July 1998
forthcoming, *Economic Inquiry*

Some Evidence on the Continuity of the Growth Process Among the G7 Countries*

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ABSTRACT

The stability of the growth process, whether growth rates are rising, falling, or constant, is one of the central questions of economic growth theory. We use recently developed techniques for identifying structural change in economic time series, and find evidence of multiple breaks in per capita real GDP of the G7 countries over the past 120 years. Once determined, these breaks are used to delineate time periods. While there is some evidence of individual periods of slowdowns, the overall tendency appears to be one of increasing steady state growth over the long run.

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* We thank Alex Cukierman, Neil Gandal, Bent Sorensen, Danny Tsiddon, Yoram Weiss, two anonymous referees and the seminar participants of the CEPR conference on Regional Integration and Economic Growth for their comments and suggestions.

I. INTRODUCTION

This paper examines the growth process of each of the G7 countries between 1870 and 1989. The question that lies at the heart of the analysis that follows centers on the stability of the growth process. Specifically: (a) are there distinct periods of development for each country; (b) in the event that there are distinct periods, when did one period of development end and the next begin; (c) what evidence do we have regarding growth rates over the long-run? Are these steady, as Solow (1956) and Kaldor (1961) proposed? Are they falling, as Malthus believed that they eventually would? Or, are they increasing, as Romer (1986) and others have recently suggested?

One of the interesting, and related, questions that this analysis raises is the issue of the postwar slowdowns among the G7. How prevalent, and how severe, were these slowdowns? When did they begin and how do the post-slowdown growth rates compare to earlier periods when examined from the long-run perspective of 120 years?

One of the goals of this paper is to provide a precise characterization of takeoffs and slowdowns. This is done by sequentially determining the timing of breaks in the trend process for per capita real GDP and estimating changes in the coefficients. Once a break has been identified and determined to be statistically significant, takeoffs and slowdowns are defined by changes in the slope coefficient of the trend function.

The trend breaks are determined in the next section. We find evidence of two breaks for Canada, Japan, the United Kingdom, and the United States, three breaks for Germany, four breaks for Italy, and five breaks for France. A number of the breaks, associated with the World Wars and the Great Depression, follow a pattern of an initial drop in the level of output followed by an increase in the growth rate. Only two countries, France and Japan, display evidence of a postwar growth slowdown.

The third section examines the growth implications of these results. While no two countries are identical, the estimated break dates partition the past 120 years into eight distinct time periods for the G7 countries as a whole. The long-run tendency is one of increasing steady state growth. Comparing the first to the last period, steady state growth rates increased for all seven countries and, on average, almost doubled. The major events of the last century had both common and idiosyncratic effects on the countries. World War II affected the continental European countries much differently than the others, and the Great Depression was significant only for Canada and the United States. Section four concludes.

II. TREND BREAKS

It is possible to think of log per capita output y_t as being the sum of a deterministic component TD_t and a stochastic component Z_t,

$$y_t = TD_t + Z_t , \tag{1}$$

where the deterministic component TD_t is linear in time t,

$$TD_t = \mu + \beta t . \tag{2}$$

As shown below, a takeoff is associated with an increase in β while a slowdown is associated with a decrease in β. We define takeoffs and slowdowns as changes in β associated with statistically significant breaks in the deterministic component TD_t of per capita output.

Our objective is to test for possible multiple structural changes in long-term per capita output. The null hypothesis of no structural change is that the parameters μ and β are constant over the span of the data, while the alternative allows for one or more changes in both the intercept and the slope. We use 120 years of per capita GDP data for the G7 countries from Maddison (1991), starting in 1870 and ending in 1989.[1]

The existence of a unit root in both aggregate and per capita output has been a matter of controversy, and tests for structural change are dependent on whether the stochastic component Z_t contains a unit root. Vogelsang (1997) develops tests for a one-time break in either trending or non-trending data which are valid in the presence of serial correlation whether or not a unit root is present. With multiple breaks, the issue becomes clouded. A unit root process can be considered a limiting case of a stationary process with multiple breaks, one that has a break (permanent shock) every period. Following Bai (1998) and Bai and Perron (1998), we assume that per capita output is regime-wise trend stationary, ruling out unit roots *a priori*.[2]

The Vogelsang tests for one break in linear trending data (denoted here as T_{B1}) involve estimating the following regressions,

$$y_t = \mu + \theta_1 DU_{1t} + \beta t + \gamma_1 DT_{1t} + \sum_{j=1}^{k} c_j y_{t-j} + \varepsilon_t \ , \qquad \textbf{(3)}$$

where $DU_{1t} = 1$ if $t > T_{B1}$, 0 otherwise, and $DT_{1t} = t - T_{B1}$ if $t > T_{B1}$, 0 otherwise.[3] Equation (3) is estimated sequentially for each possible break year. The $SupF_t$ (or Sup Wald) statistic is the

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[1] The data for Japan begins in 1885.

[2] Ben David and Papell (1995) and Ben-David, Lumsdaine, and Papell (1997) provide evidence that the unit root null in long-term per capita output can be rejected in favor of the regime-wise trend stationary alternative, using one or two breaks, for most of these countries.

[3] We only consider structural change in the trend function of the data. Other types of structural change, such as changes in volatility or in the coefficients on the lagged values of output, may also have occurred.

maximum, over all possible trend breaks, of two times the standard F-Statistic for testing $\theta_1=\gamma_1=0$. The null hypothesis of no structural change is rejected if $SupF_t$ is greater than the critical value.[4]

For each choice of T_{B1}, the value of the lag length k is selected by the criteria advocated by Campbell and Perron (1991). Start with an upper bound on k chosen *a priori*. If the last included lag is significant, choose the upper bound. If not, reduce k by one until the last lag becomes significant. If no lags are significant, set $k = 0$. Following Perron (1989) and Zivot and Andrews (1992), we set the upper bound on k to equal 8 and the criterion for significance of the t-statistic on the last lag equal to 1.60.

We extend the Vogelsang (1997) methodology to allow for multiple breaks. For each series, we estimate Equation (3) with two additional dummy variables,

$$y_t = \mu + \sum_{i=1}^{m} \theta_i DU_{it} + \beta t + \sum_{i=1}^{m} \gamma_i DT_{it} + \sum_{j=1}^{k} c_j y_{t-j} + \varepsilon_t \ , \qquad \textbf{(4)}$$

where $m = 2$ and $DU_{2t} = 1$ if $t > T_{B2}$, 0 otherwise, and $DT_{2t} = t\text{-}T_{B2}$ if $t > T_{B2}$, 0 otherwise. The year T_{B1} is fixed by the year chosen by estimation of the one-break models. Equation (4) is estimated sequentially for each potential break year (T_{B2}), and the $SupF_t$ statistic is calculated as described above. The procedure now becomes a test of the one-break null against a two-break alternative. In order to avoid breaks which are "too close", we require the second break to be separated from the first by at least five years.[5]

We investigate the possibility of a third break by adding two additional dummy variables to Equation (4) and increasing m to 3. In this case, $DU_{3t} = 1$ if $t > T_{B3}$, 0 otherwise, and

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[4] Vogelsang (1997) also develops tests for non-trending and quadratic trending data, and provides asymptotic critical values for both unit root and stationary data.

[5] Allowing breaks to be closer together results in additional significant breaks in the middle of World War II. These appear to reflect short-term spikes of GDP rather than long-run changes in growth.

$DT_{3t} = t\text{-}T_{B3}$ if $t > T_{B3}$, 0 otherwise, while T_{B1} and T_{B2} are the years chosen by estimation of the one and two-break models, respectively. The sequential estimation and calculation of the $SupF_t$ statistic is as described above. Fixing T_{B1} and T_{B2}, we search over the sample for a third potential break year, subject to the requirement that T_{B3} be separated from both T_{B1} and T_{B2} by at least five years. Extension of the procedure to consider additional breaks is straightforward.[6]

While we could use Vogelsang's (1997) asymptotic critical values for testing the no break null against the one break alternative, there are no existent critical values for testing two breaks against one, three against two, etc. Using Monte Carlo methods, we compute finite sample critical values for our $SupF_t$ test statistics assuming that the true data generating process is a linear trend with Gaussian innovations. We construct pseudo samples of length 120 (plus 50 initial observations which are discarded), perform 5000 simulations, and obtain the critical values from the sorted vector of replicated statistics. They are reported in Table 1.[7]

Bai and Perron (1998) develop methods for estimating and testing linear models with multiple breaks in regime-wise stationary data which allow for serial correlation. While their consistency results are valid for trending data, their distributional results, and tabulated critical values, require non-trending data. Bai (1998) has recently developed a method which remains valid with trending data. In contrast with both our procedure and Bai and Perron, where the breaks are estimated sequentially, Bai's method requires the breaks to be estimated globally.

[6] Our univariate approach ignores the possible commonality in the break dates. Extending the methods of Bai, Lumsdaine, and Stock (1996) to multiple common breaks could increase the precision of the estimated breaks.

[7] The critical values for testing the no break null against the one break alternative are about 16 percent higher than those reported by Vogelsang (1997) with 1 percent trimming. This is because we compute finite sample, rather than asymptotic, critical values which incorporate the lag length selection criteria. Following Bai and Perron (1998), we perform 5 percent trimming, which lowers the critical values compared to 1 percent trimming.

This increases the computational requirements with more than two breaks tremendously, especially when calculating critical values.[8]

The results of the tests are reported in Table 1. Under the "Break" heading, the number *x* indicates a test of the *x* break alternative against the *x*-1 break null. The no-trend-break null is rejected in favor of the one-break alternative at the 1 percent level for Canada, France, Germany, Italy, Japan, and the United Kingdom, and at the 10 percent level for the United States.[9] We also find strong evidence of two breaks in the long-term data. The one-break null is rejected in favor of the two-break alternative at the 1 percent level for France, Germany, Italy, Japan, and the United States, at the 5 percent level for the United Kingdom, and at the 10 percent level for Canada.

The evidence for a third break is mixed. While the null can be rejected at the 1 percent level for France, Germany, and Italy, it cannot be rejected at the 10 percent level for Canada, Japan, the United Kingdom, and the United States. We extend our procedure to search for a fourth break for those countries, France, Germany, and Italy, for which we found evidence of three breaks. Following the same procedures as described above, we can reject the three-break null against the four-break alternative at the 1 percent level for France and the 5 percent level for Italy, but cannot reject the null at the 10 percent level for Germany. Searching further with the same methodology, we find evidence of a fifth, but not a sixth, break for France.

While the methodology which we employ jointly tests for breaks in both the intercept and the slope of the deterministic trend, it is possible that at least some of the breaks would be in one

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[8] An alternative approach to the problem of multiple breaks would be to use Bayesian methods.

[9] Ben-David and Papell (1995) perform the one break tests using Vogelsang’s (1997) critical values. The only difference in the results is that, in Ben-David and Papell, the null for the United States can be rejected at the 5 percent level.

but not the other. We test for significance of the individual coefficients in the following manner. Start with the model chosen above. If either the slope or the intercept coefficient on the last break is insignificant, eliminate that coefficient and re-estimate the model. Proceed to the next-to-last break, and repeat the process. Stop when all coefficients are significant.[10]

The results from eliminating individual coefficients are shown in Table 2. While none of the break years are eliminated, several of the breaks are now for either the intercept or the slope, but not both. These regressions are used below to analyze takeoffs and slowdowns.

III. THE SHORT RUNS AND THE LONG RUN

By combining the trend break test results for the G7 countries as a group, it appears that the past 120 years may be partitioned into eight distinct time periods – though each country underwent just a subset of these different periods. The first period begins in 1870 for each country except Japan (for which the data begins in 1885) while the last period ends in 1989. The timing and the frequency of the breaks also suggest a division of the G7 countries into two groups with the three countries in continental Europe in one group and the four remaining countries in the other.

The columns of Table 3 delineate between the various periods. The first row for each country displays the trend break years for that country. Underneath the T_B's are the average annual real per capita growth rates for the period. These begin 5 years after the previous trend

[10] By the "last" break, we mean the last break to be chosen, not the last chronologically. We use the 5 percent value of the t-statistic, 1.96, as the criterion for significance of individual coefficients.

break and continue up to the designated break year (in the case of the initial periods, the averages begin in 1870, or 1885 in the case of Japan).[11]

Figure 1 illustrates the relationship between the time spans of each period for each of the countries and the average growth exhibited by each country during the time spans. Moving backwards in time, the first trend break is related to the issue of the postwar slowdowns, their prevalence and their onset. Of the seven countries, only France and Japan exhibited a significant postwar break and, as the dates indicate, their slowdowns (from nearly 4% annual growth prior to the break to just under 2% for France, and from close to 8% prior to the break to 3% in the case of Japan) began *prior* to the OPEC oil embargo, albeit in close proximity to it. Note that this was also the period that the Bretton Woods system of fixed exchange rates began to collapse, hence it is possible that the symptoms underlying this collapse were only exacerbated by the oil embargo which came a few years later and the cumulative result was the growth slowdown.

Contrary to common perception (and to the conclusions of: Kahn, 1992; Shigehara, 1992; and Ben-David and Papell, 1997; to name just a few), when the postwar slowdown issue is examined from the long-run perspective of 120 years of data rather than just postwar data alone, there appears to be no indication of a significant postwar break in the growth process for the five remaining countries. Furthermore, even after accounting for the postwar slowdowns in the two affected countries, postwar growth for *each* of the seven countries is still considerably higher than the growth that each exhibited during its multi-decade initial, or baseline, period.

World War II represented a dividing point between the three continental European countries and the four remaining countries. Each of the countries in the former group

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[11] The first five years immediately following the trend break are omitted to eliminate any post-break transitional behavior.

experienced a significant trend break just prior to WWII while the others did not. The end of the war brought about structural changes for the three continental European countries as well as for three of the four other countries (Canada is the lone exception). The new postwar growth rates were considerably higher than the baseline rates of growth for each of the three continental European countries and each experienced a positive level change as well (as depicted by the positive $\hat{\theta}$'s in their 1945/46 breaks). In the case of the three other (non-continental) countries with significant breaks, all experienced drops in levels but, as in the case of the continentals, all three also exhibited postwar growth increases above the baseline rates.

The continental European countries underwent a number of important changes following the Second World War that together may provide an explanation for the positive postwar level changes not experienced by the other countries. These include – but are not limited to – the massive influx of aid provided under the auspices of the Marshall Plan and the widespread movement towards free trade that it imposed on the recipient countries. Olson (1982) adds that the elimination of old distributional coalitions in the countries could have lead to a more efficient reallocation of resources which would have amplified the impact of the other growth-enhancing postwar changes.

Before WWII came the Great Depression break which was significant only for the U.S. and Canada and was characterized by level drops and trend increases during the subsequent period. In the case of Canada, this was the only break that was accompanied by a trend change. During the earlier break which came towards the end of the First World War, in 1917, Canada experienced a drop in levels, but no change in trend. In the U.S. case, the drop in levels following the 1929 break was followed by growth which averaged 8.6% annually between 1934 and 1944 – a period which also marked the span of years between the height of the Great Depression and the end of the war in Europe.

Finally, one break that appears to be different from all of the rest is the one that Italy experienced during the waning years of the 19th century. Growth rates during the two decades prior to 1891 averaged just 0.3% annually. During the subsequent two decades however, the country experienced an economic takeoff, with growth rates increasing to over 3% annually. In the period following the Second World War, between 1950 and 1989, growth rates were even higher still – almost 4%.

What happened in Italy in 1891? The years 1891 and 1892 represented the end of a period of protectionism that had paralleled stagnant economic activity. The change of government in 1891 led to the signing of a host of commercial treaties and to a subsequent doubling of foreign trade as well as budget surpluses between 1900 and 1910. In addition, surplus agricultural labor was finally able to emigrate and did so at a rate of half a million persons per year, which in turn resulted in an inflow of remittances from the emigrants and to non-negligible improvements in Italy's balance of payments. These events helped spur the economic takeoff that began after 1891.

Rather than just comparing the average annual growth rates of the postwar period with those of the baseline period, it is useful to calculate the steady state growth rates for each country and to compare the "what would have been" question with the "what actually was" question. That is: "What would have been the country's growth rate had it continued along its original steady state path uninterrupted by structural breaks in trend?" as opposed to "What actually was the growth rate along the country's steady state path during the last period of the sample?".

As is shown in Ben-David and Papell (1995), steady state growth rates for each of the countries can be approximated by utilizing the coefficients estimated in Equation (4). Thus, rates of growth during the baseline period tend towards the constant value

$$\Delta y = \frac{\beta}{1 - \sum_{j=1}^{k} c_j} \tag{5}$$

and towards

$$\Delta y = \frac{\beta + \sum_{i=1}^{m} \gamma_i}{1 - \sum_{j=1}^{k} c_j} \tag{6}$$

in the final period of the sample, when the coefficients for the trend dummy variables are included.

Steady state growth rates were calculated for each country's baseline period and then again for each country's final period. In the case of France and Japan, this is the post-slowdown period while for the remaining countries, this is the entire postwar period. The results appear in Table 4. While steady state growth rates during the baseline period were seldom above 2% (Canada being the exception), steady state growth rates during the postwar period (or during the post-slowdown period, as the case may be) were never below 2%. The ratio of terminal-to-baseline steady state growth ranged from 1.11 in the case of Canada to 3.26, or a threefold increase, in the case of Italy.

Table 4 also lists the differences and standard errors between each country's final period steady state growth rate and its first period steady state growth rate.[12] For all but one of the countries, the increase in steady state growth is significant at the 5 percent level at least.[13]

The implication of these changes is a non-trivial one. Living standards in the G7 (which grew at a steady state rate of 1.52% on average during the baseline periods) doubled at a pace of every 47 years. The rate that living standards doubled fell to just 29 years after the Second World War, when the steady state growth rate averaged 2.54%. In terms of a 75 year lifespan, this means that individuals living at the turn of the century would get to see their living standards improve 3 fold during their lifetimes (had there been no further trend breaks) while individuals living during the postwar period would experience a 6½ fold improvement.

IV. CONCLUSION

This paper focuses on the identification of break years in the growth processes of the G7 countries over a 120 year span. Once the break years dividing the different growth periods are identified, an attempt is made at (a) discerning between the similarities and differences characterizing the periods and, (b) comparing these distinctions across countries.

Between the years 1870 and 1989, each of countries experienced between 2 to 5 different periods of development. Each of these periods differed from the preceding and/or subsequent periods by: level changes in output in some instances; growth rate changes in others; and both types of changes in the majority of cases.

[12] Standard errors were calculated using the delta method.

[13] For the seventh country, Italy, the takeoff period following the 1891 break was characterized by a significant steady state growth increase of 3.62% (and a standard error of 1.15%) from the initial, pre-takeoff, period.

Postwar growth slowdowns were found in only two of the seven countries. Nonetheless, even in these countries, as well as in the five remaining countries, the steady state growth paths are steeper than the baseline steady state paths marking the first few decades of the sample, indicating that growth rates increased over the long run.

As the literature on economic growth developed during the 1940s, 50s and 60s, one of the themes that evolved in parallel to the Kaldor-Solow view (of constant growth over long periods of time) was the idea that the growth process is not continuous. Rosenstein-Rodan's (1943) "big push" and Rostow's (1956) "takeoffs" are examples of this vein in the literature. Kuznets (1963) objected to the fuzziness in Rostow's (1960) delineation between five distinct stages of development. He wanted stages that could be quantifiable, empirically distinct, and, if they exist, could be studied separately.

This paper approached the discontinuity issue from the Kuznets perspective. The goal here was to determine when discontinuities occurred and to provide a demarcation between different periods of growth along the development paths of the G7 countries. This study is currently being extended to include earlier periods and additional countries. Once the different periods are determined, it will then be possible to proceed to the empirical testing of the various theoretical explanations of the growth process.

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Table 1 SEQUENTIAL TREND BREAK TESTS

Per Capita Real GDP

Country	**Break**	**Year**	**$SupF_t$**	***k***	**p-values**
Canada	1	1928	34.61	8	.001
	2	1917	14.15	8	.100
France	1	1939	40.98	5	.000
	2	1971	26.99	5	.001
	3	1945	21.14	4	.008
	4	1921	25.64	4	.001
	5	1910	19.58	2	.007
Germany	1	1946	45.35	1	.000
	2	1940	87.23	1	.000
	3	1913	22.16	3	.005
Italy	1	1945	23.27	2	.012
	2	1939	80.38	1	.000
	3	1918	43.46	6	.000
	4	1891	16.45	4	.032
Japan	1	1944	40.57	5	.000
	2	1968	152.28	1	.000
U.K.	1	1918	39.74	6	.000
	2	1944	20.61	6	.011
U.S.A.	1	1929	16.09	8	.082
	2	1944	50.95	6	.000

Critical Values

Breaks Under the Null	**Breaks Under the Alternative**	**1 percent**	**5 percent**	**10 percent**
0	1	23.74	17.85	15.34
1	2	21.12	16.49	14.15
2	3	20.42	15.59	13.76
3	4	19.78	15.16	13.27
4	5	18.61	14.53	12.72

Table 2 **FINAL TREND BREAK TEST RESULTS***

		Canada	France	Germany	Italy	Japan	U.K.	U.S.A.
Trend Breaks	T_{B1}	1917	1910	1913	1891	1944	1918	1929
	T_{B2}	1928	1921	1940	1918	1968	1944	1944
	T_{B3}		1939	1946	1939			
	T_{B4}		1945		1945			
	T_{B5}		1971					
Coefficients	$\hat{\mu}$	3.6254	5.1297	1.6789	1.1441	4.8770	2.9158	1.8187
		(7.45)	(10.73)	(5.52)	(4.12)	(14.16)	(7.93)	(2.94)
	$\hat{\beta}$	0.0129	0.0063	0.0041	0.0015	0.0151	0.0041	0.0039
		(7.42)	(7.34)	(4.08)	(0.94)	(13.31)	(7.25)	(2.76)
	$\hat{\theta}_1$	-0.0780	0.0905	-0.1162	-0.0429	-0.6223	-0.1073	-0.2129
		(-3.52)	(2.88)	(-4.00)	(-2.17)	(-13.69)	(-7.34)	(-6.96)
	$\hat{\gamma}_1$		-0.0191	0.0061	0.0059	0.0460	0.0039	0.0239
			(-4.35)	(3.88)	(3.27)	(15.12)	(6.88)	(7.32)
	$\hat{\theta}_2$	-0.1336	0.2355	0.2905	-0.1591	0.1235	-0.0525	-0.1571
		(-5.36)	(6.66)	(5.15)	(-7.49)	(3.81)	(-4.54)	(-4.39)
	$\hat{\gamma}_2$	0.0015	0.0175	-0.1383		-0.0354		-0.0231
		(2.15)	(3.63)	(-10.22)		(-12.29)		(-7.10)
	$\hat{\theta}_3$		-0.1323	0.6069	0.0942			
			(-2.95)	(13.44)	(2.75)			
	$\hat{\gamma}_3$		-0.0538	0.1345	-0.0825			
			(-3.97)	(9.96)	(-9.05)			
	$\hat{\theta}_4$		0.3629		0.3887			
			(8.27)		(12.19)			
	$\hat{\gamma}_4$		0.0782		0.0800			
			(5.20)		(8.67)			
	$\hat{\theta}_5$							
	$\hat{\gamma}_5$		-0.0152					
			(-5.53)					
	$\hat{c}_1$	0.8940	0.4480	0.6403	0.6866	0.2183	0.9049	0.8121
	$\hat{c}_2$	-0.0744	-0.1357	0.0124	0.0389		-0.1121	-0.0776
	$\hat{c}_3$	-0.1015		0.0966	-0.0135		-0.2876	-0.0279
	$\hat{c}_4$	-0.1445			0.1265		0.0207	-0.0580
	$\hat{c}_5$	0.0351					0.2659	-0.0510
	$\hat{c}_6$	0.0036					-0.1637	0.1694
	$\hat{c}_7$	0.1473						
	$\hat{c}_8$	-0.2793						

* *t*-statistics in parentheses.

Table 3 TREND BREAKS AND AVERAGE GROWTH RATES BY PERIOD*

		Growth Rate Prior to T_{B1} (A)	Late 1800s	Until WWI	Thru WWI	Until Great Depr.	Until WWII	Thru WWII	Until Oil Embargo	Until 1989 (B)	Ratio of B to A
Continental European Countries											
Germany	*TB*			1913			1940	1946			
	Avg. Rates	1.59%		1.59%			3.35%	NA		3.54%	2.22
Italy	*TB*		1891		1918		1939	1945			
	Avg. Rates	0.29%	0.29%		3.36%		1.53%	NA		3.91%	13.30
France	*TB*			1910	1921		1939	1945	1971		
	Avg. Rates	1.05%		1.05%	-0.78%		0.93%	NA	3.96%	1.84%	1.74
Other Countries											
Japan	*TB*							1944	1968		
	Avg. Rates	1.93%						1.93%	7.90%	3.07%	1.59
UK	*TB*				1918			1944			
	Avg. Rates	1.12%			1.12%			2.10%		2.25%	2.01
USA	*TB*					1929		1944			
	Avg. Rates	1.75%				1.75%		8.56%		2.04%	1.16
Canada	*TB*				1917	1928					
	Avg. Rates	2.23%			2.23%	5.07%				3.25%	1.46

* The averages listed below each T_B are for the period leading up to that T_B. The averages start 5 years after the prior T_B.

Table 4

COMPARISON OF STEADY STATE GROWTH RATES

	Steady State Growth Rate in Period Prior to T_{B1}	Steady State Growth Rate in Period Following Last T_{Bm}	Difference in Steady State Growth Rates	Ratio of Last Period Growth Rates to First Period Growth Rates
Average	1.52%	2.54%		1.86
Continental European Countries				
Germany	1.63%	2.57%	0.93% ** (0.45%)	1.57
Italy	0.92%	3.00%	2.08% (2.28%)	3.26
France	0.91%	2.01%	1.10% *** (0.17%)	2.20
Other Countries				
Japan	1.93%	3.28%	1.35% *** (0.04%)	1.70
U.K.	1.09%	2.15%	1.06% *** (0.18%)	1.97
U.S.A.	1.67%	2.00%	0.33% ** (0.16%)	1.20
Canada	2.48%	2.76%	0.28% *** (0.08%)	1.11

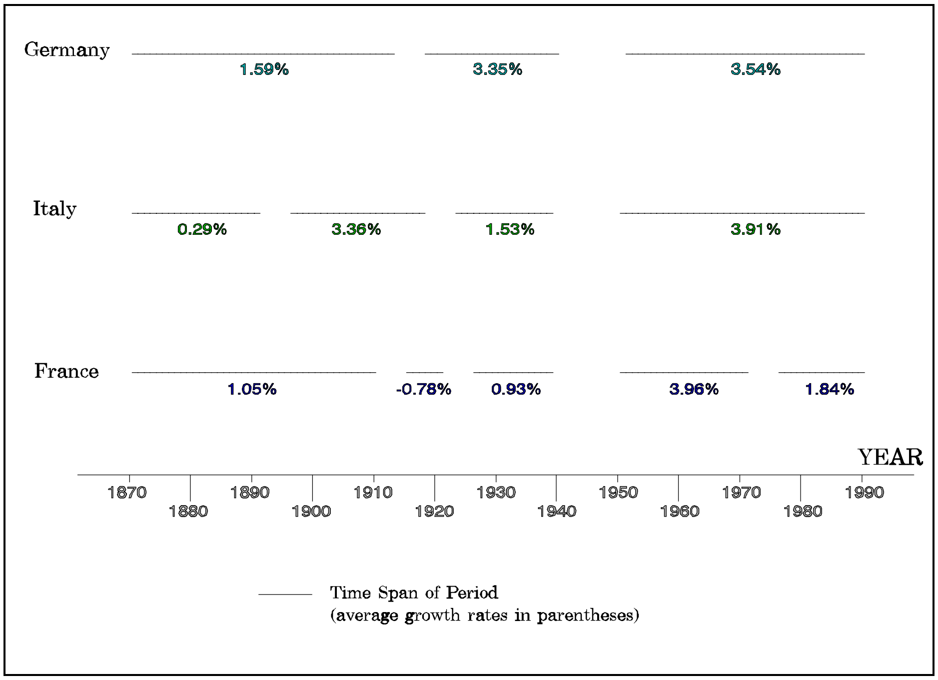
*** Significant at the 1% level
** Significant at the 5% level

Figure 1

AVERAGE ANNUAL REAL PER CAPITA GROWTH RATES EACH PERIOD

Period averages are between $T_{B,i}+5$ and $T_{B,j}$ for $j=i+1$,
except for initial period which begins in 1870 (1885 for Japan) and ends in $T_{B,1}$.

Continental European Countries:



Other Countries: