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2006

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This version: 21 October, 2006

[1]We are grateful for helpful comments from Alessandro Vercelli on an earlier draft, from participants at the Goodwin Workshop, Bremen, 11-12 November 2005, and from two anonymous referees.

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**Abstract**

This paper provides empirical support for an interpretation of the Goodwin growth cycle as isolating the main forces underlying distributive conflict, but in a fragile symbiotic mechanism because of endogenous forces that modify the balance of class power. Goodwin cycles are the shorter run cycles that appear around a long run motion that is the product of structural change. The paper describes long run trends in the Goodwin variables in the US corporate economy from 1948 to 2004, which exhibit both a sharp break at the beginning of the 80s, and no long run cycles. Short run detrended Goodwin cycles are identified, which broadly coincide in period and timing with the NBER dating of (the troughs of) business cycles. The paper then divides the employed nonfarm private industry labour force into supervisory and nonsupervisory workers, and focuses on the latter. The same two conclusions apply.

**Keywords**: Goodwin growth cycle, wage share, US economy.

**JEL classification**: E11, E32, J20

# 1 Introduction

Goodwin's predator-prey model (Goodwin 1967, 1972) is a formalization of Marx's account of class conflict over distributive shares in his theory of capitalist accumulation. Distribution and accumulation are modelled by means of a nonlinear dynamic Lotka-Volterra mechanism, yielding growth cycles. As employment grows the bargaining strength of the working class increases, yielding an increase in the wage share; the falling profit share reduces accumulation and hence the rate of employment; the bargaining strength of the working class weakens, recreating the profitability conditions necessary for accumulation. This mechanism repeats itself forever, unchanged, yielding conservative oscillations with a fixed period in the two main variables, the wage share ($u$), and the employment rate ($v$). A large number of authors have analyzed the model, extending it in many directions. This paper contributes to the much smaller literature investigating the empirical evidence for Goodwin cycles. The theoretical presumption is that because the model captures some fundamental insights of the functioning of capitalist economies, its cycles should be found in the data.

However, the empirical and econometric evidence is mixed. In the US post-war $(u, v)$ plot, Solow identified "a suggestion of predominantly clockwise motion, but in three separate episodes" (Solow, 1990, p. 39) and "a bare hint of a single large long-period clockwise sweep" (*ibid.*, p. 40). Flaschel and Groh (1995) and Harvie (2000) found a similar pattern in the post-war plots of, respectively, 8 and 10 OECD countries, with shorter (10-15 years) clockwise cycles around an incomplete long-period (50-70 years) clockwise motion. In the UK data considered by Desai (1984), the post-war period is also characterized by a similar pattern. There is moreover no common methodology of measurement across these studies. All of this raises the issues of whether Goodwin cycles exist and what they are.

*A priori* theoretical considerations and the absence of stable short run cycles have led most authors (e.g., Desai 1984; Farkas and Kotsis 1992; Harvie 2000) to interpret Goodwin cycles as long run secular waves and to adopt an "approach which attempts to argue for a large phase length and amplitude of this growth cycle" (Flaschel and Groh 1995, p. 295). From this perspective, the Goodwin cycle is seen as modelling a long run conflict between workers and capitalists, influenced by secular forces such that shorter run factors are averaged out. The main idea is that "under modern post-war conditions ... the large changes in income distribution among capital and labor which this reproduction process calls for will use up an amount of time which can be drastically higher than the 8-10 years that Solow calculated ..." (*ibid.* 1995, p. 294).

This interpretation is not entirely convincing. First, it is unclear that there is a long run empirical regularity to be explained. In several countries the long run motion is not well shaped. Moreover,

"one cycle is not a periodic motion" (Solow 1990, p. 40) and much less so the "three-quarter cycle" (Harvie 2000, p. 357) that emerges from the post-1945 data. When longer time series are analyzed, however, the existence of stable long run cycles is questionable, as shown in the UK 1855-1965 data by the "steady shift to the right (rising $u$)" (Desai 1984, p. 259). Secondly, the behavioural foundations of such secular motions are not obvious, and the role of structural breaks, such as that in all developed countries around 1980, seems underestimated.

This paper argues that the Goodwin cycle isolates *in vitro* the main forces underlying distributive conflict, but because of endogenous forces that modify the balance of power between classes and the structure of the bargaining process, the symbiotic mechanism described is fragile. This feature is captured by the structural instability of the model (Veneziani and Mohun, 2005). Goodwin cycles are then the shorter run cycles that appear around the long run trend.

If correct, this interpretation suggests that the long run behaviour of the wage share and the employment rate is mainly the product of structural change, which in turn implies that the econometric results obtained under the assumption that the model describes long-run secular motions should be interpreted with caution. For example, Desai (1984) embeds the cyclical mechanism in a more general model with money wage bargaining and adaptive expectations, in order to test the parameter restrictions that yield the structurally unstable Lotka-Volterra specification. Analysis of the UK data over the century 1865-1965 leads him to reject such restrictions and thus to reject the Goodwin's original specification. Similar results are obtained by Harvie (2000) for ten OECD countries for the post-war period. If structural changes dominate the long run motion of the wage share and the employment rate, these results are not surprising because they reflect underlying structural changes.[1] Hence this paper attempts a careful distinction between long-run structural changes and short-run cycles.[2]

A further contribution of this paper concerns the appropriate definitions of the variables for empirical analysis. This involves issues such as the appropriate treatment of the self-employed (both with respect to wage share and employment share), the appropriate definition of profits (which involves

[1] Indeed, if the data are characterized by significant structural changes over the period, a straightforward estimation of the main equations of the model under a long run interpretation is liable to produce puzzling results. Thus, for instance, in Harvie (2000) in all countries the estimated average values of the wage share and the employment rate lie outside the plot, the estimated period of the cycle is one year, and the estimates of the parameters of the Phillips curve are unrealistically high (Harvie, 2000, Table 2, p. 362).

[2] This is also broadly consonant with the approach suggested by Vercelli (1977), although his quantitative procedures were different.

decisions about data such as the rental income of persons, indirect business tax and nontax liabilities, and capital consumption), and the sectoral coverage of the statistics (corporate and non-corporate, private and public, total and nonfarm). Precise and informed definitions are desirable both to exclude data that are essentially extraneous to the issue at hand and to capture the behavioural assumptions underlying a model of distributive conflict. Much of the existing literature is not satisfactory in either of these regards, and the paper pays some attention to the issues involved.

The paper is organized in the following way. The next section explores the inspiration from Marx's *Capital* for Goodwin's model, outlines the model itself and suggests how it might be interpreted. Section 3 outlines measurement issues, and the following section describes long run trends in the US corporate economy from 1948 to 2004. The focus throughout is on the USA, the leading capitalist country, and therefore the most important test for the model. Section 5 considers the detrended shorter run data. Two main conclusions are drawn which contrast with the existing empirical literature.[3] First, the long run trends show a sharp structural change at the beginning of the 80s, but there are no long run cycles. Second, the model captures some remarkable regularities in the short run $(u, v)$ cycles, which coincide, in period and timing, with the NBER dating of (the troughs of) business cycles. Section 6 then discusses some of the requirements that the model makes of the data in order that distributive conflict be appropriately measured. This issue is pursued by disaggregating the data, dividing nonfarm private industry employees into two groups, supervisory and nonsupervisory employees, and focusing on the latter. The same two conclusions apply. However, this analysis throws up some interesting new puzzles. One is that there is a very large shift in wage share away from the four fifths who are nonsupervisory employees to the one fifth who supervise. A second is that the combination of these wage shares apparently produces *one* long run cycle in the trend data in a way that does *not* show up in the corporate sector. After a suggestion as to why this difference might be more apparent than real, an overall conclusion summarizes, and the data, sources and methods are described in an Appendix, such that the results of the paper can be replicated.

## 2 Marx and Goodwin

Marx's account of the relation between accumulation and wage fluctuations was developed in two stages. First, he assumed a fixed proportions technology, a constant 'technical composition of capital'

[3] Despite different theoretical and econometric approaches, this paper shares some features with the literature on the cyclical profit squeeze (Goldstein, 1996, 1999), in particular the emphasis on the distinction between trend and cycles and on structural changes. The results, too, are broadly consistent.

whereby "a definite mass of the means of production continued to need the same mass of labour-power to set it in motion" (Marx 1976, p. 763). Then if investment in new means of production was greater than the growth of the employed labour force, excess demand for labour-power would generate wage rises. Either this would have no effect on accumulation (because the rate of surplus value was so large that capitalists could absorb rising wages), or accumulation would slacken, reducing the demand for labour-power and hence wages to whatever levels were compatible with the rate of accumulation. Thus his causation went from the rate of accumulation to changes in the demand and supply of labour-power, and thence to changes in wages. In this manner, wages were forced to adjust to the requirements of accumulation.

This could only generate cyclical movements if there were a persistent tendency for the rate of accumulation to outstrip the growth of the labour force. But the historical era of an approximately constant composition of capital was characterized by slow development of capitalist relations on the basis of pre-existing technologies. 'Manu-factories' were only slowly developing, for markets were localized because of transport difficulties, and regulated with legacies inherited from an earlier feudal era. In such nascent capitalist conditions, the market for labour-power was undeveloped, and accumulation depended not upon technological dynamism, but upon increasing the total amount of labour time available for exploitation (the production of 'absolute surplus value'). In this sense, the exploitable working population constituted a 'barrier' to accumulation, to be overcome through a (physically and economically coercive) 'primitive accumulation' that separated the direct producers from their means of production so that they could be transformed into wage labour. Without this, the cycles of developed capitalism could not exist.

The second stage of Marx's argument related to a later historical phase of the development of capitalism, with the production of 'relative surplus value' predominating. That is, once capitalist relations began to generate their own technologies (rather than just appropriating existing ones), "the development of the productivity of social labour becomes the most powerful lever of accumulation" (*ibid.* p. 772). This occurred through the general introduction of means-of-production-using, labour-saving technologies, raising the technical composition of capital. Through technologically generated unemployment, changing industrial composition, and the growth of unstable and insecure employment, post-industrial-revolution capitalism in effect created its own labour supply,

> a disposable industrial reserve army, ... a mass of human material always ready for exploitation ... The path characteristically described by modern industry, which takes the form of a decennial cycle ... of periods of average activity, production at high pressure,

> crisis, and stagnation, depends on the constant formation, the greater or less absorption, and the re-formation of the industrial reserve army or surplus population. In their turn, the varying phases of the industrial cycle recruit the surplus population, and become one of the most energetic agencies for its reproduction. (*Ibid.* pp. 783-5)

There is, however, an unresolved tension in Marx's argument. He insisted both that

> the rate of accumulation is the independent, not the dependent variable; the rate of wages is the dependent, not the independent variable (*ibid.* p. 770),

and that

> general movements of wages are exclusively regulated by the expansion and contraction of the industrial reserve army, and this in turn corresponds to the periodic alternations of the industrial cycle (*ibid.* p. 790)

It is not obvious that these two statements are compatible. On the one hand, changes in wages are determined by changes in the industrial reserve army in a cyclical mechanism. For the existence of cycles, there has to be feedback from wage changes to changes in the rate of accumulation and hence changes in the industrial reserve army. On the other hand, that feedback is simultaneously denied by the assertion of one way causation from changes in the rate of accumulation to changes in wage rates.

But suppose capitalism has causal mechanisms that operate with very different timescales. In a long run timescale, the rate of accumulation is determined by capitals competing through innovations of product and process, generating a technical progress which is typically (although not universally) labour-saving and means-of-production-using. Long run wages respond to whatever these productivity increases allow. Technical progress determines profitability, so that the long run rate of profit is associated with particular profiles of technology and distribution, which in turn determine the long run rate of accumulation and thence the long run rate of employment.[4] Accordingly, associated with the long run evolution of the rate of profit, there will be some long run relationship between the wage share and the employment rate.

There are also shorter run cyclical patterns between wage share and employment rate. An increase in accumulation puts upward pressure on wages in the labour market; rising wages both depress profitability and hence investment and the rate of accumulation, and stimulate (generally labour-saving) technical change; demand-side pressures in the labour market subside partly because the

[4] Duménil and Lévy (1993, 2002) have written extensively in these terms.

demand for labour falls and partly because the rise in unemployment increases the supply of labour; profitability recovers as real wage rises lag productivity growth, investment increases, increasing the rate of accumulation and the labour market tightens again.

These short run cyclical fluctuations in employment rate and wage share were formalized by Goodwin (1972) "to give more precise form to an idea of Marx's - that...[capitalist cycles] can be explained by the dynamic interaction of profits, wages and unemployment" (*ibid.*, p. 442). Goodwin proposed, in a summary of the Marxian approach,

> a homeostatic mechanism which functions by means of variations in distributive shares but does so in such a way as to keep them constant in the long run. If real wages go up, profits go down: if profits go down, saving and investment lag, thus slowing up the creation of new jobs. But the labour force is continually growing both through natural increase and through men 'released' by technological progress. The reserve army of labour grows, wages lag behind the growth of productivity, profits rise and accumulation is accelerated back up to a high level. This in turn gradually reduces unemployment, wages rise, and so it goes on, indefinitely. (*Ibid.*)

His model elegantly and parsimoniously expresses an interpretation of the cycle mechanism that Marx had in mind.[5]

Goodwin began with two homogeneous and non-specific factors of production, labour and 'capital' (plant and equipment). Focusing on real net quantities, he made the following assumptions.

1. Steady disembodied technical progress, such that labour productivity $a$ grows at a constant rate $\alpha$, and hence $a = a_o e^{\alpha t}$.

2. Steady exogenous growth in the labour force, so that labour supply $n$ grows at a constant rate $\beta$, and hence $n = n_o e^{\beta t}$.

3. A constant capital-output ratio $\sigma = k/q$, with all wages $wl$ consumed and all profits $q - wl$ saved and invested. Then the wage share $u$ is $wl/q$, or $w/a$, where labour productivity is $a = q/l$, and the profit share is $1 - w/a$. So profits are $(1 - w/a)q$, which is investment $\dot{k}$. Hence the profit rate is $\dot{k}/k$ which is $\dot{q}/q = (1 - w/a)/\sigma$.

4. A real wage rate that rises in the neighbourhood of full employment. For simplicity, he assumed a linear approximation $\dot{w}/w = -\gamma + \rho l/n$, with both $\gamma$ and $\rho$ positive and where $l/n \equiv v$.

[5] It is worth noting in passing that Marx's historically specific concept of an 'industrial reserve army or surplus population' is much broader than the historically more recent concept of 'unemployment' (*ibid.*, pp. 794-7).

Putting all this together and focusing on the wage share $u$ and the employment rate $v$, the model describes closed orbits in $(u, v)$ space according to the following equations:

$$\frac{\dot{u}}{u} = -(\alpha + \gamma) + \rho v \tag{1}$$

$$\frac{\dot{v}}{v} = \left\{ \frac{1}{\sigma} - (\alpha + \beta) \right\} - \frac{u}{\sigma} \tag{2}$$

These equations describe the short run cyclical dynamics.[6]

These short run cyclical dynamics are *growth* cycles. In the long run, income shares are constant, so that, setting equation (1) to zero, the long run employment rate is

$$v = \frac{\alpha + \gamma}{\rho} \tag{3}$$

which implies from the wage equation that in the long run real wage growth is equal to the growth of labour productivity

$$\frac{\dot{w}}{w} = \alpha \tag{4}$$

Similarly, setting equation (2) to zero, the long run wage share is

$$u = 1 - \sigma (\alpha + \beta) \tag{5}$$

Consider the long run behaviour of the US economy over the 57 years from 1948 to 2004. In the nonfarm business sector, the average annual growth of real output per hour (a proxy for $\alpha$) was 2.2%, and that of real hourly compensation in nonfarm business (a proxy for $\frac{\dot{w}}{w}$) was 1.8%. Thus equation (4) is not descriptively satisfied. Neither is equation (5). The long run average value of the capital-output ratio in the corporate sector (a proxy for $\sigma$) is 2.1, and of (whole economy) labour force growth (a proxy for $\beta$) is 1.6%. Substituting these values into equation (5) gives a long run wage share of 92.1%, whereas the average (corporate sector) wage share between 1948 and 2004 was rather lower, at 78.9%.[7]

Goodwin recognized the descriptive problems of his assumptions. He characterized his model as "starkly schematized and hence quite unrealistic", with assumptions that are "too simple and too crude to represent reality". But he also asserted that the assumptions were chosen to represent "the most essential dynamic aspects of capitalism". If this is accepted, then one way in which the model

[6] Goodwin (1972 pp. 445-8). For a more detailed formal analysis of the Goodwin model, see Gandolfo (1997), Section 24.4, pp. 449-64.

[7] The variables are more precisely defined, and their coverage discussed, in the following sections. Restricting the coverage to the years of NBER peaks (1948-2000) makes only a negligible difference.

can be made "more realistic is by incorporating additional, empirically valid assumptions" (*ibid.* pp. 442-3). This is the path taken by much of the literature commenting on and developing Goodwin's model (for example, Desai 1973, Flaschel 1988, Skott 1989). The following sections take a different approach. They focus on whether the model does indeed succeed in capturing "the most essential dynamic aspects of capitalism", and they do so by exploring the differences between cycle and trend.

# 3 Measurement Issues

## 3.1 The measurement problem

There is no common methodology of measurement in those earlier studies that attempted empirically to investigate Goodwin cycles. Consider for example the wage share. Vercelli (1977, p. 66) used the ratio of compensation of employees to net national income. But this allocates to the profit share all self-employed income and all rental income of persons. These are substantial categories at best of doubtful relevance to the Goodwin model. Desai (1984) analyzed a theoretical model in which "the share of wages in national income" is "the ratio of the real wage to the average product per worker", and then conceded that in order to estimate the model

> we have to somehow pretend that our highly aggregative model with one good, homogeneous labour, malleable capital stock, constant rates of growth of labour force and productivity, no government sector is in some sense an approximation to the UK economy ..." (*ibid.* p. 259).

Solow (1990, pp. 39-40) used data for the US non-farm business economy, had a wage share that for the period 1947-86 varied between 0.94 and 1.07, and gave no details on how the wage share was measured. Flaschel and Groh (1995, p. 308) used the ratio of compensation of employees to GDP, which includes in the implicit profits share all self-employed income, and rental income of persons (as with Vercelli); it also includes *inter alia* indirect business tax and nontax liabilities, and capital consumption. Finally, Harvie (2000, p. 356) used the ratio of compensation of employees to the sum of compensation of employees and operating surplus, which is more meaningful. But his compensation of employees data included armed forces pay, and his operating surplus data included self-employed income and the operating surplus of general government.

If the data are to be investigated for evidence of Goodwin cycles, that data has to be appropriate for the phenomena under investigation. The remainder of this section outlines the main issues involved.

### 3.2 The relevant sectors

The mechanism of distributive conflict described in the Goodwin model would not be expected to apply to general government, because general government produces negligible marketed output. Moreover, at least in the US, the government sector that does produce marketed outputs (government enterprises) is very small. Hence the scope of the economy should be restricted to private industries.

Two datasets (both excluding the government sector) are used in this paper. Dataset 1 focuses on the corporate sector (which includes the corporate farm sector). Dataset 2 is broader, covering (corporate and noncorporate) nonfarm private industries; ideally private households and not-for-profit institutions serving households should also be excluded, but the data do not consistently allow it.

### 3.3 The employment rate

The civilian labour force comprises the unemployed plus those in employment, the latter comprising employees (wage and salary earners), the self-employed (active proprietors or partners who devote a majority of their working hours to their unincorporated businesses), and unpaid family helpers. While the latter are not relevant here, the self-employed are a difficulty. They amounted to 20.3% of all employment in 1949 (10.1 million people). Their share of employment halved by 1970, and then remained fairly stable at 10-11% of employment until 1994 (increasing in number from 7.1 million in 1970 to 10.6 million in 1994 as overall employment rose), before falling back to 8.8% by the end of the century (10.3 million in 2003). Hence the self-employed are both significant in number and non-constant in their share of rising total employment.

If the employment rate is defined as

$$v = \frac{\text{All employment}}{\text{Civilian labour force}} = \frac{\text{Employees + Self-employed}}{\text{Employees + Self-employed + Unemployed}} \tag{6}$$

then compositional changes in the labour force between employees and self-employed will not matter (as long as there is no significant movement between self-employed and unemployed). But leaving the self-employed out of the numerator, or out of both numerator and denominator will generate bias in $v$ because of the non-constant movement of self-employed into employee status.

Dataset 1 uses the overall national employment rate, and so includes the self-employed in both numerator and denominator. Indeed, since the employment rate is defined to be the percentage of all in employment to the civilian labour force, it also includes such categories as employees in general government and in households and nonprofit institutions. Hence it has to be assumed that the economic trends that affect corporate sector employment and unemployment sufficiently dominate

Table 1: *Compensation of Employees by Sector and Legal Form of Organization as a Percentage of Total Compensation of Employees, 1948-2004*

| | Mean | Standard Deviation | Coefficient of Variation (%) |
|---|---|---|---|
| Corporate business | 65.6 | 1.55 | 2.4 |
| Noncorporate business | 11.4 | 3.47 | 30.4 |
| Sole proprietors and partnerships | 9.0 | 3.59 | 40.0 |
| Other private business | 0.5 | 0.07 | 15.5 |
| Government enterprises | 2.0 | 0.21 | 10.5 |
| Nonbusiness | 23.0 | 2.33 | 10.1 |
| Households and NPIs serving households | 5.6 | 1.28 | 22.9 |
| General government | 17.4 | 1.57 | 9.1 |

the data that the national employment rate can be used to proxy the unavailable corporate sector employment rate. While this is not unreasonable, it is a significant assumption since one third of employees are located outside the corporate sector.

Dataset 2 uses an employment rate restricted to nonagriculture private industry adult employees, and so excludes both the self-employed and employees in general government and private households from both numerator and denominator.

## 3.4 The wage share

There are three issues with respect to the wage share. First, what wages should count? Second, how should the income of the self-employed be treated? And third, what is the wage share a share of?

### 3.4.1 What wages should count?

Wages are taken to be 'compensation of employees', including both wage and salary accruals and employer contributions for social insurance. However, not all such wages should be included if the cyclical mechanism as a model of class conflict is taken seriously.

Table 1 describes the proportions in which the compensation of employees in the US economy is distributed by sector and legal form of organization. The proportion of total compensation of employees in corporate business is about two thirds of the total, and fairly stable over the period. That in noncorporate business (sole proprietors and partnerships, other private business and government enterprises) averages about one ninth of the total, but is fifteen times as variable. And that in

households, nonprofit institutions serving households, and general government averages about two ninths of the total, a share that is five times as variable as that of corporate business. In a Goodwin cyclical mechanism, compensation of employees in such nonbusiness sectors is clearly not relevant, and should be excluded. But the variability of share in noncorporate business is a difficulty if employees are drifting between noncorporate business and nonbusiness occupations.

A further issue is that because the Goodwin model is a model of class conflict over distributional shares, 'wages' represent the labour income of the working class. However, not all 'compensation of employees' accrues to the working class (unless the latter category is defined so broadly as to lose any analytical content). The use of Dataset 2 below attempts to take this into account.

### 3.4.2 What is the labour income of sole proprietors and partnerships?

Sole proprietors and partnerships not only employ wage workers; they earn an income ('proprietors' income') which is not differentiated between wages and profits. This income is substantial, averaging 9.3% of national income over the period. (It was 16.2% in 1948, almost halves by the mid-60s - mostly owing to the decline of proprietors' income in the farm sector - and fluctuates thereafter between 6.2% and 8.6%.) For most purposes, this income has to be treated entirely as profit (which it is not), or entirely as labour income (which it is not), or split by some imputation procedure into elements of both (which might be true but entails in a model of class struggle that the self-employed exploit themselves).

In Dataset 1 the corporate sector does not have any self-employed, so the self-employed are irrelevant to the measurement of wages. But since they are in the employment rate, the paper assumes that the relation between the compensation of employees and employees in employment dominates the data. In Dataset 2, the self-employed are excluded from both wage share and employment rate.

### 3.4.3 What is the wage share a share of?

The third issue with regard to the wage share is difficult because NIPA aggregates (whether GDP or National Income) are much more than the sum of wages and profits. In addition to wages (compensation of employees) and corporate profits, GDP, for example, also includes proprietors' income, net interest, rental income of persons, indirect business tax and nontax liabilities, the current surplus of government enterprises less total subsidies, and capital consumption, and excludes net income receipts from the rest of the world. Moreover, both corporate profits and proprietors' income include inventory valuation and capital consumption adjustments, and the rental income of persons incorporates the

latter as well. The same issues are relevant with respect to National Income. So taking the wage share as compensation of employees to GDP or National Income hugely exaggerates the implied profits share, and it is very difficult then to relate the latter to the behavioural hypotheses suggested by Goodwin. Hence these behavioural hypotheses require an appropriate definition of 'profits'.

In both Datasets 1 and 2, the denominator of the wage share is measured as that net value added category most (approximately) appropriate to the coverage of the wage data in the numerator.

# 4 Long Run Trends in the US Corporate Sector 1948-2004

Consider the corporate sector in the US economy. Net value added is the sum of compensation of employees, net operating surplus and taxes on production and imports less subsidies. In order to focus directly on distributive conflict, corporate net value added ($Y$) is considered in what follows as just the sum of compensation of employees and net operating surplus ($\Pi$). (Taxes on production and imports less subsidies are thereby excluded.) The corporate rate of profit ($r$) is defined conventionally as the ratio of corporate profits to the corporate capital stock ($K$), where profits are identified as the net operating surplus of domestic corporate business in current dollars, and the capital stock as the sum of the current-cost net stock of private nonresidential fixed assets (equipment, software and structures) and the nonfarm inventories of nonfinancial corporate business. Decompose this rate of profit into the product of corporate profit share and corporate capital productivity (the inverse of the corporate capital-output ratio),

$$r = \frac{\Pi}{Y}\frac{Y}{K} \tag{7}$$

and consider the long run time path of this decomposition.

The discussion following equations (3)-(5) above merely took log differences of the various series and divided each by the relevant number of years. A more sophisticated approach to establishing long run trends is to filter the data using the Hodrick-Prescott procedure (1997 (1980)). Suppose that a series $y_t$ can be considered as the sum of a growth component $g_t$ and a cyclical component $c_t$ whose average in the long run is close to zero. Then the HP filter chooses the $g_t$ to minimize

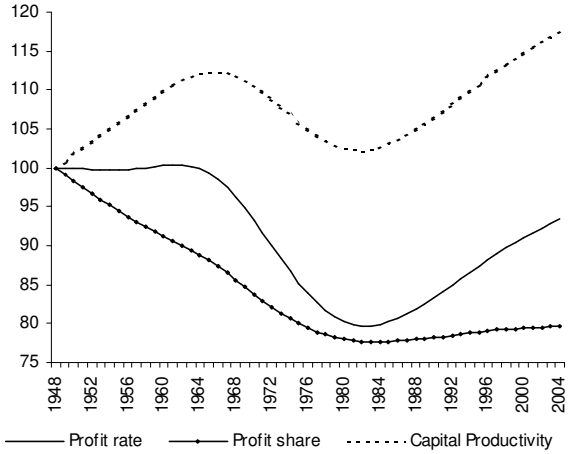
$$\sum_{t=1}^{t=T}\left(y_t - g_t\right)^2 + \lambda\sum_{t=1}^{t=T}\left[\left(g_t - g_{t-1}\right) - \left(g_{t-1} - g_{t-2}\right)\right]^2 \tag{8}$$

Here $\lambda$ is a positive number which "penalizes variability" (Hodrick and Prescott 1997, p. 3) in the trend; the larger is $\lambda$, the closer the solution of the programming problem (8) to a least squares fit of a linear time trend. Choice of $\lambda$ is then a compromise between the distance of the variable from its trend (the first term in equation (8)) and the curvature of the trend (the second term). Hodrick and

Prescott originally suggested values for $\lambda$ of 100 for annual series and 1600 for quarterly series. More recently, Ravn and Uhlig (2002) have argued that *if* a value of $\lambda$ of 1600 is appropriate for quarterly series, then the value for the corresponding annual series should not be 100 but rather 6.25. On the other hand, Duménil and Lévy (1993, p. 223) have suggested that, for 100 years of annual data, in order to obtain what they called a "more rigid trend" a higher value of $\lambda$ was necessary, and they set $\lambda$ at 5,000. There is no 'correct' value; the choice entirely depends upon what the research is trying to do. In what follows, $\lambda$ is set at 1000 for annual data, and for the corresponding quarterly data, at 256,000. While the trends thereby obtained are 'more rigid' (for visual convenience), they are also robust to a much lower choice of $\lambda$.

The long run trends for the decomposition of equation (5) are shown in Figure 1, each series being indexed to 1948. In terms of trend, the profit share falls by just over a fifth from 1948 to 1982, and

Figure 1: *Long Run Trends: Profit Rate, Profit Share and Capital Productivity, Corporate Sector, USA, 1948-2004*

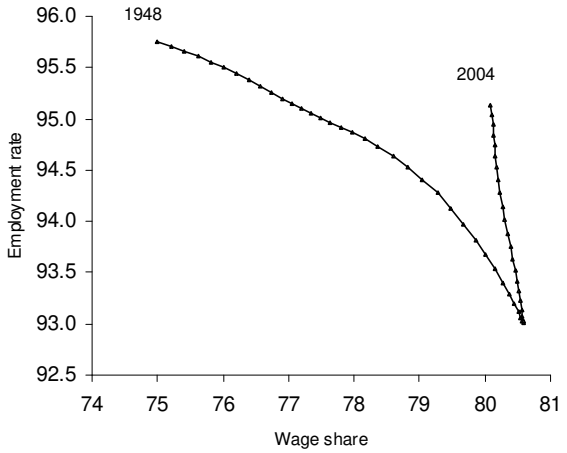



then is approximately constant. But trend capital productivity rises by about 12.5% from 1948 to 1966, a rise sufficient to prevent any significant fall in the trend rate of profit up to 1964. The fall in trend capital productivity after 1966 combines with the falling trend profit share to produce a precipitate decline in the trend rate of profit from 1964 to 1982. Its recovery thereafter to the end of the century is primarily associated with rising trend capital productivity.

Thus for the corporate sector, neither the profit share (and hence the wage share) nor capital productivity (and hence the capital output ratio) are constant in long run terms. If they were, Figure 1 would depict a single horizontal straight line. In terms of the broad spirit of the Marxian approach to the long run sketched in Section 2 above, one would expect a positive long run relationship between

the profit rate and the employment rate, and, to the extent that the profit share tracks the profit rate, a negative one between the wage share and the employment rate. Figure 2 shows the corporate wage share, defined as the ratio of corporate employee compensation to corporate net value added, and the employment rate as the percentage ratio of total employment to total employment and unemployment, defined across all sectors of the economy. There are two noteworthy features.

Figure 2: *National Employment Rate and Corporate Wage Share in Corporate Net Value Added, Long Run Trends, USA, 1948-2004*




1. In trend terms there is in general a strong negative relationship between wage share and employment rate, until 1982. The gradient is much steeper after 1982 than before, indicating a fundamental change in the early 1980s. Thereafter only a small fall in wage share is sufficient to generate a comparatively large rise in the employment rate (because of rising capital productivity).

2. There are no cycles in the long run trend data.

Thus the Goodwin model, as measured by the corporate sector, does not capture well the long run dynamics of US capitalism.

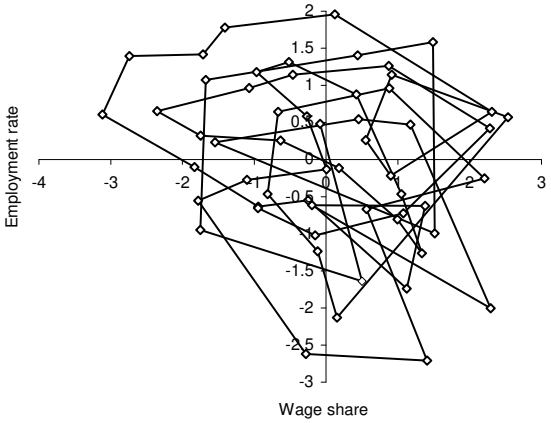
# 5 Empirical Evidence for Goodwin-type Cycles

Leave aside the issue of whether the addition, rather than the substitution, of more realistic assumptions will help the model, and focus instead on the claim that the underlying assumptions and hence equations (1) and (2) represent in the short run "the most essential dynamic aspects of capitalism". If

this claim were valid, then, in however attenuated a form, it should show up in the data. The issue is whether there are identifiable short run cycles that equations (1) and (2) might 'essentially' represent.

Figure 3 displays the cyclical relationship between the corporate wage share and the national employment rate (in annual data). A cyclical pattern is apparent, but relative to equations (1) and

Figure 3: *Detrended Cycles, National Employment Rate and Corporate Sector Wage Share, USA, Annual Data, 1948-2004*




(2) stochastic perturbations are altering the period, amplitude and position. This is clearer in Figures 4 and 5, which depict the individual cycles separately using quarterly data. While quarterly data enable greater precision in the dating of individual cycles, and show more clearly the effects of perturbations, they do not essentially alter the qualitative $(u, v)$ results found from the annual data. The cycles are broadly coterminous with NBER trough dates (about 4 quarters later than NBER peak dates), except for that ending in 1974Q4 (the NBER trough being one quarter later). Also the short NBER 1980Q3-1982Q4 cycle is amalgamated with its successor 1982Q4-1991Q3.

Conformity with the NBER dates is better before the structural turning point of the early 1980s than after. The left hand picture in Figure 5 shows four quarters following 1980Q3 which seem transitional in that they do not appear to belong to any cycle at all. Thereafter, there is some visual indication that the 1980s cycle in fact comprises two cycles: from 1981Q3 to 1986Q2, entirely below the horizontal axis, and then from 1986Q2 to 1991Q1, mostly above the horizontal axis. Moreover the 1990s cycle is also odd in that from 1991Q1 through to 1994Q2 it is hard to discern a cyclical movement at all. This is in marked contrast to the second half of the 1990s when the 'normal' cyclical pattern was re-established.

Thus examination of the data for the US corporate sector provides strong *prima facie* evidence that

Figure 4: *Detrended Corporate Sector Cycles, USA, Quarterly Data, 1949-1980*

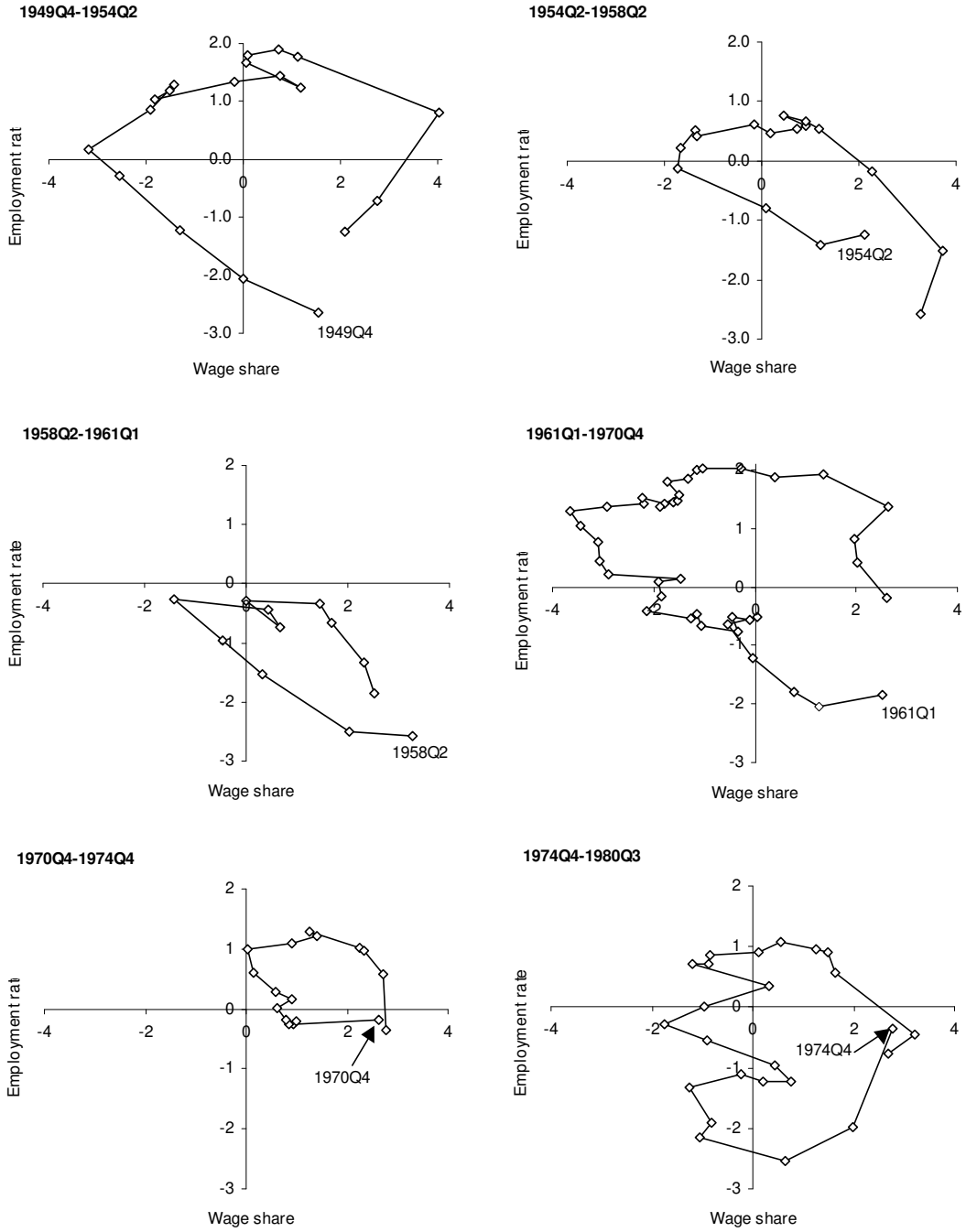
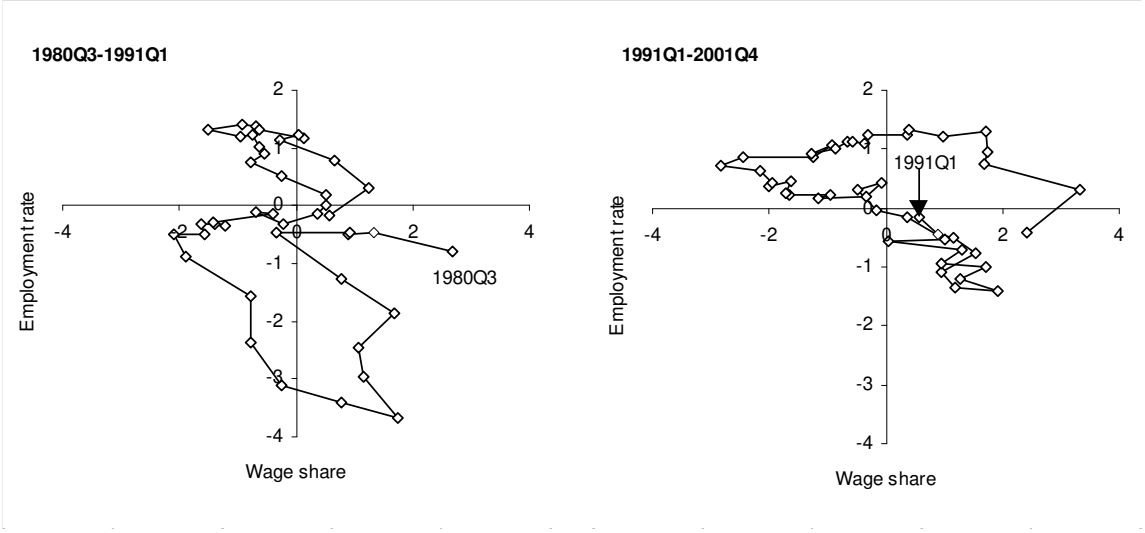


Figure 5: *Detrended Corporate Sector Cycles, USA, Quarterly Data, 1980-2001*




there are (detrended) cycles in the wage share and the employment rate, approximately identifiable with NBER trough to trough dates. All of the cycles are clockwise in direction, as the underlying causal argument would predict. But each cycle is different in position, amplitude and duration, so that the economic relationships generating detrended cycles do so in a way that is both systemic (cycles exist) and historically contingent (no two cycles are the same).

# 6 Wages, the Working Class and Distributive Conflict

## 6.1 Wages and the working class

The Goodwin model is a 'predator-prey' dynamic system in which, by equation (1), the more the prey population (the employment rate), the faster the growth of the predator population (the wage share), and, by equation (2), the smaller the number of predators, the faster the growth of the prey population. Goodwin commented that while this characterization is "to some extent ... purely formal", the analogy with "the symbiosis of two populations - partly complementary, partly hostile - is helpful in the understanding of the dynamical contradictions of capitalism, especially when stated in a more or less Marxian form" (Goodwin 1972, p. 445). For Goodwin, the cyclical mechanism described by equations (1) and (2) is "essentially what Marx meant by the contradiction of capitalism and its transitory resolution in booms and slumps" (*ibid.* p. 448). The two classes depend upon each other in an antagonistic relationship.

In the *model*, wages (and hence the wage share) accrue to the working class and profits (and profit

share) to the capitalist class. But in the *data* this is not true. Wages in Dataset 1 are identified with compensation of employees, which covers everyone employed by the corporate sector. If the earnings of all corporate employees are classified to wages, this leaves the corporate capitalist class with no obvious membership. If the earnings of the mightiest CEO and those of the humblest shop-floor worker are both 'wages', it is not easy to see how structural class relations can be personified. Yet they must be so personified for the Goodwin cyclical mechanism to work.

One way in which this issue might be approached is through a focus on hierarchy within the firm. Those lower down the hierarchy are hired and fired by those higher up; negotiations around wage increases are between those lower down the hierarchy and those above them; those lower down 'strike', and those higher up 'lock out'. Subordination to hierarchy is the pervasive experience of employment in capitalist firms; some people supervise, while most people are supervised.

Data on those who are supervised are available ('production and related workers' in Mining and Manufacturing, 'construction workers' in Construction, and 'nonsupervisory employees' in Private Service-Producing Industries). The questionnaires eliciting the raw data in the establishment survey define production and related workers and construction workers to include "working supervisors or group leaders who may be 'in charge' of some employees, but whose supervisory functions are *only incidental* to their regular work", and nonsupervisory workers to include "every employee *except* those whose *major* responsibility is to supervise, plan, or direct the work of others" (emphases added). The production and related workers and construction workers categories exclude those employed in financial and trade functions, plus a small miscellany of other functions.[8] Therefore amalgamating production and related workers, construction workers and nonsupervisory workers into a proxy measure of the working class is very approximate (although improving through time as the employment weight of the service sector increases). Imperfect though it is, it enables a better measure of 'wages' than the standard category of all employees who receive wages and salaries.

Henceforth 'nonsupervisory workers' refers to the aggregate of production and related, construction and nonsupervisory workers, and 'supervisory workers' refers to the residual aggregate of those whose

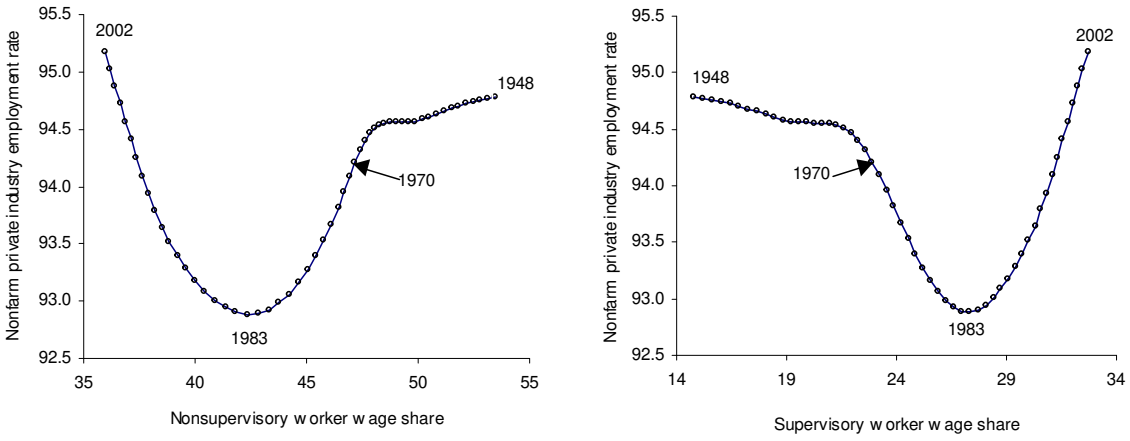
[8] For more descriptive detail, see U.S. Department of Labor, Bureau of Labour Statistics 1994, p. 1221. In Mining, and Construction, the production worker category excludes individuals working in accounting or finance, advertising, cafeterias, collection and credit, executive, professional and technical (including legal and medical) positions, personnel, purchasing and sales; in Manufacturing it excludes in addition people working in force account construction, product installation and servicing, recordkeeping not related to production, and delivery. See the BLS *Handbook of Methods*, ch. 2 for further detail and definitions. Sample questionnaires are in the appendix to this chapter.

major responsibility is supervision. The coverage is broadly all nonfarm private industry.[9] In 1948 87.9% of all nonfarm private industry employees were classified as nonsupervisory. This proportion falls to 82.6% in 1970, and thereafter fluctuates within a 2 percentage point band. Hence for most of the period some 81-82% of employees in nonfarm private industry are a proxy measure for the working class, and some 18-19% of employees supervise them. As just mentioned, some of these latter are engaged in low-level finance and trade functions, and it is obviously stretching credulity to call such office employees (in mining, construction and manufacturing) agents of capital. However, this is not too important: because of the highly skewed wage and salary distribution, the trend in the labour income of supervisory workers will be dominated by the trend of the higher labour income earners.

## 6.2 Nonfarm private industry: long run trends

Figure 6 is the analogue of Figure 2, and shows the overall nonfarm private industry employment rate against nonsupervisory and supervisory wage shares taken separately.

Figure 6: *Employment Rate and Wage Shares in Net Value Added, Nonsupervisory and Supervisory Workers, Nonfarm Private Industry, Long Run Trends, USA, 1948-2002*




Each graph in Figure 6 displays a roughly similar U-shape as that in Figure 2, with a similar turning point (1983 instead of 1982). But for nonsupervisory workers, the direction is reversed, so that 1948-83 exhibits declines in both their wage share and the overall employment rate; thereafter the nonsupervisory wage share continued to decline as the overall employment rate rose. Part of the decline was due to the falling proportion of nonsupervisory workers, but that was primarily confined to the years before 1970.[10] By contrast, for the much smaller number of supervisory workers, 1948-83

[9] Further details are given in the Appendix.

[10] If the proportion of nonsupervisory to all employees is held at its 1948 level, and the resulting nonsupervisory trend

Table 2: *Cycle Date Comparisons*

| NBER | Corporate Sector | Nonfarm private industry |
|---|---|---|
| Trough to trough | All employees | Nonsupervisory employees |
| 1949Q4-1954Q2 | 1949Q4-1954Q2 | 1951-56 |
| 1954Q2-1958Q2 | 1954Q2-1958Q2 | 1956-60 |
| 1958Q2-1961Q1 | 1958Q2-1961Q1 | |
| 1961Q1-1970Q4 | 1961Q1-1970Q4 | 1960-71 |
| 1970Q4-1975Q1 | 1970Q4-1974Q4 | 1971-76 |
| 1975Q1-1980Q3 | 1974Q4-1980Q3 | 1976-84 |
| 1980Q3-1982Q4 | 1981Q3-1986Q2 | |
| 1982Q4-1991Q1 | 1986Q2-1991Q1 | 1984-91 |
| 1991Q1-2001Q4 | 1994Q3-2001Q4 | 1994-2001 |

shows a large increase in their wage share as the overall employment rate fell; after 1983, the long run relationship between supervisory worker wage share and the overall employment rate was positive. For both supervisory and nonsupervisory workers, as with corporate sector employees in Figure 2, there are no cycles in the long run data.

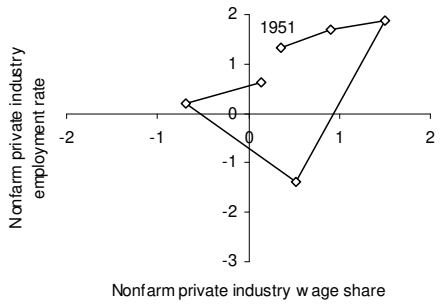
### 6.3 Nonfarm private industry: short run cycles

Dating of the short run cycles is more approximate, because of the lack of quarterly data. Figures 7 and 8 are drawn starting with the NBER trough dates, and then adjusting visually. If the years 1991-4 are ignored (analogous to 1991Q1-1994Q3 for the corporate sector), then all the cycles are clockwise in direction. The dating is close to that in Figures 4 and 5, but is not exactly the same, and this is summarized in Table 2. For the corporate sector, the transitional dates of 1980Q3-1981Q3, and 1991Q1-1994Q3 are omitted, and similarly the transitional years 1991-4 for the nonsupervisory employees in nonfarm private industry. Thus the data display a similar pattern: Goodwin-type cycles exist, they are clockwise in direction, short run rather than long run, and similar to NBER business cycles. They are not constant in either period or amplitude or position, consistent with an interpretation of continuous displacement. While the results show some sensitivity in dating and shape to the choice of dataset, the qualitative conclusions are unambiguous.

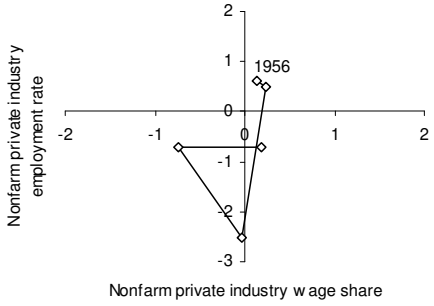
wage share compared with the actual trend, for all years to 1967, between 50 and 56% of the decline is attributable to the falling proportion. This proportion then declines sharply (47% in 1970, 32% in 1982, and 13% in 2002).

Figure 7: *Nonsupervisory Employees, Detrended Cycles, Nonfarm Private Industry, USA, Quarterly Data, 1951-1991*

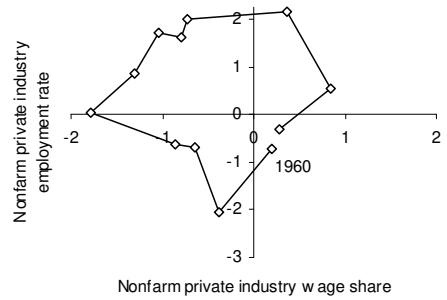
**1951-56**



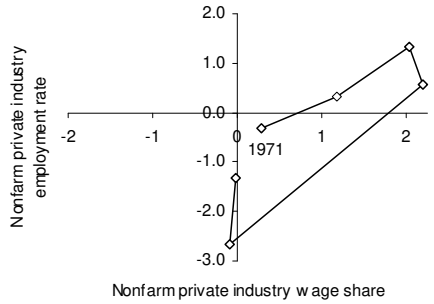

**1956-60**



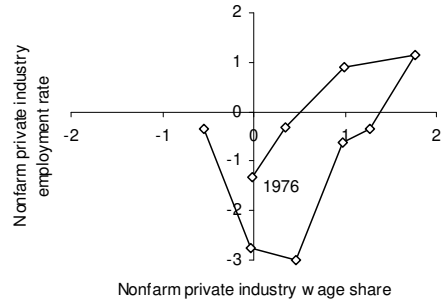

**1960-71**




**1971-76**




**1976-84**




**1984-91**

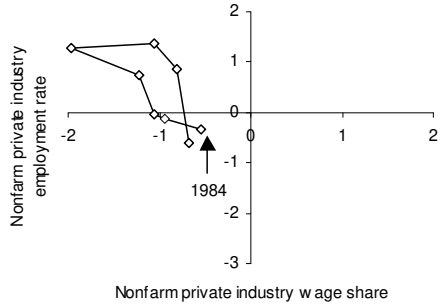
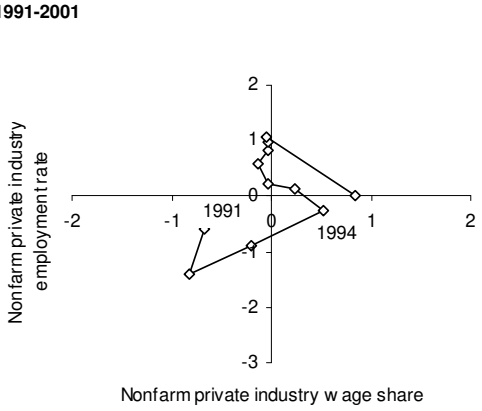


Figure 8: *Nonsupervisory Employees, Detrended Cycle, Nonfarm Private Industry, USA, Quarterly Data, 1991(1994)-2001*




## 6.4 An anomalous picture

If supervisory wages are added to nonsupervisory wages in order to derive an all employee wage share for nonfarm private industry, a rather different long run picture emerges. Figure 9 shows that from 1953

Figure 9: *Employment Rate and All Employee Wage Share, Nonfarm Private Industry, Trends, USA, 1948-2002*


to 1999 there is one complete long run cycle in the trend data in a clockwise direction. The difference with Figure 2 showing the analogous picture for all employees in the corporate sector is marked. While the different employment rate definitions (whole economy trend versus nonfarm private industry trend) do have some effect, it is quantitative rather than qualitative.[11] The qualitative difference is caused by

[11] A similar pattern (not shown in this paper) is obtained from a long run scatter of the nonfarm private industry all employee wage share against the economy-wide employment rate.

the different wage share definitions (affecting both numerator and denominator). Why then does the addition of the noncorporate wage share to the corporate wage share produce such a contrast with the trend of the corporate wage share alone, producing a cyclical pattern when there is no such pattern in the trend wage share in the corporate sector alone? Three related comments suggest themselves.

First, the variation in the trend employment rate is small, at just 1.8 percentage points. Similarly, that in long run wage share is just 1.65 percentage points. [12] But as was shown in subsection 6.2 above, this small variation in long run wage share conceals a very large wage share shift from nonsupervisory to supervisory workers. Amalgamating these two categories alters the focus in a Goodwin model from distributive conflict between classes to an untheorised conflict in the functional distribution of income. It is not obvious that such an alteration of focus is desirable either from an interpretative point of view or from the perspective underlying this paper, for it runs counter to the spirit of Goodwin's model, and it renders the notion of class and class conflict opaque.

Second, Figure 9 could be interpreted as not showing a cycle at all in any meaningful sense. Rather, it shows a long run negative and elastic relationship between employment share and wage share from 1948 to the early 1970s, characterising the 'golden age' of the post-war boom. This is followed by a decade of transition from the early 1970s to the early 1980s, with its attendant well-known instabilities, which culminated in the change of monetary policy in 1979 and a decisive shift away from social and economic parameters of the 'golden age' as the balance of class power tilted towards capital. What was thereby established after 1983 was a different long run negative and inelastic relationship between employment share and wage share. Hence Figures 2 and 9 tell the same story of a shift from an elastic to an inelastic negative relationship, but differently nuanced because of the different underlying data. Decomposing Figure 9 into the two graphs of Figure 6 then allows a more detailed description of the underlying class struggle.

Third, the noncorporate sector raises notorious difficulties in classification terms. Obvious candidates for investigation in the measure of net value added are first, proprietors' income, raising the issues surrounding self-employment, and second, the inclusion of net interest, because the receipt of net interest by the largely unincorporated real estate sector dominates the category, and increasingly so through time. For example in 2002 the component of the net operating surplus 'net interest and miscellaneous payments' was about five times larger for private industry than it was for the corporate sector. Thus further research is necessary on whether the components of the wage share of the

[12] In Figure 9, the $(u, v)$ data points for 1953 and 1999 are effectively the same, being the co-ordinates of where the time-path crosses itself. Hence the variation in $u$ between 1953 and 1975 is the same as that between 1975 and 1999. Similarly for the variation in $v$ between 1953 and 1983, and 1983 and 1999.

noncorporate sector are appropriate for the exploration of Goodwin cycles of distributional conflict.

In sum, functional measures of aggregate income distribution are not categories of class income. Since the latter are the focus in a Goodwin model, considerable care is required in the construction and interpretation of the wage data. In particular, a more detailed class analysis is required of both the 'compensation of employees' in the corporate sector, and the income categories of the noncorporate sector. For the most casual inspection of Figures 2, the left hand side of 6, and 9 shows that different definitions matter.

# 7 Conclusion

This paper has attempted to interpret the US economy in terms of long run trends and short run cycles within an overall perspective of class conflict. The evidence for short run cyclical behaviour involving the wage share and the employment rate is strong. These short run cycles are 'Goodwin cycles' in the sense that they describe a cyclical relation between the latter variables. They are little different from the NBER business cycle. Moreover, the Goodwin mechanism is a 'pure' mechanism of distributive conflict that is structurally unstable. Hence again it is not surprising that the cycles are different in period, amplitude and position. As noted by Solow "the displacements [of the shorter-run cycles] are quite large and they suggest that the Goodwin model cannot be the only mechanism governing the relation between the wage share and the employment rate" (Solow, 1990, p.39).

This paper finds no evidence that long run Goodwin cycles exist, at least in the corporate sector. This result is arguably sensitive to the choice of data, for there is apparently one 46 year cycle for nonfarm (corporate and noncorporate) private industries. The previous section has suggested that such a cycle is more apparent than real, but substantiating this at a level beyond suggestion requires further investigation of the national accounts categories of the corporate and noncorporate sectors. Indeed, no previous study has investigated the adequacy of the category 'compensation of employees' to measure the 'wages' required to construct the wage share needed by the Goodwin model. For the latter is a model of class conflict, but national accounts do not (unsurprisingly) distinguish classes. While the recipients of labour income include the classically-defined working class, they are also rather more than this. Using the distinction between nonsupervisory and supervisory employees to proxy relations of hierarchy and control in a class-divided society, the paper documents the extraordinary trend shift in labour income away from nonsupervisory employees. Nevertheless, detrended short run Goodwin cycles remain.

This raises a number of issues. Given the very large fall in the nonsupervisory trend wage share

shown in the left hand graph of Figure 6 of 17.5 percentage points, why did supervisory wages rise by 17.9 percentage points to produce a long run approximate constancy in trend total wage share? And why did the same huge redistribution produce such a small variation in the long run trend of the aggregate wage share? What were the forces making for redistribution? Were they separate from the Goodwin-type cyclical mechanism, or were they in some as yet unspecified manner tied up with it? Hence the final conclusion of the paper is both to validate a short run Goodwin-type mechanism and to raise a rich research agenda concerning the theoretical and empirical significance of the decomposition of employees into more class-delineated categories.

# A Appendix:

The paper uses two different data sets, called Dataset 1 and Dataset 2.

## A.1 Electronic sources

For business cycle dates: National Bureau of Economic Research (NBER), "Business Cycle Expansions and Contractions" <http://www.nber.org/cycles/cyclesmain.html>

For wage share data in Dataset 1: National Income and Product Accounts (NIPA), US Department of Commerce <http://www.bea.gov/>

For all employment rate statistics, for wage share data in Dataset 2, and for the *Handbook of Methods*: Bureau of Labor Statistics (BLS), US Department of Labor <http://www.bls.gov/>

For the capital stock data for the rate of profit in Dataset 1: Fixed Assets Tables (FAT): Bureau of Economic Analysis, US Department of Commerce <http://www.bea.gov/> and Flow of Funds Accounts (FoF), Federal Reserve Board <http://www.federalreserve.gov/>

## A.2 The long run averages

In the discussion following equation (5), the data for the long run averages were calculated as log differences. The capital-output ratio is the inverse of capital productivity, which is the ratio of the capital stock to net value added in the corporate sector. For the corporate capital stock, see below. Labour force growth is calculated from the BLS series LNU01000000, labour productivity growth from the BLS series PRS85006093, and real wage rate growth from the BLS series PRS85006153.

## A.3 The rate of profit

Profits are the net operating surplus of the corporate sector (NIPA Table 1.14 line 8, W322RC1). For the profit share, see the wage share below. The capital stock is corporate equipment, software and structures

(FAT Table 4.1 line 13) plus nonfarm, nonfinancial corporate business inventories (FoF Table B102, line 5).

## A.4 The employment rate

### A.4.1 Dataset 1

There is no employment rate that is confined to the corporate sector, and so a national employment rate is used. The data are taken from BLS, Table A1 of the Employment Situation News Release, constructed from the Current Population Survey (CPS) and cover those who are aged 16 or over. In terms of the series identifiers, the annual employment rate (not seasonally adjusted) is measured as the percentage ratio of the total in employment (LNU02000000) to the total labour force (LNU01000000). The (seasonally adjusted) quarterly employment rate is measured as the ratio of LNS12000000Q to LNS11000000Q.

### A.4.2 Dataset 2

The employment rate is one for Nonagriculture, Private Industries Wage and Salary Workers (16+), constructed from Table A5 of the Employment Situation News Release as the ratio of Employment (LNU02032189) to Employment (LNU02032189) plus Unemployment (LNU03032229). Note that 'nonagriculture' is a slightly broader category than 'nonfarm'.

The different employment rates make little difference to the results (the largest difference in the rates being in the early years of the period).

## A.5 The wage share

### A.5.1 Dataset 1

The wage share is defined with respect to the corporate sector (NIPA Table 1.14, annual and quarterly), and is the ratio of compensation of employees (line 4, series A442RC1) to the sum of compensation of employees and net operating surplus, where the net operating surplus is taken as the sum of net interest and miscellaneous payments (line 9, series A453RC1), business current transfer payments (line 10, series W323RC1), and corporate profits with inventory valuation and capital consumption adjustments (line 11, series A445RC1). Note that the sum of compensation of employees and net operating surplus is less than net value added because taxes on production and imports less subsidies are excluded. (The quarterly line numbers and series identifiers are the same.)

### A.5.2 Dataset 2

Wages of nonsupervisory workers are collected from the Current Employment Statistics (CES) Survey, which

is a payroll or establishment survey. This creates issues of comparability. Whereas the CPS counts people, the CES counts jobs. The former counts multiple jobholders once, whereas the latter counts every job. This is significant, because between 4.5% (in 1974) and 6.4% (in 1995) of those in employment were multiple jobholders. There are also differences in employment definitions: CPS includes the unincorporated self-employed, agricultural and related workers, private household workers, and workers absent without pay, and excludes people under 16; the CES survey excludes these categories of employment (except for the logging industry) and has no age restriction. Moreover, the CES Survey excludes employees on leave without pay for the entire pay period and employees on strike for the entire pay period. Finally, in June 2003, the CES survey underwent a complete industry reclassification, changing from the 1987 Standard Industrial Classification System (SIC) to the 2002 North American Industry Classification System (NAICS). NAICS-based data is only available back to 1964; SIC-based annual data goes back to 1948 (for the relevant categories of this paper, but is no longer produced, and is available to 2002 only. Quarterly data can be determined from the CES Survey by averaging seasonally adjusted monthly data, but only from 1964. Because of this, only annual data are used.

The paper tries to overcome the issues of comparability as follows. Use the SIC-based data, and for all private industry, take the ratio of nonsupervisory workers (EEU00500003) to all employees (EEU00500001). Apply this ratio to the NIPA series of full-time equivalent employees for all private industry less farms (NIPA Table 6.5 line 3 (A4303C0) minus line 5 (B4305C0)). This will not be completely accurate for a number of reasons: for example, multiple job-holding may be unequally distributed between supervisory and nonsupervisory employees; the NIPA data includes private households and nonfarm agricultural industries. The hope is that given the level of aggregation of the paper, the inaccuracies thereby imported are not large.

Total wages of nonsupervisory employees are calculated as average weekly earnings (EEU00500004), multiplied by the NIPA ratio (for private industry less farms) of employee compensation (NIPA Table 6.2 line 3 (A4003C0) minus line 5 (H4005C0)) to wage and salary accruals (NIPA Table 6.3 line 3 (A4103C0) minus line 5 (B4105C0)), multiplied by the constructed number of nonsupervisory employees (described in the preceding paragraph), multiplied by 52. Total wages of supervisory employees are calculated as the difference between NIPA employee compensation (private industry less farms) and the constructed total wages of nonsupervisory employees.

The operating surplus component in the denominator of these constructed wage shares of supervisory and nonsupervisory employees is the NIPA net operating surplus of private industry (NIPA Table 1.10 line 12 (W260RC1) less farms (Table 7.3.5 line 23 (W251RC1)), less the rental income of persons (NIPA Table 1.10 line 16 (A048RC1)). It thereby includes nonfarm proprietors' income, (otherwise there would be no profit component in noncorporate industry), but since this is included in all three wage shares (nonsupervisory,

supervisory, and both together), it should not distort the comparisons made in the paper.

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