Procedures for periodizing history: determining eras in the histories of Britain, France, Germany and Italy

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Veröffentlichungsversion / Published Version
Sammelwerksbeitrag / collection article

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Procedures for Periodizing History: Determining Distinct Eras in the Histories of Britain, France, Germany and Italy*

Fernand Braudel in the prefaces to the editions of his great work *The Mediterranean World in the Age of Philipp II* emphasizes the contradiction at the heart of all efforts to study societies over the *longue durée* while still acknowledging the force and pull of *l'histoire évènementielle.* Braudel responds to this conflict by finding event centered history dangerous and misleading. Historians and social scientists indebted to his work and to that of the *Annales* school have imitated his decision to give priority to the *longue durée.* Problems persist, however, even after this theoretical and methodological choice has been made. How shall the periods that identify the essential continuities and discontinuities in a society be established? What procedures most effectively establish the periodization critical to the analysis of a society? What methods make it possible to test the validity of the periodization adopted in historical and sociological analysis? Why does it matter? What are the substantive issues at stake for history and the social sciences?

Answers to these questions must first take into account methodological and theoretical problems of measurement in the construction of time series data. Secondly, it is necessary to examine the possibilities and limits of periodizing on the basis of a single variable. Thirdly, and only after the other issues have been considered, it is necessary to consider the implications of periodizations that are possible employing multiple variables.

In the sections that follow some light will be thrown on these issues by using, for illustrative purposes, the problem, of periodizing and analyzing the growth of public expenditures for education, health, welfare, and social security in Britain, France, Germany, and Italy from 1870 through 1965. In the last three decades of the nineteenth century and in the twentieth century expenditure for these purposes was at the nexus of the changes affecting the modernization of these societies.

* Prepared with the support of the National Science Foundation (SOC 75–192821), the Ford Foundation, the Graduate Research Committee, University of Wisconsin, and the Institute for Research on Poverty, University of Wisconsin. Their financial support does not indicate acceptance of the ideas or opinions in this paper. We are particularly grateful for the loyal support, work and ideas of George Pasdirtz.

Methodological and Theoretical Problems of Measurement in Preparing Historical Time Series Data for Periodization

To gain the fullest benefits of data reduction and explanation that periodized analysis can give, some attention must be paid to properly preparing the time series data. A number of problems occur in dealing with historical time series, and the manner of dealing with them will have a significant impact on the success of the later analysis. While not an exhaustive list, standardization, the number of time points and frequency of measurement, and the handling of missing data are among the most common difficulties.

Issues in Standardization

Any attempt to periodize is, at least implicitly, an effort at comparative analysis either across time within one nation or across nations. For this reason it is necessary to standardize the time series so that the generalizations sought are less bounded by a particular space and time. Where it makes theoretical sense to do so it is also advisable to standardize in a way that reduces the series in question to percentage figures. Such series are easily interpreted and are relatively easy to manipulate. Standardizing the time series as percentages also has the advantage of yielding readily interpretable unstandardized beta coefficients when regression models are used in analysis.

The use of standardized data in addition to facilitating comparative analysis provides a control that protects against false periodization. For example, the period following the First World War in France would be incorrectly classified as one of decline in education if the sheer number of students were considered. Expressing students as a percentage of the population 6–19 years of age, however, leads to an opposite conclusion because the decline in the number of students was less proportionally than the decline in the actual number of young persons.

In any comparative analysis it is necessary to choose a theoretically important variable on which to standardize the series of interest. Governmental expenditure for education can be expressed as a percentage of G.N.P. or as a percentage of all government expenditure. We have applied several periodization techniques to time series on government expenditure for education and for health, welfare, and social security as a percentage of G.N.P., which is particularly appropriate to theories about societal resource allocation.

The choice of a denominator should be tied to the theoretical questions addressed, but within this structure the choices made can affect the generalizability of the analytic results. For example, Labour Party votes as a proportion of all votes cast in

a meaningful standarization for Britain and a few other countries at a few points in time. If the theoretical question to be addressed is a larger one a more generalizable choice is desirable. For example, if the theory is about the relationship between working-class political participation and resource allocation, a wider range of parties including all those „left of center" is necessary.

Number of Time Points and Frequency of Measurement

For any technique of periodization the length of the series and the frequency of measurement need to be taken into account. The series must be long enough to allow for significant change to have occurred and measurement must be frequent enough so that the timing of the changes can be captured accurately.

The questions of length and frequency are linked to the nature of the theory and the nature of the phenomenon under study. In the study of resource allocation and modernization in Western Europe we have chosen to take yearly measures for at least one century. For some phenomena such as urbanization, political development, and income distribution less frequent measurement is necessary. However, there are a number of important variables that require more frequent measurement, for example, strikes, balance of trade movements, and immigration. To correlate a rapidly changing series, such as strikes, with a slowly changing one, such as urbanization, requires that urbanization be measured as frequently as strikes.

Handling Missing Data

The larger the number of cases, the longer the time span covered, and the more frequent the measurement the more likely one is to have difficulties with missing data. Conventionally, missing data is estimated by linear interpolation and extrapolation. If correlational and linear regression techniques are used for periodization, however, linear estimates of missing data will bias the results. The use of non-linear estimation techniques will avoid these biases.

We prefer to use a cubic polynominal spline method to estimate missing data. This method fits a non-linear function to each set of three „real" observations and generates estimates for the missing data between them. For example, the proportion of the labor force in agriculture in France is directly observed only at the census that are, in most cases, five years apart. The polynominal spline used the three observations that occur over a fifteen year period to fill in the missing years. If the

trend in the real data over the period is linear, the estimated data will also be linear; if the trend is non-linear, the polynomic spline will produce a smooth, but non-linear, series.

We might point out as well that even qualitative estimates are better than nothing at all when attempting to estimate missing periods. This is especially important because the more frequently one can at least estimate time points the better any interpolation program will work. If one connects a series of qualitative estimations by non-linear interpolations is one constructing a house of cards? The answer is, not really. Different estimations and interpolations can be checked for the general plausibility both from the standpoint of the different periodizations they produce as well as their pattern of association with other variables. This is a variation on the theme of counter-factual history. If the estimated time series works reasonably well in data analysis and the same data analysis has been demonstrated to work in other countries or from historical eras then we can assume we have not done great violence to historical reality.

For example, union membership in Italy during the past World War II period has been a secret. We have used some „soft" estimates based on attendance of delegates at conferences and interpolations between these estimates. English public education statistics in the 19th century are very misleading without some attempt to estimate the private sector. If one examines literacy rates in Britain, and especially England, they are as high or higher than those in France suggesting that not all students are accounted for in the official records. Qualitative reports indicate there were a large number of small, private, and usually for profit schools especially in the urban centers. Not to estimate them, however crudely, will mislead any technique of periodization.

In summary our rules for preparing data for periodization require the following procedures: (1) standardize and employ percentages whenever possible; (2) generalize the variables as much as possible, even if the analytical interest is relatively „narrow"; (3) obtain at least yearly measures for a *longue durée* of a century or more; (4) use non-linear estimation procedures for missing data; (5) attempt to use qualitative sources and reasonalbe guesses to supplement official records.

Periodizing with a Single Variable

The coherence and explanatory power of periodized analysis can be achieved by examining even movements in a single time series. Economic historians, in particular, have effectively utilized this approach to identifying periods that make intelligible such diverse problems as long-run economic growth and business cycles. The identification of periods by either changes in the rate of change of by deviations from a

function of time are two such techniques that can be readily extended to sociological and political variables. Each of these two procedures has particular strengths and paticular weaknesses, as are illustrated below.

Changes in the Rate of Change as Periods

One of the basic questions in examining a single time series is the identification of periods within time-point to time-point changes (slope of the variable plotted against time) which are similar and different from other periods. That is, one seeks to decompose the series into periods not by the level of the process, but rather by movements in the trend. As a hypothetical example, we would *not* make the statement „real G.N.P. per capital was higher in the 15th century than in the second half of the 16th", but rather „both the 15th and late 16th centuries were characterized by stability in real G.N.P. per capita, while the first half of the 16th century is a period of decline". Statements of the latter type lead us closer to an examination of processes – dynamics and statics – and away from pure description.

To identify periods by the techniques of changes and changes in the rate of change, one simply takes the time series in question and expresses it in time-point change scores (t_2-t_1) or in percentage rate of change scores (t_2-t_1/t_1). In the case of relatively homogeneous time series, as in the examples below, transformation of the data are often unnecessary. Simple examination of the series by eye to identify trends and turning points will suffice. What is important is a sensitivity to the slope of the series (change), and changes in the rate of change (inflation points where the slope becomes different).

The demand and supply of public education expenditure in Britain, France, Italy, and Germany over the century 1870 to 1965 provides a convenient example of the technique. If one believes that an important cause of resource allocation to education is the demand for it, as is the assumption in economics, it is very important to be able to measure and periodize this variable.

One way to measure demand for public education expenditure is to use the number of students and the cost of educating them. As the proportion of persons ages 6–19 enrolled increases, and as the cost per student increase, the need for public expenditure grows. The cost of primary, secondary and higher education differs because of varying teacher-student ratios, the size of plant, and technological intensity. Clearly educating 100 college students is not the same as educating 100 primary students. The cost of secondary and especially technical and vocational school students is much higher than the cost of educating primary students. Thus an arithmetic increase in proportion of the cohort being educated often represents results in a geometric increase in demand for government expenditures.

Our solution to this problem as suggested to us by George Pasdirth is to multiply the per student cost of education at the previous time-point by the number of stu-

dents in the current year, and then divide this sum by the G.N.P. The resulting figure is a demand for a certain percentage of the gross revenue of a society to be allocated to education:

$$\text{demand} = \frac{\text{number of students} \cdot \text{cost per student}}{\text{G.N.P.}}$$

There are, of course, several things wrong with this measure. While it is sensitive to cost increases and sudden population increases, it is less sensitive to the increases in particular school populations. This can be measured if the total school population is disaggregated into separate pools each of which has different per capita cost. In no way do the measures really distinguish between a high quality and a low quality educational system, but this is not its intent. The objective here is to measure demand or need as a percentage of the total resource pool (G.N.P.).

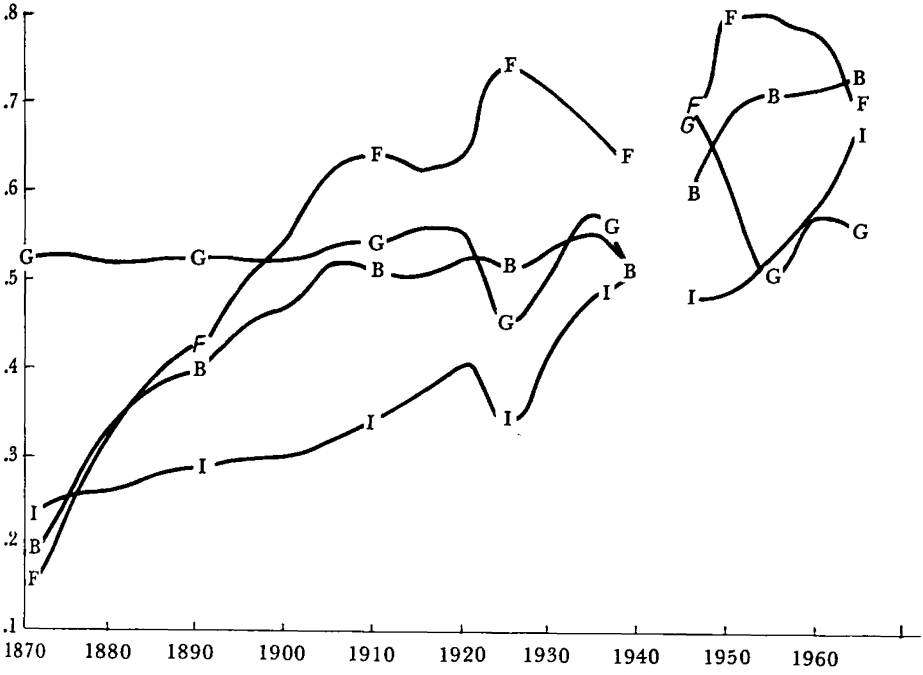
The more serious objection is that by taking only students in schools, we ignore children who would like to be in school but are not, either because of lack of facilities, inability to pay the fees, or the demands of rural work and the like. We are aware of this deficiency and are exploring several idealized models of growth curves in demand that could then be employed to estimate „true demand".

Demand for public education expenditure for Britain, France, Italy, and Germany (territory of the Bundesrepublik since 1946) is plotted in Figure 1. These trace lines show some distinct pattern. German demand was remarkably stable with only minor fluctuations associated with the economic crises of the early 1920s and the post World War II bulge. Essentially our end point (1965) is little different from the 1871 starting point. France began at a considerably lower level than Germany and displayed moderate growth up to 1925, interrupted briefly by World War I. During the period from 1925 through the Depression and up to World War II demand declined. In the post World War II era demand expanded sharply to 1950 then declined to 1965. Britain started low, though figures include only the public sector and would be somewhat higher if the private sector was included, but had rapid growth up to 1905. From 1905 to World War II there was essential stability despite the establishment and slow growth of public secondary education. Taking the post-world war growth into account, the British pattern is quite like that of France since the turn of the century. Italy started at the same place as Britain, had slower but exponential growth until World War II, and rapid post war growth.

The kind and number of periods we observe are the following: there is one for Germany and it is a time of long-term stability; demand trends identify three periods for France: 40 years of moderate growth from 1870, followed by three decades of stability, and then a period of acceleration and decline after the Second World War. Great Britain experienced rapid growth from 1870 to 1905 followed by stability to the eve of the Second World War and, as in France, rapid acceleration and stagnation in the post-war years. In contrast to the other nations, Italy has known a moderate growth for fifty years from 1870 to 1920, and thereafter a very rapid increase up to 1965.

This periodization identified by the trace lines naturally raises the questions of

Figure 1: Demand for Education



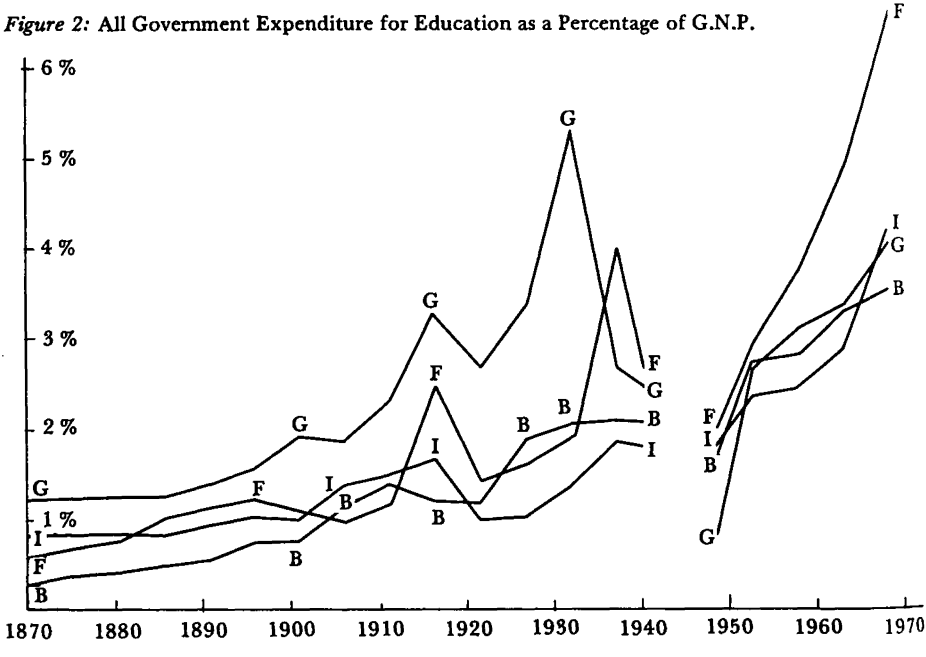
explaining the differences among periods in the rate of change and the timing of changes in the rate of change that constitute the critical demand periods in the four societies. In the trace lines of Figure 1, zero slopes may be interpreted as stability, non-zero slopes as change. More important, however, are the places where the slopes themselves change. It is these inflection points that require the most emphasis in explanation: what started the periods of growth in the first place, what halted them, and how similar are the trajectories of the four countries?

Substantively, the timing of changes in the rate of change is most interesting. Historians such as Antoine Prost have accounted major attention to the legislation which in a nation structures the goals and commitments of the society. Such specific events, however, do not account for all the subsequent movements in educational demand. Similarly, although much attention has been given to post Second World War acceleration in demand for education, upturns in demand for education occur in Germany and Italy before the war. To periodize by legislation or war is to miss some of the inflection or take-off points.

Descriptively, our procedures for periodizing a single series have raised historical questions that run counter to some of the perceptions of experts in the area. But note that these results would not be obtained without the use of time series for a *longue durée*, standardized in a consistent way, and juxtaposed vis-a-vis other countries in a somewhat similar state of modernization and of economic development.

Perhaps another example is necessary. In Figure 2 we plotted supply of education expenditure, that is the percentage of G.N.P. spent in education across all government levels in the four countries. For Britain, there were essentially two periods. Very slow growth up to World War II and after the war steady and more rapid growth. France has three distinct periods. Slow and undulating growth until a take-off in the 1930s, a violent swing associated with the war, and another take-off in the 1950s. Italy had a pattern somewhat like that of Britain. There was slow growth with some undulations in the interwar period, and then acceleration in the post World War II period. Germany again had a distinctively different pattern. There is exponential growth from 1870 to 1930 with only minor reversals, a sharp decline in the Nazi period, and rapid growth since the Second World War.

Figure 2: All Government Expenditure for Education as a Percentage of G.N.P.



It is worth noting that there is not a simple overlap between the periodization in demand (Figure 1) and supply (Figure 2). There is a good fit for Italy and Great Britain, the periods identified in demand and expenditure closely correspond. In Germany stable demand does not correspond to increasing expenditure. In France rapid post Second World War expansion of expenditure is not complementary to stable or declining demand.

These results encourage some observations on the periods that are delineated. First, we observe that the meaning of war and of depression may be quite limited when viewed in the perspective of a hundred years. Many studies of the economic growth rates in various countries indicates that they have a characteristic rate of growth. Depressions may interrupt this. But once the next boom is over, the long term average remains about the same. Here we see essentially the same phenomenon: a tendency for government expenditures on education as a *proportion of G.N.P.* to grow at a constant rate irrespective of the major discontinuities in the biographies of these four countries.

Second, we have created a new kind of datum. In so far as each country has a characteristic growth rate, then this becomes another analytical problem. From a comparative perspective what is interesting is the close correspondence between France, Britain and Italy for almost the entire time period. It is only in 1960 that France becomes quite different from the other two countries. Especially when one juxtaposes these findings vis-à-vis the different growth patterns in demand, one is struck by the similarity of government responsiveness in these three countries.

Third, if one examines the yearly changes more closely, another new datum is created: the characteristic way in which the changes in slope occur. In some countries as noted above, the slope changes are sharp, fitting more a step function pattern. In other countries, the slope changes are less distinct.

We have indicated how periodization can be accomplished by remembering that periods of constant slope are periods of continuity, and that the changes in slope represent discontinuities. We have observed that the starting points of new periods do not necessarily correspond with the dramatic events by which we frequently mark past time. This means that the root causes may best be found elsewhere.

Regression on Time Functions as Method Identifying Periods in a Single Time Series

One of the major difficulties with using changes and changes in the rate of change to identify periods is the sensitivity of method to short-term fluctuations. If the series under examination does not display relatively smooth patterns, as do educational demand and supply, it is often very difficult to decide when significant „changes in the rate of change" have occured.

Econometricians have developed a number of techniques for dealing with this

problem, including smoothing to minimize short-run fluctuation, and seasonal adjustments to remove cyclical short-run movements. The relatively shophisticated techniques of spectral analysis and Box-Jenkins and Box-Tao are designed specifically to identify and/or remove such „noise" from the basic trends of a series.

A simpler approach is to regress the time series in question on a function of time and examine the residuals of the regression. When this is done, the pattern of residuals may be used to identify pure „noise", cyclical fluctuations, and homogeneous sub-periods around the long-run trend. To use this techniques implies a focus on two major questions. First, we must answer why a particular function of time has been used to define the major trend in a series (linear, logarithmic, sine wave, logistic, etc.). Secondly, we must focus on the analysis of periods of homogeneous residuals in terms of what may cause the periods to deviate from the trend. This method then leads us into the questions of why there is a basic trend, and helps us to identify the forces that cause deviations from the trend.

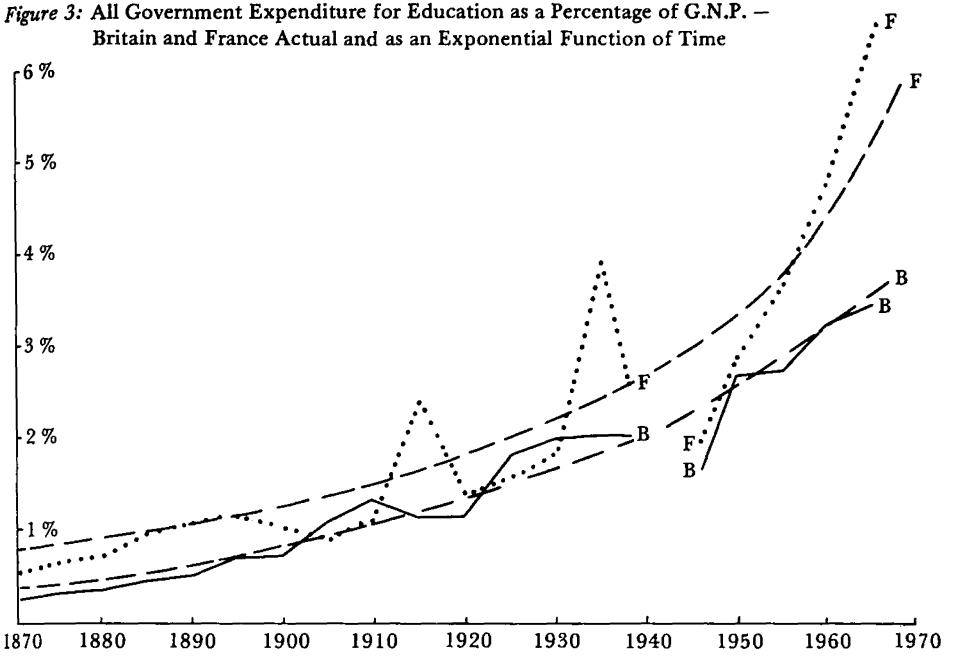
An illustration of this form of analysis is in order. Government expenditure for education as a percentage of the G.N.P. is again helpful. Examining the fit between a simple exponential function of time and the actual trend in education expenditures illustrates the way in which this technique may be used for identifying periods relevant to questions of deviation from long run trends.

We begin by supposing that the basic time function of the government education expenditure share in G.N.P. is a logistic (S-shaped) curve, but that in the time period of interest only the early exponential portions are observed. In order for deviations from the exponential pattern to be meaningful, a theoretical justification of the function is necessary. For the purposes of this illustration, let us suppose that education expenditure as a proportion of the national product grows logistically because parents who obtain education desire education for their children; the process reaches an upper bound when all children receive the maximum amount of education consistent with the maintenance of other societal functions.

In Figure 3 the trends of actual education of time for Britain and France are shown. Figure 3 raises a number of interesting questions as well as identifying periods developed through residual analysis within each series that are worthy of more detailed analysis. We are struck immediately with the problems of why the value of the French exponential parameter is greater than the British; we are also struck by the relatively small deviations around the trend in Britain and the relatively large swings in France.

In terms of periodization, deviations from the exponential time trend identify 1900–1910 and 1920–1940 as periods of more rapid expansion than expected in Britain. The periods 1910–1920 and 1946–50 require an explanation of the retardation that escapes notice when analysis is limited to changes in the rate of change. In France the periods 1895–1910, 1920–1930, and 1946–1950 display lower than expected levels while 1910–1920, 1930–38, and 1950–1965 exceed the expected values. In terms of period analysis, this examination of residuals from a time trend indicates the times where we are most likely to find evidence of forces at work that act to retard or enhance basis structural dynamics.

Figure 3: All Government Expenditure for Education as a Percentage of G.N.P. — Britain and France Actual and as an Exponential Function of Time



In summary, the analysis of a single time series can be used to identify periods that have substantive meaning. The method of periodization used is closely tied to the type of question that one wishes to investigate. Using changes (slopes) and changes in the rate of change (inflection points or second derivatives) is most helpful in identifying the causes of stability and change. Analysis of the residuals from a regression of a variable on a function of time is most helpful in identifying factors that modify the effects of an underlying dynamic process. Differences among nations or across time in the parameters of the underlying time function provide important clues to institutional differences.

The use of either approach moves one away from the temptation to perceive dramatic events as bench marks. The techniques do more than this, however, in that they raise a whole series of questions that require systematic explanations in terms of general theory. These methods allow one to note similarities and dissimilarities among countries and eras and thus speak to the basic concerns of both social science and comparative history.

Most historians and sociologists perceive periods not so much as distinctive movements in one variable, but rather as sets of time points within which the relationships among many variables are homogeneous and different from their interrelationships in other sets of time points. If one takes a large number of time series, describes each of them by periods, and seeks to identify correspondences, the sheer amount of descriptive material is overwhelming. If the relationships among the variables, that is their paramenters, remain constant over time, there is no difficulty. In this case a single set of structured equations adequately describes the entire body of data. If relationships among variables change over time, however, a single set of equations is inadequate and a new method of periodizing must be found.

Some very sophisticated techniques exist, based on variations of factor analysis, cluster analysis, spectral analysis, Box-Jenkins and Box-Tao techniques. Again, however, we advocate a simpler approach more in keeping with the current state of most sociological-historical theory and data.

The Use of Parameter Changes in the Delineation of Periods

In the cliometric work of Williamson, the parameters estimated for the 1870s for a general equilibrium model of economic growth of the United States work reasonably until World War I[1]. If one examines the large literature on the status attainment model one is struck by the changes in betas across time and samples. One could add other evidence, but all of it suggests that parameters – the relationships among multiple variables – change over time. André and Delorme for example, found that elasticities between changes in student populations and increases in government expeditures were different in different periods[2]. However, their designation of periods was conventional (1871–1914, 1921–1939, and 1946–1971). Rather than using events to identify periods, we would like a procedure that allows the periodization by multiple variables to emerge from the analysis of their interrelationships.

For example, a minimum identification of the variables at play in the growth of government expenditures for health, welfare, and social security would include real

[1] Williamson, Jeffrey G., Late Nineteenth-century Amercian Development. A general equilibrium history, London 1974.

[2] André, C., and Delorme, R., Etude analytique et numérique des tendances significatives et des facteurs explicatifs de l'évolution des dépenses et recettes publiques Françaises au cours de la période 1870–1970, Paris 1973.

G.N.P. per capita, labor force structure, and political polarization as measured by the votes received by left and right parties. A number of other independent variables, of course, might be identified, but for illustrative purposes of periodizing with multiple variables, this list will suffice. How then can the relationships among these variables be periodized to aid in the explanation of governmental expenditure?

Our recommendation is that we regress government expenditures for health, welfare, and social security as a percentage of G.N.P. on indicators of the set of independent variables and examine the residuals. Periods are identified by clusters of residuals above or below the line that summarizes the „average" relationship among the variables over the entire time period[3].

In Table 1, the summary statistics are presented of the regression of government expenditure for health, welfare, and social security as a percentage of the G.N.P. on indexes of three sets of independent variables for Britain, France, Germany, and Italy over the period 1875–1965. The „resources" index includes real G.N.P. per capita and labor force structure; the „right" index includes the percentage of votes for conservative and centrist political parties, the proportion of the labor force in agriculture, and the average size of firms; the „left" index includes the proportion of the labor force in unions, and votes for Socialist and Communist parties.

Table 1: The Partial Correlation of Resources, Right Power Base, and Left Power Base on Government Expenditures for Health, Welfare, and Social Security as a Percentage of G. N. P.

	Resources	Right	Left	R	R^2	DW*
Britain	−.27	−.66	+.57	.98	.96	yes
France	+ .41	−.30	+.22	.92	.85	yes
Germany	+ .10	−.39	+.32	.87	.75	yes
Italy	+ .74	−.10	+.41	.92	.84	no

*Significant negative autocorrelation as measured by the Durbin-Watson statistic.

As can be seen from Table 1, the model works quite well in each of the four countries, accounting for between three-fourth and ninety-five percent of the variance (R^2). Admittedly, the correlations are somewhat inflated because of significant and negative autocorrelations in three of the four nations. In Britain and Germany the political variables are more important than the economic, in France and

[3] Details of definition and measurement for this specific example are described in Hage, Jerald, and Hanneman, Robert, The Growth of the Welfare State in Four Western European Societies, 1870–1965. Institute for Research on Poverty Discussion Paper, University of Wisconsin, Madison (forthcoming).

Italy the reverse is true. This finding is interesting because in most cross-sectional studies political variables appear to be of lesser significance.

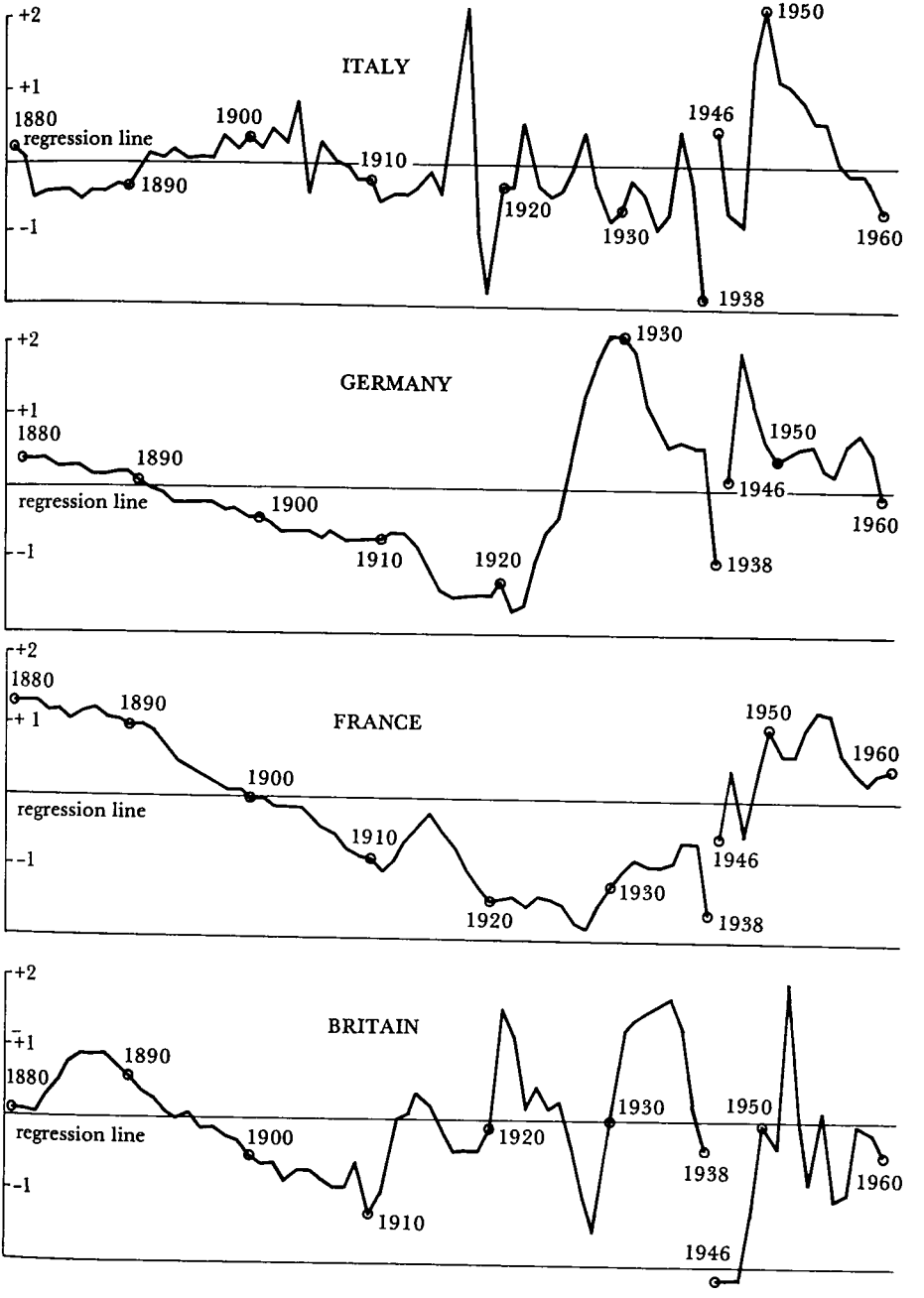
With these very high correlations, one might assume that a quite adequate job had been done in explaining the extent of government expenditures. However, this ignores the fact that for some periods the model might work very well and in other periods the model may break down. When and where the model does and does not fit well is an important datum, and can be seen by examining the residuals – that is, the goodness of fit between the predicted government expenditure in a year and the actual expenditure. Residuals of the model for each nation are presented in figure four. In Figure 4, a positive residual indicates that the actual expenditure in the year is greater than the prediction from the model, a negative residual that the expenditure is less than the prediction.

In Italy, from a regression point of view, the results have a nearly ideal pattern. Residuals do not cluster above or below the line for sets of sequential years, and consequently here is little autocorrelation. Most important, there are not long time periods when the residuals are either positive or negative. With the exception of the 1950s and 1960s, where there are some patterns among the residuals, there are, by this method, no distinct periods for Italy, and the parameters of the model as originally estimated are a good characterization of the relationships among the multiple variables for the entire century.

In Germany, the exact opposite is the case. The model accounts for less variation in Germany and there is a significant negative autocorrelation. Here we find two long periods and two short ones that correspon not only to the history of social welfare effort in Germany, but also, to some extent to political periods. The first period, 1878–1891, corresponds closely to the time of the Bismarckian welfare and social security legislation. From 1891, one year after Bismarck was dismissed, a long period continues through the First World War and the hyperinflation during which expenditures are less than the predictions of the model. This would appear to define a distinct historical era. From the mid-twenties until the beginning of the sixties, one finds another distinct period, one that includes Weimar, the Third Reich, and the Adenauer post-Second World War years. Throughout, more was expended than is predicted by the model. Finally, there is another short period that starts with 1960 and continues to our last data point at 1965.

In France there are three distinct periods, each of very long duration, and each raising interesting historical questions. Although the amount of variation accounted for is the same as Italy, the patterns of residuals indicate the existence of distinct periods. The first period goes from 1878 to 1900, during which expenditure is greater than predicated. From 1900 until about 1950, the reverse is the case, with normal fluctuations about the two wars. The third period starts at about 1950 and continues to the present.

Figure 4: Residuals from Regression



The case of Britain is in certain respects more like that of Italy than like the other two nations. In this country the model accounts for more variance than in any other of the four societies. There are more swings in the residual pattern and less distinct demarcations of historical periods, but some exist nevertheless. There is one long period from 1878 to 1896 and then another up to 1911. The interwar period is one when there is in general more expenditure than predicated. What is perhaps most surprising is the long period after the Second World War when there is less expenditure than the model predicts. Since this is the era of a number of Labour governments and „the growth of the welfare state", this seems surprising. The results suggest, however, that the welfare state did not expand as much as would have been the case if the conditions of resources and right and left strength had the same impact in the post-war period as they did over the entire period. Finally, there is a short period in the 1960s in Britain when expenditures again exceed the expected.

The examination of the residuals from a single regression model (and more complex models could be used in the same fashion) enables us to identify periods where the model does not fit. Due to limitations of space, the analysis of this example will not be pursued further. It should be pointed out that, once the initial set of residuals have been examined, the model may be re-estimated for shorter periods, so that the patterns among the residuals may be summarized by sets of parameter estimates. Once this is done, the logical questions becomes: why are the parameters different in different periods?, and what are the causes of the parameter shifts? This method not only allows us to identify periods of time when, for example, resource constraints are more important than political process in the explanation of social welfare effort, but also forces us to explain why this is not always the case. We are obliged to try to understand the conditions under which one „model" of the behavior in question works better than another, and how a social system may move from one set of dynamics to another.

Conclusion

We have tried to remain faithful to both the topic of how to create meaningful historical periods and finding new sources of data. The problem is usefully seen as both a descriptive and analytical one, both theoretical and methodological. Periods may be idendified by changes in slopes or deviations from a time trend in a single variable, or they can be determined by changes in the parameters defining the relationship between two or more variables.

A consequence of the periodizations established here is that, in some instances, traditional chronology is sustained, and in others it is inadequate. Critical attention is drawn to the times when societal performance shifts. The multiple variable periodi-

zation technique highlights breaks in the consistent interplay of variables and accents the critical changing weights of variables. The much celebrated autonomy of politics is reinforced at times with regard to public expenditure, and at other times it must give place to other social phenomena such as demand and resource availability. This experience enhances the significance of the periods in public expenditure for Britain, France, Italy, and Germany where simple models do not fit and calls for historically specific evaluation. Periodized analyses of this sort indentifies the actual periods persumed to occupy historians and likewise the complexities best approached by social science analysis. The concerns of historians and social scientists become then complementary, and the generalizations and theory they seek are not competitive but mutually supportive.