POLITICAL ECONOMY - 6 - SPRING 2000 - p.p. 137 - 160

Employment Profitability Cycles in the economy of the United States: An empirical point of view

by
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I. Introduction

In this paper we examine the empirical strength of Richard Goodwin's 1967 growth cycle model when applied to the economy of the U.S. over two distinct periods that cover a good part of the last 150 years. After a short overview of the theoretical origins and the analytic structure of the model we proceed, using nonlinear least squares, to its econometric applications which we believe as faithful as possible to the original contribution. In order to concentrate on the temporal horizon most appropriate, in our opinion, to the writings of the classics on the subject and the spirit of Goodwin's article, we have filtered the statistical series by using the Hodrick–Prescott method that we describe briefly in a footnote. At the end of the paper we examine some of the social and political implications of our results, and of the predator–prey dynamics over the distribution of income in general.

Goodwin's publication came out in a period particularly fertile for the theory of economic growth during which the models proposed by J. Robinson, N. Kaldor and L. Pasinetti among others, represented the core of the heterodox answer to the developing at the time Solowian tradition. At closer examination though, the theoretical foundations of this neokeynesian current revealed that the construction of the model on the basis of the distributional conflict, does not constitute in itself a fundamental rift with the mainstream analysis of the labor market. It diminishes, thereby, its social and historic pertinence because it obfuscates a significant part of the capitalist-worker interaction. To break away from the contractual logic of the neoclassicals, one must go beyond the rejection of the marginalist theory of distribution and proceed along the lines of classical and marxian political economy that threats the labor market as a particular and extremely important domain of capitalism with its own dynamics and specificity. Only then, can it be seen that the supply and demand interaction is far from implying the automatic clearing of all markets, and exclude full employment from the key characteristics of the capitalist system, right from the start.

It is crucial point on which Goodwin's model of cyclical growth distinguishes itself from the other contributions. In the models expounded by Harrod and Kaldor for instance, full employment is an integral part of the fluctuations mechanism, and the scarcity of workers lies at the heart of the reversal of activity rates. In Goodwin's on the contrary, the rate of employment becomes one of the two principal state variables that depends crucially on the growth of wages, and full employment does not intervene in itself as a maximal growth barrier. Keeping in mind at this point, that in the classical model of growth, unemployment has little to do with some "natural" rate the way neoclassicals suggest, but rather with the absence of any tendency proper to the capitalist system to eliminate the problem. The creation and the renewal of an important pool of unemployed, becomes in this case a precious tool in the hands of the capitalist class for the exploitation and discipline of workers. Goodwin's nonlinear construction based on the Lotka-Volterra equations has been proven capable of illustrating in an elegant and instructive way this cyclical interaction between employment and the wage-share. The weak point of this analytical choice is the global instability of the model, and even more so, from a theoretical point of view, the permanent gravitation of the state variables around their average values which do not evolve overtime. In a sense therefore, the notion of a fixed point is not completely absent from the model and contradicts its marxist inspiration. Unless one specifies clearly a temporal horizon appropriate to this type of model that would allow for this .We return to this important consideration later on this paper.

II. The theoretical model

The economy described by Goodwin in his model, is characterized by a population N that grows at a constant exogenous rate n:

$$\rho(N) = n \tag{1}$$

and two factors of production homogeneous and nonspecific: capital K, net of depreciation and fully utilized, and labor L whose wage-growth is a function of the rate of employment:

$$\upsilon = \frac{L}{N} \tag{2}$$

The linear version of this proposition gives us:

$$\rho(w) = -\gamma + p\upsilon \tag{3}$$

Technical change in the model is Harrod neutral with a constant capital productivity:.

$$\frac{Y}{K} = \frac{1}{\sigma} \tag{4}$$

where σ represents the capital output ratio of the economy, and a labor productivity that grows at a constant exogenous rate λ:

$$\rho\left(\frac{Y}{L}\right) = \lambda \tag{5}$$

Goodwin adopts the strict version of the Cambridge savings function according to this all wages are consumed and all profits Π are saved, while Say's law applies and the latter are automatically invested. The growth of the capital stock, is as a result equal to the rate of profit and can be expressed also as a function of the wage-share n and the capital-output ratio.

$$\rho(K) = r = \frac{1-u}{\sigma} \tag{6}$$

On the basis of this assumptions, Goodwin constructs a dynamical system whose dependent variables are the rate of employment and the wage share. By using the relationships (1), (4), (5), and (6) we can express the rate of growth of the former as:

$$\rho(\upsilon) = \frac{1-u}{\sigma} - (\lambda + n) \tag{7}$$

Following expressions (3) and (5), the rate of growth of the wage share may be written as:

$$\rho(u) = -(\lambda + \gamma) + p\upsilon \tag{8}$$

Equations (7), and (8) constitute a system of dimension two, describing a predator–prey dynamics similar to that proposed by Lotka and Volterra in the 1920's.We may rewrite the system as follows:

$$\dot{\upsilon}=\left[\frac{1}{\sigma}-(\lambda+n)-\frac{1}{\sigma}u\right]\upsilon$$

$$\dot{u}=[-(\gamma+\lambda)+p\upsilon]u \qquad (9)$$

$$0\leq\upsilon\leq 1 \text{ and } 0\leq u\leq 1$$

where the dot above the two variables implies their respective time derivatives. Given the wage–equatation adopted by the author, and the inverse relationship between w and υ in the model, the "predator" is represented here by the wage-share, and the "prey" by the rate of employment.

In the absence of the predator υ grows without limits at a rate equal to:

$$\rho(\upsilon)=\frac{1}{\sigma}-(\lambda+n)$$

On the other hand, in the absence of a prey u is condemned to extinction at a rate:

$$p(u)=-(\lambda+\gamma)$$

The coefficients p and $1/\sigma$ representing the effects of interaction between the two groups.

The economically significant equilibrium E is written:

$$E=\left[\upsilon_E=\frac{\lambda+\gamma}{p},\ u_E=1-\sigma(\lambda+n)\right]$$

which given the fluctuation of the two variables between zero and one implies:

$$p\geq\lambda+\gamma$$

$$\sigma(\lambda+n)\leq 1$$

The evaluation of the Jacobian matrix at E given us:

$$J_E=\begin{pmatrix} 0 & -\upsilon_E/\sigma \\ u_E & 0 \end{pmatrix}$$

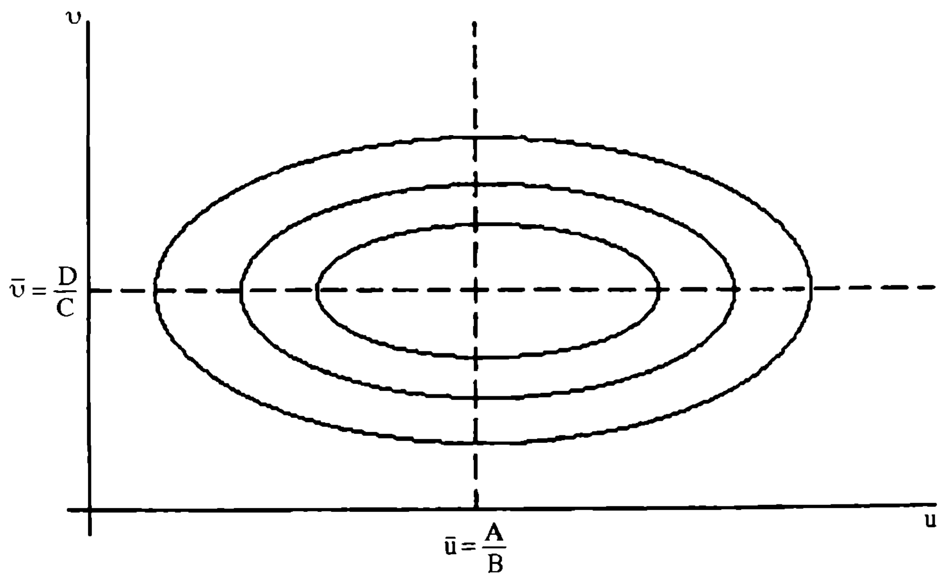
And results in the limit case of the Routh-Hurwitz stability conditions namely:

$$\operatorname{tr} J = 0$$
$$\det J > 0$$

The roots of the characteristic polynomial are purely imaginery without a real part which means that E is a center locally stable for the linear approximation of system (9), but leaves unanswered the question concerning the stability of the nonlinear system[1].

It can be shown that the trajectories of the linearized version of the system are ellipses whose exact amplitude depends on the parameters:

Figure 1



Predator u and prey υ fluctuate then in sinusoidal form which reminds us the harmonic oscillator with a period T:

$$T = \frac{2\pi}{\sqrt{(\lambda + \gamma)(\frac{1}{\sigma} - (\lambda + n))}}$$

1. A good introduction to stability study of the nonlinear system appears in Luenberger(1979).

III. On the temporal horizon of Goodwin's growth cycles

Following the classical economists and Marx, we consider that the trajectory of capitalist economy overtime results from the superposition of a multitude of more or less independent dynamics. They are manifested in temporal horizons sufficiently distinct to be able to study and concentrate on one among them while abstracting from the others. A good example of this position in the classical tradition is the relationship between the rate of profit and the wage rate. Even though it does not constitute neither a general rule, nor a theoretical necessity, we may assert, for instance, that during a short term crisis characterized by a stagnant aggregate demand and a rising rate of unemployment, the revitalization of economic activity would prove beneficial to both classes though in sensibly unequal proportions. In a longer term, during which the rate of utilization of productive capacity already in place is on average close to its normal value, the accumulation of capital increases the pressure for available workers in the labor market, and the consequent wage augmentations end up eroding capitalists' return on their investment. It is the case of "profit-squeeze", frequently referred to in the heterodox literature, which constitutes the basis for Goodwin's growth model. In the analysis of the long term, on the contrary, when the dynamics of technical change, and in particular the rise of the capital –output ratio, fully manifest themselves, the dominant variable of the system is the rate of profit. The wage rate in this case is the dependent variable that varies within the limits defined by the profitability of capital. One deals in other words with three different levels of abstraction, and three distinct links[2]. Having said that, only the dynamics of the long term can be considered as fundamental to capitalism, according to Marx, and the tendency of the profit rate to fall should not be attributed to the antagonism between wages and profits.

In the econometric application of Goodwin's model the principle of coexisting multiple dynamics and the simplistic at times theoretical assumptions made by the author posė directly the problem of specifying the appropriate temporal horizon, for its empirical evaluation. All the more since

2. We may apply the same principle to differentiate between the probable causes of an increase in output. In the short term the analysis concentrates on the variation of rate capacity utilization, whereas in the medium term, it is investment which propulses economic activity. Finally, to explain the long term trend of the series, technical change and the evolution of capital and labor productivity become the first priority.

this has been the subject of debate among non-mainstream economists dating back to the publication of the article. The assumption of the author concerning technical progress, and the closed circles around the fixed point obtained for the main variables, exclude in our opinion, the model from constituting a developed enough framework for the study of capitalist dynamics in the long term. This would necessitate a more elaborate analysis of technology and structural change, and Goodwin's construction seems too limited to us for this task. In fact, the generation of cycles in the model is independent of technical change, which the author manifestly situates in a longer temporal horizon than that of the profit squeeze.

In the eyes of many heterodox economists, nevertheless, the assumption of a fixed capital output ratio strips for the essential the model of its marxist character since it masks the mechanization of production, a key element of the classical and marxian long term. The elegant closed orbits obtained by Goodwin depend precisely on this assumption. A persistent rise of capital intensity in production, however slow, is tantamount to the progressive collapse of the system at a speed that depends on the rhythm of mechanization. In addition, the fixed gravitation centers of variables such as production growth, employment rate, and the share of wages leave the determination of the rate of profit to the "natural" rate of growth found in Harrod, Solow and Kaldor in an ahistoric theoretical framework, well distant from Marx's view of this temporality.

This critique should be somewhat tempered though. Without denying the importance of the conflict over distribution, Marx has expressly underlined the importance of the material reproduction of the system in the long term, represented best by the normal rate of profit on the capital advanced and the technical structure of economy. The influence on labor market conditions play a limited role in this context, and wage growth in the long term is conditioned strictly by the internal profitability of the system. The wage equation proposed by Goodwin is by and large the key element of his model, and focuses uniquely on supply and demand conditions in the labor market. It makes no direct reference to the prevalence of the rate of profit, and becomes thereby the basis for crisis of the profit squeeze type. It is then clear, we believe, that at the center of marxists' prejudice over the world lies Goodwin's ambiguous position concerning the temporal horizon of the dynamics he describes, rather than his analytical results themselves.

There lies probably the main reason for which a number of keynesian economists, but also of marxists, have adopted the model for the study of the business cycle despite the absence of a demand analysis there in. Short-term cycles manifest themselves by important fluctuations in production and employment, and according to this scenario, the duration of wage contracts-closely linked to labor market conditions-has a definitive impact on their amplitude and duration. In most instances in fact, the first modification proposed of the original model pertains to the addition of an investment function.

The question remains of course, whether this suffices for business cycles to become its natural domain of application. Though demand analysis should occupy a central place in a model focusing on the short term, we doubt whether it can be developed to its fullest extent, at least in the short term, without paying particular attention to the role of money. A model that makes no reference to the monetary dimension of the economy, and puts aside altogether, the link between the financing of an activity and the realization of the surplus value produced, is not in our view, a good candidate for the study of business cycles. This remains valid despite the insertion a posteriori of an investment function.

Goodwin's decision to keep the active side of economy and the influence of money outside his analysis, certainly maintained a reasonable level of analytic complexity, but it gives at the same time a clear indication of the term in which he situates it. The full utilization of productive capacities, an assumption used extensively by the classical economists, and the adoption of Say's law of the automatic investment of all profits, are illustrative examples in that respect. Consequently, any modification of the assumptions of the model, or its complementation with new theoretical insights should be done within the framework and intentions of the original contribution. The simple addition of an investment equation does not make of the model one appropriate for short-term cycles, nor the elaboration of a different theory of technical change transforms it automatically to a valid description of the long term.

For our part, we believe that a model of this type is more appropriate for the medium term, defined as a period between fifteen and twenty-five years, during which the rate of capacity utilization, is on average, close to its normal level, and the impact of technical change of production's prime costs has not attained yet its maximum.

In the words of Dumenil and Lévy:

> "Once this short-term effect has been taken out, a negative correlation becomes apparent since labor cost, as a cost, impacts negatively on the profit rate. This second relationship is characteristic of the long term, and could be christened "Ricardian"... Large labor costs are reflected negatively in the profit rate, since technology is only slowly affected by the variation of labor cost.".[3]

In this context the case of profit squeeze is most relevant, and labor cost control through lower wages becomes a first order imperative for firms. The econometric application of Goodwin's model that follows in conducted in this light.

IV. Statistical Methodology

Working with the medium term fluctuations of statistical series presupposes two things: First, that the elimination of the short-term movement does not distort the cycles obtained, and second, that the historic trend of the series is relatively independent of fluctuations of shorter periodicity. We are confronted in other words, with the issues involved in the literature concerning the existence of a unitary root and the co-integration of series. Namely, the legitimacy of breaking down a statistical series to its different components depending on the frequency of movement that they represent and the pertinence of filtering in general.

The critiques concerning the validity of the methods testing for these issues left aside, there are cases in which the decomposition of the series is necessary for important practical reasons as well.[4] According to Zarnovitz (1992), the mere reference to a growth cycle presupposes, that one accepts that a clear differentiation between the historical trend of the series and its fluctuations is not possible, but also necessary and even constructive for the outcome of the study. For all empirical work in this area, Zarnovitz continues, it is almost inevitable to assume that the influence of short-term fluctuations on the historic trajectory of the economy is minimal. Any cyclical movement observed in this context appears as a deviation from the trend.

3. Duménil and Lévy (1993), p.286.
4. For a critique of the unit-root tests widely used see in particular Pirotte (1995), Erthur (1992), and Perron (1989).

The Hodrick and Prescott (1980) filter constitute, in our opinion, one of the most flexible alternatives to the methods proposed by Beveridge and Nelson (1981), and Harvey (1985, 1989) because it allows the user, by choosing different values for the parameter λ ,to favor one of the two components of a series –trend or short term (conjectural) fluctuations– over the other, depending on the temporal horizon that is to be analyzed. In addition, the robustness of the method in case of case of mispecification further justifies its use for the isolation of medium term fluctuations[5].

We have chosen to remove the historical trend of the series using a λ value of 1000, but we retain the fluctuations of high frequency to avoid as much as possible any distortions during the estimation of the model that could be linked to the smoothing process. Once the trend is removed, the short-term movement should, in principle, be part of the residuals without having a strong impact on the empirical results. In the two figures that follow we can see the effect of filtering the short-term fluctuations of the profit rate and the correspondence between the unfiltered series of labor productivity growth and its medium term fluctuations.

5. The filter elaborated by Hodrick and Prescott is derived from that proposed by Whittaker and Henderson and allows for the elimination of high frequency movements in statistical series. It is defined as the solution to the following minimization problem:

$$\min_{Y_t}\left\{\sum_{t=1}^{N}\hat{Y}_t^2+\lambda\sum_{t=3}^{N}\left(d\bar{Y}_t-d\bar{Y}_{t-1}\right)^2\right\}$$

$$\text{s.t.}\qquad Y_t=\bar{Y}_t+\hat{Y}_t$$

where the first component represents the trend and the second the short-term fluctuations of the series. The first part of the minimization problem represents the distance of the variable from its trend, and the second term describes the curvature of the trend of the series. The rigidity of filtering depends on the l value that we choose. When $\lambda=0$ there is no filtering and the original series remains intact, whereas when $\lambda=\infty$ we end up with the determinist long term trend of the series which represent the growth at a constant rate of the variable. Evidently, all intermediate λ-values determine the relative weight of the two components, trend and fluctuations. One should admit, on the other hand, that the choice of λ is not the result of a statistical estimation, and the parameter value retained for each study has a subjective dimension that cannot be avoided. For a more detailed analysis of the Hodrick-Prescott filter see King and Rebelo(1989) and Varelas (1995).

Figure 2
The rate of profit (1869-1912). Before (——) and after (----) filtering.

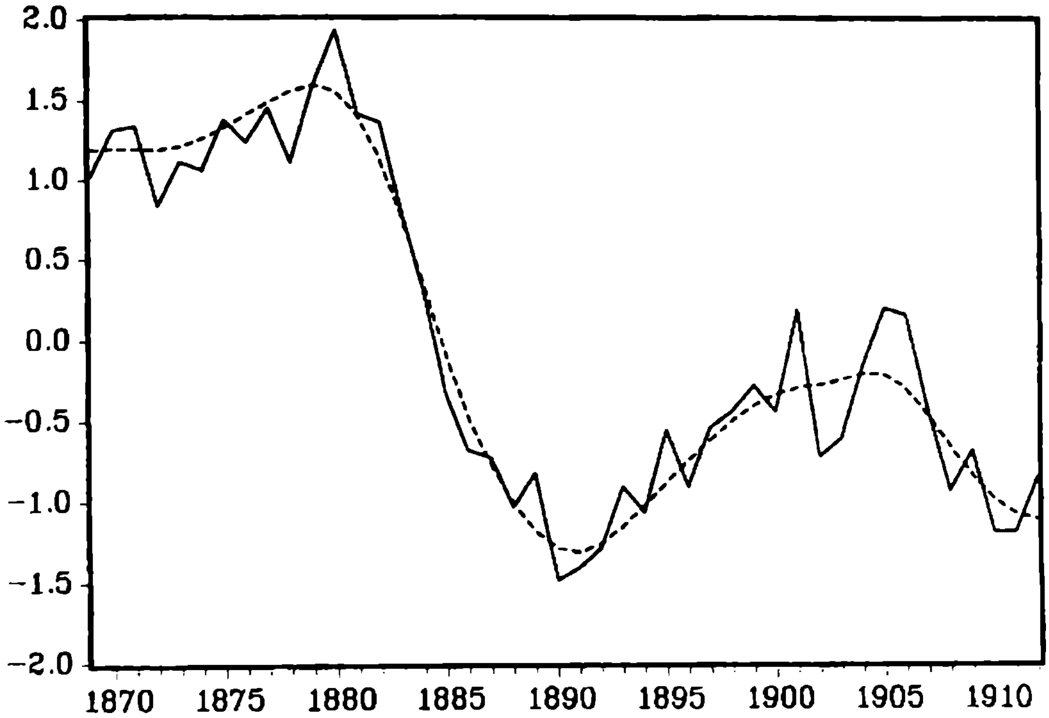
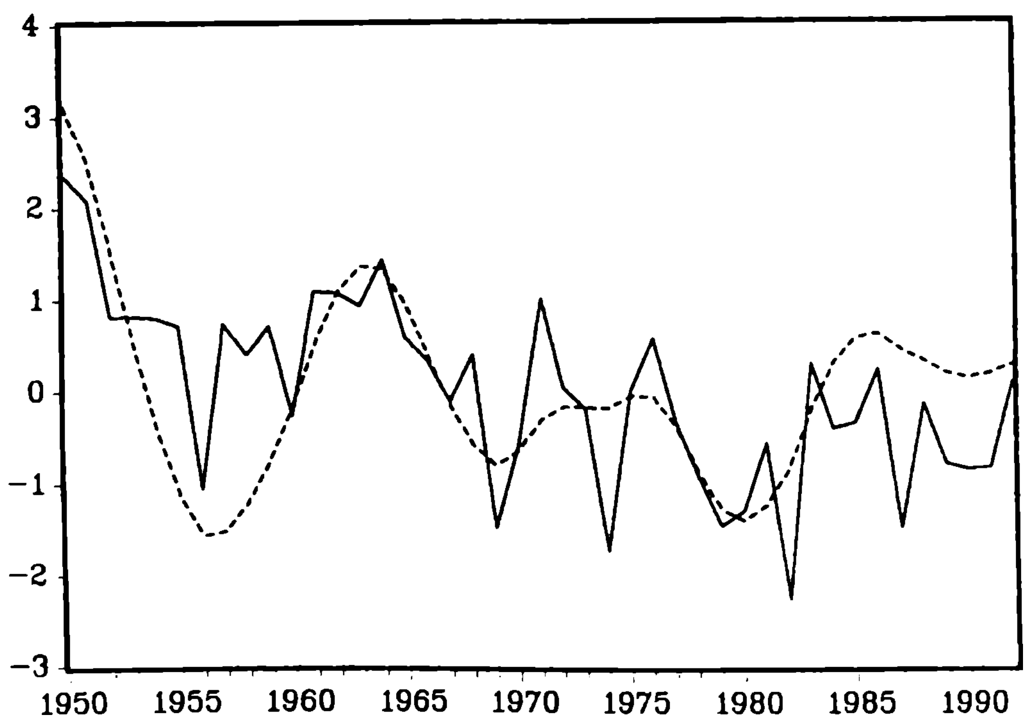


Figure 3
Labor productivity growth (1950-1992).
Actual series (——) and medium term fluctuations (----).



The removal of the trend results, however, to the loss of the constant each decomposed series. This inconvenience is particularly acute in the case of Goodwin's model because its non-linear construction presents us from working with fluctuations around zero. To resolve this, we have decided to add to the fluctuations of each series once the trend has been removed, its average value during the estimation period. By doing this, the econometric application of the model remains very close to the theoretical intentions of Goodwin, and respects at the same time his analytical choices.

V. The data

All the data used for the period 1929-1992 come from the Bureau of Economic Analysis (B.E.A.). For the data concerning the period 1869-1928,we follow Dumenil and Lévy (1993), who have collected data available in different historical studies: Balke and Gordon (1989) for the GNP, Goldsmith (1952) for the stock of capital, Kendrick (1961) for employment, and Lebergott (1964) for wages. Unfortunately, U.S. unemployment data are available only after 1890 and we are obliged to replace the rate of employment used by Goodwin by a proxy variable. According to (1), the labor force in the model grows at a constant exogenous rate n, but there are no statistical data that go back to the second half of 19th century, neither for population nor for its active part. We make thus the assumption that a good measure for U.S. population is given by the long term trend of employment:

$$N = \bar{L}$$

The rate of employment can then be written as:

$$\upsilon = \frac{L}{N} = 1 + \left[\frac{L}{N} - \left(\frac{\bar{L}}{N}\right)\right] + \left(\frac{L - \bar{L}}{\bar{L}}\right)$$

The last component of its expression is very small and can be written as:

$$\frac{L - \bar{L}}{\bar{L}} = \ln\left(1 + \frac{L - \bar{L}}{\bar{L}}\right)$$

Consequently, we can write:

$$\ln\left(\frac{L}{\bar{L}}\right) = \ln L - \ln \bar{L}$$

The series that will be used as a proxy for the rate of employment in the estimation is then:

$$\upsilon = \upsilon^* + \ln L - \ln \bar{L}$$

where υ^* is the average value of the series during the period. It cannot be determined empirically, and the working assumption adopted is to consider it equal to one.

The definition of the second endogenous variable, the wage share, is of course:

$$\text{Wage share} = \frac{\text{real wage rate} \bullet \text{labor hours}}{\text{GNP}}$$

Following the decomposition mentioned earlier, the series used in the estimation has the form:

$$u = \left(\frac{wL}{Y}\right)^* + \left(\frac{wL}{Y}\right) - \overline{\left(\frac{wL}{Y}\right)}$$

where the first parenthesis represents the average value of the variable during the estimation period, and the third one its trend.

Figures 4 and 5 show the medium term fluctuations of the rate of employment and the wage share used in the empirical work presented here.

Figure 4
The rate of employment and the wage share (1869-1912). Medium term fluctuations.

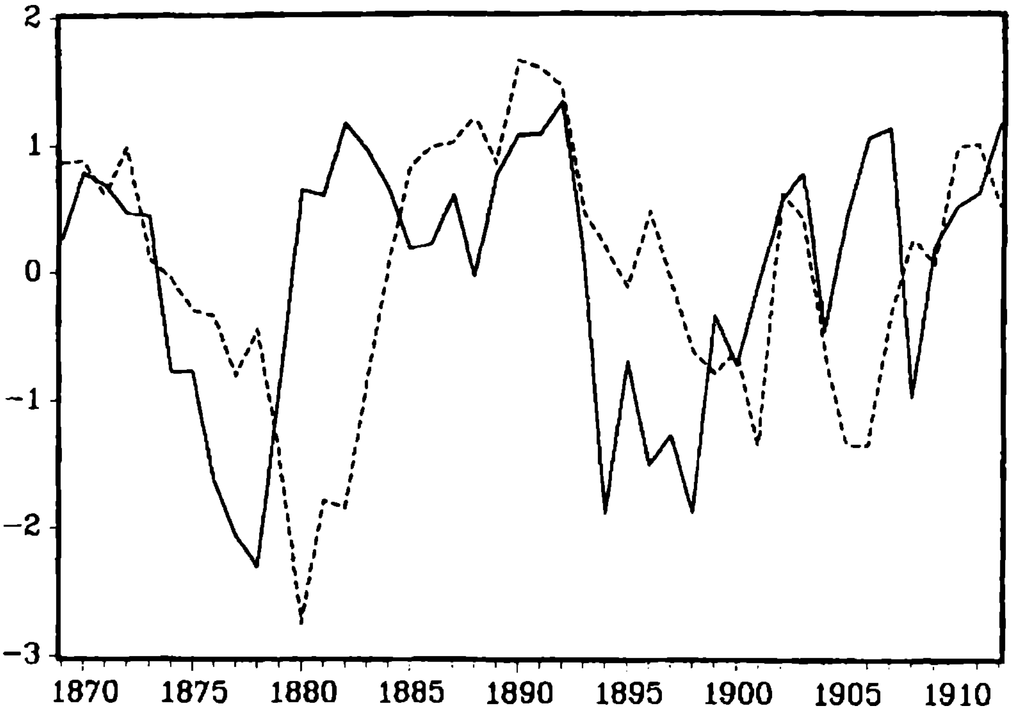
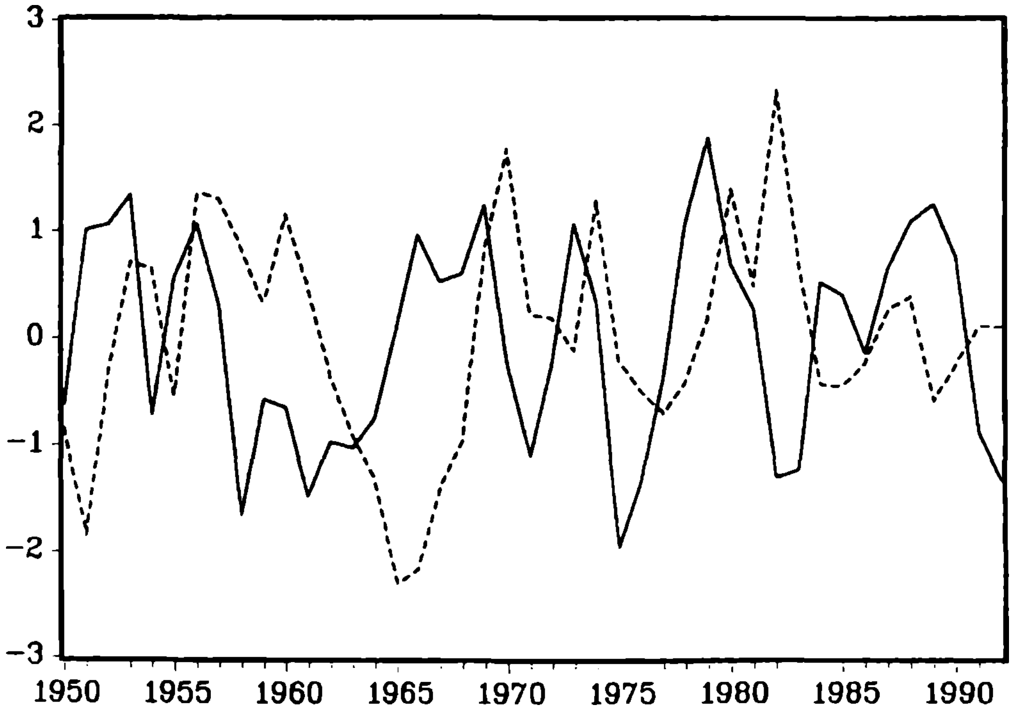


Figure 5
The rate of employment and the wage share (1950-1992). Medium term fluctuations.



VI. Estimation period and method

During the 124 years for which statistical data is available to us, the world has experienced events of great historical importance, which had great repercussions on the economic sphere. Notably two world wars, and the socioeconomic crises of 1870, 1890, and 1930. To avoid the potential prejudice and distortions that these could have on our study, we have decided to divide it in two parts corresponding to very different stages of the American economy. The first period, 1869-1912, covers the second half of the 19thcentury up to the First World War, while the second, 1950-1992, covers the years after the second war including the decade of high expansion 1955-1965 and the important fluctuations of the 1970's and 1980's. In doing so, we shall be able to estimate Goodwin's model in two periods that differ significantly not only at the economic level but also at that of the structure of American society as such. If the model describes an important dynamic of the capitalist system that depends only in a minor way on the characteristics of the historical period in question, its econometric performance should not be altered significantly by the passage from an economy closed to that described by the classical economists and Marx, to the complex reality of the post Second World War period. The scattergrams of u and u that follow confirm a priori a cyclical relationship between the two variables in both periods. One may notice, additionally that in the first period there are two quite distinct cycles that correspond to the years 1869-1885 and 1886-1902, respectively, with a progressive displacement of the center of gravitation of this relationship when the trend of the wage share is not retired.

Figure 6
Medium term fluctuations of the rate of employment and the wage share (1869-1912)

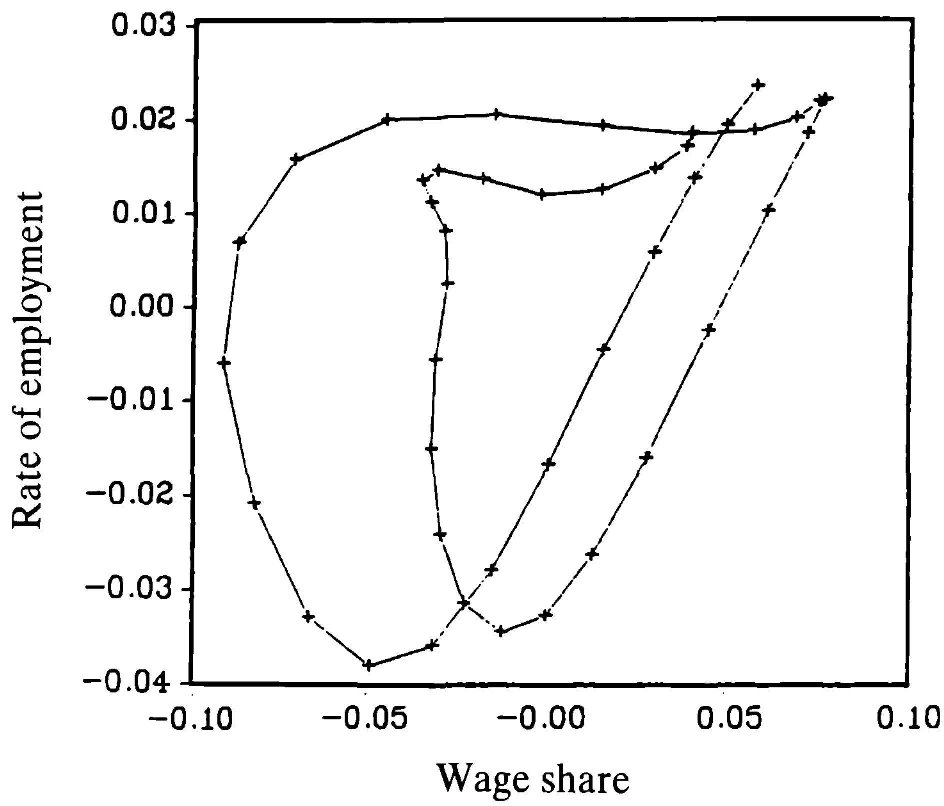
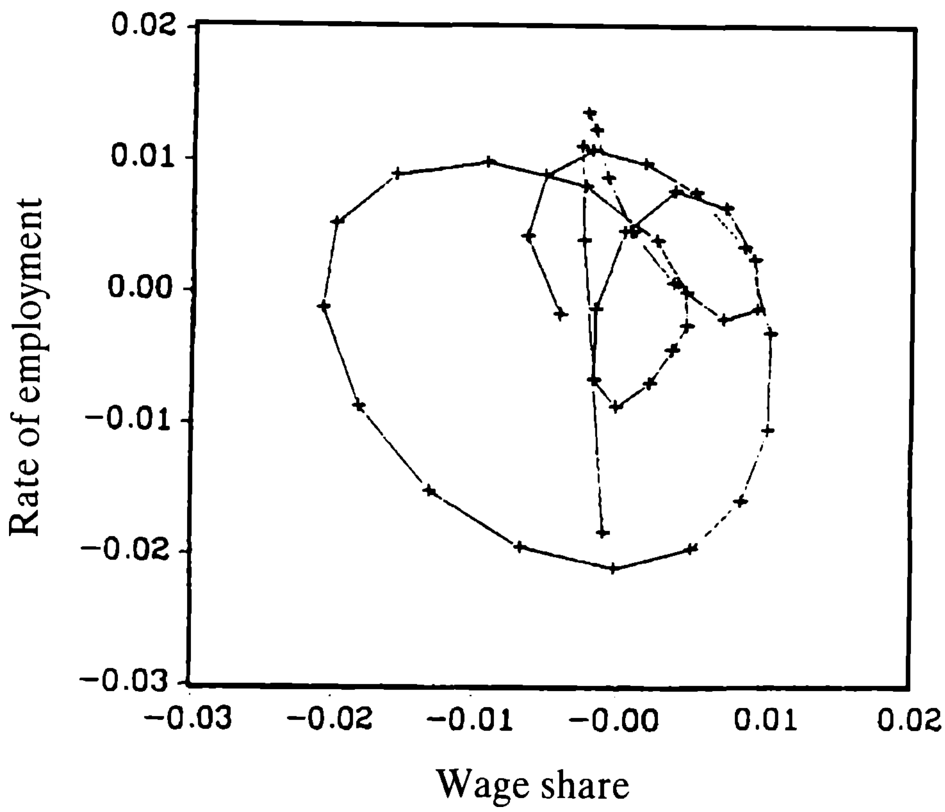


Figure 7
Medium term fluctuations of the rate of employment and the wage share (1950-1992)



The econometric model that we estimate emanates directly from the nonlinear system (9).The estimation method used is that of nonlinear least squares (NLS), a system method which gives better results in the presence of contemporaneous correlation in the residuals of the equations.[6]

All the series used in the estimation represent the medium term fluctuations of the original series, following the method already explained.

A. *The period 1869-1912*

There are different ways to write system (9) in discrete form, but the most robust is the following:

$$\upsilon_t = \upsilon_{t-1}(1-Bu_{t-1})$$
$$u_t = u_{t-1}(1+C\upsilon_t)$$

The results obtained for the period 1869-1912 are:

$$\upsilon_t = \upsilon_{t-1}(1-0.1844u_{t-1}) \quad R^2=0.384 \quad DW=2.32$$
$$(t=2.33)$$

$$u_t = u_{t-1}(1+0.511\upsilon_t) \quad R^2=0.748 \quad DW=2.09$$
$$(t=2.94)$$

These results are relatively satisfactory to the extent that the short-term fluctuations of the series have not been filtered, and the performance of the first equation deteriorates only after 1902. If we limit the estimation period to the years 1869-1902 the results obtained are:

6. Though it is the best way for obtaining undistorted econometric results in the face of contemporaneous correlation in the residuals of the equations, a system method requires the use of instrumental variables for the estimation of each equation. The absence of any exogenous variable in the model of Goodwin, led us in the use of endogenous variables with lags of one or two years as instruments. A very common practice in econometrics, but one that is not immune to the critic. Desai (1984) in the only attempt to our knowledge to estimate Goodwin's model empirically, comments that this method may be the source of distortions in the results, if there are autoregressive processes of high order in the formation of the residuals. He is quick to add, however, that should one wish to estimate the model in question, either this potential danger must be ignored, or some of the basic assumptions of the model must be changed to allow for the introduction of exogenous variables. We have chosen the first option.

$$\upsilon_t = \upsilon_{t-1}(1-0.202\,u_{t-1}) \quad R^2=0.51 \quad DW=2.24$$
$$(t=2.56)$$

$$u_t = u_{t-1}(1+0.57\upsilon_t) \quad R^2=0.787 \quad DW=2.07$$
$$(t=3.17)$$

A good way to improve the model's performance is to introduce among the explanatory variables of each equation the rate of capacity utilization θ. The values of coefficients B and C fall in this case, but this addition takes account more effectively for the unfiltered short term fluctuations of the series that our model, given its medium term orientation, is not purported to explain. Before the new estimation we have applied a light filter ($\lambda=10$) to the θ-series, to reinforce further its contribution.

The results obtained for the period 1869-1912 are:

$$\upsilon_t = \upsilon_{t-1}(1-0.104\,u_{t-1}) + 0.458\,\theta_t \quad R^2=0.78 \quad DW=2.24$$
$$(t=2.22) \quad (t=8.55)$$

$$u_t = u_{t-1}(1+0.249\upsilon_t) - 0.359\,\theta_t \quad R^2=0.847 \quad DW=2.07$$
$$(t=1.82) \quad (t=4.95)$$

There is a clear improvement over the results of the first estimation, and the capacity of the rate of employment equation to explain the fluctuations of the original series has increased markedly .The second note of the satisfaction relates to the sign obtained for the variable θ in each equation. An increase of economic activity is mirrored to a higher utilization of productive capacities and an improved rate of employment. This same process causes a relative fall of the wage share because the positive reversal of economic conditions will benefit mainly to the capitalist firms. There are no significant differences in the results if we limit the period of estimation to the years 1869-1902, though the t-statistics for the explanatory variables are somewhat higher.

B. ***The period 1950-1992***

The encouraging empirical results obtained so far have added further interest to the application of Goodwin's model in the years following the

Second World War. The goal of the experiment being to compare the explanatory power of the antagonism between wages and profits in this term in two periods with very different characteristics. We shall then be able to appreciate more fully the potential effects of structural and other changes on the distributional conflict and the functioning of the labor market.

The econometric model estimated remains (10). The results obtained are:

$$\upsilon_t = \upsilon_{t-1}(1-1.92u_{t-1}) \quad R^2=0.184 \quad DW=2.10$$
$$(t=4.468)$$

$$u_t = u_{t-1}(1+0.30\upsilon_t) \quad R^2=0.538 \quad DW=2.19$$
$$(t=4.367)$$

Manifestly, the equation for the rate of employment seems the least promising in these new conditions. Despite, one may add, the value of the c coefficient and its high t-statistic. The reason for that is twofold. In the years after the Second World War the rate of unemployment for which, in this case, there is available data, performs much better as an independent variable in the wage equation produced by Goodwin, than the logarithm of labor hours that we have been using so far. We have maintained though the same scheme for reasons of direct comparison with the earlier period. The second reason holds to the maintenance of all short term fluctuations in the series used for the estimation. As was the case for the first period, we have added therefore the rate of capacity utilization θ among the explanatory variables of each equation.

The results of the new equation are notably improved:

$$\upsilon_t = \upsilon_{t-1}(1-0.873u_{t-1}) + 0.445\theta_t \quad R^2=0.58 \quad DW=2.20$$
$$(t=3.688) \qquad (t=6.27)$$

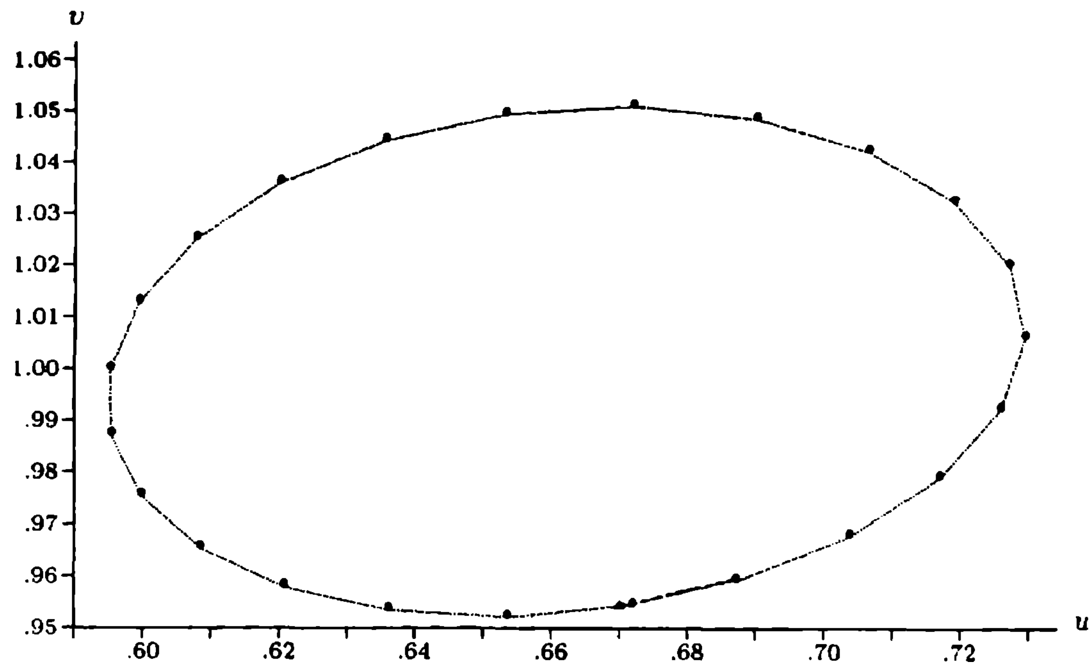
$$u_t = u_{t-1}(1+0.2358\upsilon_t) - 0.198\theta_t \quad R^2=0.784 \quad DW=2.02$$
$$(t=4.058) \qquad (t=-7.02)$$

There is no significant change in the results if we modify slightly the period of estimation.

VII. Simulation results

For the simulation of system (10) we have used the parameter values obtained in first estimation covering the period 1869-1912, before the addition of variable θ .The periodicity of the closed trajectory shown below is 23 years confirming our position on the temporal horizon of this type of model.

Figure 8



VIII. Concluding remarks

The satisfactory econometric results we have obtained for the periods as different as 1869-1912 and 1950-1992 confirm the dependence of wage growth on labor market conditions and the relative power of each class. They show that the antagonism between wages and profits in general, constitutes an integral part of capitalist logic in the medium term, quite independent of the conjuncture characterizing each period. There lies in our opinion, the principal strength of the model studied here. In a very simple theoretical construction Goodwin's description of capitalism as a "homeostatic mechanism" geared endogenously by variations in income distribution and profitability levels, leaves behind the veil of full employment, and puts for the profit squeeze dynamic as the origin of cyclical growth in the medium term. Knowing the socioeconomic and institutional differences between the second half of the nineteenth century and the period after the 1940s, including the strengthening of unionism and collective agreements, the globalization of production and exchange, and the active government intervention of economic affairs, we are inclined to interpret the model's good econometric performance as a solid first proof of the importance of income distribution and labor market dynamics in understanding the evolution of capitalism over the years.

The last issue we would like to raise here concerns the role that could be played by political authorities within the context of a profit squeeze model like Goodwin's. One could for example, reserve for the government a mediating role during collective negotiation. Optimistic expectations for the rate of profit on the part of capitalist firms remain though the key factor for durable accumulation and the creation of new jobs, and this type of intervention would have a limited impact. This is all the more true if one considers that the realization of large profits in the absence of important technological breakthroughs implies directly the reduction of production costs. The employment of cheap labor is certainly not the only way to achieve that, but the massive delocalization of production sites to developing countries, and the elaboration of political measures on selective immigration are there to remind us that the suppression of wage costs remains one of the most efficient ways for capitalists to control labor market pressures, and to rise the mass of surplus value extracted. Indeed, M. Kalecki (1971) said something very similar though in the context of a stagnant endogenous growth model, when he suggested that there are political and economic reasons for which unemployment is deeply rooted in capitalistic logic. The only way to allow for a strong government intervention in the case of Goodwin's would be to elevated public as a central element of the economy. But then, it would be difficult to talk about the medium and long term in classical and marxian terms, and the question of public expenditures financing would have to be addressed.

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