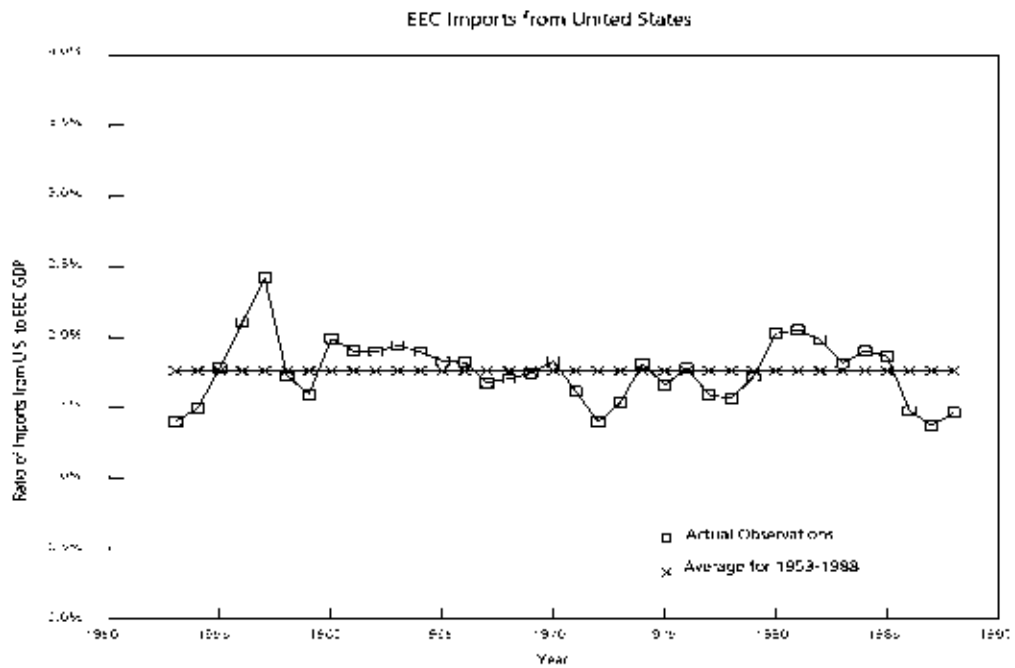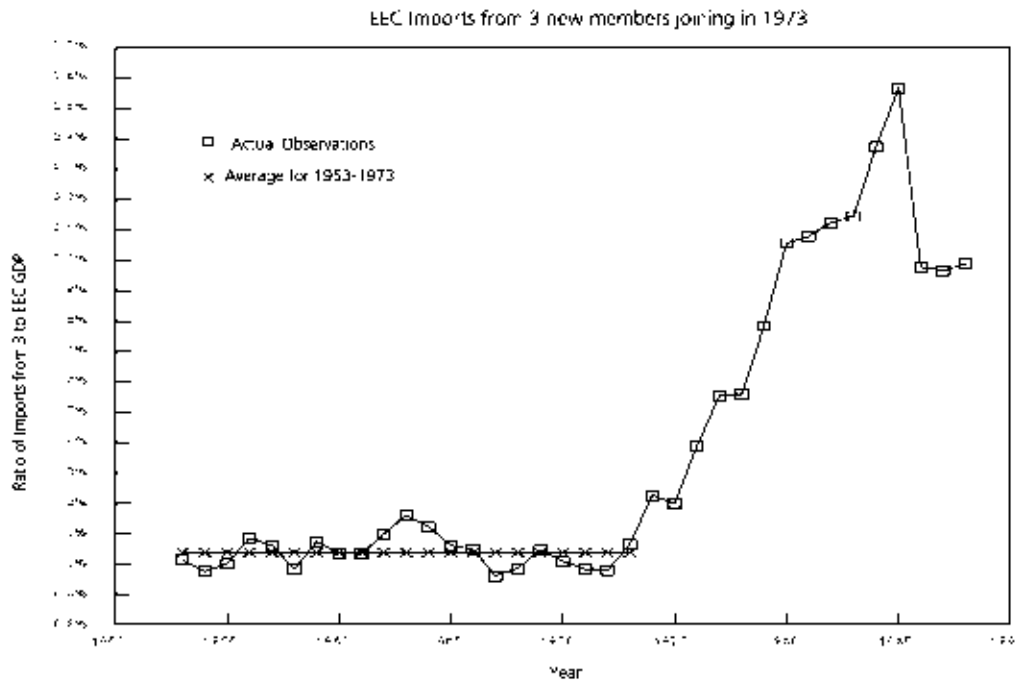
D. Trade liberalization and income convergence

As the preceding section illustrated, trade liberalization appears to have had a visible effect on trade. But, what was its effect on income disparity among the countries? To get an idea of the relationship between the income differentials within the EEC, and the timing of its trade liberalization, it is useful to examine the behavior of the annual cross-country standard deviations of the log real per capita incomes (σ). A graphical depiction of this

The signing of the Treaty of Paris creating the European Coal and Steel Community (ECSC) and consolidation of the coal and steel industries of the area was accompanied by a 16% reduction in σ. From 1954 to 1958, the σ's behaved in a cyclical manner, though they fell a bit.

The EEC was created with the signing of the Treaties of Rome in 1957. In 1959, remaining internal trade barriers began to be eliminated within this newly-created formal framework. That year, σ fell beneath its previous level and headed downward until 1962, the year that all remaining quotas were abolished. The next three to four

Figure 9

EEC Imports from 3 new members joining in 1973

□ Actual Observations
× Average for 1953-1973

Rate of Imports from 3 to EEC GDP

Year

EEC Imports from United States

Rate of Imports from US to EEC GDP

□ Actual Observations
× Average for 1953-1988

Year

Source: Ben-David, Dan and Ayal Kimhi (2000), "Trade and the Rate of Income Convergence," CEPR Discussion Paper 2390.

Figure 10: Per capita income dispersion
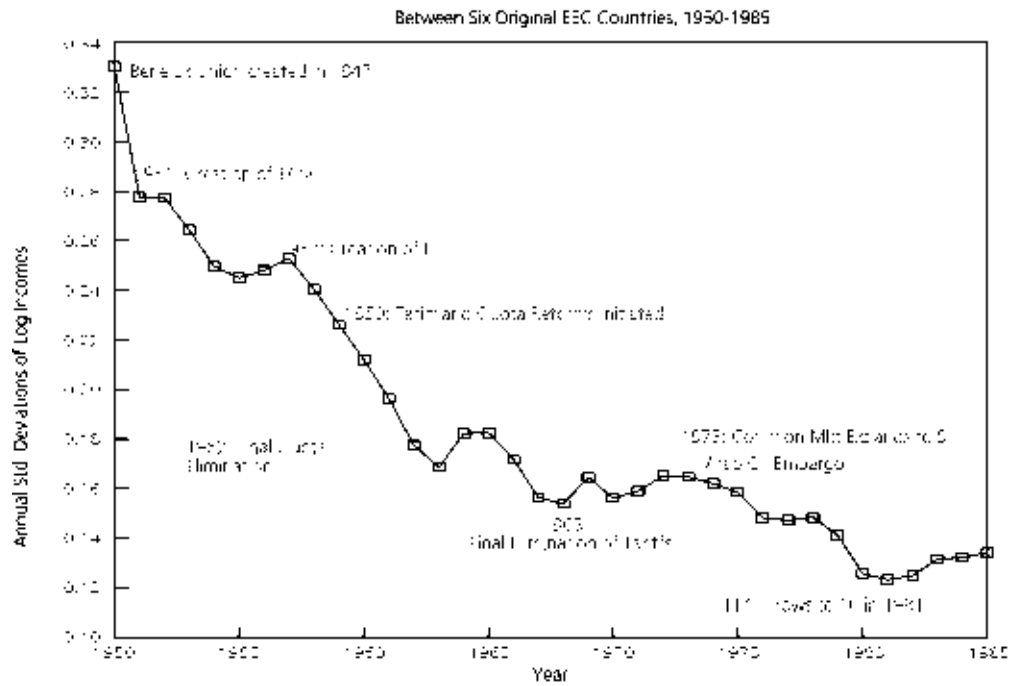
Between Six Original EEC Countries, 1950-1985

Source: Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence,"
Quarterly Journal of Economics, 108, 653-79.

Figure 11: Per capita income dispersion within the US

Between All Eight Census Regions, 1880-1985
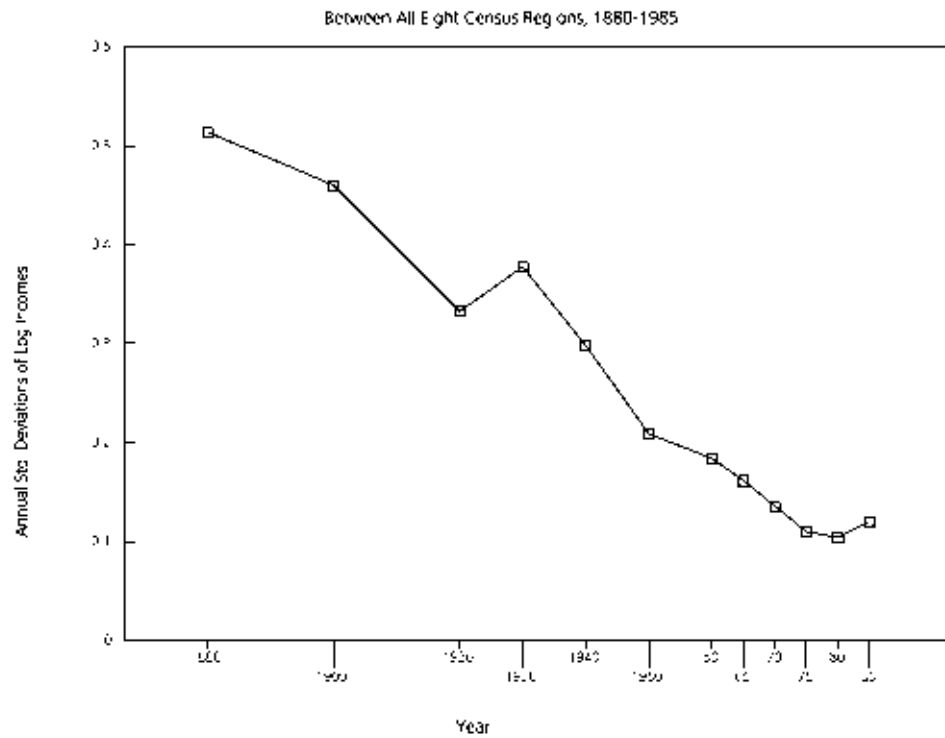
Source: Ben-David, Dan (1990), "From Liberalization to Equalization: Some Evidence on the Impact of Freer Trade on Income Differentials,"
unpublished University of Chicago Ph.D. dissertation

years saw a stabilization around this lower level of income disparity. From 1965 to 1968, there occurred further, though moderate, reductions in the degree of income dispersion.

One of the first questions that arises when one looks at the EEC convergence outcomes is the question of whether this convergence should be attributed to the shocks induced by World War II. In other words, did the fall in income disparity following the war reflect a return to relatively low levels of σ's that may have existed prior to the onset of World War II? Or, alternatively, was the reduction in income differentials a continuation of a long-term convergence trend? Existence of either of these scenarios would weaken the case for a link between trade liberalization and income convergence.

Long-term convergence has, in fact, been the case within the US. Figure 11 provides an indication of how interregional income differentials declined between 1880 and 1985. Despite a slight rise in disparity during the inter-war period, the US income convergence resumed and even returned to the earlier pre-World War II convergence path. There had been no regime of interstate trade barriers that had to be abolished and the graph reveals no abrupt change in direction that might have accompanied a major change in policy. Instead, it would appear that the primary trade barriers were the costs of transportation and communication and as these gradually declined over time, so did the income differentials between the different regions.

What was the path of the EEC income gap in the decades prior to the creation of the Community? Using Maddison's (1995) data, it is possible to determine if either of the two alternative scenarios described above might be applicable. The income gaps between the EEC founders since 1870 appear in Figure 12 (the Maddison data does not include Luxembourg so it is not included in the calculations of the income gaps).

Looking at the gaps since 1870, the behavior of the σ's clearly indicates that, during the three decades prior to World War II, neither of the alternative two scenarios appears to hold. The dispersion of real per capita incomes was fairly stable during the inter-war period preceding World War II. Only after the onset of the post-war trade liberalization did the σ's begin to drop in a sustained manner to gaps that had hitherto been unseen among the countries during the previous eight decades.[6]

The liberalization-equalization focus has, until now, been on the founding countries of the EEC. Would it be possible to reproduce similar convergence results for the next three countries that joined the EEC (Ireland, Denmark and the UK)? And, if these countries exhibit a reduction in income differentials after eliminating trade barriers amongst themselves, would this behavior be any different than their pre-liberalization behavior?

The income gaps between the three new members are plotted in Figure 13. The σ's between the three actually increased until the mid-sixties. With the implementation of the Kennedy Round agreements in 1968 and the subsequent accession of the three countries to the European Economic community in 1973, the σ's began to stabilize and then decline as the countries began to converge with one another—and also with the six original members of the Community (the latter convergence is not shown here).

While the EEC countries have exhibited a significant reduction in the degree of income disparity among themselves, this has not been a prevalent feature of the international data, as was indicated earlier. An interesting experiment would be to compare the EEC to opposing benchmark cases and see to how the Community moved from one type of income gap path to another.

As noted above, the United States can be used as a best-case scenario for what may be accomplished within a completely integrated world economy, where there is unrestricted trade and factor flows. At the other end of the spectrum is the actual world economy , where there exist curbs on the mobility of goods and factors between countries. The EEC provides the intermediate case that depicts a steady liberalization of trade, but where factors do not flow as freely as within the US. This places it between the restrictive world case and the free trade, free factor flow, US case.

Figure 14 provides visual support for the worldwide divergence that occurred during the post-war period. However, such a grouping that includes extremely poor developing countries is not too useful a benchmark for comparison with the EEC. Instead, a subgroup comprising the 25 middle and high income countries of the world was formed and the income gap within this group plotted. For all but the latter years of the sample, the income gaps within this group display neither convergence nor divergence—a feature that resembles quite closely the relatively flat path of the inter-war EEC income gaps in Figure 12. The EEC income gaps moved from their flat pre-war path (that was at a relatively similar height as that of the 25 benchmark countries in the post-war) to a path that exhibits convergence rates and income gaps quite similar to those between the US states.

The estimation results in Table 3 support the visual evidence. Pre-war EEC convergence coefficients are not significantly different from one. Neither are the convergence coefficients for the top 25 countries or for the 14 countries with initial incomes between the wealthiest and poorest EEC countries.

On the other hand, post-war EEC convergence coefficients are significantly less than one, with the strongest convergence occurring during the ten-year transition period in which the EEC formally removed all remaining barriers on trade within it. It is interesting to

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6   As Rodriguez and Rodrik (1999) point out, the period between 1879 and 1901 was accompanied by increases in tariffs by Germany, France and Italy. As the figure indicates, incomes gaps rose considerably during this period—after which they fell by a substantial margin in the years prior to World War I. From the long-run perspective, σ was relatively stable during the inter-war years, though it is still noteworthy to point out that the erection of trade barriers in Europe during this period was accompanied by a slight, though noticeable, rise in the size of the income gaps. As Germany began to prepare for war in the 30s, the income of that country (which had been among the poorest of the group at that point) began to rise—an outcome that is reflected in the slight non-trade related reduction in income differentials that occurred in the 1930s, which later bottomed out by the outbreak of World War II.

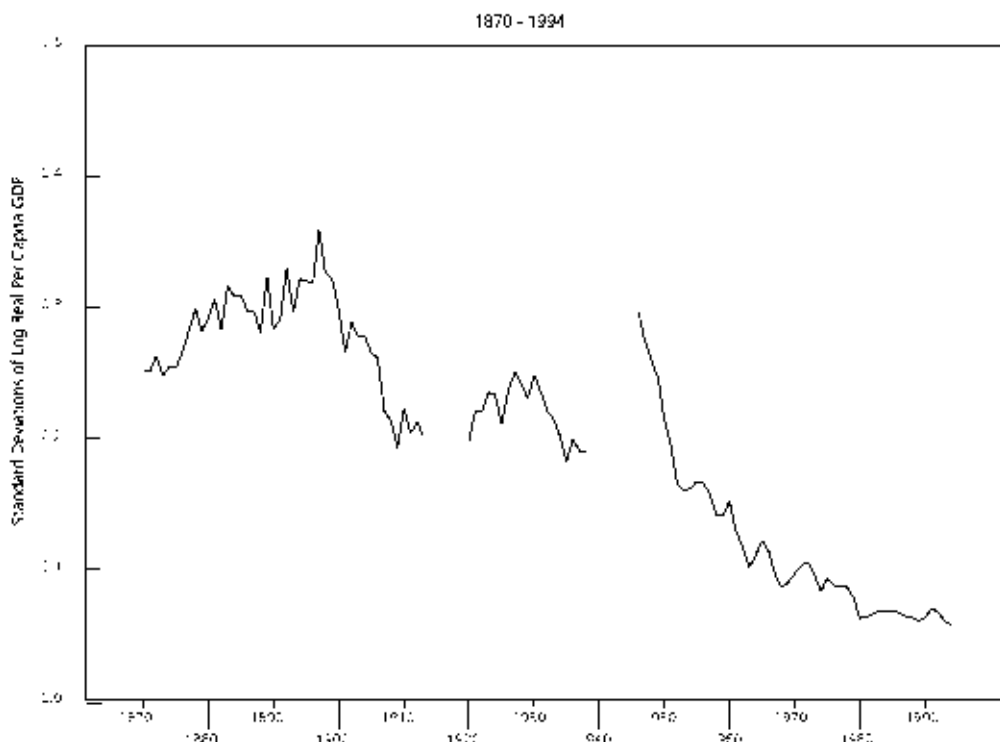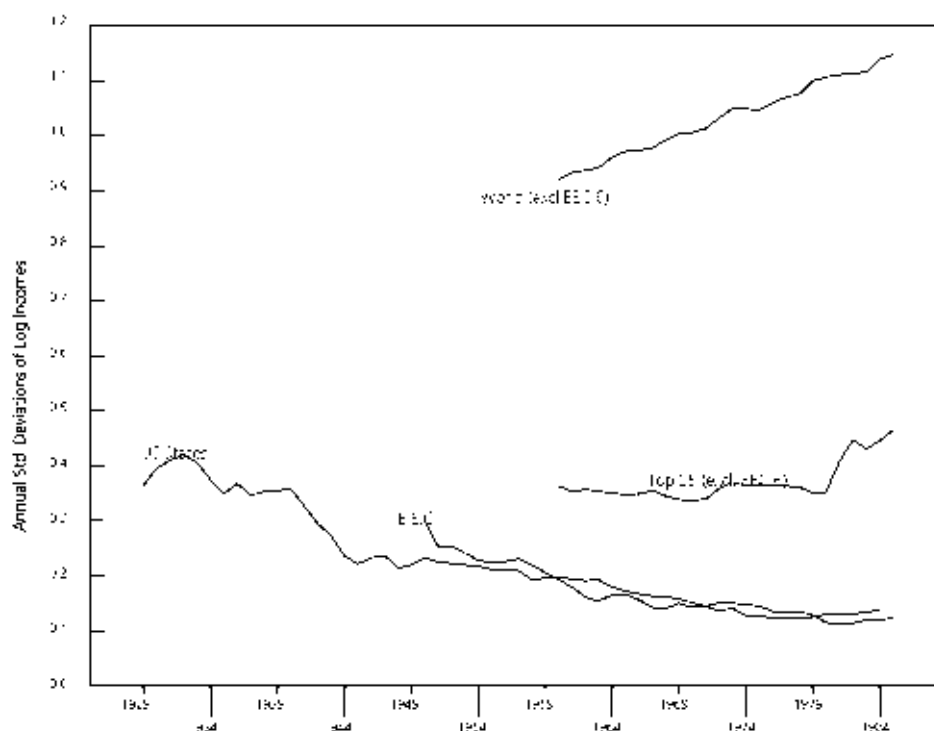Figure 12: Income dispersion between 5 future EEC founders

1870 – 1994

Figure 13: Per capita income dispersion

Between the United Kingdom, Denmark, and Ireland, 1950–1985

Year

Source: Ben David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics*. 108, 653–79.

Figure 14: Comparison of Income Dispersions, 1929-1985

Source: Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics,* 708, 653-79.

note that the half-life during the transition period was very similar to the half-life of the United States convergence over the past 55 years.

Until now, the emphasis has been on trade liberalization and income convergence between the countries forming the European Economic Community. But this is not the only instance of substantial trade reform coupled with declines in income disparity. Another example is that of the United States and Canada, two current members of the North American Free Trade Agreement (NAFTA). These two countries embarked on the road to free trade a couple of decades prior to the creation of NAFTA, first with the signing of the auto pact in 1965 and then within the framework of the Kennedy Round Agreement signed under the auspices of the GATT. Under the terms of the Kennedy Round Agreement, they removed approximately 40% of the tariffs on their bilateral trade between the years 1968 and 1973. As the bottom panel of Figure 15 shows, the relatively stable trade-output ratio began to rise as the trade reforms were initiated. By the end of the reform period in the early 1970s, this ratio again stabilized—at over twice its pre-reform levels.

The top panel shows how the income gap between the two behaved during the post-war period. After fluctuating between 15% and 20% between 1950 and 1967 (as well as for many decades prior to World War II), the gap began to fall in 1968 and to level off in 1973 at levels between 0 and 4%—a very close reflection of the Kennedy Round trade reform dates.

A final example of the link between trade liberalization and income convergence is that of the European Free Trade Association, or EFTA as it came to be called. EFTA, which comprised eight countries, began to abolish tariffs on trade in manufactured goods in 1961 and completed the process by 1967. The EFTA countries included Austria, Denmark, Finland, Norway, Portugal, Sweden, Switzerland, and the United Kingdom. Portugal was exempt from a large number of the Association's trade reforms, hence it is not included in the EFTA analysis here. Another country omitted from the analysis is Austria, a country that was among the most developed in Europe at the turn of the century and devastated economically in the two World Wars. The resultant postwar resurgence of Austria led to substantial convergence with the EFTA countries that were initially wealthier following World War II. Since the focus here is on trade-related convergence, Austria is removed from the sample of EFTA countries in order to remove the pro-convergence bias that it introduces.

In contrast with the previous cases of trade liberalization examined above, the income gap in EFTA did not begin falling as the countries began to remove obstacles to trade (top panel of Figure 16). Instead, it began to decline later, between the late 1960s and the mid-1970s. This mismatch between the timing of the reforms and the timing of the convergence reflects an apparent contradiction with the earlier findings.

However, it turns out that EFTA did not represent a grouping of countries that traded extensively with one another as was the case in all of the examples studied

Table 3: Convergence coefficients, by group[a]

	$\acute{\phi}$	N	R^2	t-stat. H_0: ϕ=1	Half life	Double life
EEC						
Pre-war,[b] 1900-1933	0.9909 (0.0094)	135	0.988	-0.98	75.5	
Post-war, 1951-1985	0.9709 (0.0066)	204	0.991	-4.39**	23.5	
Transition Period 1959-1968	0.9494 (0.0103)	60	0.993	-4.90**	13.3	
UNITED STATES, 1931-1984	0.9558 (0.0038)	2554	0.961	-11.64**	15.3	
WORLD (excl. EEC 6), 1960-1985						
All 107 Countries	1.0074 (0.0012)	2675	0.996	6.42**		93.9
Top 25 Countries	1.0027 (0.0056)	625	0.981	0.47		260.9
14 Countries[c] (w/o Venezuela)	1.0132 (0.0093)	325	0.973	-1.42		52.7

[a] Standard deviations are in parentheses.

[b] Does not include Luxembourg due to lack of data and excludes the World War I years, 1914-1919.

[c] These are the 14 countries with the same per capita income range as the EEC 6 in 1960.

** Significant at the 1% level.

Source: Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics*, 108, 653-79.

above. Their primary trade partners belonged to the EEC and as such, it was the implementation of the Kennedy Round Agreement between the EEC and EFTA between 1968 and 1973 that brought about income convergence between the countries of the two groups (not shown here) as well as within EFTA as is borne out in the top panel of Figure 17. The bottom panel of the figure displays the behavior of EFTA imports from the EEC relative to EFTA output. The changes in this ratio appear to have coincided with the timing of the Kennedy Round agreement.

Table 4 provides a comparison of the convergence coefficients by liberalization group and by time periods. Significant income convergence in the 1950s occurred between the EFTA and EEC countries as they began to dismantle the quantitative restrictions on trade with one another. Between 1959 and 1967, the formative years of the EEC, it was only this group of countries that exhibited significant convergence. The subsequent decade began with the implementation of the Kennedy Round and it included income convergence within each of the affected groups. The last period, 1978 to 1985, involved no major trade reforms by any of the groups and it was not characterized by significant convergence either.

One last issue remains before this section ends. The previous examples have shown European convergence within the EEC and also among the EFTA countries. While these instances of convergence occurred at different times and in apparent conjunction with the relevant free

trade agreements, there might still be a question of whether the post-war convergence was, in fact, a universal phenomenon among the European countries— even those that did not engage in trade liberalization.

The remaining non-EEC and non-EFTA countries of the Summers and Heston sample are collected in Figure 17. In contrast with the EEC and EFTA examples, the annual income gaps between these countries have not tended either downwards or upwards, i.e. no signs of either convergence or divergence.
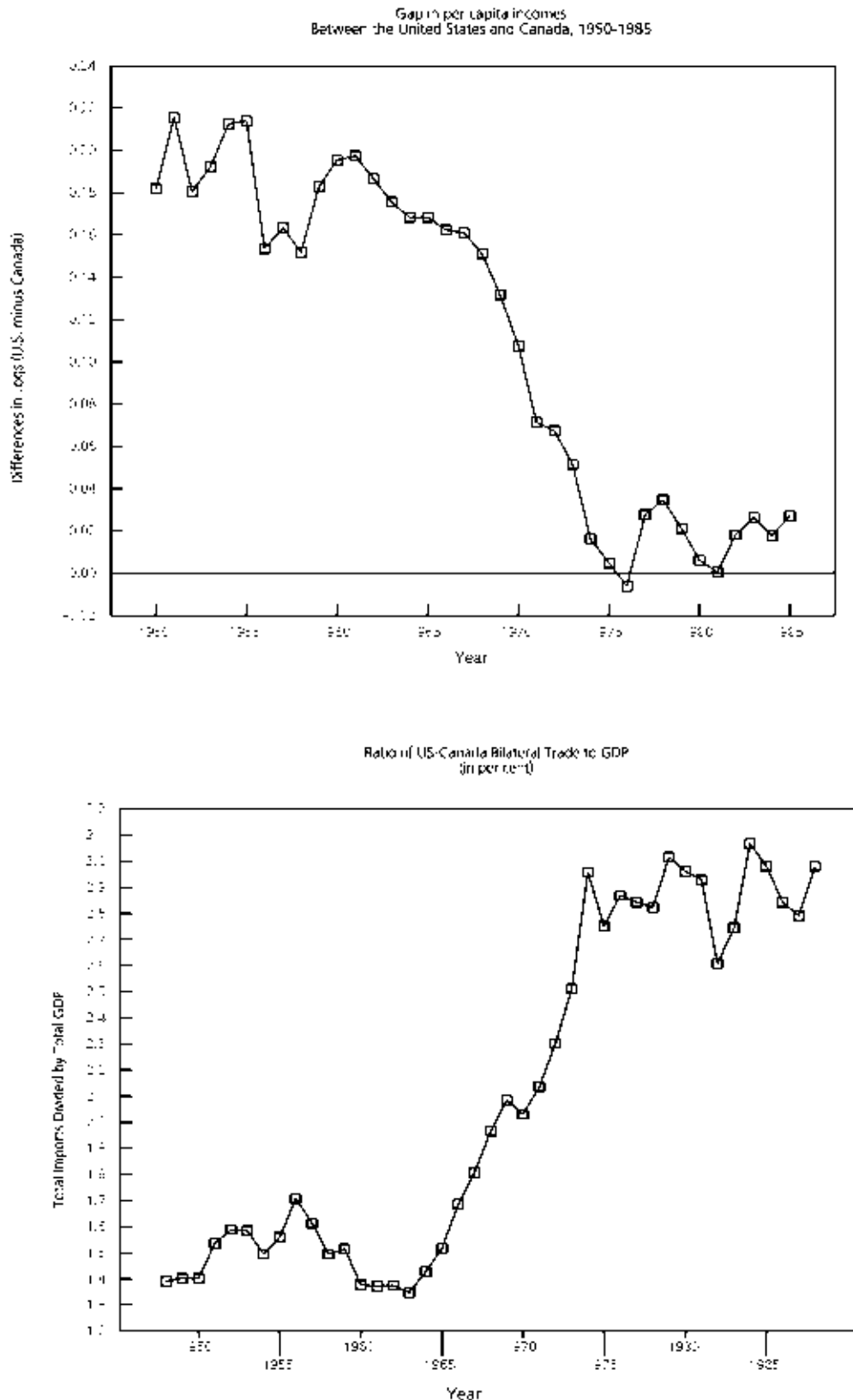
E. Trade (in general) and income convergence

The emphasis in the earlier sections has been on an examination of specific cases of trade liberalization and the impact of the trade reforms on trade volumes and income gaps. The goal of this section is to move beyond these limited instances of trade liberalization to an examination of the relationship between international trade in general and cross-country income differentials.

The experiment is as follows. The sample period is 1960 through 1985. All of the non-communist and non-oil-producing developing countries in the Summers and Heston (1988) dataset are ranked according to their 1960 per capita incomes. Since the IMF's directional trade data declines in accuracy with the developmental level of countries, then all countries with per capita incomes below 25% of the wealthiest country's—the United States—are omitted from the sample. The 25 remaining
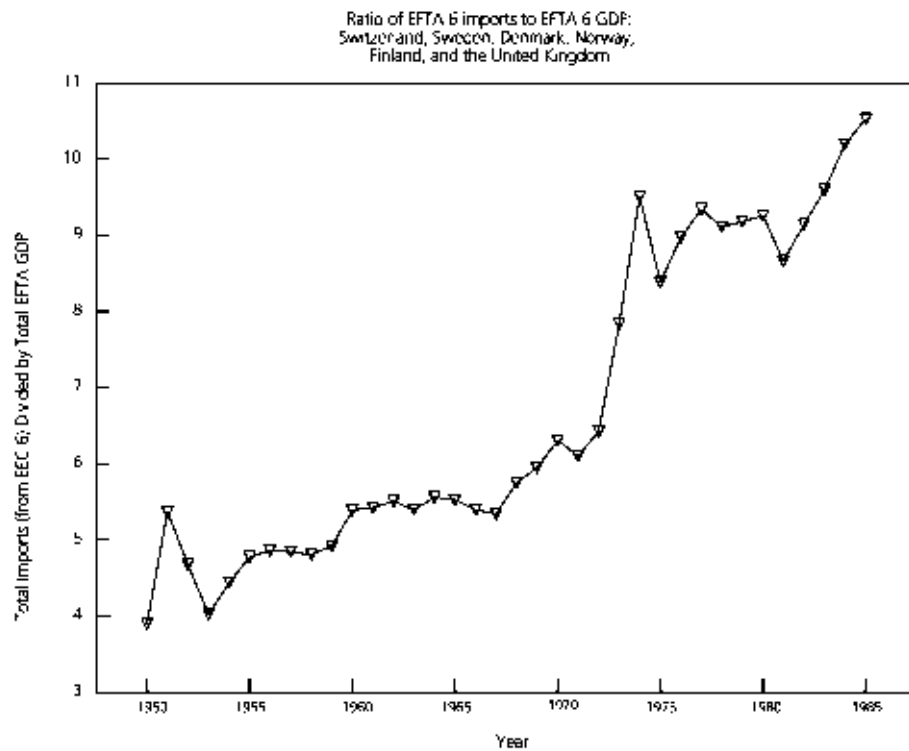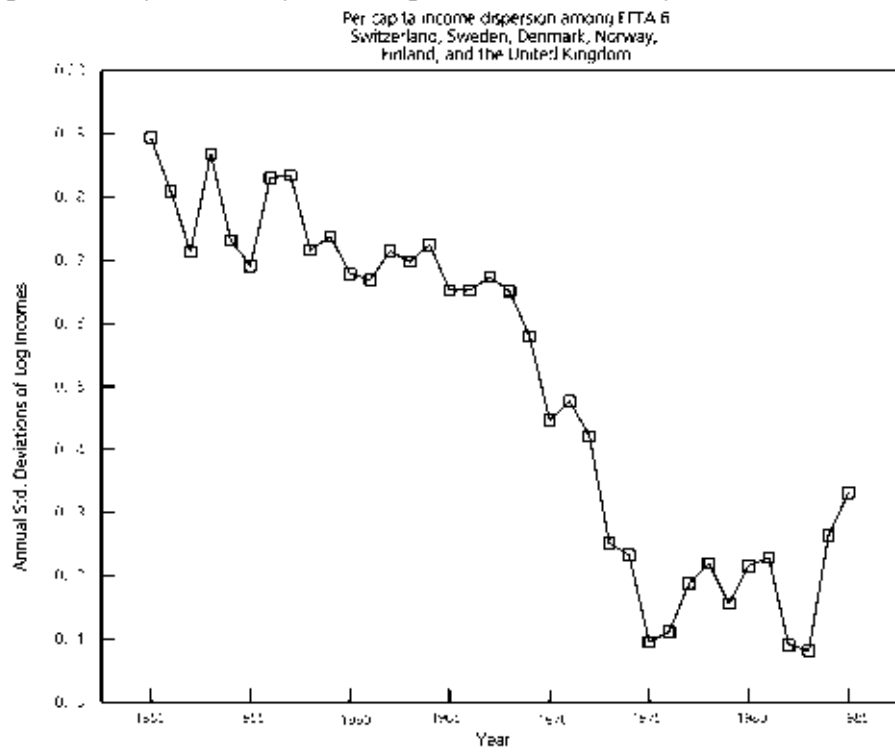
Figure 15: Gap in per capita incomes and bilateral trade to GDP, United States and Canada, 1950-1985

Gap in per capita incomes
Between the United States and Canada, 1950-1985

Ratio of US-Canada Bilateral Trade to GDP
(in per cent)

Source. Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics, 108*, 653-79

Figure 16: Per capita income dispersion among EFTA 6, ratio of EFTA 6 imports to EFTA 6 GDP

Per capita income dispersion among EFTA 6
Switzerland, Sweden, Denmark, Norway,
Finland, and the United Kingdom

Ratio of EFTA 6 imports to EFTA 6 GDP:
Switzerland, Sweden, Denmark, Norway,
Finland, and the United Kingdom

Source. Ben-David, Dan (1993), "Equalizing Exchange. Trade Liberalization and Income Convergence," *Quarterly Journal of Economics*, *108*, 653-79.

Table 4: Post-war convergence coefficients, by group[a]

Period	Group	$\acute{\phi}$	Std.Dev.	N	R^2	*t*-stat. H_0: $\phi=1$	Half life	Double life
1951-1985	EEC6	0.9709	0.0066	204	0.991	-4.39**	23.5	
	EFTA6	0.9809	0.0097	204	0.981	-1.98	35.9	
	US-Can[a]	0.9534	0.0240	34	0.980	-1.95	14.5	
	EF6-EC6[b]	0.9676	0.0091	204	0.976	-3.58**	21.0	
1951-1958	EEC6	0.9752	0.0144	42	0.991	-1.73	27.6	
	EFTA6	0.9858	0.0180	42	0.987	-0.79	48.5	
	US-Can[a]	0.9435	0.0559	7	0.979	-1.01	11.9	
	EF6-EC6[b]	0.9544	0.0151	42	0.980	-3.02*	14.8	
1959-1967	EEC6	0.9496	0.0118	48	0.993	-4.28**	13.4	
	EFTA6	0.9903	0.0144	48	0.990	-0.68	71.0	
	US-Can[a]	0.9845	0.0154	8	0.998	-1.01	44.3	
	EF6-EC6[b]	0.9834	0.0125	48	0.988	-1.33	41.3	
1968-1977	EEC6	0.9893	0.0154	54	0.987	-0.70	64.1	
	EFTA6	0.9460	0.0230	54	0.970	-2.35*	12.5	
	US-Can[ac]	0.8145	0.0416	5	0.990	-4.46**	3.4	
	EF6-EC6[b]	0.9254	0.0247	54	0.958	-3.02*	8.9	
1978-1985	EEC6	0.9784	0.0159	42	0.989	-1.35	31.8	
	EFTA6	0.9972	0.0293	42	0.966	-0.10	242.9	
	US-Can[ad]	0.7657	0.2298	11	0.526	-1.02	2.6	
	EF6-EC6[b]	1.0242	0.0313	42	0.959	0.77		29.0

EEC 6 includes Belgium, France, Netherlands, Germany, Italy and Luxembourg.

EFTA 6 includes Sweden, Switzerland, Finland, Norway, the United Kingdom and Denmark.

[a] The annual US-CAN data are gaps, rather than differences from a group mean as in the case of the other groups.

[b] The annual EF6-EC6 data are differences between each of the EFTA 6 incomes and the EEC 6 average income rather than from the EFTA average as in the EFTA 6 rows.

[c] Period: 1968-1973.

[d] Period: 1974-1985.

** Significant at the 1% level.

* Significant at the 5% level.

Source: Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics*, *108*, 653-79.

middle and high income countries with per capita incomes above the 25% threshold will heretofore be referred to as source countries (this group excludes countries that are primarily oil-producers and communist countries).

In light of the earlier evidence that trade liberalization among countries that trade extensively with one another is linked to income convergence amongst them, a list of each source country's major trade partners is created, once on the basis of exports and once on the basis of imports. The criteria for determination of a given country j as a major trade partner of source country *i* is that *i*'s exports to *j* must comprise at least 4% of *i*'s total exports.[7] Or alternatively, i's imports from j must comprise at least 4% of i's total imports.[8] This criteria yields trade-based groups ranging in size from three to nine countries in each.

Hence, each source country has two trade groups associated with it, one created on the basis of its exports and one on the basis of its imports. The question at the

[7] Data source: International Monetary Fund, Direction of Trade Statistics Yearbook, various editions.

[8] This experiment is detailed more fully in Ben-David (1996).

Figure 17: Per capita income dispersion: 1950-85

All Non-EEC9 & Non-EFTA European Countries
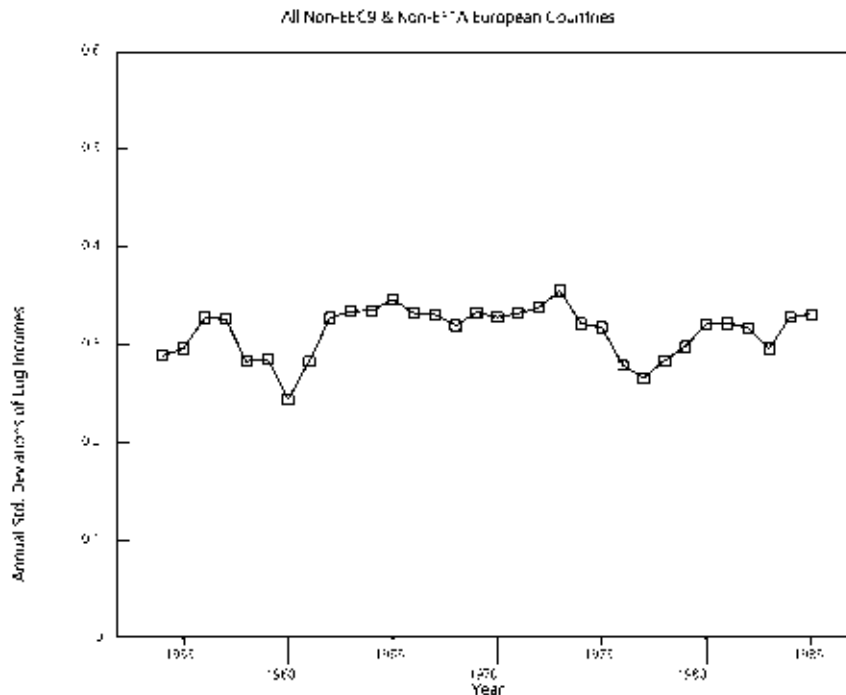
Source: Ben-David, Dan, *Free Trade and Economic Growth*, MIT Press, forthcoming.

center of this experiment is whether these trade-based groups exhibit income convergence. The distinction between the export-based and import-based groups is made in order to allow for the possibility that the outcomes from each might not be the same.

The convergence equation (equation 2.2, Box 1) is estimated for each one of the trade groups and the outcomes appear in Table 5 with the left side of the table detailing the export groups' results and the right side detailing the import groups' results. In both the export and import cases, the source country's name is listed in the left column. To the right of this column is a column of numbers representing the number of countries in each of the trade-based groups. The groups are sorted according to their t-statistics. Out of the 25 export-based groups— one per source country—24 have estimated ϕ's below one, 16 of these significantly below one. Twenty-two of the import-based groups have ϕ's below one with 17 of these significantly below one.

In other words, while most of the countries in the world have exhibited income divergence from one another, this experiment suggests that major trade partners tend to exhibit income convergence more often than not. But is the statistical significance of these results really indicative of this conclusion?

It turns out that if one creates a pool of all of the major trade partners and all of the source countries, then this pool will comprise 32 countries—just seven more than the total number of source countries. In other words, most of the source countries reappear as major trade partners of other source countries. So it may be that any

randomly selected group from the pool of 32 countries might exhibit the same incidence of convergence as the trade-based groupings.

Since trade group sizes range from three to nine, then up to 5000 random groupings in each of these various sizes were created from the pool of 32 countries and equation 2.2 estimated for each grouping. Table 5.1 indicates the uniqueness of each of the trade group outcomes.

For example, take NZ (New Zealand), the 7th source country on the list of export-based groups. Its export-based group included five countries and yielded a convergence coefficient of 0.966, an outcome that is significantly less than one at the 1% level. What is the likelihood of reproducing such an outcome of 0.966 in a group of five countries that are randomly selected from the pool of 32? As the right-hand column indicates, there is less than a 5% likelihood that a randomly-created group will yield such an outcome.

The probabilities of attaining each of the trade group outcomes in random groupings is listed in the table for each of the groups for which this probability is less than 50%. In all, the likelihood of replicating the convergence coefficients is less than 10% in 35 of the 50 groups—i.e in 70% of the trade groups. Further tests were also conducted (these are reported in Ben-David, 1996) to gauge the sensitivity of the results to various other possible reasons that might be behind these outcomes, but the conclusion remains that grouping the countries together on the basis of major trade ties yields income convergence in many instances where such convergence

Export-based groups[a]				Probability of random replication from among all 32 traders	Import-based groups[b]				Probability of random replication from among all 32 traders
Source Country	#	ώ	t-stat		Source Country	#	ώ	t-stat	
1 CAN	3	0.935	-4.571***	1%	CAN	3	0.935	-4.571***	1%
2 AUSTR	6	0.974	-3.760***	1%	NOR	9	0.959	-4.452***	1%
1 CAN	3	0.935	-4.571 ***	1%	CAN	3	0.935	-4.571 ***	1%
2 AUSTR	3	0.974	-3.760 ***	1%	NOR	9	0.959	-4.452 ***	1%
3 GER	9	0.976	-3.713 ***	1%	SWED	9	0.959	-4.452 ***	1%
4 ICE	5	0.957	-3.565 ***	5%	FIN	6	0.955	-4.380 ***	1%
5 JAPAN	3	0.984	-3.470 ***	5%	ICE	9	0.958	-4.024 ***	1%
6 FRA	8	0.978	-3.236 ***	5%	GER	8	0.973	-3.526 ***	1%
7 NZ	5	0.966	-3.057 ***	5%	JAPAN	3	0.959	-3.496 ***	1%
8 ITAL	6	0.979	-2.883 ***	5%	DEN	9	0.969	-3.249 ***	1%
9 SWIS	6	0.979	-2.883 ***	5%	SWIS	8	0.978	-3.236 ***	1%
10 BELLU	7	0.981	-2.643 ***	5%	AUSTR	4	0.975	-3.233 ***	5%
11 NETH	7	0.981	-2.643 ***	5%	AUSTL	6	0.966	-3.209 ***	5%
12 SPA	7	0.983	-2.413 **	5%	NZ	6	0.966	-3.209 ***	5%
13 AUSTL	4	0.973	-2.309 **	5%	FRA	7	0.981	-2.643 ***	5%
14 SWED	9	0.979	-1.990 **	5%	UK	9	0.979	-2.613 ***	5%
15 UK	8	0.992	-1.796 *	10%	ITAL	6	0.983	-2.300 **	10%
16 FIN	7	0.980	-1.745 *	10%	BELLU	6	0.979	-2.078 **	10%
17 IRE	7	0.994	-1.359	10%	NETH	6	0.979	-2.078 **	20%
18 DEN	7	0.985	-1.237	10%	SPA	7	0.993	-1.339	20%
19 CHIL	8	0.993	-1.117	20%	IRE	5	0.994	-1.295	30%
20 NOR	7	0.988	-1.037	20%	US	6	0.996	-0.731	40%
21 ARGN	5	0.996	-0.909	30%	URUG	5	0.998	-0.445	40%
22 US	6	0.996	-0.731	30%	MEX	3	0.999	-0.208	30%
23 URUG	6	0.998	-0.404	30%	SAFR	6	1.003	0.553	50%
24 MEX	4	0.998	-0.327	30%	ARG	8	1.003	0.883	40%
25 SAFR	7	1.005	1.782 *		CHIL	6	1.006	0.903	

***Significantly different from one at the 1% level.

** Significant different from one at the 5% level.

* Significant different from one at the 10% level.

a Export groups include all countries that receive over 4% of the source countries total exports.

b Import groups include all countries that are the origin of over 4% of source countries total imports.

The column heading, #, represents the number of countries in each group.

Source: Ben-David, Dan (1996), "Trade and Convergence Among Countries," *Journal of International Economics*, 40, 279-298.

is not otherwise found when these same countries are grouped according to different criteria.

Using more recent Summers and Heston (1995) data that includes output per worker rather than output per person, the incidence of convergence is even higher (Table 6). In this case, 22 of the 25 export-based groups and 21 of the import-based groups—or 86% of the trade-based groups—exhibit significant convergence at the 5% level.

These tables show that grouping countries according to trade criteria yields convergence results considerably more often than do random groupings of countries.

Moreover, as shown in Box 2, increases in trade, whether on the export and import side, contribute to

Table 6: Convergence in output per worker
(Trade groups sorted by t-statistics)

	Export-based groups						**Export-based groups**			
	Source country	Size	$\hat{\phi}$	t-stat			Source country	Size	$\hat{\phi}$	t-stat
1	NZ	5	0.956	-7.05 ***		1	GERM	8	0.966	-5.94 ***
2	CAN	3	0.945	-5.19 ***		2	UK	9	0.967	-5.74 ***
3	AUSTL	4	0.945	-5.01 ***		3	ICE	9	0.963	-5.41 ***
4	GERM	9	0.963	-4.64 ***		4	FIN	6	0.962	-5.35 ***
5	US	6	0.966	-4.14 ***		5	SWED	9	0.968	-5.22 ***
6	IRE	7	0.975	-4.06 ***		6	NOR	9	0.968	-5.22 ***
7	JAP	3	0.977	-4.01 ***		7	CAN	3	0.945	-5.19 ***
8	FRA	8	0.964	-3.99 ***		8	JAP	3	0.936	-5.15 ***
9	AUSTR	6	0.965	-3.86 ***		9	AUSTL	6	0.964	-5.10 ***
10	UK	8	0.975	-3.85 ***		10	NZ	6	0.964	-5.10 ***
11	ICE	5	0.967	-3.72 ***		11	AUSTRV	4	0.938	-4.77 **
12	ITAL	6	0.966	-3.53 ***		12	DEN	9	0.972	-4.48 ***
13	SWIS	6	0.966	-3.53 ***		13	US	6	0.966	-4.14 ***
14	BELLU	7	0.968	-3.48 ***		14	SWIS	8	0.964	-3.99 ***
15	NETH	7	0.968	-3.48 ***		15	MEX	3	0.959	-3.58 ***
16	MEX	4	0.966	-3.29 ***		16	FRA	7	0.968	-3.48 ***
17	SPA	7	0.973	-3.19 ***		17	ITAL	6	0.970	-3.25 ***
18	SWED	9	0.975	-3.07 ***		18	IRE	5	0.980	-2.70 ***
19	FIN	7	0.973	-2.90 ***		19	BELLU	6	0.976	-2.57 ***
20	NOR	7	0.976	-2.56 ***		20	NETH	6	0.976	-2.57 ***
21	DEN	7	0.978	-2.29 **		21	SPA	7	0.978	-2.54 ***
22	ARGN	5	0.986	-2.25 **		22	SAFR	6	0.992	-1.63
23	CHIL	8	0.991	-1.53		23	ARGN	8	0.997	-0.90
24	URUG	6	0.994	-0.91		24	URUG	5	0.994	-0.85
25	SAFR	6	1.002	-0.91		25	CHIL	6	1.006	0.67

Significantly different from unity at the 1% (***) and 5% (**) levels.
Source of Table: Ben-David, Dan, *Free Trade and Economic Growth*, MIT Press, forthcoming.

even faster rates of income convergence among major trading partners.

F. Economic growth

It is interesting to note that, while the post-war period has been characterized by movement towards freer trade, most countries experienced either growth slowdowns, or no noticeable growth improvements.[9] Using structural break tests that endogenously determine the existence of a trend break along a given growth path—and determine its statistical significance—Ben-David and Papell (1998) examine the post-war growth paths of 74 countries between 1950 and 1990. We find that 54 of the countries exhibit a significant structural trend break in their growth path during this period. Of these 54 countries, 46 experienced significant slowdowns fol-

lowing their breaks and only eight countries out of the entire sample exhibited increases in their rates of growth.

The post-war growth paths of the three biggest EEC founding countries, France, Germany, and Italy, appear in the three panels of Figure 18. Together with the actual paths are the extrapolated paths (based on the coefficients derived in the structural break tests) that the countries would have continued to be on had they not experienced the trend breaks. As the pictures quite clearly illustrate, the original EEC's Big Three experienced substantial growth slowdowns.

While most countries experienced a slowdown in economic growth during the post-war years, the majority of them exhibited increases in the volume of their trade (Ben-David and Papell, 1997). The evidence of heightened trade on the one hand, combined with growth slowdowns on the other, appears to indicate that the

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9   A sample of the studies examining these slowdowns includes Griliches (1980), Bruno (1984), Romer (1987), Baumol, Blackman, and Wolff (1989), and De Long and Summers (1992).

relationship between trade and growth, to the extent that one exists, is a negative one.

But this is not the only way to interpret the empirical evidence. The post-war period is, by definition, a period following a major upheaval. Standard growth theory tells us that in the aftermath of a negative shock as great as World War II, countries should be expected to exhibit growth rates that initially exceed their steady-state rates (upper panel in Figure 19). Eventually, as countries return to their original growth paths, their growth rates should fall back to the original steady-state values (Ben-David and Papell, 1995, calculates and compares the pre- and post-war steady state growth paths). One source for such an explanation of the post-war slowdowns would be the Solow growth model.

So maybe, instead of focusing on just the post-war, we should take a step back and look at the big picture. The fact that growth rates have fallen during the past several decades could very well be due to the return of countries to their long-run growth paths.

However, in light of the extensive trade liberalization that has occurred since the war, one might ask whether post-war steady-state paths are the same as the pre-w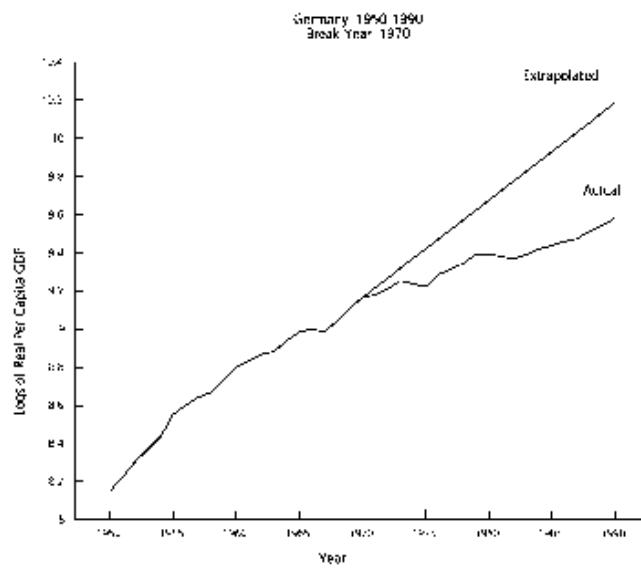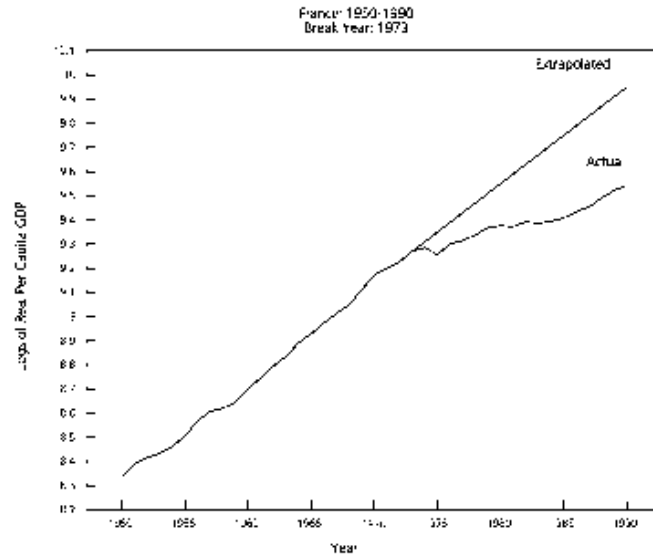ar paths or are they new paths characterized by faster growth and higher incomes? In other words, could the relevant diagram be the lower panel in Figure 19 rather than the upper panel?

One illustration of post-war slowdowns in economic growth within the long-run context is Japan (Figure 20). The country had two significant trend breaks over the past century: in 1944 and 1973. The first was followed by a sharp drop in levels of growth and subsequent high growth. The period of high growth ended in 1973, and the slowdown began. But the levels of the new post-slowdown path followed by Japan are clearly above the levels of the pre-World War II path.

Also, the slope of the post-1973 path is higher than that of the pre-World War II path, even though Japan exhibited a substantial slowdown following the steep post-war transitional phase. From 1885 to 1944, Japan grew at an average rate of 1.7%. Between 1944 and 1973, this rose to 7.7%—and then fell to 3.3% between 1973 and 1989, a ratio of nearly 2:1 when compared to the pre-World War II average.

What happened to the EEC countries? The earlier sections showed that they converged with the onset of liberalization, but is the trade-related convergence that they exhibited a goal that countries should strive for? If,

France 1950-1990
Break Year: 1973

Germany 1950-1990
Break Year: 1970

Italy: 1950-1990
Break Year: 1974
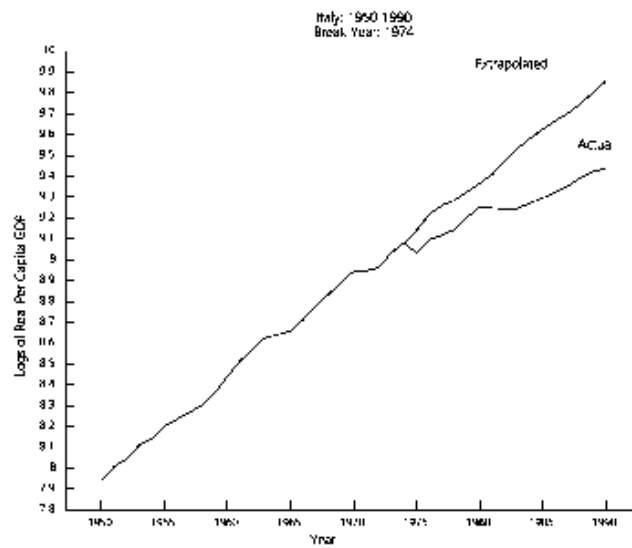
Source: Ben-David, Dan and David H. Papell (1998), "Slowdowns and Meltdowns: Postwar Growth Evidence from
74 Countries," *Review of Economics and Statistics*, 80, 561-571.

for example, one comes from a country that is initially better off than its trade partners, then the distinction between convergence towards the middle as opposed to catch-up convergence towards the wealthier group members is not a trivial concern. Is this a zero-sum game where any benefits that accrue to one country must come at the expense of its trade partner?

A look at Belgium between 1870 and 1989, in the top left corner of Figure 21, is revealing. Growth rates prior to World War I were steady, while the export-output ratio of the country was also fairly stable. The outbreak of World War I resulted in a severe drop in levels of GDP per person. In the years following the war, while the export-output ratio continued to remain at its pre-war level, the country experienced a transition back to its original multi-decade growth path—just as predicted by the neoclassical growth model. However, the aftermath of World War II reflects another story altogether. While the export-output ratio increased throughout the post-war period, the country not only rebounded to its earlier path, it eclipsed it altogether and kept right on growing. The post-war slowdown, when it occurred, did not signal a return to the old growth path levels. It did not even signal a return to the old growth rates.

In France, World War I and its aftermath also fit the Solow model prediction. But, as in the Belgian case, World War II and its aftermath do not. In short, each one of the other original EEC countries ended up on higher growth paths in the latter decades of the sample.

The removal of trade barriers between these countries led to substantial increases in trade, with the average ratio of exports to GDP in five of the six original member countries (Belgium, France, Germany, Italy, and the Netherlands—no data for Luxembourg, the sixth country) during the post-war years exceeding the average ratio for these countries in the seven decades preceding World War II by a factor of 2.11. Although the increased openness of the post-war period is accompanied by higher growth rates, it would be presumptuous to attribute all of the faster growth following World War II to increased trade.

Nevertheless, it is still useful to compare results between the relatively free trade years prior to World War I (1870-1913) and the years following the onset of the post-World War II slowdown (1973-1989). The average export-output ratio across the five countries for the post-World War II slowdown period exceeds the pre-World War I ratio by a factor of 2.83. Likewise, the five country average growth rate of per capita real GDP for the post-slowdown period is also higher, exceeding the pre-World War I rate by a factor of 1.63. So, not only did the degree of income disparity among the EEC countries decline significantly in the post-World War II period, they all experienced faster economic growth as well.

What happened after World War II to some of the other countries for whom we have historical data? In general, in each of 16 OECD countries examined over the

Figure 19: Post-war slowdowns in long-run context
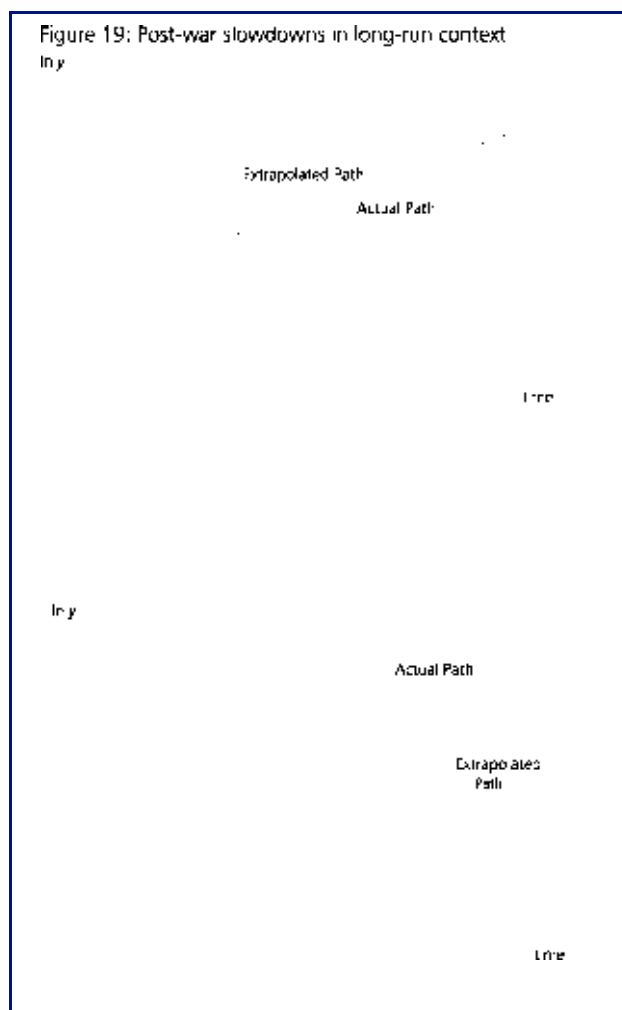
long run, the average ratio of post-war to pre-war growth rates (with the post-war period not including the very high-growth first few years following World War II) was greater than one (Table 8). Post-war growth rates for the group as a whole were 142% higher in the four decades following World War II than they were in the seven decades preceding it.
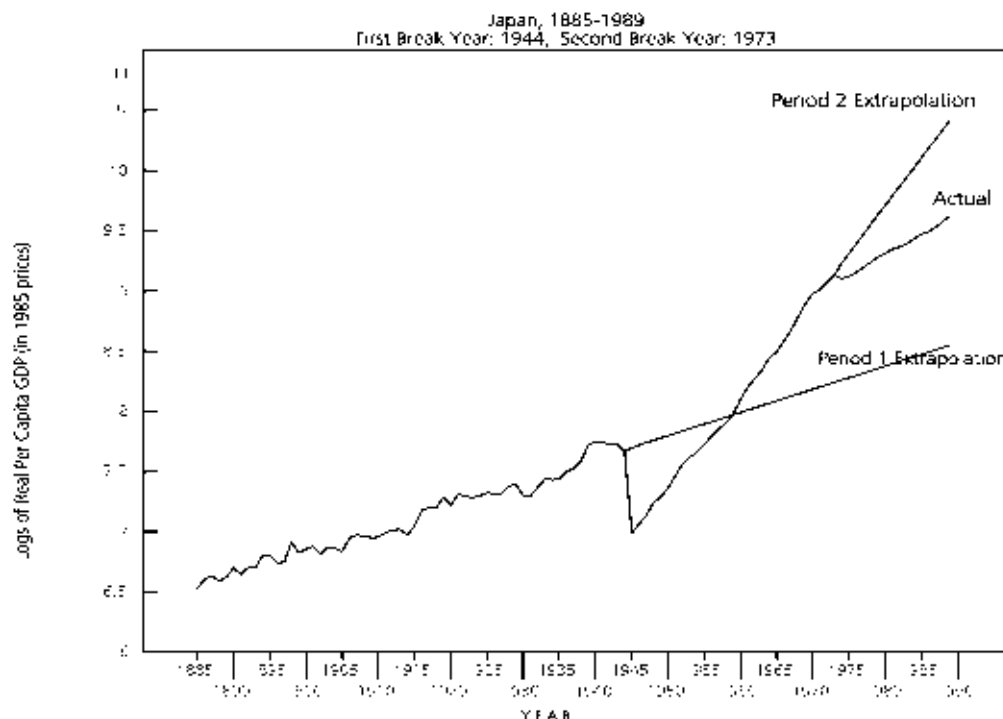
Average levels of export-output ratios were higher for all but one of the countries.[10] For the group as a whole, these averages were nearly twice as high following World War II. Figure 22 displays the relationship between the changes in trade and the changes in growth and suggests—with the exception of Australia (AUL in the diagram)—a somewhat positive relationship between the two.

The positive relationship between trade openness and economic growth is shown in a number of studies (for example: Harberger, 1984; Dollar, 1992; Gould, Ruffin and Woodbridge, 1993; Henrekson, Torstensson and Torstensson, 1996; Harrison, 1995) though a recent paper by Rodriguez and Rodrik (1999) challenges some of these results.[11]

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[10] The lone exception, Australia, experienced large migration inflows rather than trade inflows following World War II.

[11] Michaely (1977) and Feder (1982) provide evidence on the positive relationship between exports and output growth, while Ram (1990) finds a positive link between imports and growth. Baldwin and Seghezza (1996) emphasize the impact of trade-induced investment-led growth and find that openness spurs investment, which in turn stimulates economic growth. A general survey of the relationship between openness and growth is provided in Edwards (1993).

Figure 20: Logs of per capita GDP in Japan, 1885-1989

Japan, 1885-1989
First Break Year: 1944, Second Break Year: 1973

Period 2 Extrapolation

Actual

Period 1 Extrapolation

Logs of Real Per Capita GDP (in 1985 prices)

YEAR

Source: Ben-David, Dan, Robin Lumsdaine, and David H. Papell (1999), "Unit Roots, Postwar Slowdowns and Long-Run Growth: Evidence From Two Structural Breaks," unpublished working paper.

Sachs and Warner (1995) find a positive relationship between countries that removed trade barriers and countries that exhibited faster growth. Focusing on developing countries, for example, Sachs and Warner classify 34 developing countries as having been relatively closed to trade during the entire period between 1965 and 1986. They classify another seven developing countries as having been open to trade during this period. For comparison purposes, we will also look at 18 developed countries, that are also classified by Sachs and Warner as open economies.

It is interesting to compare between the growth rates of these three groups of countries (Figure 23). In particular, the group of seven open developing countries grew by an average of 3.5 percentage points faster than the group of 34 closed developing countries. By comparison, the group of open developed countries grew by an average of 1.5 percentage points faster than the group of closed developing countries.

Put differently, at the average growth rate of 1.15% exhibited by the closed developing countries, an average person's real income would double after 62 years. Alternatively, an average person in one of the open developing countries would see their real income grow 16 fold during this 62 year span—and an average person in one of the open developed countries would experience a five-fold increase in their real income. These are not marginal improvements when one considers them from the perspective of an average citizen. They represent substantial progress up the income ladder, particularly for the average person in one of the open developing countries.

And finally, these results are also supportive of the divergence between developed countries that are relatively open to trade and developing countries which are relatively closed to trade. They also indicate an income convergence between the open developing countries with the open developed countries.

G. One explanation for the empirics

What might be the source of the income convergence described in the earlier sections? From traditional trade theory, the Factor Price Equalization Proposition (Samuelson, 1948; Helpman and Krugman, 1985) can explain how free trade might lead to an equalization of factor prices—but not necessarily the equalization of per capita incomes. From traditional growth theory, the neoclassical growth model (Solow, 1956; Cass, 1965; Koopmans, 1965) can explain per capita income convergence, but this occurs within a closed economy model in lieu of trade. Furthermore, neither model is able to explain how trade policy might affect steady state growth. This is one of the gaps in the traditional literature that some of the new endogenous growth models have attempted to fill.[12]

12 See for example: Romer (1990), Jones and Manuelli (1990), Grossman and Helpman (1991a, 1991b), Rivera-Batiz and Romer (1991a, 1991b), Stokey (1991), Young (1991), Backus, Kehoe, and Kehoe (1992), Easterly, King, Levine, and Rebelo (1994), Feenstra (1996) and Connolly (1997).

How might trade have played a role in the heightened growth and the income convergence that occurred? The competition that trade induces between importers and exporters forces them to learn and utilize ever better technologies in the struggle to survive and grow. In the process, trade acts as a conduit for the dissemination of ideas.[13] Trade barriers, to the extent that these are erected, inhibit the flow of ideas and diminish the ability of countries to develop.

In theoretical models, the level of technology plays an important role in determining a country's output level and growth. From an empirical standpoint however, technology is an intangible that is extremely difficult to quantify analytically. To get around this problem, empirical research uses the total factor productivity (TFP) as a proxy for technology,[14] and the difference in TFP among countries as a proxy for the technological gap.

The "catch-up hypothesis" (Veblen, 1915; Gerschenkron, 1952; Abramovitz, 1979, 1986; and others), while not directly related to trade, suggests that the larger the technology gap between countries, the faster the laggard country should be expected to grow as it catches up to the leaders. But as Figures 2 and 3 indicate, the groups with the largest initial income gap do not exhibit the fastest convergence. In fact, they are not even converging at all.

What happens when we look at the TFP levels of the countries in the trade-based groups discussed earlier? As the discussion above indicated, the majority of these exhibited income convergence. Did they also exhibit technological convergence?

Convergence will be estimated by regressing σ, the TFP gap, on trend. A negative trend coefficient implies convergence. As is indicated in Figure 24, most of the trade-based groups exhibited TFP convergence (i.e. 77% had significantly negative trend coefficients—82% export and 71% import). In addition, the trade groups with the highest initial technological gap were also the groups that tended to exhibit the fastest technological convergence. The correlation coefficient between the initial gap size and the speed of convergence in the export case is –0.83. For imports the correlation coefficient between the initial gap size and the speed of convergence is –0.60 with inclusion of the Argentinean import group and –0.82 without it.

And finally, the speed of the TFP convergence appears to be fairly closely related to the speed of the income convergence. Groups that exhibit faster rates of TFP convergence tend to exhibit faster rates of convergence in output per worker as well. The correlation between the speed of output convergence and the speed of TFP convergence is 0.77 for exports and 0.68 for imports.

H. Conclusion

Before closing, let's put this all into perspective. There is very little evidence that countries, in general, are

Table 8: Changes in export-GDP ratios and changes in rates of growth for 16 OECD countries
Post-war (1950-1989) versus pre-war (1870-1939)

Country	Ratio of post-war average to pre-war average	
	Growth rates	EX/Y
Australia	3.75	0.96
Austria	3.38	2.37
Belgium	3.12	2.63
Canada	1.74	1.24
Denmark	1.62	2.02
Finland	2.26	1.31
France	2.44	2.15
Germany	2.09	1.16
Italy	3.51	2.34
Japan	3.14	3.15
Netherlands	2.38	2.21
Norway	2.00	1.97
Sweden	1.64	1.94
Switzerland	1.66	1.48
UK	2.55	1.03
US	1.38	1.31
Average	2.42	1.83

Source: Ben-David, Dan and Michael B. Loewy (2000), "Knowledge Dissemination, Capital Accumulation, Trade and Endogenous Growth," forthcoming *Oxford Economic Papers*.

converging towards one another in terms of their income gaps. In fact, income gaps between the majority of countries appear to be growing over time.
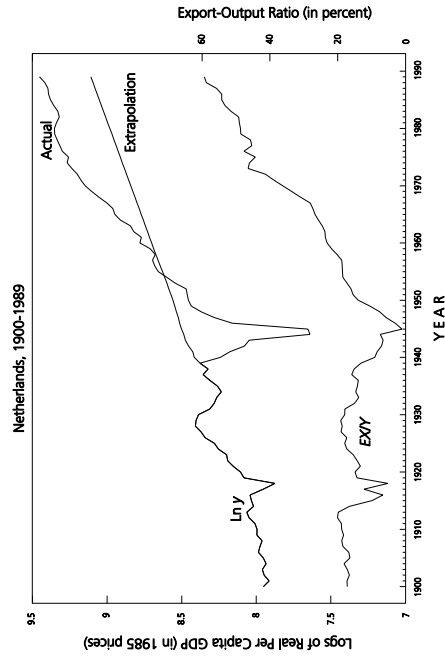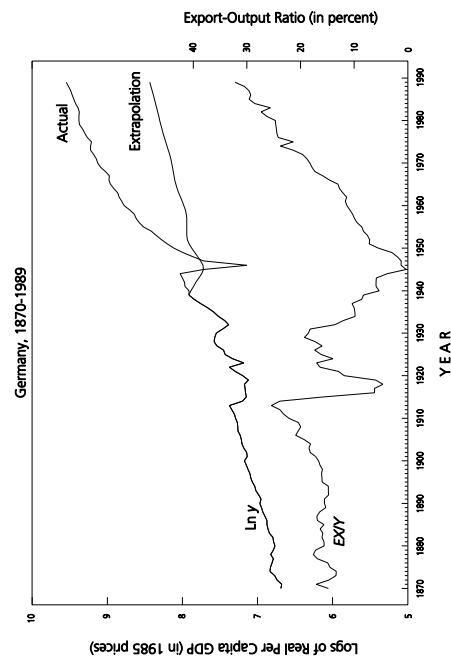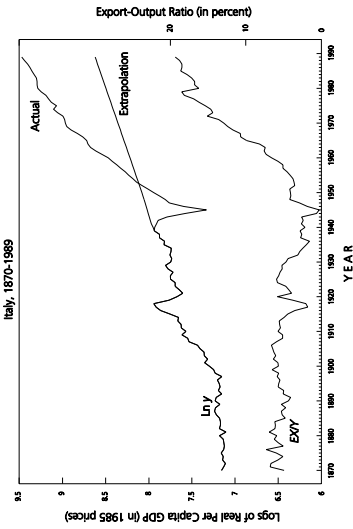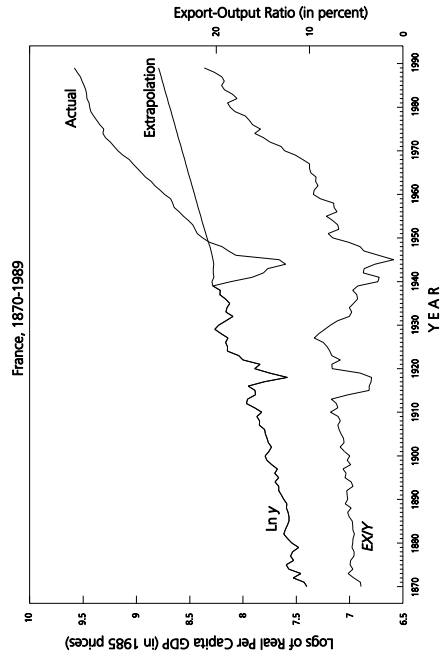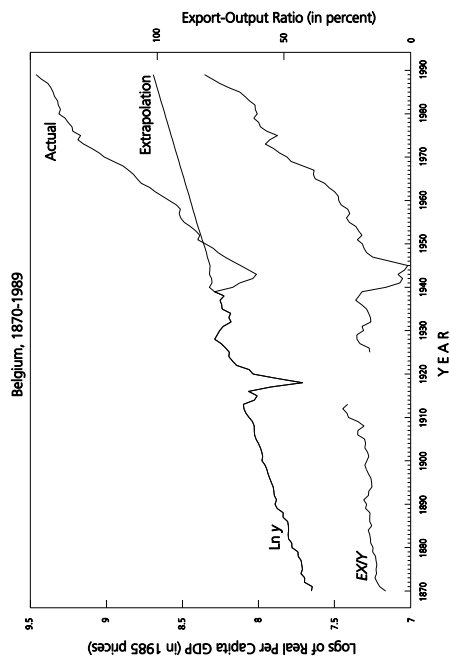
Among those countries whose income gaps are nonetheless converging, an important thread that appears to tie together many of them is international trade. Countries that formally enacted trade liberalization policies exhibited a convergence in income gaps once they implemented trade reforms. The trade reform programs examined here were performed according to specific timetables that varied from group to group. Although no intra-group income convergence was evident prior to the inception of the individual trade reforms, significant convergence, together with significant increases in the volume of trade, began to occur simultaneously with the removal of the trade barriers.

In a generalization of this finding, it is shown that countries that trade extensively with one another tend to exhibit a relatively high incidence of income convergence. An increase in the extent of trade by these countries is associated with even faster rates of convergence.

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[13] Studies showing various channels through which trade acts as a conduit for the dissemination of ideas include: Dollar, Wolff and Baumol (1988); Marin (1995); Coe and Helpman (1995); Coe, Helpman and Hoffmaister (1997); Eaton and Kortum (1996) and Keller (1999). Grossman and Helpman (1995) formalize this relationship and also provide a review of the related literature.

[14] Total factor productivity is given by the output after discounting for the input of physical labour, physical capital, and human capital in the production process.

Figure 21: Comparison of 1940-89 growth paths with 1870-1939 paths

Belgium, 1870-1989

France, 1870-1989

Italy, 1870-1989

Germany, 1870-1989

Netherlands, 1900-1989

Source: Ben-David, Dan and Michael B. Loewy (1998), "Free Trade, Growth, and Convergence" *Journal of Economic Growth*, 3, 143-170.

The trade-related convergence does not appear to have come at the expense of the wealthier countries. In fact, not only have the relatively poorer liberalizing countries been able to move to higher and steeper growth paths, so have their wealthier trade partners. When put in a long-run perspective, the post-war slowdowns were to growth rates that were nonetheless higher than the growth rates of the pre-war decades.

In summing up, the results shown in this paper suggest that international trade provides an important contribution toward the economic growth of nations—in particular, for those countries that are lagging behind their trade partners.

That said, it should be noted that the results of this paper in no way imply that trade policy is the most important policy from a long-run growth perspective. Other aspects of openness such as foreign investments were not examined here and there are several studies that report the contribution of these. More importantly perhaps, is the fact that data limitations precluded the analysis of poor countries here—and it is far from obvious

(at least to this author) that the impact of trade liberalization found on incomes in the middle and high-income countries could also be found in the poorest countries in the world. In the case of the poorest countries, a range of constraints to economic growth and development must be addressed if openness to trade is to have an impact on income levels and growth.

In this regard, the contribution of several critical institutions in providing the overall environment so that openness to trade can contribute to growth is extremely important. Although trade can serve as a conduit for knowledge spillovers, the capacity of each country to absorb these trade-induced spillovers is different. If a country wishes to develop and compete, then exposure to technology must be accompanied by a serious investment in domestic education—as well as in infrastructure, telecommunication, preservation of property rights, and all of the other essential ingredients so important in enabling a country to grow in general, and to enjoy the fruits of openness to the rest of the world in particular.

Figure 22: Comparison of Changes in Growth Rates with Changes in Export-GDP Ratio Postwar (1950-1989) versus Prewar (1870-1939)
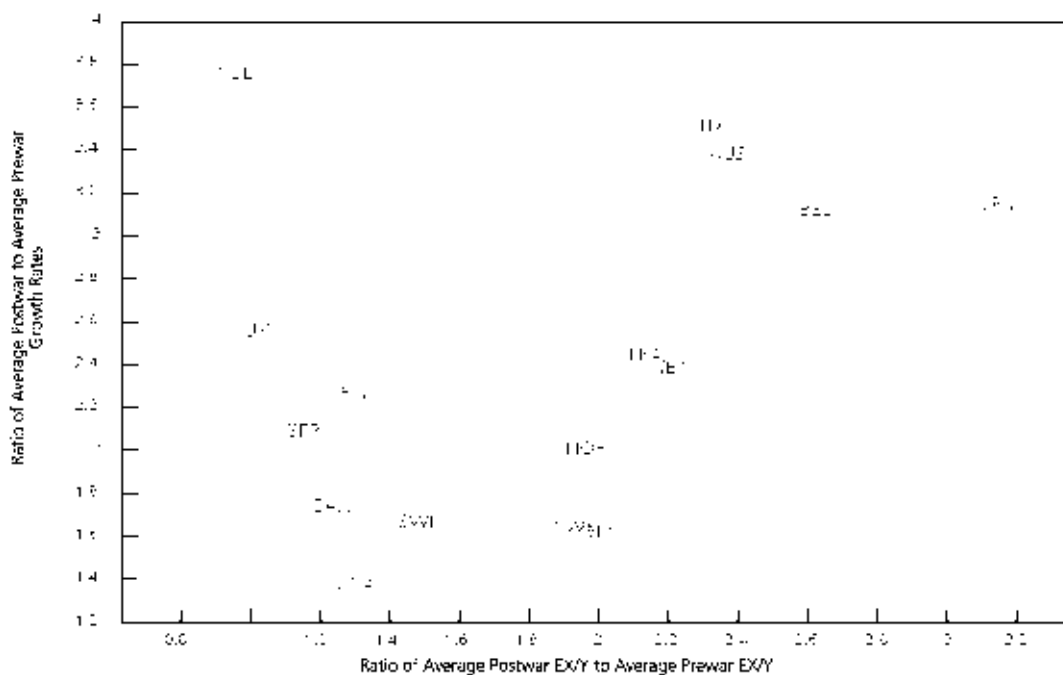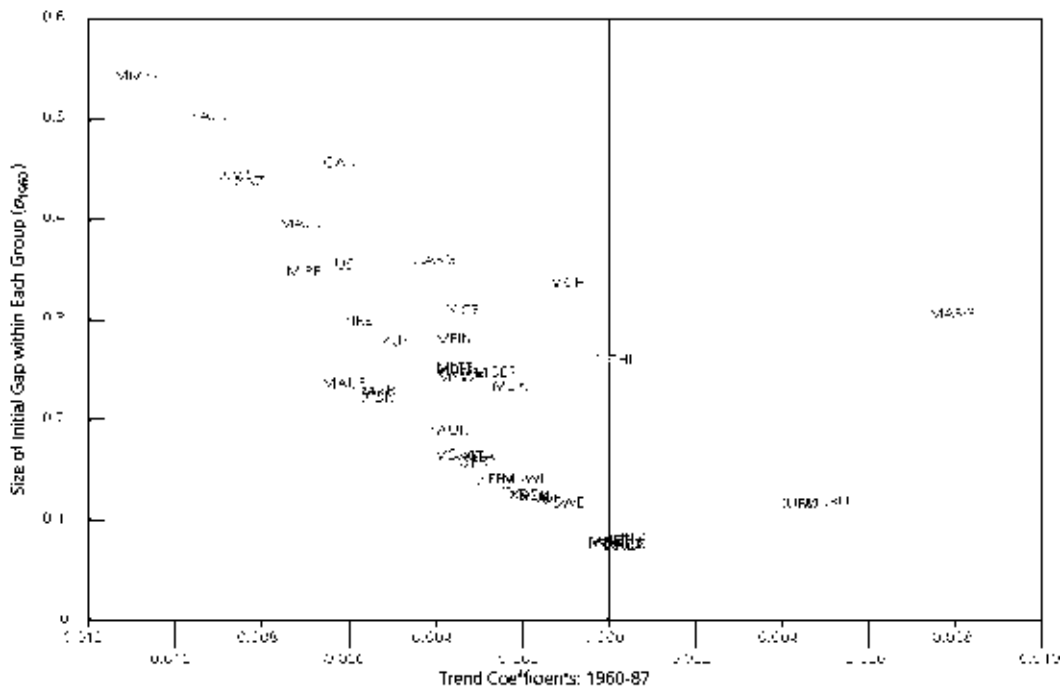
Source: Ben-David, Dan, Free Trade and Economic Growth, MIT Press, forthcoming.

Figure 23: Average Growth Differences Between Always Open Economies and Always Closed Developing Economies: 1965-86
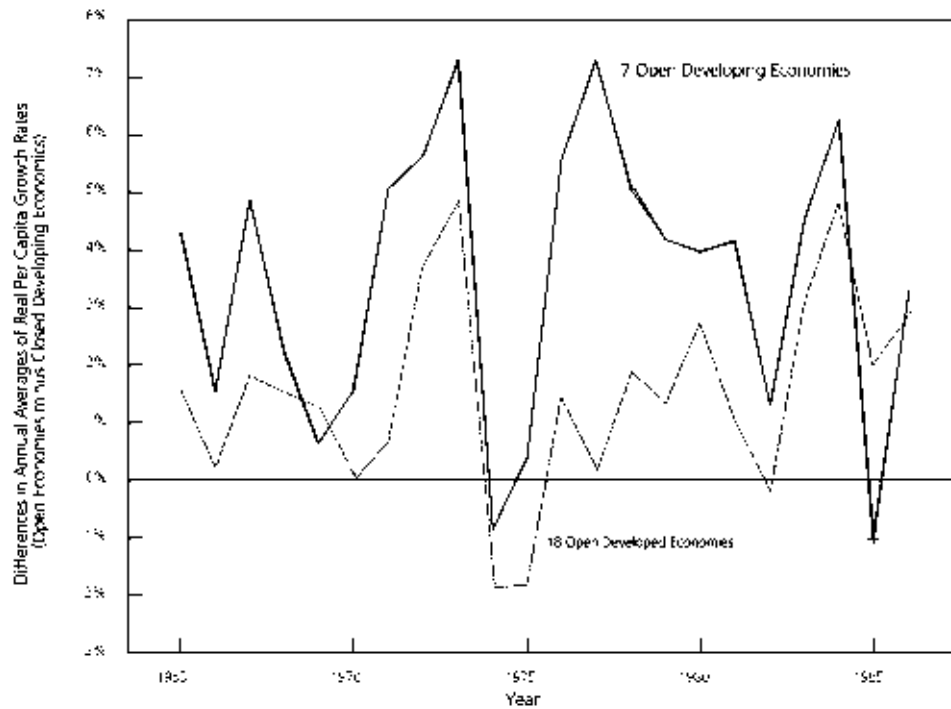
Figure 24: Catch-up and Convergence in TFPs Within Trade-Based Groups

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Figure 19: Post-war slowdowns in long-run context

ln y

Extrapolated Path

Actual Path

time

ln y

Actual Path

Extrapolated
Path

time