CONTINUITIES AND DISCONTINUTIES IN THE ECONOMIC GROWTH OF SPAIN, 1850-1936*

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A B S T R A C T

The Spanish pattern of economic growth during the last two centuries is quite unique. In the nineteenth century, Spain remained outside the process of industrialization, but during the twentieth century it has joined the small group of developed economies. This article checks the possible existence of discontinuities between 1850-1936 in the series of PNB, industrial production and private and public investment by utilizing recent developments in the econometric analysis associated with the work of Perron and Ziwot and Andrews. The results confirm the continuity of the Spanish growth during the long period considered. However, they also show two breakpoint years: 1870 in the series of industrial production and 1919 in the data of public investment.

Key Words: economic growth, continuity, 1850-1939.

R E S U M E N

El crecimiento económico en España durante los dos últimos siglos, ha sido un proceso singular. Durante el siglo XIX su economía quedó al margen del proceso de industrialización, pero durante el XX ha conseguido incorporarse al reducido grupo de los países desarrollados. Aprovechando algunos de los recientes avances de la econometría asociados a los trabajos de Perron y Ziwot y Andews, este artículo contrasta, para la etapa 1850-1936, la posible existencia de rupturas en las series de PNB, producción industrial e inversión pública y privada. Los resultados confirman la continuidad básica del crecimiento económico español en el largo plazo. Sin embargo, al mismo tiempo, muestran dos rupturas estadísticamente significativas: 1870 en la serie de producción industrial y 1919 en la de inversión pública.

Palabras clave: crecimiento económico, continuidad, 1850-1939.

INTRODUCTION

Spain's economic growth during the last two centuries has been, without doubt, a quite unique process. As Tortella summed it up, "If authors agree that the 19th century was the century of failure, they also agree that the 20th is that of the success of industrialization"[1]. Thus, in the century when other European economies, following Great Britain, underwent a profound process of structural change that consolidated their industrialization, the Spanish economy continued to be dominated by the agricultural sector, to such an extent that in 1900 the active population of the primary sector was two thirds of the total[2]. On the other hand, during the present century, when industrialization has been an exceptional result of economic growth, Spain has managed to radically transform its economic structure, joining the small group of developed countries. But taken into account the political consequences of the Second World War and its repercussions on the economies of Central and Eastern Europe, especially on those that in the years before the conflict had reached a higher level of per capita income**,** this exceptional character should not be exaggerated**.** But we cannot ignore that the transformations occurring in the 1950s and 1960s were a very unusual phenomenon in the economic history of the 20th century.

One of the main questions posed by this evolution is the relevance of the period before 1936 when the Spanish civil war began, in the changes consolidated during the second third of the century. To answer this question is the main challenge to the research into Spain's long-term economic growth, and goes beyond the scope of this paper. However, the notable advances achieved in the quantitative economic history of Spain, and the possibilities afforded by some of the advances in econometrics and statistics, enabled us to make a contribution on an important aspect much reiterated by historians: was the consolidation of industrial society in Spain a process of long-term structural change whose beginnings can be dated long before its culmination, or, on the other hand, was it the result of a slow but steady increase in production until reaching the threshold necessary to cause, within the favorable international situation of the 1950s and 1960s, a rapid process of structural transformations?

The question is directly related to a debate of long tradition among economic historians both in Spain and in other countries, especially Britain: the continuities and discontinuities of the industrialization process. Although it was during the 1960s and 1970s when the debate reached

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[1] G.Tortella, (1994), p.255

[2] R.Nicolau, (1989), in A.Carreras, coord., (1989) p. 79.

its peak[3], in recent years also important contributions have been published on the predominant features of the processes of growth accompanying industrialization[4]. The case of Spain has been no exception. The influential book by Jordi Nadal[5] considered the failure in Spain during the long 19th century (1814-1913) of the classical English model of industrialization, due to the lack of internal demand and in spite of a promising start. A widely debated thesis, to which Antonio Gómez Mendoza has added important remarks insisting on the natural factors endowment[6]. Albert Carreras[7], on the basis of his outstanding quantitative research, has offered stimulating and accurate information on the progress of Spain's economic growth from 1850, and Leandro Prados de la Escosura[8] has for years been continuing this fundamental work of quantification of contemporary growth with an estimation of GDP which, though not yet finished, has been used by various researchers[9] thanks to his generosity.

In this context, this paper aims to provide information on the basic features of Spanish growth, testing for the existence of statistically significant discontinuities in the long period from 1850 to 1936. Its implicit intention is to contribute to confirming or denying the existence of a stage prior to that of the consolidation of industrial society in the second half of the 20th century, of deep fracture in the rate of growth reflected either directly in production or indirectly in investment. It thus links up with several of the recent debates on Spanish economic history, such as the possible discontinuity in the evolution of the two centuries, or the identification of stages particularly relevant to long-term growth related with tariff policy or with the technological changes related to electrification. The text is organized very simply and despite the econometric nature of the tests used and the contents of the second section devoted to the description of them, the text aims to be a contribution to economic history. Our objective in using them is only to suggest new or complementary ways of explaining the long-term transformations of the Spanish

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[3] A. Gerschenkron (1962) and , W.W. Rostow (1960, 1963), inseparable from the severe critiques by A.Fishlow (1965) and Kuznets (1963).

[4] In both historical and theoretical fields, where some of the recent contributions are based explicitly on the debate of the 1960s. By way of example: K.M. Murphy, A. Shleifer y R.Vishny, (1989); C.Aranzadis and A.Drazen (1990).

[5] J.Nadal, (1975).

[6] A. Gómez Mendoza (1995, 1997).

[7] Can be consulted in A.Carreras (1990).

[8] In its most recent version: L.Prados de la Escosura, (1995).

[9] J.Nadal and C. Sudrià (1993); A.Herranz and D.Tirado (1996); D.Tirado (1996).

economy. In a first section the methodology is described. Then, the main body of the article lays out consecutively the results obtained from its application to the series of GDP, industrial production, and investment both private and public[10]. Finally a brief recapitulation of the main findings is included.

ESTIMATION OF A BREAK IN THE BEHAVIOR OF MACRO-ECONOMIC SERIES

The measurement of structural change in economic history has benefited from the advances in statistical and economic literature regarding the existence of units roots in macro-economic series. The use of these tests contributed new elements to the debate on the existence of a break in the trend in industrial production in Great Britain around 1780. Their intention, obviously, was to test to what extent the period 1780-1851 was one of structural discontinuity as the Industrial Revolution has been described[11]. Also, the discontinuities in the industrial production series caused by the First World War have been analyzed, with original results regarding the influence of the return to convertibility in 1925 and the repercussions of the 1929 crisis[12].

The analytical origin of these methods can be traced to an article by Perron[13], in which they were used to analyze the influence of two moments of discontinuity, the crash of 1929 and the petroleum crisis of 1973, in a set of macro-economic series characterized by the presence of units roots. Despite the influence of his contribution, the use of information exogenous to the series to determine the moment of the break was criticized for the possibility of biasing the results towards acceptance of the hypothesis being considered. To avoid this, it has been suggested that estimates should be made sequentially until it is endogenously determined at

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[10] IPIES: A.Carreras (1984); GDP: L.Prados de la Escosura (1995); Investment: Cubel and Palafox (1997) and Public Investment: F.Pérez, M.Mas y E.Uriel (1995). We preferred to use the latter series rather than that of the Instituto de Estudios Fiscales (1976) because it follows the criteria of the National Accounts which include investment in maintenance. This causes the values for public investment to increase notably.

[11] N.F.R. Crafts and C.K.Harley (1992, 1994), D.Greasley y L.Oaxley (1994).

[12] D.Greasley y L. Oaxley (1996). A different test has been applied by K.Inwood and T.Stengos (1991) to the evolution of the Canadian economy from 1870 to 1985.

[13] P. Perron (1989).

which moment in time the existence of a break will be most probable and verifying the result with new, more severe tests.

In order to make the method used more clearly explicit, we can represent the behavior of a time series, y_t, as the sum of a trend and a random component:

$$y_t = TD_t + Z_t \qquad [1]$$

where TD_t is a deterministic trend and Z_t is the stochastic component of y. Although a wide variety of possibilities are used, the commonest is to assume that TD_t is linear in time t

$$TD_t = \mu + \boldsymbol{\beta}_t \qquad [2]$$

According to this specification the behavior of any economic variable, e.g. GDP, can be characterized by:

$$y_t = \mu + \boldsymbol{\beta} t + u_t \qquad [3]$$

where the level of production at a time t is the result of an initial level μ, the cumulative effect of the growth of earlier periods represented by the trend $\boldsymbol{\beta}$t, and a stochastic element u_t, that reflects any deviation from the path of linear growth defined by μ, $\boldsymbol{\beta}$ and t.

In the last decade this way of representing the series has been altered. The analyses by Nelson and Plosser[14] showed that the majority of macro-economic variables are characterized by the presence of a unit root, i.e. with mean and variance not constant over time. These series are called non-stationary. To check the difference between stationary and non-stationary series, let us consider the following characterization of *y:*

$$y_t = \boldsymbol{\beta} + y_{t-1} + e_t \qquad [4]$$

in which unlike (3) it is considered that the variable is determined by its own previous values. Substituting recursively and assuming an initial level of the variable, y_0, we reach the expression:

$$y_t = y_0 + \boldsymbol{\beta} t + \sum_{j=1}^{t} e_j \qquad [5]$$

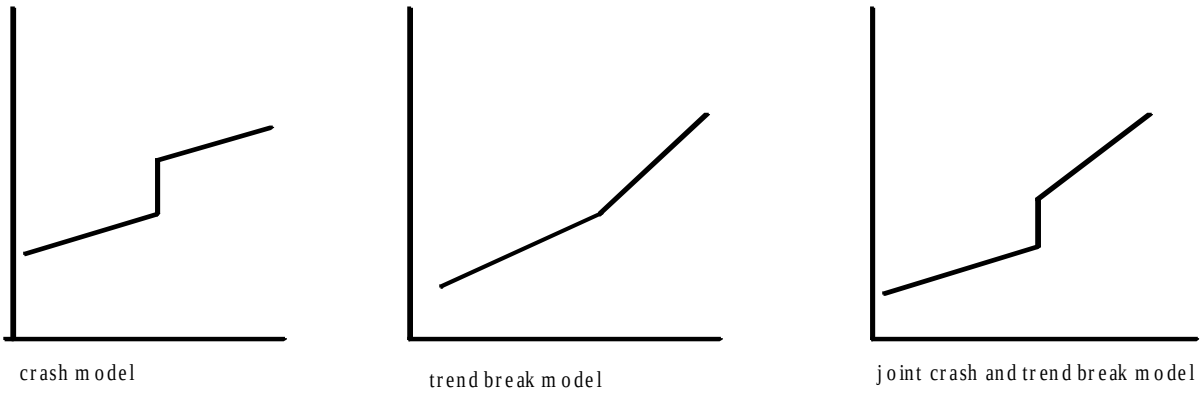
[14] C.R. Nelson and C.I.Plosser (1982).

whose difference from (3) is to be found in the last term. In (5) this is interpreted as the effect in the current period of the shocks occurring in the past, represented by the term of disturbance *e*. However, as can be deduced, in a non-stationary series the shocks have a permanent effect on the values of the series. On the other hand, in (3) the effect on production of the stochastic variable *u* is transitory. It is therefore possible to distinguish two models for y_t. In the first, stationary with respect to a trend *y*, the effect of exogenous shocks is transitory. In the second, stationary in differences, their effect is permanent.

As has just been indicated, these studies confirmed that most macro-economic series were non-stationary. Therefore, the disturbances experienced by the series in the past persisted in the present. The implication of this is that in these series it is hard to distinguish when these disturbances could be considered "big shocks", infrequent and with permanent effects on the trend or level of the series, or "ordinary shocks" (or habitual ones), occurring regularly and which may or may not have permanent effects on the level of the series, according to the unit root hypothesis.

The big shocks hold most interest for economic history, insofar as their existence implies a change in the behavior of the variables. These can be divided into three groups: (a) change of level or crash model, in which the variable rises (or falls) in the year after the break, and its growth resumes at the previous rate from the higher (lower) level; (b) a trend change in which the growth rate accelerates (or decelerates), from the year after the break; and (c) a joint crash and trend change which combines the two effects. Figure 1 shows their representation on an upward trend.

Figure 1.



The method of searching for the presence of a structural change consists of performing the regression for the different models, and verifying the null hypothesis of presence of a unit root, i.e. testing the persistence of the shock under analysis. One difference between the method used by Perron and the one used here is the nature of the break. As we have mentioned, Perron determined it exogenously, i.e. he assumed that the evolution of the series did not generate the break in its behavior, but that this was exogenous the series. The effect of acting in this way is that the analyzed break points are those at which the change in the behavior of the series looks most obvious[15]. Therefore, the derived statistics were biased in favor of rejecting the null hypothesis. The strategy followed by Zivot and Andrews favor an alternative approach based on the recursive searching for endogenous discontinuities at every year within the sample. Their solution consisted of constructing an algorithm to obtain the point that conferred highest probability to the existence of a break. The argument could be summarized by defining the null hypothesis for each of the three models as an integrated process of order one

$$y_t = \mu + y_{t-1} + e_t \qquad [6]$$

as against an alternative hypothesis represented by a model that is stationary around a trend with a single break. The models to be estimated test the null and alternative hypotheses.

$$y_t = \mu^A + \theta^A DU_t(\lambda) + \beta^A t + \alpha^A y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t \qquad [7]$$

$$y_t = \mu^B + + \beta^B t + \gamma^B DT_*(\lambda) + \alpha^B y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t \qquad [8]$$

$$y_t = \mu^C + \theta^C DU_t(\lambda) + \beta^C t + \alpha^C DT(\lambda) + \alpha^C y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t \qquad [9]$$

where $DU_t = 1$ if $t>T_B$ and T_B is the year of discontinuity; $DT_t^* = t - T_B$ if $t > T_B$ and 0 otherwise and where $DT_t = t$ if $t>T_B$ and 0 otherwise.

[15] E.Zivot and D.Andrews (1992). A similar approach, developed independently, was that of L.J.Christiano (1992).

Therefore, the methodology used below consists of performing the regression corresponding to the model chosen in a range that includes the whole period analyzed. The aim is to allow the free variation of the moment of break over the whole series, by choosing the observation in which the probability of accepting it is maximum, i.e. when the significance of the presence of a unit root in the series is greatest.

In conclusion, the strategy for finding a discontinuity in the behavior of the analyzed series consists of: i) verifying the existence of a unit root, as a means of knowing the persistence of the shocks; ii) performing the regression of the break model that most suits the behavior of the series or analyzing the three models, assuming that the period in which the break occurs varies: iii) finding the value of the statistic t of the coefficient of the lagged endogenous variable for each break period calculated; and iv) comparing the maximum value of statistic t with the tabulated values.

CONTINUITY AND DISCONTINUITY IN THE GROWTH OF THE SPANISH ECONOMY

Having described the method, the aim now is to present the results in order to verify if they allow the identification of a discontinuity in the behavior of the different series representatives of the growth of the Spanish economy. Following the work of Dickey and Fuller, the test for the estimation of unit roots takes the form of the regression :

$$y_t = \mu + \beta t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \, \Delta y_{t-i} + e_t \qquad [10]$$

Table 1 presents the values of statistic t of coefficient α for the different series. The first column shows the values of the regression performed on levels and the second on differences. As can be seen, it is not possible to reject the presence of units roots in the series of public investment and GDP. The private investment series rejects the existence of units roots at 5 %, but using the Philips-Perron test this rejection cannot be maintained. The Industrial Production Index series rejects the existence of a unit root at 5 %, using either the Dickey-Fuller or the Philips-Perron procedures. In all cases, the estimate on first differences rejects the existence of unit roots.

Table 1. Unit Root Test, 1850-1935

	y_t	Dy_t
Public Investment	-2,22 (0)	-5,53[b]
Private Investment	-3,74[a] (1)	-4,81[b]
Phillips-Perron	-3,38	-6,77[b]
IPIES	-3,60[a] (2)	-6,64[b]
Phillips-Perron	-3,52[a]	-10,17[b]
GDP	-2,34 (0)	-5,63[b]

Note: In brackets the number of lags of the endogenous variable needed to eliminate autocorrelation. The critical values are 3'46 at 5% and 4'07 at 1%. (a) means rejection of the null hypothesis of unit root at 5%, (b) means rejection of the null hypothesis of unit root at 1%.

The results obtained, therefore, point to the presence of unit roots in all series, i.e. to the persistence of the shocks. As we have indicated, our aim is to separate the deep persistent changes and the slight movements that are re-absorbed by the evolution of the variables itself. This requires verifying the possible existence of break points along the course followed by each series.

It seems obvious that the first series to be analyzed should be that of the GDP estimated by Leandro Prados de la Escosura. Even though the data are subject to their final presentation, the estimate, as we have already indicated, has been widely used. Figure 2 represents its behavior from 1850 to 1935, a stage during which the existence of three great discontinuities with respect to the preceding decades has been noted: the years of moderate free trade begun with the approval of the 1869 Tariff, the raising of tariffs and the leaving of the gold standard in the 1880s, and more clearly in 1891, and the First World War.

Table 2 and Figure 3 show the analysis of breaks using equations 7, 8 and 9 to find the lowest value (highest in absolute terms) of t-statistic over the whole sample. In all the models used the lowest values of the statistic are obtained in the 1920s. In the crash model two peaks appear: one around 1885 and another in 1919. When dealing with the trend, the t values of the coefficient associated with the lagged endogenous variable increase steadily until [they reach the maximum in] the last of the years mentioned. In the joint crash and trend break model various points of breaks appear, the maximum being in 1914. However, in spite of this evidence agreeing with the theses habitually held in Spanish Economic History regarding the shift in the growth rate after the First World War, the existence of a break cannot be accepted, in the sense defined here, in any period with a significance of 5 % using the critical values tabulated by Zivot and Andrews.

Figure 2. Logarithm of GDP, 1850-1935

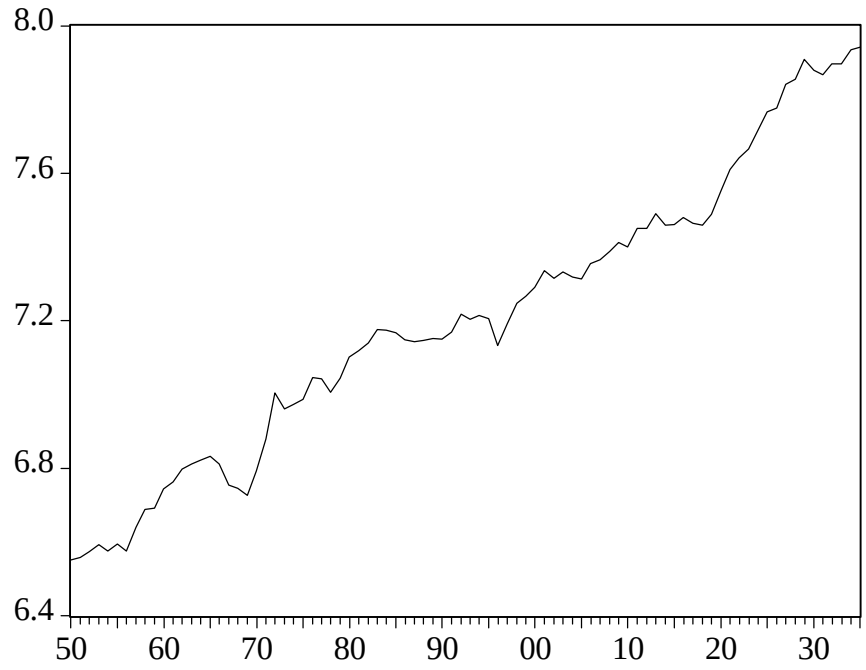
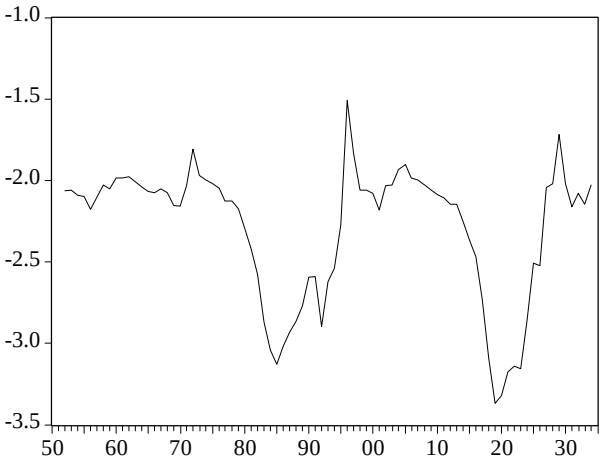


Table 2. Discontinuities in GDP, 1850-1935

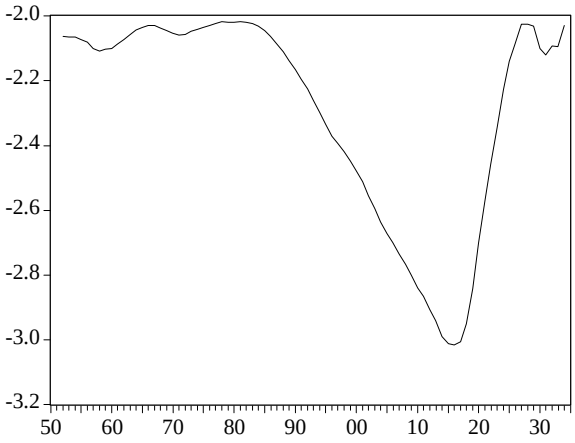
	Crash	Trend Break	Joint
1870	-2,15	-2,05	-2,15
1891	-2,89	-2,22	-3,11
1919	-3,36	-2,84	-2,96

Figure 3. Discontinuities in GDP, 1850-1935

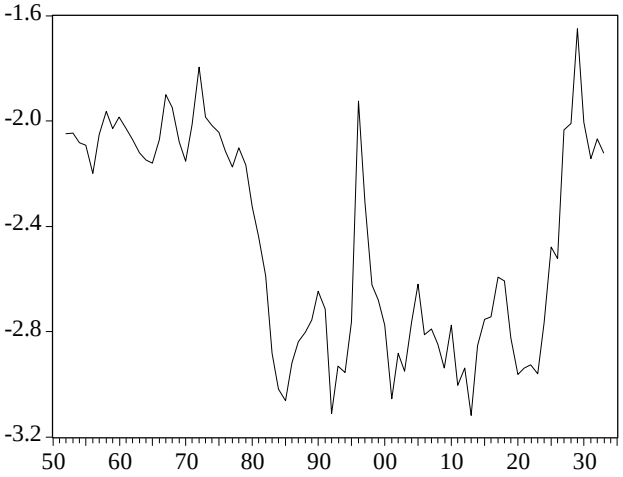
Crash Model (Critical value at 5%, -4,80)



Trend Break Model (Critical Value at 5%, -4,42)



Joint Crash and Trend Break Model (Critical Value at 5%, -5,08)



Perron and Vogelsang[16] suggest that in the crash model the estimate of equation (7) may not be adequate, it being more appropriate to estimate:

$$y_t = \mu^A + \theta^A DU_t + \beta^A t + d^A D(TB)_t + \alpha^A y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t \qquad [11]$$

which includes an additional variable, $D(TB)_t$, which takes value 1 in the year of the break and 0 otherwise.

However, this estimation does not alter the results. Once again the maximum value of the t-statistic (in absolute value) is reached in 1919, with two lags in the differences of the endogenous variable, but it continues to be lower than the critical value tabulated by Perron and Vogelsang of -4'39 for a significance of 5%.

Therefore, if the quantitative information offered by the currently available estimate of GDP is corroborated in the definitive version, the most suitable characterization of its evolution in the long term is that of a steady growth for nearly a century, without any kind of sudden stage of discontinuity in any of the three stages habitually emphasized by economic historians nor at the turn of the century. Although the results point to the occurrence of important changes during the First World War, the existence of a statistically significant discontinuity cannot be accepted. Accordingly, it can be concluded/ affirmed that the behavior of the GDP, in the estimation calculated by Prados de la Escosura, is the result of both the trend and of the cumulative effects of the different shocks occurring over time. The conclusion to be drawn is immediate and seems important. The test performed completely rules out the possibility that either changes in economic or foreign trade policies (from moderate free trade to protectionism and from a linkage with the countries of the gold standard to isolation in foreign exchange relations), or the economic transformations that crystallized during the First World War, structurally modified the long-term behavior of the economy.

The presence within the economy of a large agricultural sector whose evolution was in large part independent of the progress of the rest of the economy due to its backwardness and poor resources endowment, invites us to consider whether, as against this result in the evolution of GDP, that of the industrial production index (IPIES) presents structural discontinuities. The evolution of this variable has been subjected to close scrutiny in search of the causes of the

[16] P. Perron and T.J. Vogelsang (1992).

increase in size of the secondary sector. The discussion has centered largely on the role played by the protectionist policy established in the last decade of the 19th century (Trade Law of 1891) and the first of the twentieth (Trade Law of 1906), and on the effect of the First World War and the Dictatorship of Primo de Rivera (1923-1930), although the hypothesis of a change in the technological parameters of industrial sectors is mentioned ever more insistently.

Studies made before the estimation of the Industrial Production Index[17] noted that Spain's industrialization started at the beginning of this century, favored by the adoption of heavy protective tariffs and specific public policies for encouraging national industry. In clear opposition to this thesis, the author of the estimate, Albert Carreras, has written that "There exists no discontinuity in industrial growth around 1900, or around 1890 or 1906 (...) Quite the contrary: in the light of the new data it seems more legitimate to consider that the ninety years prior to the Civil War (...) were a long period of growth, sometimes faster, sometimes slower, which would indicate that Spain's industrializing tradition is a long one. This continuity during the inter-war period, however, should not conceal the fact that in these years industry experienced a "spectacular"[18] growth rate at the same time as intense modernization and diversification[19] of its structure.

Figure 4 presents the evolution of the Industrial Production Index and Figure 5 the values of the t-statistic t for the three models. The hypothesis of structural change cannot be accepted for either of the two moments analyzed (1891 and 1921). This confirms Carreras' thesis as against the one which defends the acceleration of change in any of the quoted periods. These new results, together with those obtained in the case of the GDP, reinforce an interpretation of the progress of the economy based more on continuity than on a break linked to the existence of a Gerschenkronian "industrializing spurt" , or if Rostow's terminology is preferred, of the start of a take-off. Even without denying the importants consequences of the new frontier of technological possibilities opened up by the spread of electricity, its impact in the series shows that these effects were not of such magnitude as to alter the fundamental pattern of industrial growth.

Together with this conclusion, the results show a statistically significant discontinuity in the year 1870. As can be seen in Figure 5, when the crash model is used, the highest absolute value of the statistic t is found at that date, with a value of -4'95 below the critical value of -4'80 significant at 5%. Perron and Vogelsang's methodology confirms the result, and strengthens the

[17] Especially Donges (1975) and J.Fontana and J.Nadal (1975).

[18] A.Carreras (1987), p. 284.

[19] C. Betrán (1995).

Figure 4. Logarithm of IPI, 1850-1935

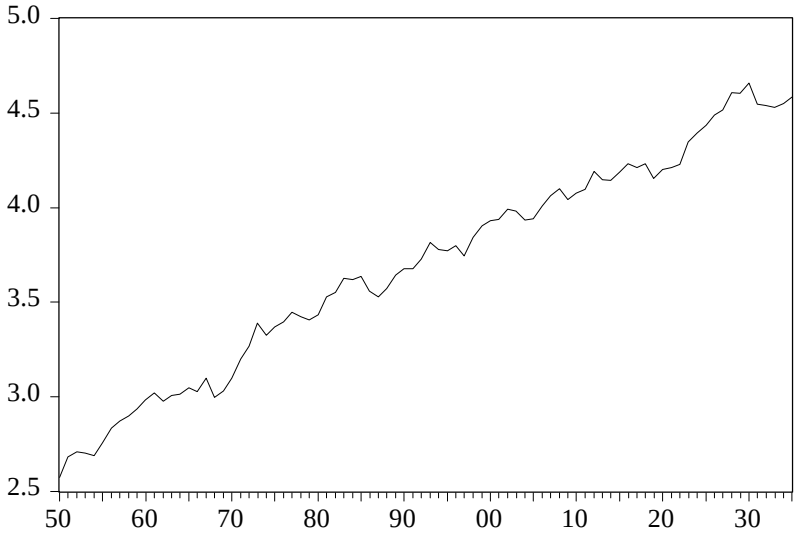


Table 3. Discontinuities in the IPI, 1850-1935

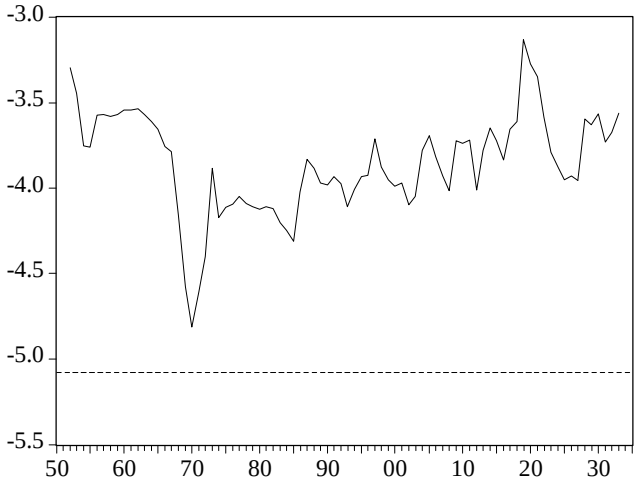
	Crash	Trend Break	Joint
1891	-4,11	-3,75	-3,95
1921	-3,35	-3,34	-3,62

Figure 5. Discontinuities in IPI, 1850-1935

Crash Model (Critical Value at 5%, -4,80)

Trend Break Model (Critical Value at 5%, -4,42)

Joint Crash and Trend Break Model (Critical Value at 5%, -5,08)



thesis of the existence of a change of this type in this year. It is not easy to draw conclusions from this result because up to now it had not been pointed out. It seems clear, however, that this disturbance confirms the positive consequences for the industrial sector of the liberal economic policies applied during the period known as the Sexenio Liberal(1868-1874) linked with the Revolution of 1868. During this period one of the most outstanding reforms was Figuerola's liberal Tariff Reform.

In addition to the evolution of production, it is interesting to verify to what extent the course followed by investment, both private and public, presents statistically significant discontinuities. The behavior of private investment in the long term has been described as "an erratic fluctuation around stable levels"[20]. And in Figure 6 a greater cyclic component can be observed than in the GDP and IPIES series. The tests for structural change, however, also give negative results. As can be seen from Table 4, the statistics do not reach the critical values at any time, the maximum being in 1855. This year corresponds to the starting point of an investment cycle associated with the construction of the railway network. The exercise performed, then, would seem to confirm two aspects of interest. On the one hand, continuity - already mentioned in the case of the GDP and IPIES - as predominant feature of Spain's economic growth from 1855 to 1936. On the other, the importance of the Progressive Biennium (1854-1856) in the trend followed by investment, although as occurs with the extraordinary conditions created by the First World War, its repercussions were not enough to cause a break in the series.

More controversial has been the description and analysis of the evolution of public investment. Tedde de Lorca and Comín have drawn the distinction between a liberal State, whose intervention in the economy was of little importance due to the scarcity of the funds obtained by an ever insufficient taxation system, and a more interventionist State in social and economic matters, the transition from one to the other occurring in the first two decades of the 20th century[21]. Palafox and Cubel, for their part, have underlined the importance of the change experienced by public intervention after the First World War, when there occurred an increase in the participation of public investment in GDP leading to a duplication of the figures for previous decades[22] with a significant positive impact on the course of the economy, the more so as the first

[20] A. Carreras (1985), p. 31.

[21] F. Comín (1989), p. 644 and P.Tedde de Lorca, (1981, 1996).

[22] J. Palafox and A. Cubel (1996), p. 116.

Figure 6. Logarithm of private investment, 1850-1935

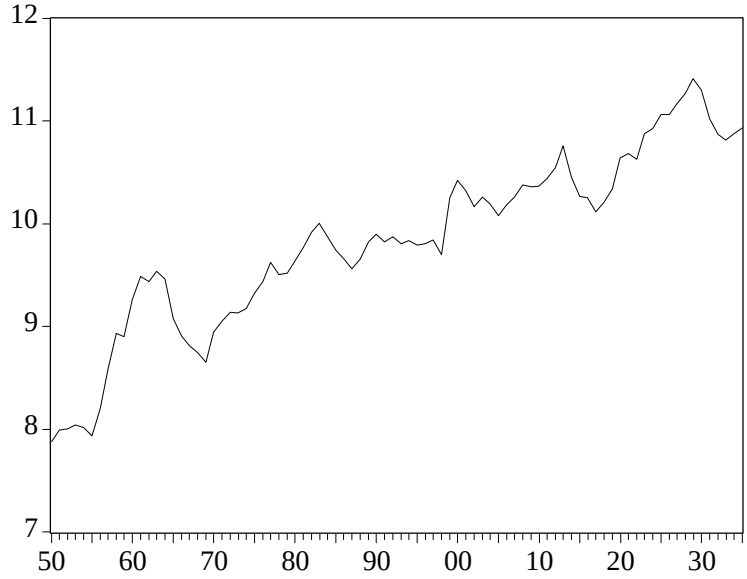
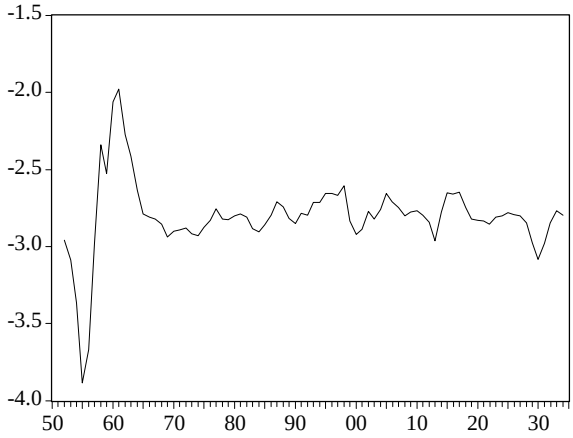


Table 4. Discontinuities in private investment, 1850-1935

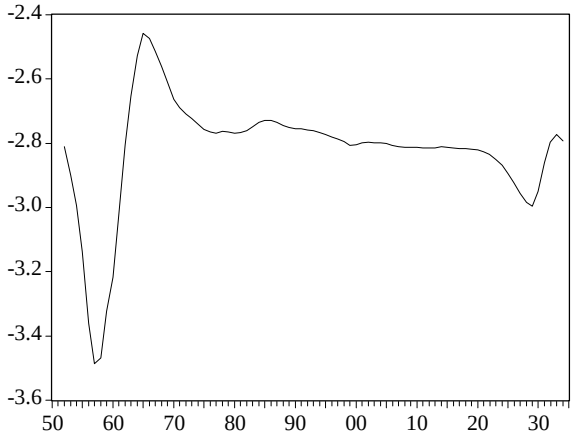
	Crash	Trend Break	Joint
1855	-3,88	-3,36	-3,87
1869	-2,93	-2,61	-2,15
1890	-2,85	-2,75	-2,77
1922	-2,85	-2,83	-3,11

Figure 7. Discontinuities in private investment, 1850-1935

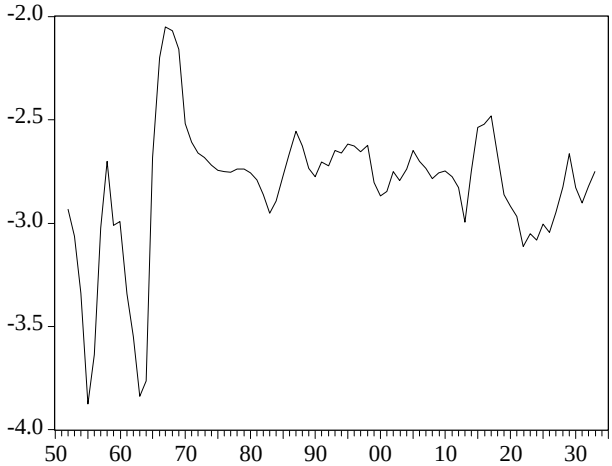
Crash Model (Critical Value at 5%, -4,80)



Trend Break Model (Critical Value at 5%, -4,42)



Joint Crash and Trend Break Model (Critical at 5%, -5,08)



third of the century advanced[23].

The test performed with the public investment series shows very different results, enabling a significant disturbance of its behavior in the 1920s to be identified. Figure 8 presents the evolution of t-statistic together with the broken line that reflects the critical value for each model. In the three specifications there is an increase in the absolute value of the statistic in 1919, exceeding the critical value in the model that permits a change in the mean of the series. Consequently there is a break in the behavior of public investment in this year, consisting of an increase in its level with no increase in the rate of growth[24]. Therefore, irrespective of the controversy as to its macro-economic impact, the test confirms that from 1919 onwards there was a change in the behavior of the investment actions of the public sector.

Figure 8. Logarithm of public investment, 1850-1935

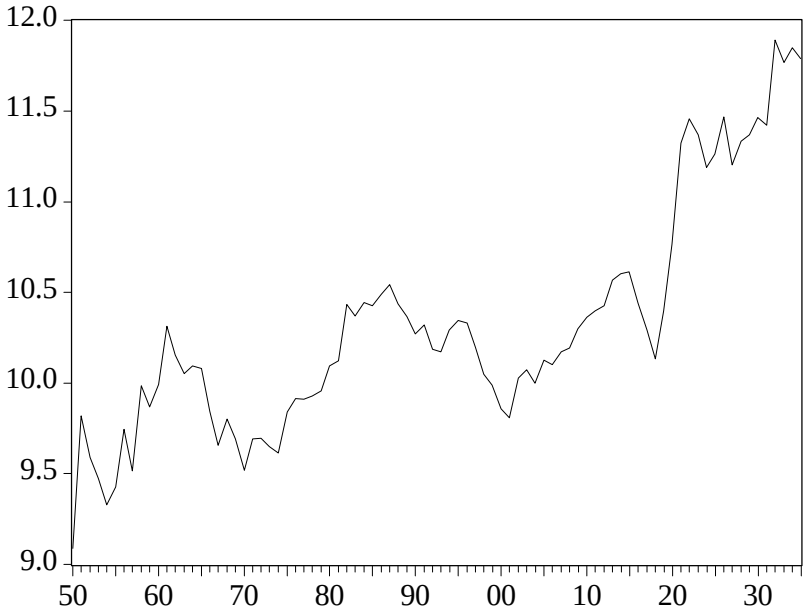


Table 5 Discontinuities in public investment, 1850-1935

	Crash	Trend Break	Joint
1896	-2,44	-3,37	-4,51
1919	-4,85	-3,51	-4,60

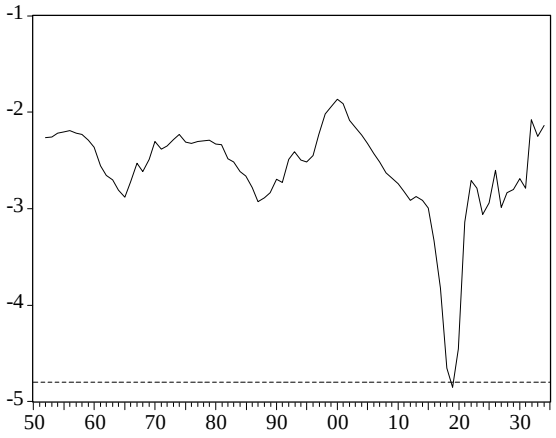
[23] J. Palafox and A. Cubel (1996), p. 116.

[24] As on previous occasions, the same estimation has been performed with the specifications recommended by Perron and Vogelsang, the hypothesis of a break in the series being accepted with a significance level of 2'5%.

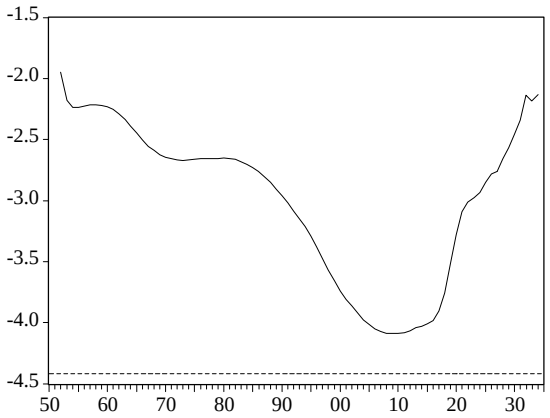
Figure 9.

Discontinuities in Public Investment, 1850-1935

Crash Model (Critical Value at 5%, -4,80)



Trend Break Model (Critical Value at 5%, -4,42)



Joint Crash and Trend Break Model (Critical value at 5%, -5,08)

CONCLUSIONS

As indicated at the beginning, the aim of this paper is to use advances in Spanish quantitative economic history to test various hypotheses on structural change in the behavior of the most important series used by Spanish economic historians. Before summarizing very briefly the conclusions already tentatively drawn, the cautions mentioned then must be repeated. Considering the evidence, certainly more scattered though no less significant, on which the theses defended in the literature are based, and the great, perhaps insurmountable, difficulties of gathering quantitative information, we cannot rule out the existence of appreciable deficiencies in the data relating to the 19th century. And this deficiencies could prevent the detection of possible discontinuities, and consequently the drawing of different conclusions. On the other hand, we want to stress the difference between the econometric definition of "structural change" used in these pages, a change in the parameters of the regression, and the more general definition used in economics based on changes in the structural behavior of the economy[25]. But even emphasizing both cautions, the quantitative information accumulated during recent years is, in our opinion, sufficiently solid to underline the clearest result of the tests performed: the confirmation of the continuity, as Carreras has often insisted, of growth from 1850 to 1935, without the presence of any period in which a specific "industrialization spurt" can be identified.

The only exception, though an important one, constituting a second outstanding conclusion, is public investment. In this case a clear discontinuity can be detected, a consequence of a well-documented change towards a more interventionist and corporate public sector. In third place, the private investment series and the industrial production index show no break in the long term except for the change of level occurring in the latter in 1870. This is a result not highlighted until now, directly linked to the methodology used, and would confirm the great importance for industrial growth of the liberalizing measures of the "Sexenio" (1868-1874). Finally, considering together the results on the GDP and public investment series, even though in the latter case critical values are not reached, ++it seems possible to posit that the years of the First World War accumulate most evidence of change in the rate of evolution of the Spanish economy[26] . But this cannot lead us to ignore the main conclusion that has just been mentioned: the quantitative evidence now available confirms the thesis of a basic continuity in Spain's economic growth during the long stage running from 1850 to 1936. Within this, the discontinuities that stand out are just two changes of level: that of industrial production in 1870 and that of public investment in 1919.

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[25] Stressed in the *survey* by G.S.Maddala y I.M. Kim, (1996).

[26] It is also from this time onwards that the capital stock increases notably. See A.Cubel y J.Palafox, (1997).

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