

Government expenditure on education and economic cycles in the nineteenth and twentieth centuries: the case of Spain and special reference to France and Germany

Diebolt, Claude

Veröffentlichungsversion / Published Version

Zeitschriftenartikel / journal article

Zur Verfügung gestellt in Kooperation mit / provided in cooperation with:

GESIS - Leibniz-Institut für Sozialwissenschaften

Empfohlene Zitierung / Suggested Citation:

Diebolt, C. (1999). Government expenditure on education and economic cycles in the nineteenth and twentieth centuries: the case of Spain and special reference to France and Germany. *Historical Social Research*, 24(1), 3-31. <https://doi.org/10.12759/hsr.24.1999.1.3-31>

Nutzungsbedingungen:

Dieser Text wird unter einer CC BY Lizenz (Namensnennung) zur Verfügung gestellt. Nähere Auskünfte zu den CC-Lizenzen finden Sie hier: <https://creativecommons.org/licenses/by/4.0/deed.de>

Terms of use:

This document is made available under a CC BY Licence (Attribution). For more information see: <https://creativecommons.org/licenses/by/4.0>

Government Expenditure an Education and Economic Cycles in the Nineteenth and Twentieth Centuries The Case of Spain with Special Reference to France and Germany

*Claude Diebolt**

Abstract: This paper is intended to provide a new reading of the way in which aggregate series of government expenditure an education and economic growth in Spain were related from 1850 to 1965. The research is in two parts. The first concerns the theoretical framework with two major conceptualisation aspects: economic cycles and theories of the state. In the second, the concept of accompanying investment, formalised by a model of Keynesian inspiration, is developed through the presentation of empirical results.

Introduction

Throughout the nineteenth century and until the 1936-39 Civil War, the Spanish education system displayed similar characteristics to those observed in study of the German and French education systems¹. Its development was closely controlled first by the church and then by the state, and directed by the all-powerful bourgeoisie replaced on the eve of World War II by the triumph of

* Address all communications to Claude Diebolt, LAMETA/CNRS-Université Montpellier I, Espace Richter, Avenue de la Mer, B.P. 9606, 34064 Montpellier Cedex 1, France, Tel.: 33 (0)4.67.15.83.20. (direct line) – Fax.: 33 (0)4.67.15.83.83. E-Mail: diebolt@sceco.univ-montpl.fr

Special thanks go to K. Caner, V. Carpentier and V. De Faria (Université Montpellier I) and J. Litago (Universidad Politecnica de Madrid) for their advice and encouragement. Another version of this paper was presented at the 10th World Congress of Comparative Education Societies, Cape Town, July 12-17, 1998.

¹ Cf. Carry, A., Diebolt, C., Fontvieille, L., Núñez, C. and Tortella, G. (1995) *Education et croissance économique: évolution de longue période et prospective*. Une analyse comparée des systèmes éducatifs allemand, espagnol et français. Stimulation Plan for Economic Science, European Union, 4 Vols., 1482 pages.

Francoism².

Under these conditions, how did the Spanish education system succeed after the constitution of 1812³ in emerging from inertia governed by the existence of compartmentalised subsystems with different functions and ideology? It would seem that the reply to this question lies in the diversity of shocks and challenges that the education system received from the outside. The first challenge came from the acceleration of development towards an increasingly technico-economic economy in which educational problems can no longer be expressed using terms borrowed from the past. A growing society indubitably leads to a strong social demand for education. As a correlation, education planners discover that effective teaching is one of the driving forces behind expansion. Economic growth is not the least of these because it determines the sustainability and future of capitalist society. With this in mind, it is easy to understand why, in the face of new conditions established for it, the educational system adopts a new philosophy, and organises in a more original and possibly more efficient way the time devoted to information, ordering, assimilation and assessment. The importance of the human factor in the economic development of nations is confirmed with reference to the specific needs born of the development of the industrial society.

Using this general context as a basis and following on from the work of C.E. Núñez⁴ and my research on public expenditure on education in France and Germany in the nineteenth and twentieth centuries⁵, a new reading of the way

² The law of 9 September 1857 dictated the structure of the Spanish educational system until 1945. There was then a succession of reforms. The 1970 general law on education set up the educational system still in force today, in spite of several modifications. It is nevertheless noted that „when the Law on the General Regulation of the Education System or LOGSE was passed in October 1990, a root and branch education reform process got underway in Spain. The effect of the change has been to completely reorganise all the levels a root and branch education reform process got underway in Spain. The effect of the change has been to completely reorganise all the levels and stages up to university, and also to include other types of learning aimed at completing one’s education such as vocational training, artistic education and languages. Education reform has constituted a commitment to Spanish society to achieve education of higher quality in every shape and form.” http://www.ince.mec.es/pres/que_f.htm

³ The constitutional law of 1812 set up the official body in charge of public education in Spain.

⁴ Cf. Núñez, C.E. (1991) *El gasto público en educación entre 1862 y 1935*.

Hacienda Pública Española, Monografías, 1, 121-146. See also Núñez, C.E. (1992) *La fuente de la riqueza. Educación y desarrollo económico en la España Contemporánea*. Alianza Editorial, Madrid.

⁵ Cf. Diebolt, C. (1999) *Towards a Theory of Systemic Regulation? The Case of France and Germany in the Nineteenth and Twentieth Centuries*. In *Discourse Formation in Comparative Education*, (edited by Schriewer, J. with the collaboration of M.J. Halverson). Peter Lang, Frankfurt am Main, forthcoming. See also Diebolt, C. and Fontvieille, L. (1998) *Dynamic Forces in Educational Development. A Long-Run Comparative View. The Case of France and Germany in the Nineteenth and Twentieth Centuries*. *Working Paper*, LAMETA/CNRS, 25 pages.

in which the movement of aggregate series of figures for state expenditure on education is related to economic growth from 1850 to 1965 is envisaged⁶.

I. The Theoretical Aspects

The aim in this paper is to historicise analysis and economic theory, that is to say to explain the dynamic evolution of a given socioeconomic system with regard to history.

1. Definition of education in an economic perspective

Education has come within the scope of analysis of economists since the end of World War II. It was never ignored completely but it became a subject for systematic study to which economists applied their analytical tools⁷. This being so, the term „education” is more convenient than precise. It is easy to find a series of partial, imperfect substitutes such as „teaching”, „instruction” or „training” without mentioning *savoir-vivre*. In addition, the term can be applied both to a process and the result of this process. Without going further into such considerations, for purposes of this paper, education is taken in the fairly broad sense of training mainly concerning children and adolescents but increasingly applied to adults. Its result is the acquisition of a set of intellectual or manual skills and the development of all moral qualities. Then, depending on the way in which this result is attained, a classic distinction is made in the manner of A. Page⁸ between two types of education: formal and informal education. Formal education refers to all deliberate training activity aimed at developing intellectual faculties and the acquiring general or specialised knowledge, including that leading to obtaining professional skill. The main instruments used are the school and the university. Informal education encompasses all the phenomena which, outside a deliberate specific training intention, influence attitudes, behaviour, ways of thinking and knowledge. This is education provided by the family or the occupational environment in contrast with direct education dispensed by an institution designed especially for the purpose.

These two aspects of the education phenomenon obviously have economic importance. They affect the quality of men and women who, as producers,

⁶ In this article, public expenditure means the expenditure concerning non-commercial activities of the state, mainly funded by taxation. The term „state” concerns all the constitutionally organised public authorities of a nation and the administrations of all levels that report to these.

⁷ Cf. Carnoy, M. ed. (1995) *International Encyclopedia of Economics of Education*. 2nd Edition, Pergamon Press, Oxford.

⁸ Cf. Page, A. (1971) *L'économie de l'éducation*. Presses Universitaires de France, Paris, p. 8.

consumers and citizens, form one of the basic factors of economic life. However, what criteria should be called upon to demarcate within the general education phenomenon the aspects that deserve to retain the attention of economists? A possible reply would be to say that an economist glimpses education mainly through the deliberate use of rare resources that may give an economically significant result, even if the result obtained is not the one expected or displays unsought indirect effects. In other words, the economic study of education is based on the notions of input and output. The criteria for the demarcation of the phenomena to which economic analysis might be applied are therefore the existence of inputs and a corresponding output. These should be identifiable and, if possible, measurable in relation to a deliberate, specific action of training of persons. Application of these criteria leads to ruling out informal education although its economic effects can be considerable.

One of the main aims of this paper is therefore to describe the macroeconomic meaning of education according to the manner in which the resources devoted to it are allocated. Thus, if education makes men and women more productive and if it can adapt labour to new requirements of technology, one can readily conceive that it can contribute to economic growth by giving value to the labour factor. Nevertheless, even if this hypothesis were to be confirmed in such a way that education is seen to play a positive role in the process of economic growth, the relation between education and the economy is still equivocal. In fact, it is „bi-univocal”, that is to say that education has a possible causal effect in economic growth but economic growth and the level of development also have an effect on the scale of the efforts devoted to education. This interrelation is examined here.

Indeed, I have shown in previous work⁹ that the labour force developed qualitatively both in France and Germany until about 1945 during the downward phases of Kondratieff cycles¹⁰ and that in contrast it tended to deteriorate during the phases of prosperity. This phenomenon was explained by the hypothesis that until the eve of World War II, the development of the economic system was based on an alternate quantitative development of material accumulation and employment and qualitative development of the labour force and capital through the process of technological innovation. In fact, this qualitative development of the labour force during the long depression phase

⁹ Cf. Diebolt, C. (1999) *Towards a Theory of Systemic Regulation?...*, op. cit., P. Lang, Frankfurt am Main, forthcoming.

¹⁰ The first „Kondratieff” occurred between 1793/1797 and 1847/1850. The upswing finished in 1817/1823. The second cycle started in about 1847/1850 and finished in 1894/1897. The downswing occurred in approximately 1869/1873. The dates of the third cycle were 1894/1897-1944/1947. World War I formed the point of inflection between the phase of prosperity and that of economic difficulties. The fourth „Kondratieff” started approximately at the end of World War II in 1944/1947, The upswing finished in about 1968/1973 when all capitalist economies entered a new phase of structural slump.

would appear to account for the strong growth of expenditure an education. By setting up new conditions making it possible to take into account the necessary development of men and women (education¹¹, wages¹², pensions¹³, etc.), the structural transformation appears to confer renewed effectiveness to the productive forces, thus paving the way for a new accumulation cycle.

After 1945, in both France and Germany, the strong increase in expenditure an education during the phase of prosperity from 1945 to 1973 and that of slowed growth after 1973 leads to supposing that human development is tending to become dissociated from the economy and becoming one of the driving forces of growth, and possibly the driving force. Consequently, the changes that took place at the turning-point formed by World War II would be such that the initial hypotheses no longer show the evolution of the system. Insofar as they define the mode of regulation of the socioeconomic system, the regulation mode itself may have changed from one period to another¹⁴.

Study of the evolution of expenditure by Spain an education during a long period in the nineteenth and twentieth centuries should make it possible to extend these investigations. Indeed, it is difficult to conceive the theoretical analysis of the growth and transformations of education in Europe without an in-depth study of all the component education systems.

2. Economic cycles and state expenditure an education

The dynamic relations between public expenditure an education and economic growth in Spain is developed in a theoretical framework incorporating two major concepts: economic cycles and theories of the state.

2.1. Economic cycles

Economic progress takes place essentially through fluctuations in socio-economic activity, through forces and tension followed by breaks of different amplitudes and intensities, all backing against each other. Secular trends

¹¹ Cf. Diebolt, C. and Litago, J. (1997) Education and Economic Growth in Germany before the Second World War. An Econometric Analysis of Dynamic Relations. *Historical Social Research. An International Journal for the Application of Formal Methods to History*, 22(2), 132-149.

¹² Cf. De Faria, V. and Diebolt, C. (1998) Histoire quantitative et cycles économiques. Enquête sur les salaires de la fonction publique en France aux 19ème et 20ème siècles. *Association de Comptabilité Nationale*, 7ème Colloque, Paris, 28-30 January. 21 pages.

¹³ Cf. Diebolt, C. and Reimat, A. (1997) Old Age Policies in France and Germany from the Last Decades of the Nineteenth Century to the First World War. A Quantitative Re-Definition. *Historical Social Research. An International Journal for the Application of Formal Methods to History*, 22(3/4), 181-197.

¹⁴ Cf. Diebolt, C. and Fontvieille, L. (1998) Dynamic Forces in Educational Development..., op. cit., 25 pages.

synthesise the fundamental movement of socioeconomic structures and are overlaid by other fluctuations: long movements of the Kondratieff type¹⁵, Kuznets cycles¹⁶, Juglar cycles¹⁷ etc.

Economic history shows us the relativism of these movements. They are not necessarily found either in all economic systems or in all countries. Some are characteristic of a period and others of an economy. In fact, each movement draws part of its form and features from the more fundamental movement underlying it. Thus, the nature of the fluctuations depends on the socioeconomic system that engenders them, while their causes may vary during the course of history according to the economic structure of the country¹⁸.

The hypothesis put forward in this paper is that the theory of cycles is the study of the behaviour of socioeconomic variables in time using the observation of time series. Cycles are understood as alternating movements characterised by their regularity and amplitude. The various phases of the cycle of public expenditure an education are then characterised theoretically from the first derivative (direction) and the second derivative (acceleration). $F(t)$ is the volume of public expenditure an education (cf. Diagram 1).

From A to C, $F(t)$ increases ($F'(t) > 0$);

From C to E, $F(t)$ decreases ($F'(t) < 0$).

This enables us to determine an expansion phase (AC) and a contraction or falling phases (CE).

However, from A to B, $F''(t) > 0$ with $F(t)$ increasing explosively; however, from B to C, $F''(t) < 0$ with $F(t)$ increasing in a more moderate manner. Likewise, $F(t)$ decreases rapidly from C to D and slowly from D to E. Finally, strong growth is observed from E to F, like that from A to B. Four phases can be seen. Expansion and contraction split into two periods an either side of the inflection point (B and D):

- I (AB): accelerated expansion;
- II (BC): slow expansion;
- III (CD): contraction;
- IV (DE): recession.

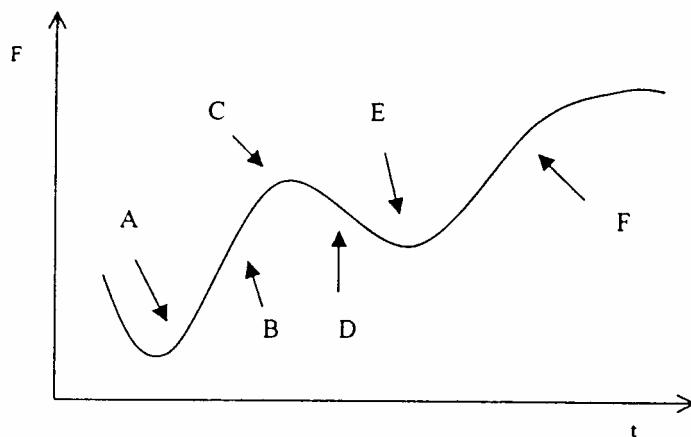
¹⁵ Cf. Kondratieff, N.D. (1992) *Les grands cycles de la conjoncture*. Economica, Paris.

¹⁶ Cf. Kuznets, S. (1930) *Secular Movements in Production and Prices. Their Nature and their Bearing upon Cyclical Fluctuations*. Houghton Mifflin Co., Boston.

¹⁷ Cf. Juglar, C. (1889) *Des crises commerciales et de leur retour périodique en France, en Angleterre et aux Etats-Unis*. Guillaumin et Cie, Paris.

¹⁸ Freeman, C. ed. (1996) *Long Wave Theory*. E. Elgar, Cheltenham

Diagram 1



However, the cycle described is often only the result of a threshold effect with growth in stages formed by an alternation of high and low plateaux.

2.2. *The role of the state in education*

In most parts of the world, the state plays a central role in education. At least two procedures are used. It first operates by funding. The state then puts to use itself the greater part of the funds devoted to education. Talking in terms of state intervention in education is therefore inadequate. The state does not just manage the production of knowledge but is behind the procedure. The state is subjected to constraints and incitations. Investigation must therefore begin by a search for the economic principles that underlie the state's operations. To what type of actions is it led, what interests does it serve and how do these actions fit in an economy that is to a considerable extent subjected to market rules? Answering this question requires the exclusion from the study of numerous educational policy procedures and above all the instruments related to institutional analysis. In short, I am trying to find the economic keys to the understanding of a host of state initiatives that are sometimes difficult to decipher or are even incoherent. For this, I make a distinction between non-commercial public sector economic activities according to their nature. The classification set out in 1959 by R.A. Musgrave¹⁹ is very enlightening. He made a general distinction between three activities:

¹⁹ Cf. Musgrave, R.A. (1959) *Theory of Public Finance*. McGraw Hill. New York.

- the allocation of resources for the production of public goods. Here, the state is considered as a producer of public goods. Optimum management of this activity raises mainly questions of efficiency;
- the redistribution of income. This is obviously based on considerations of equity. They often conflict with the objectives of efficiency;
- regulation of the economic conjuncture. This consists of state intervention in economic growth: reversal of conjunctural movements affecting employment, price levels, balance of payments, etc.

I add a fourth component here: the legislative activity that lays down the rules of law defining the institutional framework and norms of socioeconomic life. These activities should be considered jointly because of their close interdependence. In conformity with the hypotheses formed by the World War II turning-point, I shall now analyse the movement of state expenditure on education from 1850 to 1965.

II. Empirical Results

The statistical series available are used in this analysis for close examination of the long period of state expenditure on education in Spain.

1. Statistical links

Analysis of the development of education and its relation to economic growth requires first of all the production of a set of co-ordinated, homogenous and comparable data.

1.1. The choice of indicators

With regard to this research on the relations between education and economics in Spain, it is clear that there is a gap between what one wishes and what is possible. Although it is not too difficult to list the most satisfactory indicators for the work and then to hope that progress in the gathering of statistical data will one day make our dreams come true, a choice must first be made from among the indicators available.

The first requirement is that of representativeness because the educational and economic phenomena with which I attempt to characterise a certain stage or level of national socioeconomic development should be apprehended by means of synthetic indicators. This is necessary as indicators will always be weaker than the complex reality of education or the economy. Coherence is then necessary so that the indicators can be set side by side. From this point of

view, the first step is to make a distinction between stock (static) indicators and flux (dynamic) indicators. The former express the situation at a given moment whereas the latter illustrate the variation of a phenomenon during a specific interval of time. There is finally a comparability requirement because the procedures for the collection of information and the establishment of statistics vary in time and space. In addition, evaluation of monetary data always raises the difficult problem of the exchange rate or the depreciation rate for calculations using constant prices.

As an example, it is reminded here that within the framework of my work on the study of the movements in public expenditure on education in France and Germany over long periods in the nineteenth and twentieth centuries, I have always been faced with the problems of the choice of deflator for the analysis of series of data and the procedure to be used for converting standards to compare the series of figures in different countries. From World War I onwards, the series in francs or current marks obviously gives an extremely deformed image of the real growth of public expenditure on education. They thus had to be price-weighted for an approach to the volume of expenditure. However, price-weighting raises numerous problems over the long period examined. The most important is theoretical as when prices are weighted one necessarily introduces a fluctuation that is inverse to that of prices. The choice of price index therefore raises a major difficulty: should one choose an index closely linked to education activity or, in contrast, prefer as broad an index as possible to reflect purchasing power in francs or marks?

Neither of these solutions is satisfactory in itself. Indeed, a different thing is sought in each case. In the first case, it is the volume of the service rendered by education. In the second case it is the extent of the expenditure borne by the community. Thus, weighting with wholesale prices would give a volume tending to represent investments and purchases of equipment whereas weighting with consumer prices would be more representative of the movement of the wages volume.

The series of public expenditures on education are generally drawn up in current prices. Nevertheless, besides this representation in nominal value, since the level of expenditure is the joint result of a modification of prices and quantities representation in terms of real value must be established. However, it is difficult to make additions of heterogeneous quantities of goods and services. In fact, performing such an operation assumes the multiplication of the goods and services available in the reference year by the prices of another year referred to as the base year. This being so, calculation of quantities becomes a calculation of volumes. In real terms, such an operation requires the distribution of values in quantity and price. At first sight, calculation of the quantities of goods is a minor difficulty. Nevertheless, this operation is much more complex than it appears.

This can be illustrated by an example, that of the use of a tube of toothpaste. I start with the hypothesis that one can clean one's teeth 50 times with a 50-gram tube of toothpaste. However, what happens when the chemical composition of the toothpaste is changed in such a way that with less weight - say 25 grams - and for the same price it is still possible to clean one's teeth fifty times? The answer is quite simple. It appears that in the choice of unit of value - the weight in this case - a price increase of 100% has no effect on the number of times one can clean one's teeth. This small illustration shows the difficulties in calculating the quantities of goods. However, it is even more difficult to calculate the quantities of services - educational services for example.

Another important problem is that of our definition of the notion of price. From a theoretical point of view, we obviously assume that the price of goods or services is observed on a market. In this respect, the price is defined as the number of monetary units required to obtain certain goods or a service at a given moment at a given place and for a specific, precise quality. Once the definition is given, it seems that the problems that it raises emerge immediately. It should be remembered that a priori there are no market prices for public services, which are substantially dominant in educational matters. Besides these difficulties, it is also useful to remember that the success or failure of a constant price calculation depends essentially on the quality of the price and quantity indexes available. But how should one report variations in price and quantity? The ideal solution from both a general point of view and with regard to education and especially public expenditure an education would seem to be the Laspeyres index and the Paasche index bearing in mind chain indexes and measurements of the quality effect.

1.2. The series available

Our investigation concerning education is centred on the interpretation of aggregate statistical series recording the rums used for the administration of teaching, for primary, secondary, vocational and higher education and for disabled or retarded pupils. The annual data are from public finance yearbooks published by the Ministry of the Economy²⁰.

The grouped series drawn up by the Ministry of the Economy were also used for total public expenditure²¹. The 1948 peak is related to the rocketing of the public debt. The price data used is the series of national income price

²⁰ Cf. Ministerio de Hacienda ed. (1976) *Datos basicos para la historia financiera de España* Vol. 1, Fábrica Nacional de Moneda y Timbre, Madrid. pp. 1090-1104.

²¹ Cf. Ministerio de Hacienda ed. (1976) *Datos basicos para la historia financiera de España*, op. cit., pp-1090-1104.

indices (1958=100) drawn up by L. Prados²². The figures used for the population and production, that is to say the national income at the costs of the factors, were the series estimated by L. Prados until 1913²³. These were followed from 1914 onwards by those drawn up by the Ministry of the economy²⁴.

2. The trends observed

It was sought in this research to understand why the long period of state expenditure on education in Spain displays alternate phases of rapid development and slowed development or even stoppage. The question of to what extent education contributes to economic growth is also addressed.

2.1. *The profile of change*

In-depth analysis of the movement over a long period of aggregate series²⁵ of state expenditure on education leads to a major observation, that of growth in stages with strong increase during phases of economic difficulties (Figure 1).

As for France and Germany before World War II, examination of the volume of expenditure by the Spanish state on educational administration leads to concluding that there was a reverse movement in relation to the long movements of prices and production discovered by N.D. Kondratieff (Figure 2), This being so, after 1945, unlike France and Germany which displayed a strong increase in expenditure on education (closely related to the phase of economic expansion). Spain has seemed to follow a counter-cyclical movement.

2.1.1. *Threshold effects*

The profile of the structural evolution of expenditure on education by the Spanish state clearly displays threshold effects. In fact, there are periodically high growth rates followed by periods of low growth rates. This definition corresponds to growth in stages with alternate high and low plateaux.

This ratchet effect was shown for the first time by S. Kendrick and M. Wehle in their study of US federal expenditure. However, they did not provide

²² Cf. Prados de la Escosura, L. (1993) Spain's Gross Domestic Product. 1850-1990: A New Series. *Working Paper*, D-93002, Universidad Carlos III de Madrid. March.

²³ Cf. Prados de la Escosura, L. (1993) Spain's Gross Domestic Product. 1850-1990: A New Series. *Working Paper*, op. cit., March.

²⁴ Cf. Ministerio de Hacienda ed. (1976) *Datos basicos para la historia financiera de España*. op. cit., pp. 1134-1139.

²⁵ The work in this paper is centred on an aggregate series of Spanish state expenditure on education. Indeed, as for expenditure on educational administration, non-aggregate study by level of education confirms the results of analysis of the overall series.

a theoretical explanation of this type of growth and merely sought the causes in an empirical manner²⁶. In their 1961 study, A.T. Peacock and J. Wiseman²⁷ in the UK identified the Same type of development in successive stages and referred to it as the „displacement effect“. The scale of the resources that the fiscal system may produce (but without causing reactions of discontent) determines the volume of public expenditure. These authors considered that the „displacement effect“ was the direct result of the war²⁸.

This seems to be a very interesting approach. Wars are special moments in the metamorphosis of economic structures. They are stages during which the economic sphere must change under the weight of political issues. However, wars deform part of reality by preventing appreciation of the overall scope of the phenomenon. This being so, they are not just markers indicating changes in history. They exist as economic facts that are of considerable importance.

In short, whether they are considered as erratic or determined by the economic conditions of the time, their effects cause economic difficulties or complete their occurrence. However, wars do not cause socioeconomic movements. They are a link in the chain of analysis that must account for cyclical movements and threshold effects by other factors. For this, I shall make a distinction between two stages:

- presentation of the main phases of the economic history of Spain in order to appreciate the various economic, political and social factors that may affect the movement of the statistic series studied;
- the combined application of the dating procedure developed in the first part of this article and of the First differences and that of ordinary least squares to compare the results for Spain and our theoretical model (developed using data an France and Germany) And to thus determine relatively reliable periodisation.

„From this point of view, even if empirical regularities are not really laws. they are not always pure chimeras. On the contrary, they have an heuristic value and are at a high level of scientificity.²⁹

²⁶ Cf. Kendrick, S. assisted by M. Wehle (1953) *A Century and a Half of Federal Expenditures*. N.B.E.R.. Princeton.

²⁷ Cf. Peacock, A.T. and Wiseman, J, assisted by J, Veverka (1961) *The Growth of Public Expenditure in the Umted Kingdom*. N.B.E.R.. Princeton.

²⁸ As for S. von Ciriacy-Wantrup, the most serious changes seem to he those caused by wars and revolutions through the economic, institutional, legal and population changes that they inevitably cause. Cf. Ciriacy-Wantrup, S. von (1936) *Agrarkrisen und Stockungsspannen. Zur Frage der langen „Welle“ in der wirtschaftlichen Entwicklung*. P. Parey, Berlin. More recently, J.S. Goldstein established a link between the changes in trend of long movements and the periodic outbreak of wars. Cf. Goldstein, J.S. (1988) *Long Cycles. Prosperity and War in the Modern Age*. Yale University Press, New Haven.

²⁹ Diebolt, C. (1994) *L'évolution de longue période du système éducatif allemand*. Vol.I: Education, croissance et cycles longs. Vol. 2: L'histoire quantitative de l'éducation. Thèse de Doctorat en Sciences Economiques, Université Montpellier I. February, pp. 10-11.

Figure 1
The volume of state expenditure on education
Spain, 1850-1965

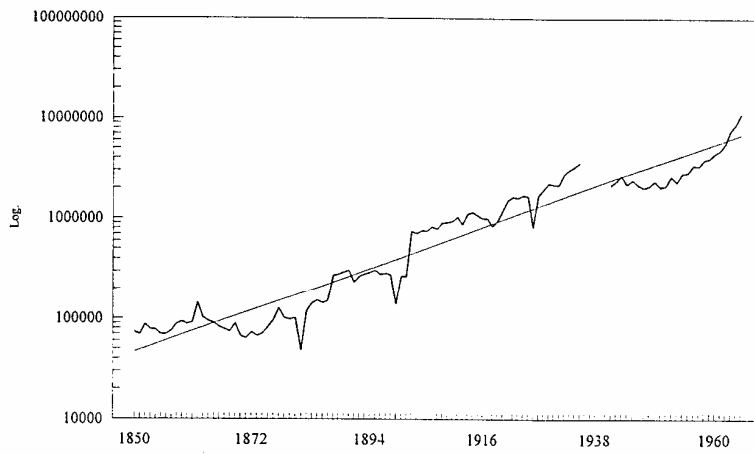
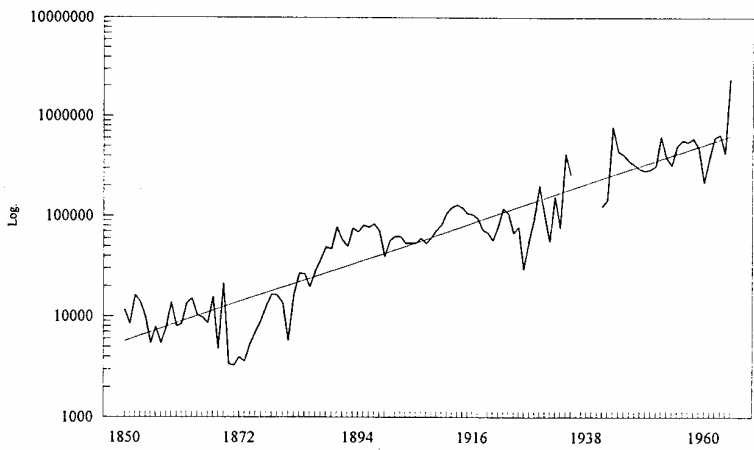


Figure 2
The volume of state expenditure
on educational administration
Spain, 1850-1965



2.1.2. Historical markers: the lag theory

Low Population density was a major factor in Spain's socioeconomic backwardness at the beginning of the nineteenth century. Another factor concerns the putting into order of public finances and the currency. Thus, state expenditure was in a catastrophic situation from 1801 to 1814. The political and administrative situation hardly changed from 1814 to 1840. Frozen in the total refusal of innovations, it was characterised by a transition from ineffective authoritarianism to the paralysis of civil war (the Carlist war). The Situation became even more complex with an agrarian crisis that did not finish until the 1830s³⁰.

In a more general manner, early nineteenth century Spain faced impossible industrialisation. There were enterprises but no industry. In other words, „*in Spain there was neither a Rostow style Take Off nor a Gerschenkron style Big Spurt.*”³¹ In fact, no real break occurred until the 1950s. Spain adopted regular, published budgets from the middle of the nineteenth century. They formed the basis of public accounts on the one hand and that of political and economic stability on the other. However, in comparison with Great Britain, France and Germany, the country remained in a situation of economic isolation. Nevertheless, from 1849 until 1931, „the Spanish economy underwent profound changes while at the same time, at least until 1923 and setting aside Coups d'Etat and constitutional ups and downs, a parliamentary system with progressive respect for public liberties emerged.”³²

Indeed, from the 1850s, Spain benefited from a combination of these factors that favoured its socioeconomic development. These were the international conjuncture and its expansionist trend, foreign investment and political stability. This being so, the 1865-1866 slump marked the end of this burst of prosperity. The bankruptcy of the railways shook the financial system and Spain experienced its first capitalist crisis, which reached a peak with the 1870-1871 Franco-Prussian war. The subsequent economic depression in 1873 was only overcome in 1878. However, another international slump occurred in 1881 and prolonged the economic stagnation. This lasted until the end of the century. Nevertheless, the phase of economic difficulties from 1873-1896 accelerated changes in production and trade structures. For example, the fall in the prices of capital goods combined with better productivity is a favourable factor for economic growth. Indeed, on an international basis, the development of the steel industry, chemistry and electricity enhanced the exploitation of the ores

³⁰ Cf. Tortella, G. (1994) *El desarrollo de la España contemporánea. Historia económica de los siglos XIX y XX*. Ahanza Editorial, Madrid.

³¹ Cf. Albert Carreras, in Broder, A. (1998) *Histoire économique de l'Espagne contemporaine*. Economica, Paris, p. 36.

³² Cf. Broder, A. (1998) *Histoire économique de l'Espagne contemporaine*. Economica. Paris, p. 58.

available and also accompanied profound social changes (the growth of urbanisation, the concentration of workers, etc.).

However, Figures 3 and 4 below Show the comparative neglect of the Spanish state with regard to the development of schooling. Apart from debt servicing, the army and everyday administrative expenditure accounted for most of the public funds available and hence a substantial share of national wealth. Nevertheless, at the beginning of the twentieth century, the increase in expenditure on public education gave a glimpse of the progressive incorporation of the Spanish economy in a strongly growing Western Europe. But in 1914, far from reinforcing the economy, the war increased the imbalances (increased prices, social tension, etc.). In Spain, the growth trends in both the economy and education that emerged at the end of the nineteenth century continued in the 1920s and the early 1930s.

The 1936 crisis caused a clear economic and social break. The civil war resulted in an unprecedented regression of Spanish society. As a result, the post-1945 period was one of uncertainty. The first half of post-war prosperity in western Europe coincided with one of the most difficult periods in contemporary Spain. This Situation can be Seen in particular in the education System which, in terms of allocation of public resources, did not display the strong growth rates observed in particular in France and Germany. In a more general manner, it were as if in Spain the development of education and more particularly mass education starting after 1945 were out of phase by two decades in comparison with countries in the centre of Europe such as France and Germany. From the end of the 1960, and the beginning of the 1970s, the status, of Spain changed gradually from that of an economically retarded nation to a developed country. I am convinced that education, training and the development of men and women in general have played a major role since the 1970s in this evolution process towards economic growth and political stability.

2. 1. 3. Empirical regularities

The continuous search for greater realism in statistical formalisation often requires the improvement or even the questioning of traditional methods and the use of specially adapted techniques. Thus, in recent decades, there has been considerable, varied development of econometric methods applied to macroeconomic data and especially methods for the processing of non-stationary chronological series.

Indeed, econometric series were for a long time based on the central hypothesis of the stationarity processes underlying macroeconomic data. However, changes in the mean and covariance of socioeconomic series are often observed and the stationarity hypothesis cannot be retained. In addition, traditional econometric processes seem to have special properties when they

are applied to non-stationary series. In fact, non-stationarity causes loss of information because of the absorption by the time factor of a sometimes substantial part of the variance of the time-series. Some joint movements result from the weight of the time variable; regression between these variable, is then called as distorted regressions.

This being so, the mistrust of econometricians with regard to non-stationarity has led until recently to the use of transformations to recover the stationarity hypothesis. Two methods have been recommended for this *a priori*: the extraction of a determinist trend by regression (I) and transformation by differences of order (II). In fact, under the influence of G. Box and G. Jenkins³³, stationarisation by differences of order in the time-series is favoured. However, non-stationarity is not only determinist but is also stochastic. Here, the work of C. Nelson and C. Plosser has proved the interest and pertinence of the hypothesis³⁴. The non-stationarity consideration nevertheless raises two points. From the methodological point of view, is it preferable to work cm the variables in differences that are then stationary or to favour variables in level because of the loss of information caused in de long term by differentiation? Then, from de theoretical point of view, how can one account for the fact that individually non-stationary series appear to move together in time?

Using cointegration makes it possible to answer those questions. Certain series will be said to be cointegrated if, whereas they are individually non-stationary and of the same order of integration, there is a stationary linear combination of these variables. Classic econometric estimation and testing procedures developed on the assumption of stationarity cannot be applied to cointegrated series and new procedures have been developed. The most important are those of R. Engle and C. Granger³⁵. It has been found more recently that an even broader procedure can he observed. This is called multicointegration or trivariate cointegration as it consists of two cointegration relations between three variables taken two at a time³⁶. This being so, like most recent theories, multicointegration is difficult to apply. On the one hand it only applies to series with the same order of integration and without a determinist component and on the other it is only used in so-called „linear“ models. In short, multicointegration is an area of research h that is still being developed and will be used in future research insofar an this will enable finer and deeper analysis of the dynamic aspects of socioeconomic phenomena.

³³ Cf. Box, G. and Jenkins. G, (1970) *Time Series Analysis. Forecasting and Control*. Holden Day, London.

³⁴ Cf. Nelson, C. and Plosser C. (1982) Trend and Random Walks in Macroeconomic Time Series. *Journal of Monetary Economics*, 10(1), 139-162.

³⁵ Cf. Engle, R. and Granger, C. (1991) *Long-Run Economic Relationships. Readings in Cointegration*. Oxford University Press, Oxford.

³⁶ Cf. Hamilton, J. (1994) *Time Series Analysis*. Princeton University Press, New Jersey.

Figure 3
The ratio of State expenditure
on education to total public expenditure
Spain, 1850-1965

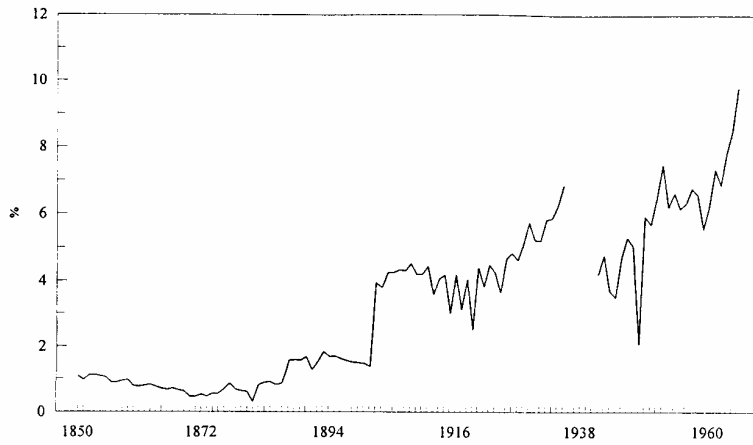
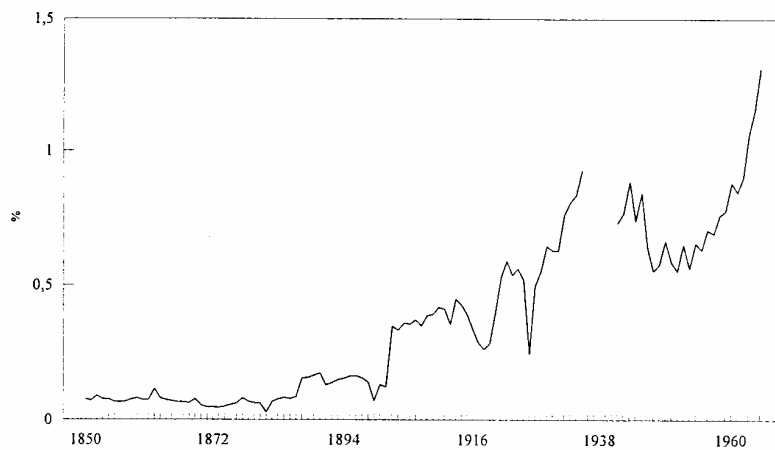


Figure 4
The ratio of State expenditure
on education to national income
Spain, 1850-1965



In the context of this article and in order to detect empirical regularities in the movement of expenditure by the Spanish state on education over a long period, transformation by differences of order is applied first. In other words,

the time-series are rendered stationary by the first differences method. The series thus obtained will enable us to see whether the increased effort devoted to education precedes an acceleration of economic growth, whether it follows the latter or whether the two phenomena are simultaneous. A double hypothesis is proposed for this. On the one hand, public expenditure on education is considered as a major indicator for characterisation of the growth of the educational system in Spain. On the other, the national income is assumed to be representative of economic wealth.

More formally, a process (Z_t) is stationary if:

$$E(Z_t) = m \text{ and } \text{Cov}(Z_t, Z_{t-k}) = F(k) \text{ whatever the value of } t.$$

Most of the chronological series actually encountered obviously do not display the characteristics of a stationary process. Any strictly increasing series can be examined to observe this. An important stage in analysis is therefore the stationarising of the series, that is to say the application of the transformations and operators that render it stationary. The means most frequently used in social science to achieve stationarity are logarithmic transformation (to eliminate heteroscedasticity) and first differentiation (to eliminate the trend). As an extension of this, the operator defined for all processes, (Z_t) by $B(Z_t) = (Z_{t-1})$, is referred to as the lag operator of order 1, noted B. Iteration k of B is noted B^k and defined by $B^k(Z_t) = (Z_{t-k})$. The operator defined for any process (Z_t) by $\nabla(Z_t) = (1-B)(Z_t) = Z_t - Z_{t-1}$ is called the differentiation operator ∇ . The operator defined for any process (Z_t) by $\nabla^d Z_t = (1-B)^d Z_t$ is called the differentiation operator ∇^d .

This being defined, the increase in expenditure on education and that of the national income of Spain are shown in Figures 5 and 6 after calculation of the first differences. The deviations from the regression line using the least squares method are also calculated for the subsequent part of the argument (Figure 7). Finally, I attempt to establish periodisation.

Although we consider that accurate setting of the years of inflection of Spanish state expenditure on education is impossible and that the results of our dating procedures leave a margin of error in the determination of the years of changes of movement, the following dates can be taken as the most probable.

Cycle	Expansion	Contraction
I		1850-1872
II	1872-1894	1874-1918
III	1918-1936	1936-1960

Nevertheless, even if the aggregate series of state expenditure on education displays a certain regularity, this in no way means that this is true for all the

series. Subsequent studies devoted to the internal dynamics of expenditure on education will thus be performed to shed light on this point. However, it is not necessary for the long fluctuations observed in the aggregate series to match all the time-series to be able to say that they exist.

Figure 5
State expenditure on education
(first differences in current Pesetas)
Spain, 1850-1965

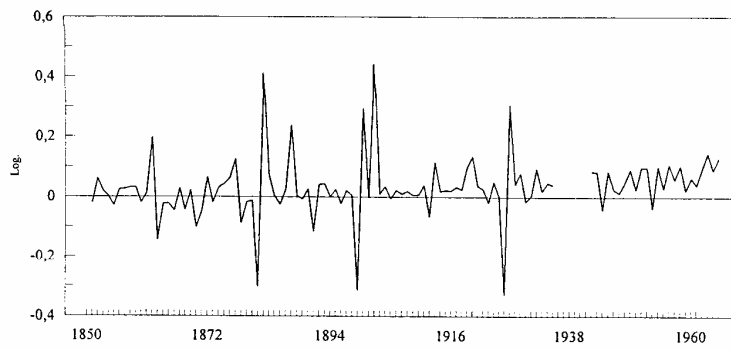
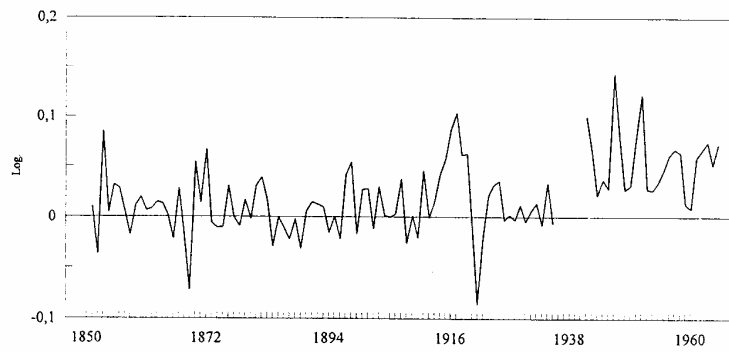
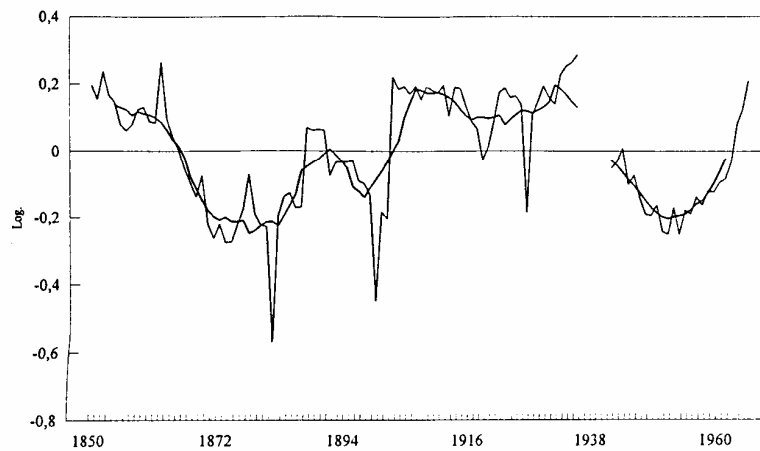


Figure 6
National income
(first differences in current Pesetas)
Spain, 1850-1965



Indeed, „[...] logic does not impose the rejection of theoretical hypotheses in case of conflict with observation. Science abounds with examples of rejections of observations and of cases of the maintaining of the theories that they contradict. Conversely, in case of verification, it cannot completely destroy the doubt associated with the initial hypotheses. The law, will only be considered as highly probable.”³⁷

Figure 7
Deviation from the logarithmic regression line
and 9-year moving averages of state
expenditure on education, R = 0.9319
Spain, 1850-1965



2.2. The sources of change

I shall now seek to explain the causal relation between education and the economy in Spain in the nineteenth and twentieth centuries. For this, education is considered as an investment. However, the allocation of resources to education as an investment raises the major problem of knowing the nature of this investment. Indeed, education can be considered either as a directly productive investment or as an investment in infrastructure.

³⁷ Diebolt, C. (1996) Repères épistémologiques sur la connaissance en économie de l'éducation. *SAVOIR Education Formation*. 8(1), p. 16.

2.2.1. An accompanying investment

In the first case, education incorporates in a person a kind of capital that increases the effectiveness of his/her work. Nevertheless, the possibility of investment induced by such an investment remains conditional. Indeed, we should not forget that material investment is considered as a driving force behind economic growth because it is performed with a view to production that should find outlets. In other words, production means are created with a reasonable prospect of their being used. As a result, it is not certain that an analogous forecasting calculation is performed for education. Indeed, is there a requirement for the economic use of the *products* of the education system, that is to say the adaptation of education to the absorption capacity of the economy?

In the second case, education is considered as an investment in infrastructure. This changes the perspective elaborated in the first case. Education appears more as a condition for development and no longer a driving force behind growth. Here we stress the complementary nature of education in relation to the labour factor, which is in turn complementary with regard to capital. Education then becomes a condition for the effectiveness of material means. The Problem of the economy's capacity for the absorption of the products of the educational system can now be approached using two notions

The first notion sees the investment in infrastructure as a driving force behind investment. With regard to material investments, it leads to seeking a logical definition of the infrastructure corresponding to a given growth level (desired and attainable). I consider that this infrastructure encourages the adoption of a policy of technical operations that gives rise to new production activities and has a stimulating effect. Transposed to education, this analysis leads to recommending a certain education structure (levels and types of studies) corresponding to a certain professional structure suited to the level of economic growth desired. In these terms, the supply of trained persons produced by the educational system may have a stimulating effect insofar as the availability of qualified persons can encourage certain activities and form an incitement to use certain techniques. Nevertheless, such a stimulating effect is by definition delayed, random and partial. It includes the risk of not using qualified persons or using them badly. The investment in infrastructure thus becomes an investment not followed by production, that is to say economic waste.

The second notion considers investment in infrastructure as a simple accompanying investment. With regard to material investments, it leads to defining the infrastructure required by the prospects of economic growth related to directly productive investments. Unless there are differences in time lags inherent to the various investment operations, we can say that investment in infrastructure follows investment in production instead of preceding it. In other words, the former is modulated according to the latter.

Application of this reasoning to education means that the flow of the education system is adapted to forecastable future demand for labour with various levels and types of qualifications.

Finally, there must be economic use of the *products* of the educational system whether education is considered as a productive investment or as an investment in infrastructure. In the latter case, the results of my analysis of the dynamic relations between public expenditure on education and economic cycles in Spain in the nineteenth and twentieth centuries lead me to considering that the investment is more in the accompanying category than a „driving force” investment.

2.2.2. A Keynesian style model

To formalise my hypothesis of education as an accompanying investment, I start with the assumption that public expenditure on education and economic growth are interdependent. The latter is formalised by a matrix equation:

$$X = AX + Y$$

which can be written as follows after inversion:

$$X = (1-A)^{-1} \times Y$$

This equation shows how the vector of education X is a function of the vector of economic growth Y:

$$\begin{matrix} f(A) \\ Y \rightarrow X \end{matrix}$$

The transition operation $f(A)$ is called the matrix multiplier:

$$f(A) \equiv (1-A)^{-1}$$

This multiplier shows the static equilibrium of education and of economic growth. Time must be introduced and the functioning of the multiplier observed in order to make it dynamic. The situation is as follows at time t:

$$X_t = f(A_t) \times Y_t$$

During the following period (t + dt), the variation of the vector X is obtained by differentiation:

$$dX/dt = f(A) \times dY/dt + Y \times (df/dA) \times (dA/dt)$$

Writing:

$$dX/dt = (dX/dt)_1 + (dX/dt)_2$$

isolates two fundamental mechanisms. The first term:

$$(dX/dt)_1 = f(A) \times dY/dt$$

shows the influence of the variations in economic growth on public expenditure on education, assuming a stable production system (the technical matrix A is fixed). It is therefore a stimulation effect for a short period of time, that is to say the functioning effect.

The second term can be written:

$$\begin{aligned}(dX/dt)_2 &= Y \times (df/dA) \times (dA/dt) \\ &= -Y \times (I-A)^{-2} \times (dA/dt) \\ &= K_t \times (dA/dt)\end{aligned}$$

Factor K_t has a value at a given time t independent of the variations in time of the variables $X(t)$, $Y(t)$ and $A(t)$. Thus, even if economic growth remains stable, the structural changes in matrix A are capable alone of causing a variation in public expenditure on education X . The second term thus illustrates a substitution effect. It is a corrective term that can disturb the functioning of the simple theoretical model. In this model of functioning, we therefore assume that the production system and matrix A are stable. The matrix formulation is therefore:

$$dX/dt = dX/dt_1 = f(A) \times dY/dt$$

It can thus be seen that there are at least two different multiplication mechanisms according to the nature of the variations in economic growth $Y(t)$.

There may be a simple increase in volume. Only the module of vector Y is involved, with a value changing from $|Y_0|$ to $k \times |Y_0|$, in which k is a positive scalar. As function $f(A)$ is linear, there is a homothetic development of public expenditure on education X , which changes from X_0 to $k \times X_0$. The initial cause (a variation in economic growth) has been passed through all the technical links of the production structure with no distortion.

At this point, it should be noted that an effect of a different nature may accompany the first. An increase dY in economic growth Y is essentially caused by the increase in national income over a long period, expressed as dR . As has just been seen, the increase in dY causes a homothetic increase in public expenditure on education. This increase leads to extra national income. A

closed circuit is thus set up thanks to this return effect that I shall call the multiplying effect.

The pattern is as follows:

$$dR_0 \rightarrow dY_0 \rightarrow dR_1 \rightarrow dY_1 \rightarrow \dots \rightarrow dY_t \rightarrow dR_t$$

As the marginal income distributed is $dR_n = k \times dY_{n-1}$, marginal economic growth is $dY = c \times dR_n$. The circle is complete: $dY_n = c \times k \times dY_{n-1}$, whence:

$$dY_t = [1 + (c \times k) + (c \times k)^2 + \dots] \times dY_0 = 1/1 - c \times k \times dY_0$$

The classic formula for a multiplier can be seen here. However, the fluctuation of the vector Y may be of another kind. A political decision may change the structure of vector Y and bring the matrix operator into play:

$$(dX/dt)_1 = f(A) \times (dY/dt)$$

Changes then occur that may influence the movement of public expenditure or education. In short, in the light of the theoretical developments that have been discussed, I put forward the hypothesis that in Spain between 1850 and 1965, the stimulating effect of economic growth on public expenditure on education is the driving force behind economic development.

Conclusion

Statistical analysis of movements in state expenditure on education in Spain in the nineteenth and twentieth centuries reveals a particularly complex conjuncture. Short, medium and long periods of renewed activity and recessions similar to those observed in France and Germany can be observed but the pattern is different.

Study of the case of Spain thus makes it possible to broaden the scope of the hypotheses drawn up using only the analysis of expenditure on education in France and Germany. It is recalled briefly here that the analysis of the educational systems in the two latter countries led to put forward the hypothesis of a periodic structural transformation of education hinged on that of the economic system.

Throughout the nineteenth century and then until World War II, this change took place mainly during the long depressed phases of the economy (1820-1850, 1873-1896 and 1920-1945). In the light of this, I assumed that the changes and development of the educational and training system contributed to improve the quality of the labour force, just as technical innovation contributes

to improving the quality of production facilities. However, there seems to have been a fundamental change in the relation of education to the economy after World War II. Indeed, the educational system developed very rapidly from 1945 to approximately 1973. The change in trend in 1945 is particularly clear in the case of France and Germany. I explained this phenomenon by putting forward the hypothesis that in the most advanced countries education no longer operates as an exogenous component that helps to correct imbalances in the economic system but has become an integral part of the economy, possibly forming one of the main driving forces of growth. In fact, action is at two levels. It first increases the production capacity of the economic system and is also a consumer good corresponding to strongly growing demand related to life style (increased leisure time and the availability of culture and leisure). The phase of economic prosperity from 1945 to 1973 should therefore be studied as a period of extensive development of the educational and training system and especially secondary and higher education.

As a corollary, the current depression phase should be considered as a period of intensive development and of a search for effectiveness characterised by a qualitative improvement of training and the search for new forms that are likely to increase the efficiency of the relation between education and the economy. By instituting training on a lifelong basis, the development of continuing training³⁸ contribute to this change by simultaneously developing the side of education and training that is not directly productive. This being so, cyclical movements and more particularly the trend reversal of 1945 observed initially for France and Germany do not stand out clearly in the case of Spain. In fact, although the movement of state expenditure on education seems to be close to the major conjunctural cycles, most of the trends are still strongly marked by plateau effects. In addition, setting aside the ratio of expenditure on education to national income, analysis of the raw series does not clearly show the existence of a change in trend.

Is this a simple conjunctural effect related to Francoism or might there be a phenomenon represented an indicator of a possible difference in phase (or lag) between the countries in the centre of Europe (France and Germany) and those in the south (and especially Spain) with regard to economic and social development? In any case, with the emergence and consolidation of the European Union and more broadly with the increasing globalisation of the economy, possible lags established during the course of history will gradually dwindle or disappear. The accumulation of knowledge will truly become the driving force of growth, especially in the most highly developed countries.

As a continuation of this and with the prospect of a probable end to the marked slump that has affected the world economy for nearly three decades,

³⁸ Cf. Canals, V. and Michel, S. (1995) *La formation insertion. Vers une nouvelle forme d'emploi?*. Sciences de la Société, 36, 111-126.

issues concerning the future development of educational systems are particularly important. Are we moving towards fresh extensive development of educational and training systems based on the changes that have occurred since the turning point in the early 1970s? In countries where the situation is relatively out of phase, as in Spain, will this extension really take place and be sustainable or will the inverse trend in education remain? Finally, like product life cycles, may education have reached its peak and might there now be stagnation or decline in relation to the movement of the national product?³⁹

The answers provided by the scientific community to this set of questions will go a long way towards determining our ability to forecast coming socioeconomic changes.

References

- Ashton, D. and Green, F. (1996) *Education, Training and the Global Economy*. E. Elgar, Cheltenham.
- Box, G. and Jenkins, G. (1970) *Time Series Analysis. Forecasting and Control*. Holden Day, London.
- Broder, A. (1998) *Histoire économique de l'Espagne contemporaine*. Economica, Paris.
- Canals, V. and Michel, S. (1995) *La formation insertion. Vers une nouvelle forme d'emploi?*. Sciences de la Société, 36, 111-126.
- Carnoy, M. ed. (1995) *International Encyclopedia of Economics of Education*. 2nd Edition, Pergamon Press, Oxford.
- Carreras, A. ed. (1989) *Estadísticas históricas de España siglos XIX-XX*. Fundación Banco Exterior, Madrid.
- Carry, A., Diebolt, C., Fontvieille, L., Núñez, C. and Tortella, G. (1995) *Education et croissance économique: évolution de longue période et prospective. Une analyse comparée des systèmes éducatifs allemand espagnol et français*. Stimulation Plan for Economic Science, Union Européenne, 4 Vols., September, 1482 pages.
- Cohn, E. and Geske, T.G. (1990) *The Economics of Education*. 3rd Edition, Pergamon Press, Oxford.
- Comin, F. (1988) *Hacienda y economía en la España contemporánea (1800-1936)*. Vol. 1: *EL afianzamiento de la hacienda liberal (1800-1874)*, Vol. II.: *La hacienda transicional (1875-1935)*. Ministerio de Economía y Hacienda, Madrid.
- De Faria, V. and Diebolt, C. (1998) *Histoire quantitative et cycles économiques. Enquête sur les salaires de la fonction publique en France aux*

³⁹ Cf. Diebolt, C. (1997) Education et croissance économique en France et en Allemagne aux 19^{ème} et 20^{ème} siècles. *Revue Française de Pédagogie*, 121, 29-38.

- 19ème et 20ème siècles. *Association de Comptabilité Nationale*, 7ème Colloque, Paris, 28-30 January, 21 pages.
- Diebolt, C. (1993) Du cycle des affaires au mouvement long de l'économie chez Arthur Spiethoff. *Economies et Sociétés*, Cahiers de l'ISMEA, Série F. 33, 295-318.
- Diebolt, C. (1994) Le financement de l'éducation en République Fédérale d'Allemagne ou l'affirmation de la souveraineté des Länder en matière de gestion des institutions éducatives. *Revue d'Economie Régionale et Urbaine*. 3, 429-451.
- Diebolt, C. (1994) *L'évolution de longue période du système éducatif allemand*. Vol. 1: *Education, croissance et cycles longs*. Vol. 2: *L'histoire quantitative de l'éducation*. Thèse de Doctorat en Sciences Economiques. Université Montpellier I, February, 1042 pages.
- Diebolt, C. (1995) Le compte de l'éducation des universités en Prusse: 1868-1921. *Revue Historique*, 119(CCXCIV/1), 85-107.
- Diebolt, C. (1995) L'enseignement supérieur allemand est en crise. *SAVOIR Education Formation*, 7(2), 263-268.
- Diebolt, C. (1995) *Education et croissance économique. Le cas de l'Allemagne aux 19ème et 20ème siècles*. L'Harmattan, Paris.
- Diebolt, C. (1996) Repères épistémologiques sur la connaissance en économie de l'éducation. *SAVOIR Education Formation*, 8(1), 13-20.
- Diebolt, C. (1996) Deutsche und französische Bildungsausgaben im 19. Jahrhundert im Vergleich. *Leipziger Beiträge zur Universalgeschichte und vergleichenden Gesellschaftsforschung*, 6(2), 72-84.
- Diebolt, C. (1996) La croissance des dépenses publiques d'éducation en Allemagne: 1829-1989, *International Review of Education*, 42(5), 463-474.
- Diebolt, C. (1997) La théorie de la sous-consommation du cycle des affaires de Emil Lederer. *Economie Appliquée. An International Journal of Economic Analysis*, 50(1), 27-50.
- Diebolt, C. (1997) *L'évolution de longue période du système éducatif allemand: 19ème et 20ème siècles*. Numéro spécial de la revue *Economies et Sociétés*, Cahiers de l'ISMEA, Serie AF, 23.
- Diebolt, C. (1997) Education et croissance économique en France et en Allemagne aux 19ème et 20ème siècles. *Revue Française de Pédagogie*, 121, 29-38.
- Diebolt, C. (1998) *Développement des hommes et croissance économique*. Habilitation à diriger des recherches en sciences économiques, Université Montpellier I, October, 302 pages.
- Diebolt, C. and El Murr, B. (1998) Vers une théorie macro-économétrique de l'engorgement? Le cas de l'enseignement supérieur allemand aux 19ème et 20ème siècles. *Association Française des Historiens Economistes et Société de Démographie Historique*, Paris, 4-5 décembre 1998, 52 pages.
- Diebolt, C. (1998) L'école en chiffres. Le système éducatif de l'ancienne République Démocratique d'Allemagne, 1950-1989, *SAVOIR Education Formation*, 10, forthcoming.

- Diebolt, C. (1999) Les effectifs scolarisés en France: XIXème et XXème siècles. *International Review of Education*, 45(2), forthcoming.
- Diebolt, C. (1999) Le système d'invalidité et de vieillesse en Allemagne avant la Première Guerre mondiale. *Economies et Sociétés*, Cahiers de l'ISMEA, Serie HEQ, forthcoming.
- Diebolt, C. (1999) Towards a Theory of Systemic Regulation? The Case of France and Germany in the Nineteenth and Twentieth Centuries. In *Discourse Formation in Comparative Education*, (edited by Schriewer, J. with the collaboration of M.J. Halverson). Peter Lang, Frankfurt am Main, forthcoming.
- Diebolt, C. and Fontvieille, L. (1998) Dynamic Forces in Educational Development. A Long-Run Comparative View. The Case of France and Germany in the Nineteenth and Twentieth Centuries. *Working Paper*, LAMETA/CNRS, 25 pages.
- Diebolt, C. and Litago, J. (1997) Education and Economic Growth in Germany before the Second World War. An Econometric Analysis of Dynamic Relations. *Historical Social Research. An International Journal for the Application of Formal Methods to History*, 22(2), 132-149.
- Diebolt, C. and Reimat, A. (1997) Old Age Policies in France and Germany from the Last Decades of the Nineteenth Century to the First World War, A Quantitative Re-Definition. *Historical Social Research. An International Journal for the Application of Formal Methods to History*, 22(3/4). 181-197.
- Engle, R. and Granger, C. (1991) Long-Run Economic Relationships. Readings in Cointegration. Oxford University Press, Oxford.
- Freeman, C, ed. (1996) *Long Wave Theory*. E. Elgar, Cheltenham.
- Gil, G.A. (1994) Spain: System of Education. In *The International Encyclopedia of Education* (edited by Husén, T. and Neville Postlethwaite, T.), 10, 2nd Edition. Pergamon, Oxford, pp, 5650-5658.
- Hamilton, J. (1994) *Time Series Analysis*. Princeton University Press, New Jersey.
- <http://www.ince.mec.es/pre/que f.htm>
- Intervención General de la Administración del Estado ed. (1891) *Estadística de los presupuestos generales del estado y de los resultados que ha ofrecido su liquidación*. Años 1850 á 1890-91. Fábrica Nacional de Moneda y Timbre, Madrid.
- Juglar, C. (1889) *Des crises commerciales et de leur retour périodique en France, en Angleterre et aux Etats-Unis*. Guillaumin et Cie, Paris.
- Kendrick, S. assisted by M. Wehle (1953) *A Century and a Half of Federal Expenditures*. N.B.E.R., Princeton.
- Kondratieff, N.D. (1992) *Les grands cycles de la conjoncture*. Economica, Paris.
- Kuznets, S. (1930) *Secular Movements in Production and Prices. Their Nature and their Bearing upon Cyclical Fluctuations*. Houghton Mifflin Co., Boston.

- Ministerio de Hacienda ed. (1976) *Datos basicos para la historia financiera de España* (1850-1975). 2 Vols., Fábrica Nacional de Moneda y Timbre, Madrid.
- Ministerio de Hacienda ed. (1979) *Estadísticas de la cuentas generales del estado*. Años 1908 á 1923/1924, Fábrica Nacional de Moneda y Timbre. Madrid.
- Musgrave, R.A. (1959) *Theory of Public Finance*. McGraw Hill, New York.
- Nelson, C. and Plosser, C, (1982) Trend and Random Walks in Macroeconomic Time Series. *Journal of Monetary Economics*, 10(1). 139-162,
- Núñez, C.E. (1991) El gasto público en educación entre 1862 y 1935, *Hacienda Pública Espanola*, Monografías, 1, 121-146,
- Núñez, C.E. (1992) *La fuente de la riqueza. Educación y desarrollo económico en la España Contemporánea*. Alianza Editorial, Madrid.
- Page, A, (1971) *L'économie de l'éducation*. Presses Universitaires de France, Paris
- Peacock, A.T. and Wiseman, J. assisted by J, Veverka (1961) *The Growth of Public Expenditure in the United Kingdom*. N.B.E.R., Princeton.
- Prados de la Escosura, L. (1993) Spain's Gross Domestic Product, 1850-1990: A New Series. *Working Paper*, D-93002, Universidad Carlos III de Madrid. March.
- Schumpeter, J. (1939) *Business Cycles. A Theoretical, Historical and Statistical Analysis of the Capitalist Process*. 2 Vols., McGraw-Hill Book Co., London.
- Tortella, G, ed. (1990) *Education and Economic Development since the Industrial Revolution*. Generalitat Valenciana, Valencia.
- Tortella, G. (1994) *El desarrollo de la España contemporánea. Historia económica de los siglos XIX y XX*. Alianza Editorial, Madrid.