The Circuit of Capital, U.S. Manufacturing and Non-Financial Corporate Business Sectors, 1947–1993

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Abstract

Marx's analysis of the circuits of capital in Volume II of *Capital* provides a powerful framework for the empirical study of the dynamics and structure of capitalist production. Methods of Foley (1986) are applied to a wide range of official statistical sources to recover estimates of the rate of exploitation, composition of capital flows, markup, turnover times, profit rate and capitalization rate for U.S. capital in the Manufacturing and Non-Financial Corporate Business sectors from 1947–1993. Both sectors show strong fluctuations at business cycle frequencies, a secular rise in the rate of surplus value, and a fall in the composition of capital costs concentrated in the early 1970s. In the Manufacturing sector a rise in the markup was offset by a rise in turnover times, so that the rate of profit is essentially stationary. In the NFCB sector a stationary markup was offset by a similar modest rise in turnover times, so that the rate of profit fell slightly.

1 Introduction

In Volume II of *Capital* (Marx, 1967b), Karl Marx develops an analysis of the circuits of capital, a method of conceptualizing the dynamic movement of value through the capitalist production process. The circuit of capital emphasizes the relation between stocks and flows in capitalist production: because calendar time is required for each phase of the circuit of capital, production, realization, and reinvestment of realized value, flows of value through the circuit accumulate in stocks.

This conceptual framework constitutes an alternative to production functions as a method of analyzing capitalist production. The circuit of capital treats "capital" as stocks of value tied up in capitalist production as a result of time lags, rather than as an independent productive factor, and is thus compatible with the labor theory of value. Changes in capital invested per worker or per unit of output are decomposed in the circuit of capital analysis into changes in the turnover time required by the phases of production, and in the vintage structure of capital invested and its division between wage and non-wage components.

We have collected a wide range of statistical series covering the U.S. Manufacturing and Non-Financial Corporate Business sectors over the time period 1947–1993. The analysis of this data using methods developed by Foley (1986a, 1986b) allows us to recover estimates of the time profiles of the structural parameters of capitalist production in these sectors over this period. The detailed results are presented in charts and tables below. All the series exhibit considerable fluctuation at and above business cycle frequencies.

Abstracting from these high-frequency fluctuations, we find a tendency for the rate of surplus value to rise, and for the composition of capital costs (the ratio of wage to non-wage capital outlays) to fall in both sectors. In the Manufacturing sector a rise in the markup was offset by a rise in turnover times, so that the rate of profit is essentially stationary. In the NFCB sector a stationary markup was offset by a similar rise in turnover times, so that the rate of profit fell slightly.

Throughout we adopt the interpretation of the labor theory of value put forward by Gérard Duménil (1980) and Duncan Foley (1982, 1986), which regards observed money flows as directly representing underlying flows of labor time, the ratio of money to labor time being the *monetary expression of labor time*, measured over the whole economy as the ratio of value added to living labor time. Many key parameters of the circuit of capital take the form of ratios of contemporary money magnitudes, and are thus independent of changes in the monetary expression of labor time. The rate of profit we measure, however, is a monetary rate of profit, and includes changes in the monetary expression of labor time.

2 The circuit of capital

Marx begins his analysis of capitalist production by thinking of it as process by which capital in the form of money, M, is transformed first into commodities, C, labor-power and means of production, $\{LP, MP\}$, through the purchase of these inputs on the market, and then through the real production process (P) into newly produced commodities, C', which contain both the value of the means of production and the new value produced by labor, which are sold on the market for a sales price M', which can be decomposed into the recovery of the original capital outlay, M, and the surplus value (or in accounting terms, gross profit on sales) ΔM. This approach is summarized in Marx's well-known formula:

$$M - C\{LP, MP\} \ldots (P) \ldots C' - M' = M + \Delta M$$

Foley (1982, 1986a, 1986b) puts forward a mathematical framework for the circuit of capital in the following terms. At any moment there is a flow of *capital outlays*, $C(t)$, the sum of wages, $C_w(t)$, non-wage circulating capital inputs, $C_i(t)$, and investment in fixed capital, $C_f(t)$.

$$C(t) = C_w(t) + C_i(t) + C_f(t) \tag{1}$$

The flow of circulating capital outlays, $C_c(t) = C_w(t) + C_i(t)$ enters the production process, which is represented by a distributed lag $a_c(\tau, t)$, interpreted as the fraction of the circulating capital value entering the production process at time t that emerges in the form of finished product at time $t+\tau$. The value of the finished goods represented by the circulating capital, $P_c(t)$, can be written as the convolution:

$$P_c(t) = \sum_{t'=-\infty}^{t} C_c(t')a_c(t-t',t') \tag{2}$$

The flow of the value of circulating capital $P_c(t)$ can be decomposed into the recovery of the wage component, $P_w(t)$ and the recovery of the non-wage circulating capital component, $P_i(t)$:

$$P_w(t) = \sum_{t'=-\infty}^{t} C_w(t')a_c(t-t',t') \tag{3}$$

$$P_i(t) = \sum_{t'=-\infty}^{t} C_i(t')a_c(t-t',t') \tag{4}$$

The *stock of circulating capital*, the value tied up in circulating capital in the production phase of the circuit at any moment, $K_c(t)$, represents the value of the inventories of circulating capital, including inventories of partly finished commodities that contain the value of the wages expended in their production, and obeys the law:

$$\Delta K_c = C_c(t) - P_c(t) \tag{5}$$

The value of fixed capital emerges from production as *depreciation* imputed to the finished product, according to the distributed lag $a_f(\tau, t)$, which may differ from a_c. (Conceptually it would be possible to decompose the flow of capital outlays into any number of components with different distributed production lags.) Thus the value of depreciation at time t, $P_f(t)$, can be written as:

$$P_f(t) = \sum_{t'=-\infty}^{t} C_f(t')a_f(t-t',t') \tag{6}$$

The *stock of fixed capital*, the value tied up in fixed capital in the production phase of the circuit at any moment, $K_f(t)$, obeys the law:

$$\Delta K_f = C_f(t) - P_f(t) \tag{7}$$

The total flow of value emerging from the production phase of the circuit is $P(t) = P_c(t) + P_f(t)$.

The flow of finished commodities enters the circulation process, where it is sold, realizing a revenue $R(t)$, which can be decomposed into two components, the *recovery of capital outlays*, $Q(t)$, and the *realization of surplus value*, $S(t)$. The recovery of costs in general is related to the flow of value of finished product by the distributed lag $b(\tau, t)$, representing the fraction of finished product emerging at time t that is sold at time $t + \tau$:

$$Q(t) = \sum_{t'=-\infty}^{t} P(t')b(t - t', t') \tag{8}$$

The recovery of costs can be decomposed into the recovery of wage costs, non-wage circulating input costs, and fixed capital depreciation:

$$\begin{aligned} Q_w(t) &= \sum_{t'=-\infty}^{t} P_w(t')b(t - t', t') &(9)\\ Q_i(t) &= \sum_{t'=-\infty}^{t} P_i(t')b(t - t', t') &(10)\\ Q_f(t) &= \sum_{t'=-\infty}^{t} P_f(t')b(t - t', t') &(11) \end{aligned}$$

The surplus value is equal to the *markup on costs*, $q(t)$ times the costs of commodities sold at time t:

$$S(t) = q(t)Q(t) \tag{12}$$

The sales revenue is then the sum of the cost and surplus value components:

$$R(t) = Q(t) + S(t) = (1 + q(t))Q(t) \tag{13}$$

From the point of view of the labor theory of value, we can decompose the markup into the product of the *rate of surplus value*, $e(t)$, which is the ratio of surplus value to wage costs in the commodities sold at time t, and the *composition of costs*, $k(t)$, the ratio of wage costs to total costs in the commodities sold at time t:

$$\begin{aligned} k(t) &= \frac{Q_w(t)}{Q(t)} &(14)\\ e(t) &= \frac{S(t)}{Q_w(t)} &(15)\\ q(t) &= \frac{S(t)}{Q_w(t)}\frac{Q_w(t)}{Q(t)} = e(t)k(t) &(16) \end{aligned}$$

The *trade capital*, the value tied up in the realization process as inventories of finished commodities awaiting sale, valued at cost, $X(t)$, obeys the law:

$$\Delta X = P(t) - Q(t) \tag{17}$$

The circuit of capital is closed when some part of the revenues are recommitted to production as capital outlays. By convention, we regard the whole of the recovery of capital outlays, $Q(t)$, to be recommitted, together with a fraction $p(t)$, the *capitalization rate*, of surplus value, $S(t)$. ($p(t)$ may be negative, if capital is being withdrawn from production in the circuit under consideration.) These sources of internal finance are subject to a *finance lag*, represented by the distributed lag $c(\tau, t)$. They may be supplemented by net borrowing, $B(t)$, which is by convention not subject to the finance lag. This leads to the following convolution for capital outlays:

$$C(t) = \sum_{t'=-\infty}^{t} (Q(t') + p(t')S(t'))c(t-t', t') + B(t) \tag{18}$$

The *stock of financial capital*, the value tied up in financial assets, $F(t)$, obeys the law:

$$\Delta F(t) = R(t) + B(t) - C(t) \tag{19}$$

The relation between stocks and flows of value are commonly expressed as *turnover times*, the ratio of the stock to the outflow of value arising from the stock. These turnover times do not in general accurately represent the dynamics of the circuit of capital, which depends on the distributed lags a_c, a_f, b, and c, but can give a sense of the order of magnitude of the lags.

The *circulating capital turnover time*, λ_c, is the ratio of the stock of circulating capital to the flow of circulating capital costs:

$$\lambda_c = \frac{K_c(t)}{Q_c(t)} \tag{20}$$

The *fixed capital turnover time*, λ_f, is the ratio of the stock of fixed capital to the flow of depreciation:

$$\lambda_f = \frac{K_f(t)}{Q_f(t)} \tag{21}$$

The *production turnover time*, λ_p, is the weighted average of the circulating capital and fixed capital turnover times:

$$\lambda_p = \frac{Q_f(t)}{Q(t)}\lambda_f + \frac{Q_c(t)}{Q(t)}\lambda_c \tag{22}$$

The *realization turnover time*, λ_r, is the ratio of the stock of trade capital to the flow of recovery of costs in sales:

$$\lambda_r = \frac{X(t)}{Q(t)} \tag{23}$$

The *rate of profit*, $r(t)$, is the ratio of the flow of surplus value to the capital tied up in production, either $K(t)$, or $K(t) + X(t)$, or $K(t) + X(t) + F(t)$, depending on the context in which the rate of profit is being used. In this paper we will adopt the convention of measuring the rate of profit relative to the stock of productive capital, $K(t) = K_c(t) + K_f(t)$.

$$r(t) = \frac{S(t)}{K(t)} \quad (24)$$
$$= \frac{S(t)}{Q(t)}\frac{Q(t)}{K(t)}$$
$$= \frac{q(t)}{\lambda_p} \quad (25)$$

See Foley, 1986b, for a more detailed treatment of the theoretical relation between the distributed lags governing the circuit of capital and the rate of profit.

The circuit of capital framework in this form is a purely *descriptive* accounting framework. It can be transformed into a predictive or explanatory model by appending behavioral hypotheses about the determination of the various flows and stocks. In this paper, however, we confine ourselves to using the framework to analyze the *ex post* path of U.S. capital from historical statistics.

3 Operationalizing the circuit of capital

Some elements of the circuit of capital framework can be observed directly from historical statistics available for particular sectors. The U.S. Census' Survey of Manufactures, for example, provides quarterly time series for C_w, C_i, C_f, P_f, K_c, K_f, X, and R for the U.S. manufacturing sector.

Our aim is to recover estimates for as many of the other variables in the circuit of capital, $e, k, q, a_c, a_f, b, c, p$, and r as possible.

The first step in this analysis is to recover estimates of the production and realization lags. In general the information in a time series of inflows, outflows and stocks is not sufficient to identify a distributed lag such as a_c econometrically without making further assumptions about the shape or stability of the lag to recover the lag coefficients from the inflow and outflow data, that is, to *deconvolute* the data series.

Two approaches to this problem have been suggested in the literature. Peter Matthews (1995) assumes that the production lag is stable over time and has a geometric form, and then uses regression analysis to recover the average lags. Andrew Senchak (1983), Hamid Azari (1996), and Piruz Alemi (1997), on the other hand, allow the production and realization lags to vary from period to period, but assume a *point-input-point-output, first-in-first-out* form, which makes the lag a pure *time delay.* We follow Senchak's procedures for circulating, trade and finance capital. We have devised another method for treating fixed capital, which we will describe below.

The pure time delay model assumes that all units of value entering a process at a given time experience the same time delay, and emerge together at the same later moment. With this convention, the distributed lag $a_c(\tau, t)$ graphed as a function of τ is a spike (or "delta function") at the current time delay, $T_c(t)$. This strong assumption allows us to deconvolute the stock-flow data series by recovering the time delay in every period. Under this assumption the stock is the accumulation of past inflows back to the current value of the time delay. In the case of circulating capital, for example:

$$K_c(t) = \sum_{t-T_c(t)}^{t} C_c(t') \tag{26}$$

If we have a time series for the inflow and for the corresponding stock, we can recover the time delay in any period by counting how many periods of inflow are needed to account for the accumulated stock.

For example, suppose that $C_c(t')$ for the last 5 months has been $(C_c(t-1) = 10, C_c(t-2) = 5, C_c(t-3) = 30, C_c(t-4) = 18, C_c(t-5) = 22)$, and that the current stock $K_c(t)$ is 54. Then the current lag is 3.5 months, since $54 = 10 + 5 + 30 + 9$, and the contribution of the 4th month is $9/18 = .5$.

This method allows us to recover the circulating and trade capital time delay series, $T_c(t), T_r(t)$ reported below.

The time delay assumption unambiguously associates the flows of value at any point in the circuit with specific inflows at some point in the past. If we know $T_c(t)$ and $T_r(t)$, for example, we can associate the flow of sales revenue $R(t)$ or surplus value, $S(t)$, with labor inputs at $t - T_r(t) - T_c(t - T_r(t)))$. (Note that this mapping requires us to use the realization time delay at time t and the circulating capital time delay at $t - T_r(t)$. This allows us to impute the value realized in any period to the labor expended in a specific earlier period.

Fixed capital presents an inherently more complex problem. In any period we can regard the stock of fixed capital, $K_f(t)$ as being made up of a sequence *vintages*, each corresponding to the (depreciated) fixed capital outlay at a past moment, $(C_f(t-1, t), C_f(t-2, t) \ldots)$. Here $C_f(t', t)$ is the value of fixed capital outlay in period t' remaining undepreciated in period t. The point-input, point-output model is not a suitable framework for measuring the relation between gross investment and depreciation of fixed capital, because it is unrealistic to impute the whole depreciation of a given period to the oldest surviving vintage of investment. In fact, all existing vintages of investment contribute to current depreciation, though the basic statistics we have do not distinguish these vintages of depreciation.

We present two measures of the time lag in depreciation of fixed capital. The first is the *fixed capital delay*, $T_f(t)$, a weighted average of the age of the capital stock, with the weights proportional to the gross investment in each period.

$$T_f(t) = \sum_{t'=-\infty}^{t} t' \frac{C_f(t', t)}{K_f(t)} \tag{27}$$

The fixed capital delay is a measure of the average age of the capital stock.

The other measure is the *fixed capital turnover time*, $\lambda_f(t)$, defined above, which is the ratio of the current capital stock to the flow of current depreciation:

$$\lambda_f(t) = \frac{K_f(t)}{Q_f(t)} \tag{28}$$

The fixed capital turnover time is just the inverse of the *rate of depreciation*, $\delta(t)$:

$$\delta(t) = \frac{Q_f(t)}{K_f(t)} \tag{29}$$

The fixed capital turnover time has the advantage of being linked directly to the rate of profit, but it is at best a very crude measure of the actual time lags in fixed capital depreciation.

To derive the estimates reported below, given time-series data on C_w, C_i, C_f, P_f, K_c, K_f, X, R, and, when available, F, and B we proceed in the following fashion:

1) Taking $C_c = C_w + C_i$ as the inflow and K_c as the stock, the time-delay deconvolution procedure described above yields the time series for the circulating capital delay, $T_c(t)$. Symbolically, using $\perp$ to represent time-delay deconvolution:

$$T_c(t) = K_c(t) \perp C_c(t) \tag{30}$$

2) Using $T_c(t)$, we can recover the value of the flow of output corresponding to circulating capital, $P_c(t)$, and its components, $P_w(t), P_i(t)$:

$$P_c(t) = C_c(t) = C_w(t - T_c(t)) + C_i(t - T_c(t)) = P_w(t) + P_i(t) \tag{31}$$

3) Using $P = P_c + P_f$ as the inflow and X as the stock, time-delay convolution yields the trade capital delay, $T_r(t)$:

$$T_r(t) = X(t) \perp P(t)) \tag{32}$$

4) Using $T_r(t)$, we can recover the value of the flow of sales at cost, $Q(t)$, and its components, Q_w, Q_i, and Q_f:

$$Q(t) = P(t - T_r(t)) = Q_w(t) + Q_i(t) + Q_f(t) \tag{33}$$

5) The difference between $R(t)$, given by the data, and $Q(t)$ is the surplus value realized in period t, $S(t)$:

$$S(t) = R(t) - Q(t) \tag{34}$$

6) From S, Q, and Q_w we can derive time series estimates for the markup on costs, $q(t)$, and its components, the rate of surplus value, $e(t)$, and the composition of costs, $k(t)$:

$$q(t) = \frac{S(t)}{Q(t)} \tag{35}$$

$$e(t) = \frac{S(t)}{Q_w(t)} \tag{36}$$

$$k(t) = \frac{Q_w(t)}{Q(t)} \tag{37}$$

7) The depreciation rate in the period, $\delta(t)$, is the ratio of depreciation, $P_f(t)$, to the stock of fixed capital, $K_f(t)$:

$$\delta(t) = \frac{Q_f(t)}{K_f(t)} \tag{38}$$

The fixed capital turnover time is the inverse of the depreciation rate:

$$\lambda_f(t) = \frac{K_f(t)}{Q_f(t)} \tag{39}$$

8) The fixed capital time delay is computed as the weighted average of the vintages of capital, with weights proportional to the gross investment of that vintage:

$$T_f(t) = \sum_{t'=-\infty}^{t} t' \frac{C_f(t', t)}{K_f(t)} \tag{40}$$

9) Given $T_c(t)$ and $T_f(t)$, we calculate the production time delay, $T_p(t)$ as a weighted average:

$$T_p(t) = \frac{Q_c(t)}{Q(t)} T_c(t) + \frac{Q_f(t)}{Q(t)} T_f(t) \tag{41}$$

10) Alternatively, we compute a hybrid production turnover time, λ_p', as a weighted average of the circulating capital time delay and the fixed capital turnover time:

$$\lambda_p(t)' = \frac{Q_c(t)}{Q(t)} T_c(t) + \frac{Q_f(t)}{Q(t)} \lambda_f(t) \tag{42}$$

11) In any period we measure the *rate of profit*, $r(t)$, as the ratio of the monetary surplus value to the stock of productive capital:

$$r(t) = \frac{S(t)}{K_c(t) + K_f(t)} \tag{43}$$

12) When data on the stock of financial capital, $F(t)$ is available, using R as the inflow and F as the stock, time-delay convolution yields the financial capital delay, $T_m(t)$:

$$T_m(t) = F(t) \perp R(t) \tag{44}$$

13) When data on the flow of net borrowing, $B(t)$, is available, we can recover the capitalization rate, $p(t)$, the fraction of surplus value recommitted to production:

$$C(t) = Q(t - T_m(t)) + p(t)S(t - T_m(t)) + B(t) \tag{45}$$

$$p(t) = \frac{C(t) - Q(t - T_m(t)) - B(t)}{S(t - T_m(t))} \tag{46}$$

It would be possible to complete the picture of the circuit of capital by calculating growth rates of the various concepts of capital.

14) The *growth rate of the productive capital stock*, $g_K(t)$, is the ratio of net capital outlays $C(t) - Q(t)$, to the existing stock of productive capital, $K(t)$.

$$g_K(t) = \frac{\Delta K(t)}{K(t)} = \frac{C_c(t) + C_f(t) - P_c(t) - P_f(t)}{Q(t)} \frac{1}{\lambda_p} \tag{47}$$

4 Empirical results

We present the results of our work in a series of charts, linked to table in Appendix 1. A summary of the data sources we used appears in Appendix 2.

All the charts graph monthly data (sometimes interpolated from lower-frequency series) from January, 1952 to December, 1994.

Figure 1 shows the evolution of the composition of cost, $k(t)$, in the Manufacturing and NFCB sectors. The composition of cost for the Manufacturing sector is directly available from the Census' Survey of Manufactures. We have constructed the NFCB series by extrapolation from wage costs, using the Manufacturing sector as a benchmark (for details, see Appendix 2). The composition of cost declines from about .20 (wages representing 1/5th of total costs) to about .14 (wages representing 1/7th of total costs). Most of this decline takes place in the 1970s, and the bulk of it at the time of the first oil crisis in 1973.

This general trend is in line with Marx's presumption that variable capital (here measured by wages) tends to decline in importance relative to constant capital (here measured by the sum of gross investment in fixed capital and purchases of raw materials) with the development of capitalist production. This effect seems to be quantitatively important and persistent through the period.

Figure 2 shows the evolution of the rate of surplus value, $e(t)$, (measured as the ratio of gross profit on sales to the wage bill) in the two sectors. Both sectors show a substantial rise, but considerably larger in Manufacturing, where the rate of surplus value rises from around 1.5 to 3.75, than in NFCB where the rise is from 1.5 to 2.25. This rise is also consistent with Marx's general view that rates of exploitation rise with capitalist development, starting out low when

Figure 1: Manufacturing and NFCB Composition of Cost

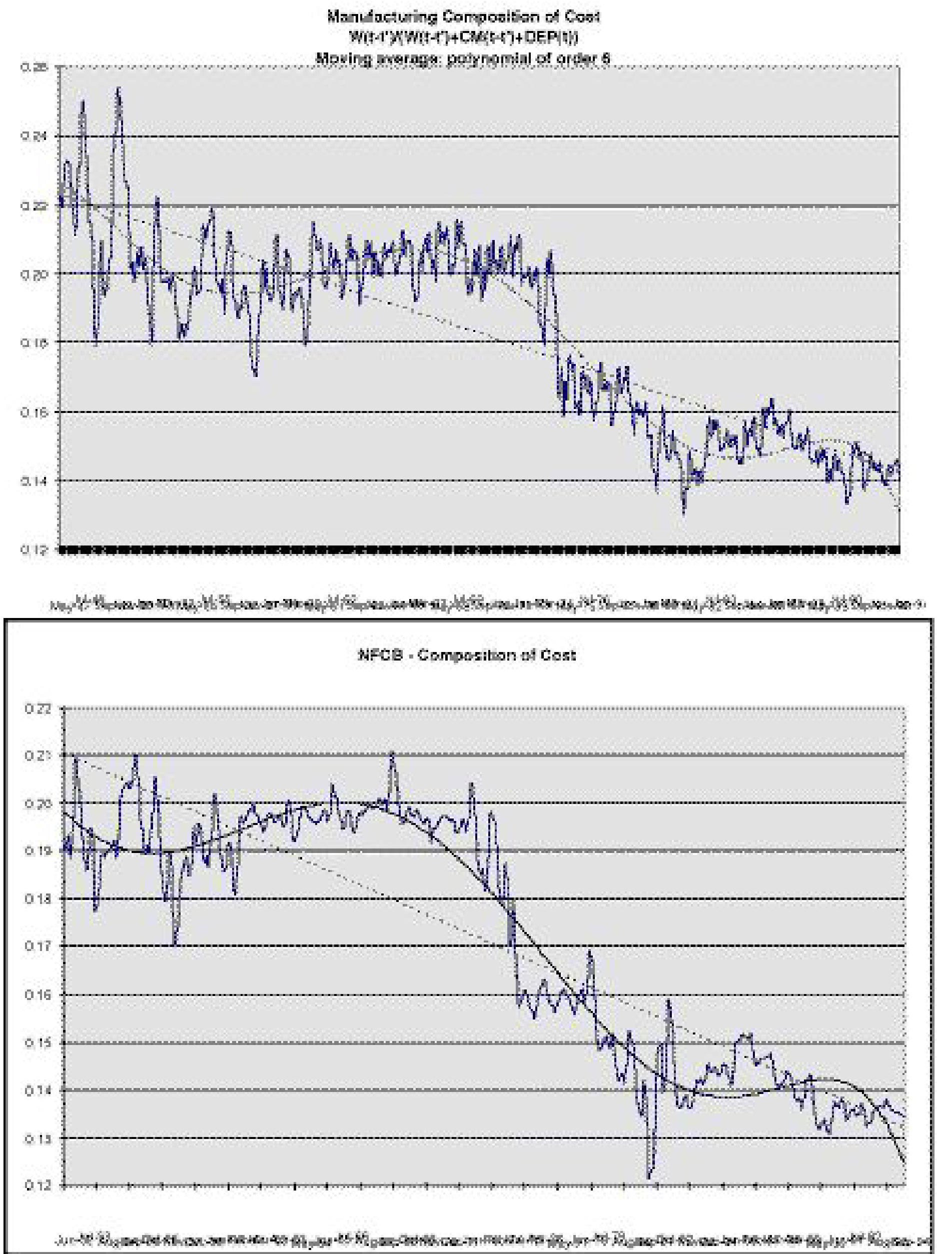
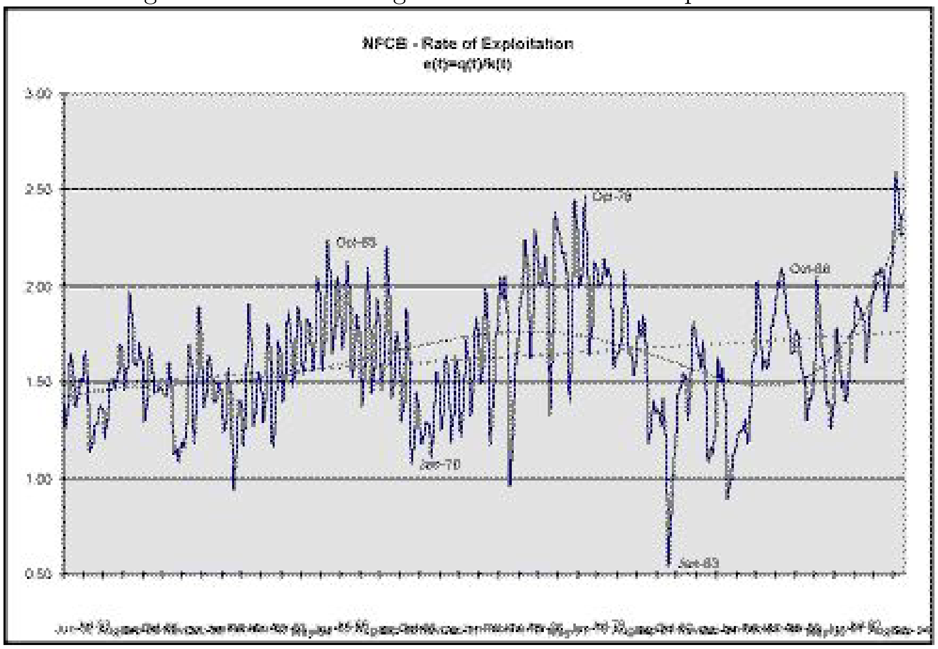


Figure 2: Manufacturing and NFCB Rate of Surplus Value



capitalism takes over technologies developed under previous modes of production, and rising over time as capitalists adapt technology to the imperative of increased labor productivity.

Figure 3 plots the markup, $q(t) = e(t)k(t)$ in the two sectors. The contrary movements of the rate of surplus value and the composition of costs largely offset each other in the NFCB sector, where the markup fluctuates above and below .3, but shows no trend. In the Manufacturing sector the stronger increase in the rate of surplus value is reflected in a rising trend of the markup over the period, from around .3 to over .5.

From the point of view of the circuit of capital, the profit rate differs from the markup because of the turnover time in moving capital outlays through the production process. Figure 4 plots the evolution of the production time delay and its components for the NFCB sector, and Figure 5 the same delays for the Manufacturing sector. The circulating capital delay in Manufacturing rises very slightly over the period, while the fixed capital delay rises with a noticeable "bulge" from 1974–1984. In the NFCB sector, the circulating capital delay fises from about 2 months to 3 months, and the fixed capital delay shows a similar bulge in the 1974–1984 period. The production time delay for the Manufacturing rises with substantial fluctuations from around 3.5 months at the beginning of our period to about 4.5 months at the end. The production time delay for the NFCB sector is longer, and rises with substantial fluctuation from about 6 months at the beginning of the period to 10 months at the end.

Figure 3: Manufacturing and NFCB Markup

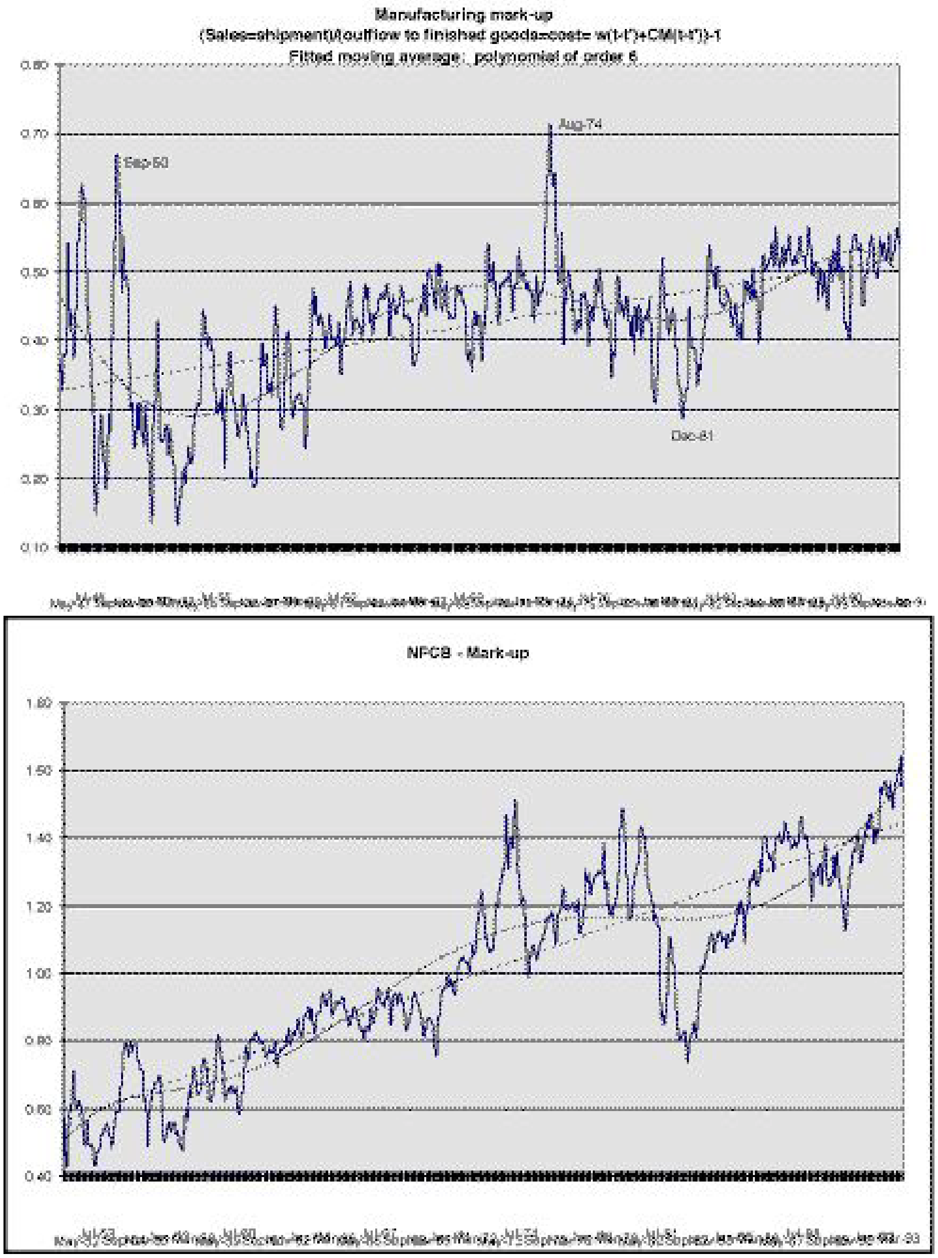


Figure 4: NFCB Production Delay

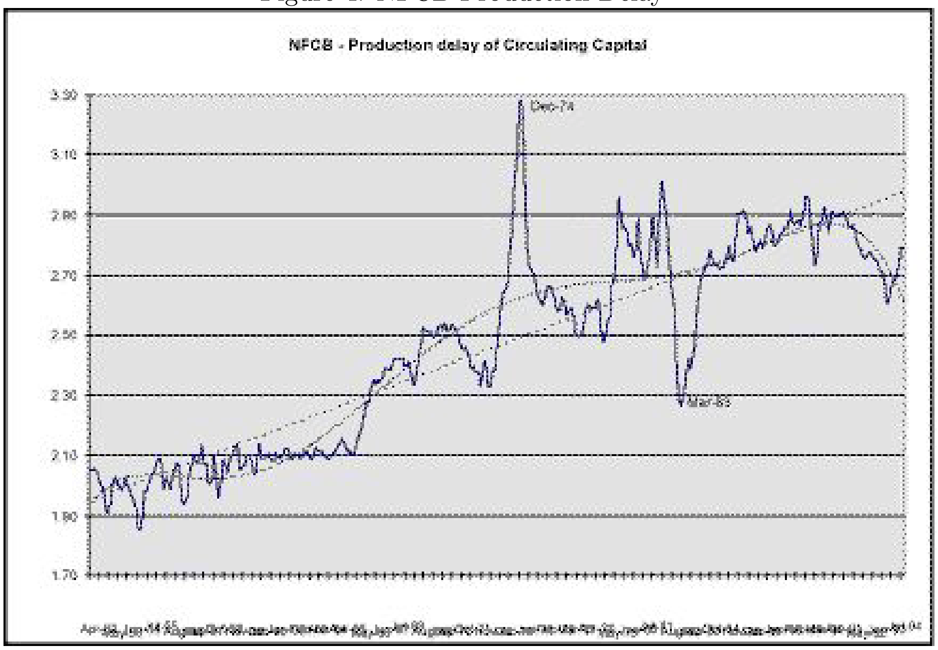


Figure 5: Manufacturing Production Delay

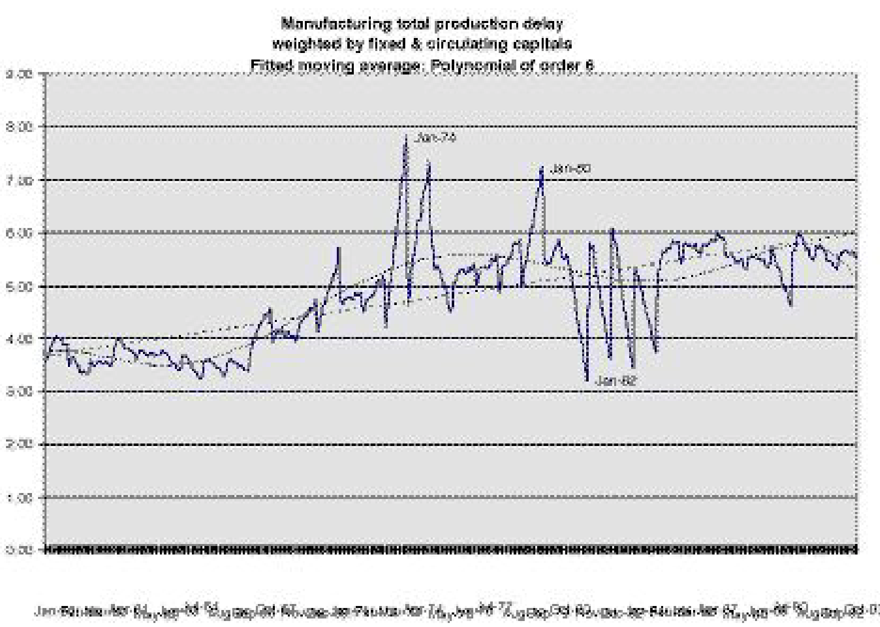


Figure 6: Manufacturing and NFCB Capital Outlay Weights

Figure 7: Manufacturing Hybrid Production Turnover Time

The production time delay is also affected by the relative weights of depreciation and circulating capital in total capital outlays. Figure 6 shows that the weight of fixed capital in total capital outlays, though less than 10%, has been growing steadily over the period in both sectors.

As was apparent from Senchak's work (1983), the turnover time of fixed capital in the U.S. economy is much longer, on the order of 12 years, than the turnover time of circulating capital, 1–3 months. Furthermore, the flow of circulating capital is much larger than the flow of gross investment or depreciation. Circulating capital represents over 90/the total of capital outlay recovery at the end of the production process. The hybrid production turnover time weights the time delays of circulating and fixed capital with weights proportional to the corresponding flows. Figure 7 shows the hybrid production turnover time for the Manufacturing sector. The rise in this turnover time is largely due to the increase in the weight of fixed capital in total capital outlays.

Figure 8 plots the profit rate for the Manufacturing and NFCB sectors over the period, measured as the ratio of surplus value to the sum of net fixed capital and stage I and II inventories (inputs to production and partly finished goods). The Manufacturing rate of profit falls from about 8% per year in the early years of our period to about 4% per year toward the end. The manufacturing markup rises during our period, but this profit rate-enhancing effect was more than offset by the slowing in the turnover of capital. In the NFCB sector the profit rate shows no strong trend, remaining around 6% from the beginning to the end of the period, though it was subject to considerable fluctuation in the intervening period.

The circuit of capital continues with the realization of commodities through sales, a process that involves a further *sales time delay*. Figure 9 plots the sales time delays for the two sectors. These delays are quite short, on the order of 1 month, with a modestly rising trend in the NFCB sector. Most of the output of these sectors is sold to rapidly to jobbers and wholesalers in the trade sector. The impact of the business cycle on the fluctuations in sales delays is evident despite the short absolute times involved.

The value realized in the sale of commodities is held in the form of financial capital during the *expenditure delay* in the circuit. Figure 10 plots the expendi-

Figure 8: Manufacturing and NFCB Profit Rate

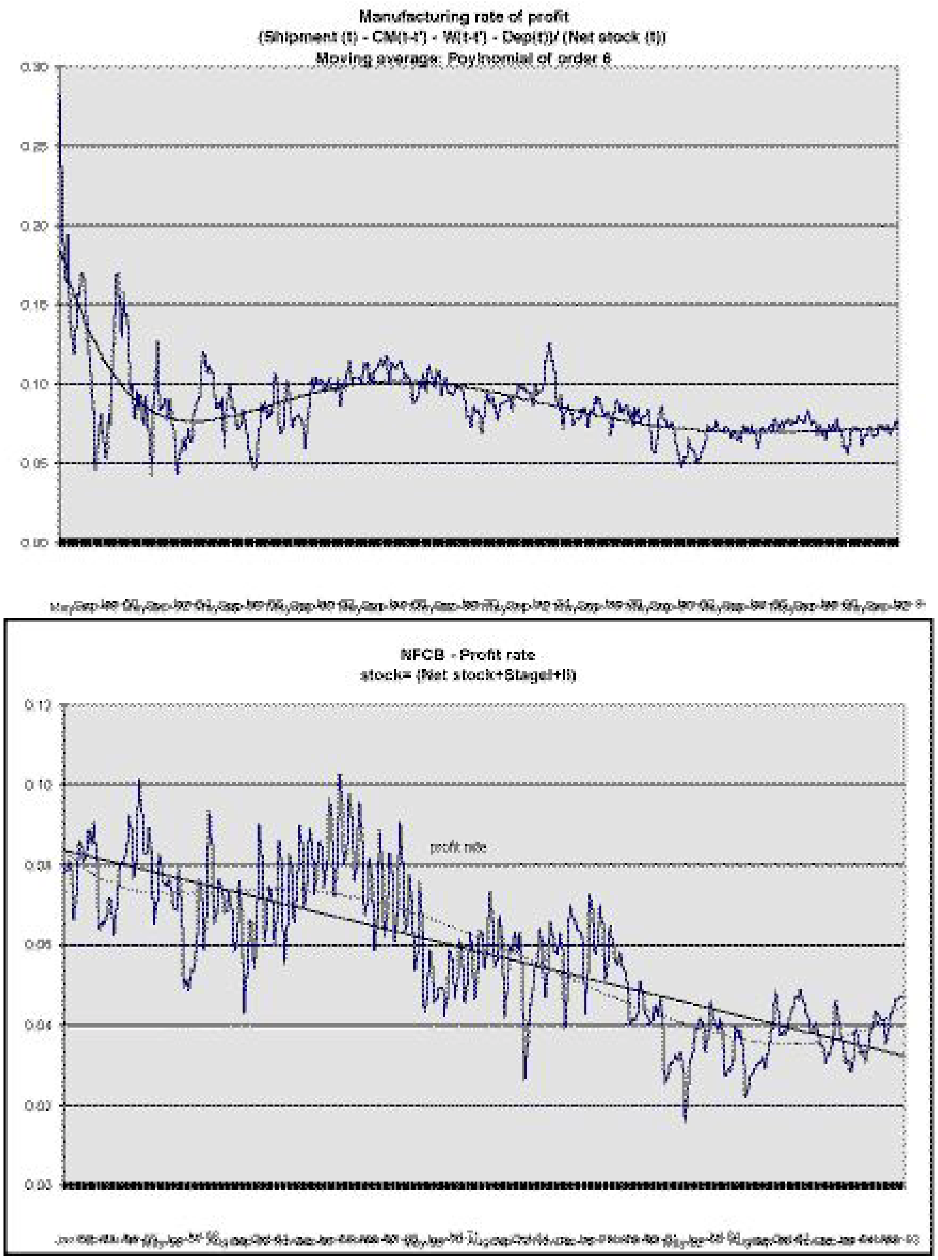
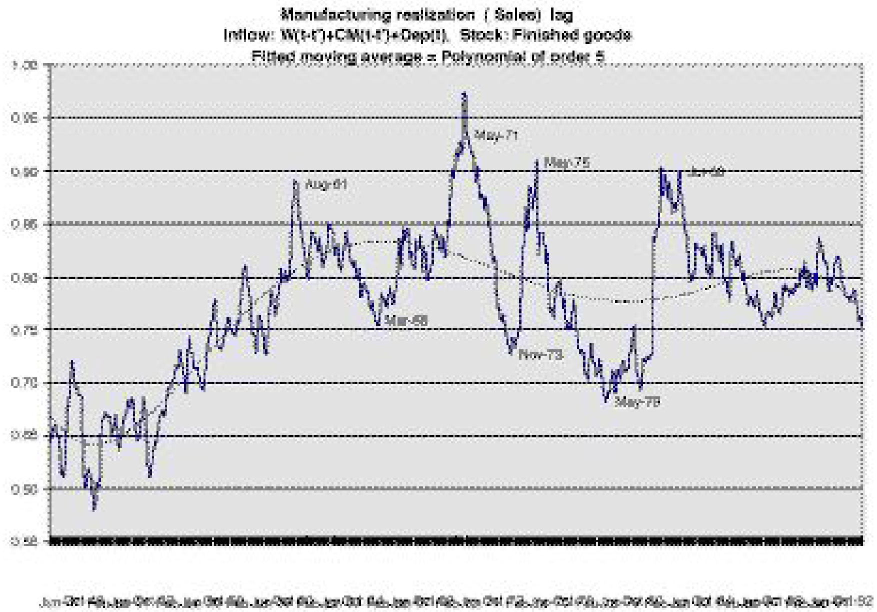
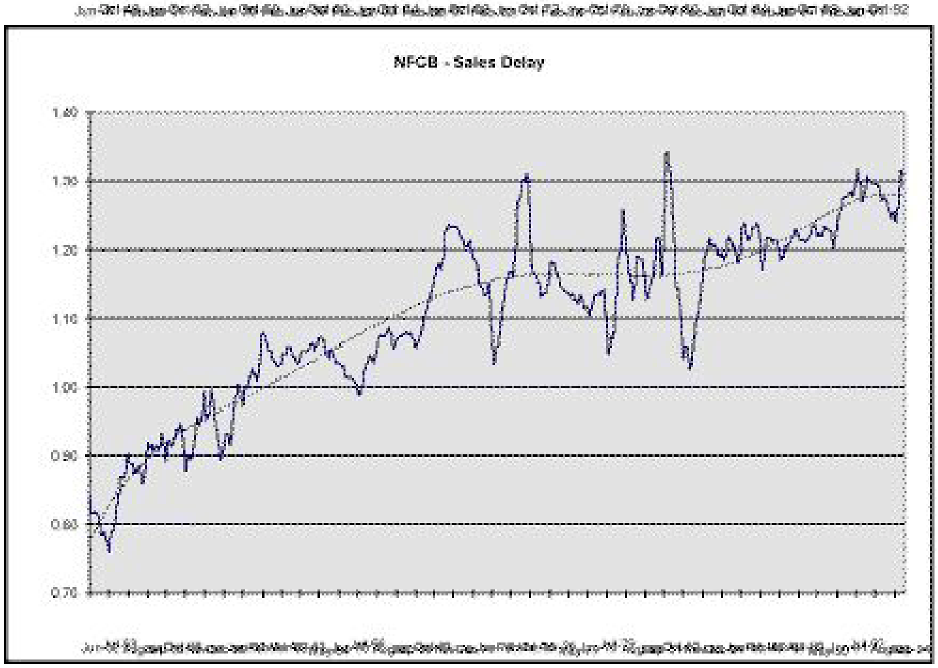


Figure 9: Manufacturing and NFCB Realization Delays





ture delays for the two sectors. Both are on the order of 2–4 months, and show a modestly rising trend over our period.

Figures 11 and 12 plot the total delay, summing the production, realization and expenditure delays, for the two sectors. The fluctuations are dominated by the production delay changes, since sales and finance delays are smoother and show more of a gradual trend. For Manufacturing the total delay rises from about 6 months to about 10 months over our period, while for NFCB the rise is from about 10 months to about 14 months. The gradual rise in turnover time appears to be an important structural feature of the development of U.S. capital during this period.

The circuit of capital closes with the recommittal of surplus value to the ongoing capital outlays. We measure this recommittal as the *capitalization rate*, $p(t)$, the proportion of the surplus value realized in sale that is reinvested in capital outlays. (Of course, a sector may also finance capital outlays through net borrowing.) The definition of the capitalization rate assumes that the whole of the recovery of capital outlays is recommitted to production. The definition and measurement of the capitalization rate are inherently error-prone because they depend on differences and ratios of large numbers. Figure 13 shows our estimates of the capitalization rate in the two sectors. These exhibit no trend, a lot of short-term fluctuation, some of which may be an artifact of our estimation methods, and a strikingly low level, hovering around 4–5% for both sectors. This very low level of recommittal has to be reconciled with the much larger role retained earnings appears to play in corporate finance.

5 Concluding Remarks

On the whole, our empirical results show a great degree of continuity in the underlying structure of U.S. capitalist production, as one would expect of a large, mature, industrial capitalist economy. There are some important secular trends in key parameters: the fall in the composition of capital, modest rise in the rate of surplus value, and an increase in fixed capital outlays as a proportion of total capital outlays.

To the degree that these results indicate a period of rapid structural change, they suggest that it occurred in the early 1970s, and took the form of a sharp fall in wages as a proportion of total capital outlays. Although this fall coincides with the sharp increase in energy prices during the "oil shock" of the 1970s, the persistence of the change through the 1980s suggests that it reflect deeper structural factors.

The Manufacturing and NFCB sectors manifest substantially different trends in the rate of surplus value over the period: the Manufacturing rate rises significantly, while the NFCB rate shows no trend. Some of this difference is due to the fact that the Manufacturing rate of surplus value is calculated on the wages of production workers, while the NFCB data does not allow a decomposition of the labor force between production and nonproduction workers. The difference in the two series thus may reflect a structural shift in the proportion of produc-

Figure 10: Manufacturing and NFCB Expenditure Delay

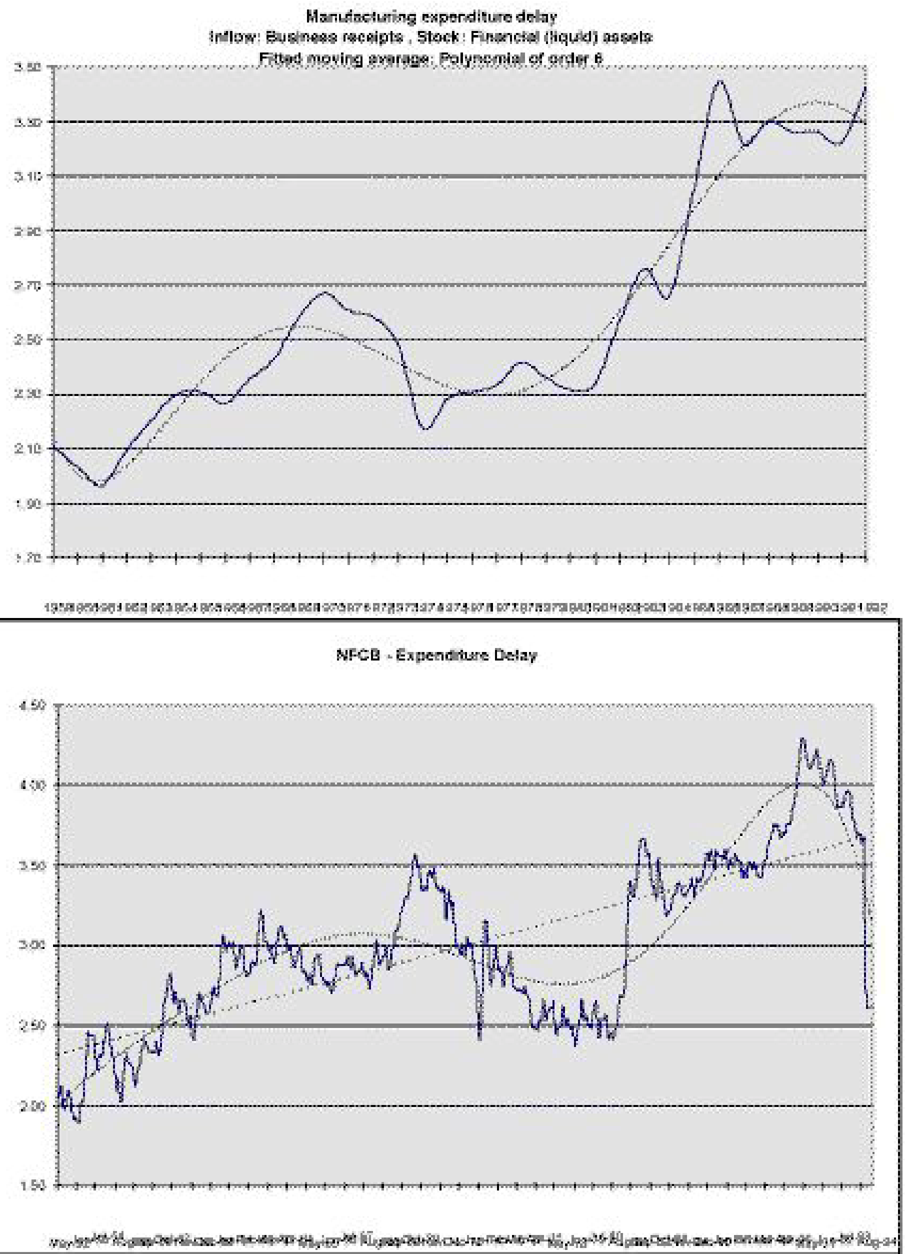


Figure 11: Manufacturing Total Delay

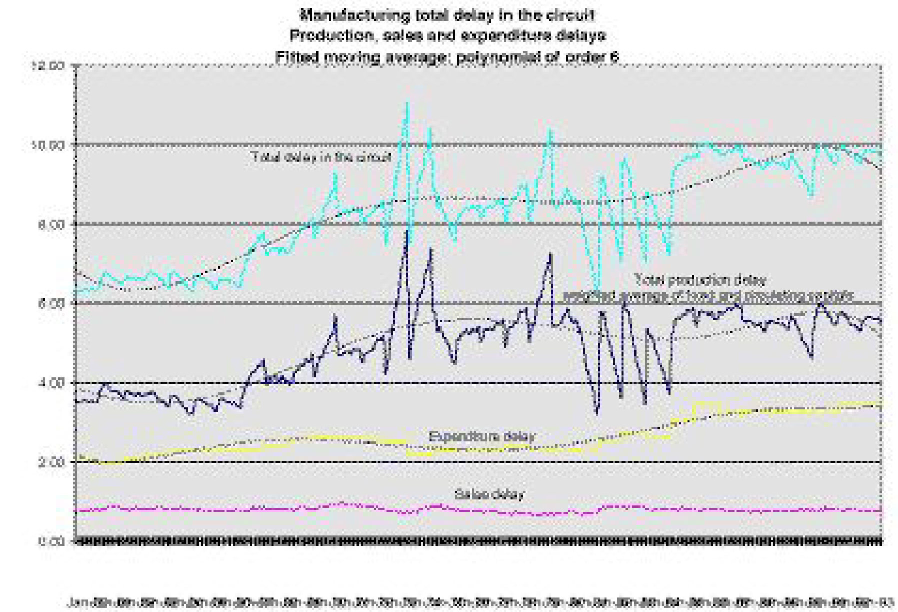


Figure 12: NFCB Total Delay

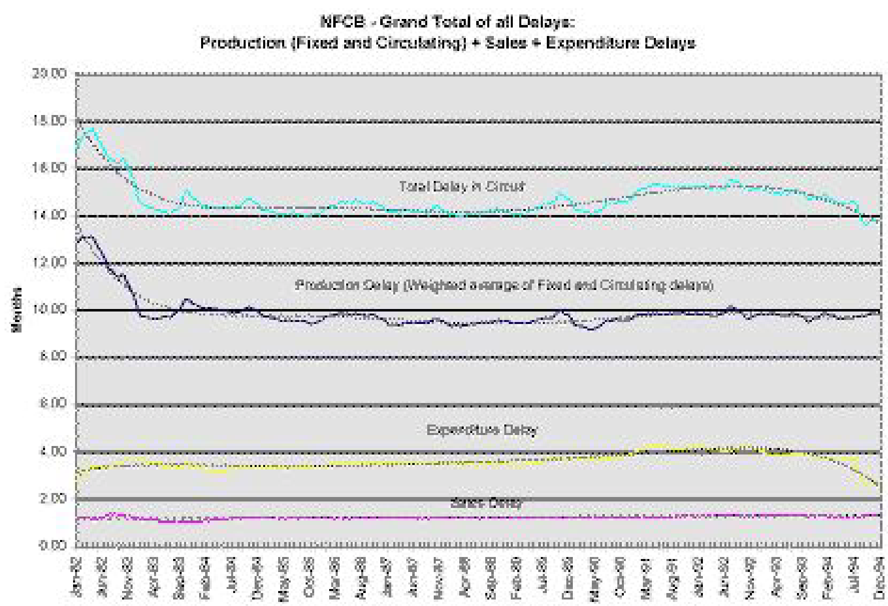
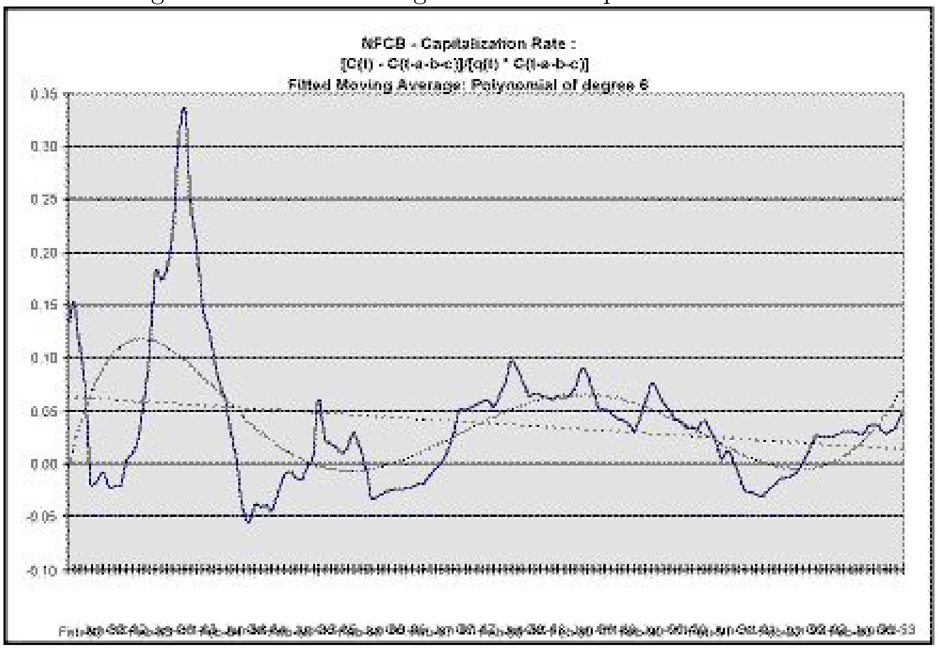


Figure 13: Manufacturing and NFCB Capitalization Rate



tive to unproductive labor over the period. Similarly, the Manufacturing rate of profit includes the wages of nonproduction workers as part of the gross profit, which may explain why the Manufacturing profit rate remains steadier than the NFCB profit rate.

Our results suggest several lines of further research. It would be interesting to understand the relation between the high frequence movements we detect and conventional business cycle analysis. In particular, we wonder whether any of our ratios serve as leading indicators of business cycle movements. Our treatment of fixed capital and depreciation is suggestive at best. More sophisticated methods of deconvoluting the fixed capital production lag, using the information on vintages of capital available in the series, are needed to give an accurate picture of the evolution of dynamics of the circuit of fixed capital. The time series properties of these structural series could be usefully investigated with modern time series methods.

From the point of view of political economy problems, there is little in these data to indicate a looming crisis for U.S. capital. The patterns suggest that the difficulties of the 1970s have been largely resolved through real wage stagnation that offset the slowdown in the rate of growth of labor productivity, yielding constant or rising rates of surplus value sufficient to sustain the profit rate.

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Appendix 1

Appendix 2