Explaining Anomalous Wage Inflation in the 1930s U.S.

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Abstract: Wage inflation surged in the 1930s though unemployment remained high and output below trend. This is an anomaly in terms of the "Phillips curve" relationship prevailing in other eras. Proposed explanations include New Deal labor policies, and Roosevelt's package of inflationary exchange-rate and monetary policies. In standard new Keyesian models the latter could boost inflation *immediately* by raising the expected long-run future price level. I find the anomalous wage inflation can be entirely explained by New Deal labor policies. The 1930s U.S. does not give evidence that policymakers can manipulate long-run inflation expectations to boost current inflation.

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Wage inflation surged in the 1930s recovery from the Great Depression, though unemployment remained high and output low relative to the pre-Depression trend. This is an anomaly in terms of the "Phillips curve" relationship that appears in other historical eras. In the first study that applied the Phillips curve (Phillips 1958) to American data, Samuelson and Solow (1960:188) observed: "the years from 1933 to 1941 appear to be sui generis: money wages rose or failed to fall in the face of massive unemployment." Price inflation shows the same anomaly. There is an obvious explanation. Starting in 1933 the Roosevelt administration adopted "New Deal" labor policies embodied in the National Industrial Recovery Act (NIRA), which established the National Recovery Administration (NRA) codes, and the 1935 National Labor Relations Act (NLRA or Wagner Act). NRA codes boosted nominal wage rates, and imposed "labor standards" such as overtime premium pay, by regulatory fiat. Both the NIRA and the NLRA promoted formation of labor unions and strengthened workers' bargaining power over employers. These policies could boost prices, as well as wages, as they gave an extraordinary boost to labor costs of production. Thus Samuelson and Solow noted that 1930s wage inflation might be due to "the workings of the New Deal (the 20 percent wage increase in 1934 must represent the NRA codes)." Friedman and Schwartz (1963:498) judged that a cause of extraordinarily high price inflation over 1933-37 "was almost surely the explicit measures to raise prices and wages undertaken with government encouragement and assistance, notably, NIRA, ..and National Labor Relations Act."

Nevertheless economists have considered other explanations. Samuelson and Solow themselves went on to speculate: "alternatively one could argue that by 1933 much of the unemployment had become structural, insulated from the functioning of the labor market." Expanding on this idea, Blanchard and Summers (1986) argue that 1930s wage inflation

was just one instance of a general “hysteresis” phenomenon in which persistent high unemployment raises the natural rate of unemployment. Thus, after 1933 "unemployment fluctuated around a very high mean but there was essentially no deceleration in inflation” (p. 67) because the natural rate of unemployment had become elevated over 1929-33. According to Akerlof, Dickens and Perry (1996: 5), the 1930s, "a period that notoriously defies explanation with conventional natural rate models," gives evidence of a different phenomenon: a social norm that prevents absolute cuts in nominal wage rates - “downward nominal wage rigidity” - except when employers are losing money. Thus wage inflation picked up in the recovery as soon as profits reappeared, even though unemployment remained high.

"New Keynesian" macroeconomic models offer yet another explanation. In those models, current inflation is affected by current expected values for inflation rates that will prevail in future periods. An upward revision to expected values for distant-future wage and price levels can immediately boost the current inflation rate associated with a given level of real activity. As the increase in current and expected future inflation tends to reduce real interest rates, such a revision in expectations can boost real activity as well. I refer to this as the "new Keynesian policy expectations mechanism." Alongside New Deal labor policies, Roosevelt adopted a package of monetary policies that could have triggered this mechanism. In 1933 Roosevelt announced that he intended to "reflate" prices back to the pre-Depression level, and raised the dollar price of gold to depreciate the dollar against foreign currencies. Over 1934-36 American monetary authorities allowed international gold inflows to create rapid money-supply growth. Eggertsson (2008) argues that much of the post-1933 recovery in inflation and real activity was due to the effect of Roosevelt's policies on the expected future price level through the new Keynesian policy expectations

mechanism. This possibility should interest policymakers of our own day. Many economists (e.g. Bernanke 2017) are now urging adoption of new monetary policy strategies, such as price-level or nominal GDP targeting, that rely on the new Keynesian expectations mechanism to stimulate real activity at times when short-term nominal interest rates are at a lower bound. So far policymakers have rejected such advice. They recognize that these new strategies would depend "crucially on affecting private-sector expectations and therefore on both the credibility and the public's clear understanding of the policy" (Mertens and Williams 2019). In rejecting price-level targeting, Bank of Canada policymakers noted that arguments for it are based on models which "assume that agents are forward-looking, fully conversant with the implications [of the policy change] and trust policy-makers to live up to their commitments." They expressed doubt those conditions "would be sufficiently satisfied in the real world" (Bank of Canada 2011: 14).

Roosevelt's monetary policies seem to provide a historical test of this point. Krugman (1998: 161), Bernanke, Reinhart and Sack 2004:18-19) and Svensson (2004:90) all observe that they resembled the strategies urged on policymakers today. Roosevelt's devaluation of the dollar, in particular, matches a key component of Svensson's "foolproof way" out of a liquidity trap, (2003:155), a policy package in which exchange-rate devaluation "serves as a conspicuous commitment to a higher price level in the future." Thus, evidence that Roosevelt's policies created immediate inflation through the new Keynesian expectations mechanism would confirm the mechanism can work in the real world. The fact that real activity recovered in 1933 is not enough by itself. There are other plausible explanations for the recovery including extremely low nominal interest rates, resuscitation of the banking and payments system after a massive financial crisis (Hanes, 2019), and the effect of dollar devaluation in raising farmers' nominal incomes relative to

their debts (Hausman, Rhode and Wieland, 2019).

In this paper I ask whether the anomalous wage inflation of the 1930s can be fully explained by New Deal labor policies. Alternatively, does it give evidence of hysteresis in the natural rate of unemployment, downward nominal wage rigidity, or the policy expectations mechanism? I begin by reviewing existing literature on the anomalies and the explanations I will consider. Then I identify the exact timing of the anomalies by comparing monthly inflation in average hourly earnings (AHE) over 1929-1939 with the path one would expect to observe based on a variety of empirical Phillips curves estimated on post-World War II data. I also compare the path of AHE inflation with that of a series unique to the 1930s which indicates changes in wage rates as distinct from AHE. I find that practically all anomalies in AHE inflation coincide with imposition of NRA codes that boosted wage rates and introduced overtime premium pay by regulatory fiat, and/or apparent increases in workers' bargaining power evidenced by union activity and time-series data on strikes. Thus New Deal labor policies offer a plausible and *complete* explanation of 1930s wage inflation anomalies. On the other hand, neither the hysteresis hypothesis of Blanchard and Summers (1986) nor the downward nominal wage rigidity model of Akerlof, Dickens and Perry (1996) is consistent with the monthly timing of wage inflation anomalies. The new Keynesian expectations mechanism can account for some spells of anomalously high inflation, in the sense that these spells coincided with news about monetary and exchange rate policies that could have raised the expected future price level. But other, apparently similar news was *not* associated with inflation anomalies. And one long spell of anomalously high inflation was coincident with policy news that should have *lowered* the expected future price level, if anything. Thus, I conclude that the new Keynesian expectations mechanism does not offer a plausible explanation of 1930s

inflation anomalies. This does not constitute evidence against a proposition that Roosevelt's gold policies boosted real activity through other expectational mechanisms. Nor is it evidence against the *potential* existence of the new Keynesian expectations mechanism, which requires a combination of policy credibility, rationality and economic knowledge on the part of people involved in wage determination: perhaps those expectations were not sufficiently rational or well-informed; perhaps Roosevelt's pro-inflation policies were not credible. It does mean, however, that the 1930s U.S. does not give evidence that the new Keynesian policy expectations mechanism, as described in standard models, can work in the real world.

1. Wage inflation anomalies in the 1930s

Figure 1 plots series that indicate the course of real activity and inflation from the late 1920s through 1939. These particular series for real activity and wage inflation have comparable counterparts in other historical eras - constructed in the same way, with no obvious differences in cyclical properties. The unemployment rate is Weir's (1992) "private nonfarm" unemployment rate which runs from 1890 through 1990.[1] Like other comprehensive unemployment estimates for the 1930s unemployment, it is only available annually. To indicate real activity at a monthly freqneucy I plot the Federal Reserve Board's seasonally-adjusted index of industrial production (IP), expressed as deviation of the log from a linear trend between benchmark years following Romer (1989) and Balke and Gordon (1989).[2] The resulting "IP gap" is consistent with Weir's unemployment series

[1]Weir estimates the number of unemployed as the difference between employment and the long-term trend "usual labor force" based on population censuses. He excludes agriculture, government and relief workers from both employment and the labor force, sidestepping a debate as to whether the large numbers of Federal relief workers in the 1930s should be classified as employed or unemployed (Darby, 1976). Within the 1920-30s Weir's numbers for private nonagricultural employment are very similar to those used by Lebergott (1964) and Romer (1986).

[2]The benchmark years are 1924, 1947, chosen by Romer (1989) and Balke and Gordon (1989). An HP trend with conventional parameters would imply real activity was at or above "normal" in the mid-1930s, which is

(over 1929-39 the correlation between the annual average IP gap and Weir's unemployment series is -0.95) and with the conventional view that real activity remained somewhat depressed throughout the 1930s.

The only time series from the 1920s-1930s that indicate wage inflation and have comparable counterparts in other eras are average hourly earnings (AHE) by industry, for manufacturing only, originally collected by the National Industrial Conference Board (NICB) and the US Bureau of Labor Statistics (BLS). They are available monthly starting in July 1922. Figure 1 plots the 12-month percent change in an average with fixed industry weights constructed by Hanes (1996) which continues into the post-World War II era.[3] Of course, AHE series are an imperfect indicator of movements in wage rates. I will return to this issue below. The figure shows manufacturing AHE inflation was close to zero in the late 1920s. It started to fall (which meant deflation) almost immediately after the 1929 cyclical peak, generally dated at October 1929. It began to rise again in late 1932, shortly after the cyclical trough dated by Romer (1994) at July 1932 (the NBER dates it at March 1933). From late 1933 through early 1934 AHE inflation rose to extremely high rates, then fell, then rose again in late 1936. It remained high through 1937 while the economy entered a short but sharp recession from a cyclical peak dated at August 1937 (Romer 1994) or May 1937 (NBER). For price inflation, the figure plots the four-quarter percent change in Balke and Gordon's (1986) quarterly GNP deflator. Differences between AHE and price inflation are beyond the scope of this paper: price indexes for the 1930s are tricky, and several New

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inconsistent with estimates of unemployment rates and other evidence on real activity.

[3]BLS hours and earnings surveys of manufacturing establishments began in the early 1930s. NICB surveys began similar surveys in June 1920 but stopped from January 1922 to June 1922. The Hanes (1996) series links NICB to BLS data at January 1935. By fixing weights the series avoids a potential incomparability between eras. In all eras industries show different degrees of procyclicality in wage or AHE inflation (Hanes 2000). Averages with changing industry weights mix up changing composition of employment across industries with changes in the behavior of AHE industry-by-industry. All of the explanations for 1930s inflation anomalies that I will consider have to do with the latter.

Deal policies could be expected to disturb usual cyclical relationships between manufacturing AHE and product prices.[4] Note, however, that the two peaks in price inflation in mid-1933 and early 1937 were also periods of sharply increasing AHE inflation.

Samuelson and Solow (1960) observed 1930s wage inflation anomalies in a simple scatterplot of wage inflation against unemployment, with observations from the 1920s-30s placed alongside data from other eras of American history. I start the same way but I must keep in mind a change in the nature of the Phillips curve in the late 1960s. American data from the pre-1914 era, the 1920s and the early post-World War II era show a positive relationship between real activity and inflation (a negative relationship with unemployment rates) like the original pattern found by A.W. Phillips (1958). Later a different pattern appears: the "accelerationist Phillips curve," a positive relationship between real activity and the *change* in inflation from the prior year. The shift is generally observed to have occured between 1966 and 1970 (e.g. Gordon 1972; King and Watson 1994). Recently many economists have observed a shift away from the accelerationist Phillips curve back to a relationship of the original form (Gali 2011, Kiley 2015; Blanchard 2016, Ball and Mazumder 2018), but the timing of this later shift is less clear; it is variously dated from "around the mid-1980s" (Gali 2011: 451) to "around 2000" (Ball and Mazumder 2018).

Figure 2 scatters annual unemployment rates against the percent change in the annual average value of manufacturing AHE series, over 1924-39 and two other spans that are generally agreed to have followed the original Phillips curve relationship: 1891-1914

[4]High-frequency data from the 1930s on prices of services and finished manufactures are scarce, so monthly or quarterly CPIs and GNP/GDP deflators for the 1930s, including the Balke and Gordon series plotted here, must rely on problematic interpolations and assumptions. New Deal policies that might affect relationships between AHE and price inflation include labor standards (e.g., overtime premia would affect relationships between AHE and marginal cost of labor), NRA-code changes in product market structure (Taylor 2019), devaluation and farm policies (affecting agricultural prices). The apparent decline in price inflation relative to wage inflation in the 1929-33 downturn was the usual pattern in pre-World War II business cycles (Hanes 1996; Dighe 1997; Huang, Zheng and Phaneuf 2004).

and 1955-1967. All of these spans are covered by Weir's (1992) unemployment rate series. 1955-1967 is covered by a continuation of the manufacturing AHE series for the 1920s-30s and 1891-1914 by a manufacturing AHE series that is at least roughly comparable.[5] Beginning the postwar sample in 1955 avoids years directly affected by the Korean War wage (lifted in February 1953 [Rockoff 1984]). Note that wage inflation over 1929-1932 is in line with the Phillips curve prevailing in the other eras. The outliers - the anomalies - are 1933-35 and 1937-38.

Figure 3 shows the same anomalies in a different way. For this figure I regressed AHE inflation 1891-1914 and 1955-67 on the current and previous years' unemployment rate and a dummy variable for pre-World War II years. I also ran the regression with the unemployment rate replaced by deviation from trend in IP defined as for Figure 1.[6] I apply the estimated coefficients, shown on the figure, to the real activity series over 1929-39 to generate "projected" AHE inflation rates. The figure plots the difference between actual AHE inflation and these projections. The unemployment and IP series give the same result: from 1933 through 1935, and again in 1937-38, actual inflation greatly exceeds projections, far more than in any year outside that era.

2. Proposed explanations for anomalous 1930s wage inflation

2.1 New Deal labor policies

Many economists, in addition to Samulson and Solow (1960) and Friedman and Schwartz (1963), have ascribed extraordinary inflation in the 1930s to effects of New Deal labor policies. According to Wachter (1976), "The spurt [in wage inflation] in the early 1930s is generally attributed to the National Industrial Recovery Act, and the Wagner Act

[5]This is Rees' (1960) "nine-industry" manufacturing AHE series for 1890-1914 (giving annual inflation starting in 1891), which uses fixed industry weights like Hanes' series but does not cover exactly the industries and was constructed in a way that may give it a procyclical bias (Allen, 1992).
[6]IP for 1925-39 and 1955-67 is the FRB IP index, 1891-1914 from Davis (2004). IP trends log-linear between the benchmark years chosen by Romer (1989) and Balke and Gordon (1989).

and the subsequent growth of unions may have been responsible for that of the late 1930s." Mitchell (1986) observes that NRA codes "included labour provisions which boosted wage rates...also provided encouragement to unions and collective bargaining..despite the depth of the depression, a spate of wage increases developed as the codes came into force" (p. 68). Romer (1999) argues that the minimum wage provisions of NRA codes tended to boost price inflation partly because they stymied the usual effect of high unemployment rates on wage inflation. Weinstein (1980) regresses monthly wage inflation in a 1920s-30s sample on a measure of real activity, lagged inflation and dummy variables to allow for effects of NRA codes; results indicate that the advent of the NRA boosted wage inflation. Gordon (1983: 95) runs similar regressions on long samples including the 1930s, adding dummy variables to allow for effects of "the 1935 Wagner Act..unionization in 1936-37" as well as dummies for NRA years.

2.3 Hysteresis, Downward nominal wage rigidity

Both the hysteresis model of Blanchard and Summers (1986) and the downward nominal wage rigidity (DNWR) model of Akerlof, Dickens and Perry (1996) were framed in terms of the "expectations-augmented" Phillips curve hypothesized by Phelps (1967) and Friedman (1968). This is a relationship between real activity and the spread between current inflation and expectations of current inflation formed in the past, such that current inflation equals expected inflation when real activity is at its "natural rate." It appears in models where wages and prices are determined by the behavior of agents who lack (or ignore) information about current macroeconomic conditions (e.g. Phelps 1970, Lucas 1972, Mankiw and Reis 2002). It generates an empirical Phillips curve of the original form if the natural rate of unemployment is stable enough, and expected inflation is uncorrelated with recently experienced inflation. It generates an accelerationist Phillips curve if expected

inflation is strongly correlated with recent inflation. Many economists have argued that the late-1960s shift in the empirical Phillips curve to the accelerationist form can be accounted for in this way (e.g. Alogoskoufis and Smith 1991; Ball 2000). Indeed, there is evidence that the correlation between expected inflation and recent inflation increased across the late 1960s, and fell again after the 1980s consistent with the reappearance of the original-form Phillips curve (e.g. Barsky 1987; Kiley 2015).

In Blanchard and Summers' (1986) hysteresis model the natural rate of unemployment is not stable: it is affected by recent employment levels, mainly because workers with bargaining power care little about the welfare of the unemployed. Thus wage inflation can rise as soon as employment begins to recover from a large, persistent recession. Blanchard and Summers draw some of their evidence for this proposition from regressions of annual AHE inflation 1920-1941 on a proxy for expected inflation and estimates of the current and previous years' annual unemployment rates or aggregate employment. They do not discuss New Deal labor policies.

In the DNWR model of Akerlof, Dickens and Perry (1996), wage inflation usually follows a Friedman-Phelps expectations-augmented Philips curve. But wage *deflation*, which would otherwise result from high unemployment and low expected inflation, can be constrained by a social norm which prevents nominal wage cuts unless the employer is in "financial distress" evidenced by extreme decline in profit. They construct a model of annual inflation in a GDP deflator, having assumed a stable relationship between wage and price inflation. They "show that a dynamic simulation of the model fit to postwar data closely tracks price changes during the Great Depression" (p. 5). In the simulation the constraint on wage cuts does not bind over 1929-1932 but it binds strongly after that as profits recover, especially in 1933, 1936 and 1939 (pp. 44-47). Like Blanchard and

Summers (1986), they do not discuss New Deal labor policies.

2.4 The new Keynesian policy expectations mechanism

The new Keynesian Phillips curve (Roberts 1995) appears in models where there is a cost of adjusting nominal wages and/or prices (as in Rotemberg 1982, Gertler and Leahy 2008) or a constraint that prevents adjustment except at certain points in time with "staggering" (as in Taylor 1980, Calvo 1983). It is a "forward-looking" structural relationship in which current inflation is ultimately determined by two factors. One is the public's expected value for the long-run future inflation rate, that is the rate of inflation that will prevail once all predictable deviations of real activity from the natural rate have dissipated (the long-run steady-state inflation rate). The other is the entire expected path of real activity, relative to the natural rate, from the current period to that long-run future point in time. A new Keynesian Phillips curve can generate an empirical Phillips curve of the original form if expected long-run inflation is fixed. It can generate an accelerationist Phillis curve if expected long-run inflation varies and is correlated with recently experienced inflation.[7] Historical shifts in the empirical Phillips curve can be accounted for in this way. There is evidence expectations of long-run future inflation (like the short-run expectations that matter for the Friedman-Phelps formulation) were correlated with recent inflation in the late 1960s-1990s, but "anchored" in the pre-1914 era, the early postwar era, and the late 1990s-2000s (Barsky and DeLong 1991, Bordo and Dewald 2001, Kozicki and Tinsley

[7]Both the accelerationist and original empirical Phillips curves can be reproduced in new Keynesian model where wages (prices) are reset at regular, fairly short intervals following Taylor (1979); examples include Ball (2000) and Erceg and Levin (2002). Both types of curve can also be reproduced in models where wages (prices) are reoptimized randomly as in Calvo (1983), but, following Yun (1996), a wage (price) that cannot be fully re-optimized in a period is "indexed" to the expected long-run future inflation rate; examples of these include Cogley and Sbordone (2008), Coibion, Gorodnichenko and Wieland (2012). The latter type of model is simpler and can reproduce many results of the former type (Erceg and Levin 2002: 939-40). New Keynesian models with indexing to recent-past inflation (e.g. Christiano, Eichenbaum and Evans 2005) give an accelerationist empirical Phillips curve under *all* circumstances and are thus inconsistent with data from eras that follow the original Phillips curve (Ball 2002).

2001, Mishkin 2007, Ball and Mazumder 2018).

Applied to wagesetting, standard new Keynesian Phillips curve models imply that an empirical Phillips curve relationship can be disturbed by "wage mark-up shocks" (Gali, Smets and Wouters 2011; Gali 2011): exogenous shocks to the spread between wage rates and workers' opportunity cost of labor due to changes in workers' bargaining power. Changes in union power are an obvious possible source of such shocks (as noted by Christiano 2011). Thus, new Keynesian Phillips curve models are consistent with arguments that New Deal labor policies created anomalous wage inflation.

An empirical Phillips curve relationship can also be disturbed by the new Keynesian policy expectations mechanism. Because current inflation is affected by expected long-run future conditions, news that raises the expected long-run future price level gives an *immediate* boost to *current* inflation. Thus, the models imply that anomalous wage inflation could have been due to actions of the Roosevelt administration that boosted the expected long-run future price level. Eggertsson (2008) shows that, in a calibrated new Keynesian model, such a change in expectations can cause a surge in inflation and real activity like that in 1933-36. From Eggertsson's results, it is obvious that the model's path for inflation relative to real activity would appear anomalous in an empirical Phillips curve.[8] But Eggertsson does not focus on this point, or on wage inflation specifically.

Model: policy expectations mechanism, wage mark-up shocks, wage-inflation anomalies

Here I present some reduced-form expressions, mostly following Gali (2011) but meant to be consistent with many new Keynesian models, to illustrate how increases in the expected long-run future price level, as well as increases in workers' bargaining power, can cause wage-inflation anomalies of the kind seen in the 1930s within those models.

[8] Figure 3 in Eggertsson (2008) plots the paths of output and price inflation generated by his model. Panel (B) of the figure shows that inflation soars immediately on adoption of the policies in 1934, while aggregate output recovers gradually.

Variables are in logs. Aggregate output is $y_t = \lambda l_t$ where l is aggregate employment. Labor is "indivisible" - one unit of labor means employment of one worker. *z* is the number of possible workers (the labor force). The unemployment rate is approximately $u_t = (z - l)_t$. There are many groups of workers. w_j is the nominal wage rate paid to one group *j*. *w* is an average wage across all groups. The wage "desired" by group *j* for period *t* increases with the average wage and decreases with the unemployment rate:

(1) $$w^*_{jt} = w_t - \gamma u_t + \mu_{jt} = w_t + \tfrac{\gamma}{\lambda}(y - \lambda z)_t + \mu_{jt}$$

μ_j reflects a desired wage "markup" which can vary over time but not in a predictable way (the expected value of the future change in the markeup is always zero).[9] The natural rate of unemployment u^n is the rate that would prevail in the absence of nominal wage rigidity, defined by setting w_t in (1) equal to an average of w^*_{jt}'s:

(2) $$u_t^n = \mu_t / \gamma$$

where μ_t is a corresponding average of worker groups' μ_{jt}'s. The natural rate of output is $y^n_t = \lambda(z_t - \gamma^{-1}\mu_t)$. An increase in μ_t raises u^n and reduces y^n . $(x - x^n)$ is the gap between an aggregate real variable and its natural rate - a "real activity gap." For the unemployment rate, $(x - x^n) = (u - u^n)$ .. For output, $(x - x^n) = (y - y^n)$.

The wagesetting process effectively acts to minimize a loss function:

(3) $$L_t = E_t\left[\sum_{\tau=0}^{\infty}\beta^\tau (w_j - w^*_j)^2_{t+\tau}\right] \qquad 0 < \beta < 1$$

where E_t is the expected value for a future variable on the part of agents relevant for wagesetting. There is a time horizon *T*, perhaps far in the future, for which expected value

[9] Most new Keynesian models derive relationships corresponding to (1) from specific assumptions needed to fit a dynamic representative-agent setting (e.g. Erceg, Henderson and Levin 2000; Erceg and Levin 2003; Gali 2011), but (1) is consistent with many other types of employment models including efficiency-wage, insider-outsider and union-bargaining models (Summers 1988).

of real-activity gaps for period $t+T$ and subsequent periods is zero. $E_t[\Delta w]_{t+T}$, is wagesetting agents' expected value for the rate of inflation in the average wage w that will prevail at this horizon. Wage adjustment is subject to a Calvo (1983) constraint with "indexing" to the expected value of long-run future wage inflation (as in Yun, 1996; Cogley and Sbordone 2008; Coibion, Gorodnichenko and Wieland 2012). Thus with probability α a worker group's wage w_j can be fully reoptimized in a period. Otherwise it is set equal to $w_{jt-1} + E_t[\Delta w]_{t+T}$.

Assuming wagesetting agents' expectations are at least partly, not necessarily fully, rational - rational enough to satisfy the "law of iterated expectations" on average (Branch and McGough 2009; Adam and Padula 2011; Mavroeidis, Plagborg-Moller and Stock 2014) - minimizing (3) subject to the Calvo constraint with indexing gives the standard new Keynesian Phillips curve formulas:

$$\Delta w_t - E_t[\Delta w_{t+T}] = \theta s (x - x^n)_t + \beta E_t[\Delta w_{t+1} - \Delta w_{t+T}] \quad where \ \theta = \frac{\alpha}{1-\alpha}(1-\beta-\beta\alpha) \tag{4}$$

$$\Delta w_t = \theta s (x - x^n)_t + \theta s E_t\left[\sum_{\tau=1}^{T} \beta^\tau (x - x^n)_{t+\tau}\right] + E_t[\Delta w_{t+T}] \tag{5}$$

For the unemployment rate $s = -\gamma$. For output $s = \gamma / \lambda$. (5) shows that current wage inflation is determined by the expected distant-future rate of wage inflation and expected values for the cumulative real-activity gap from the current period through $t+T$. Assuming long-run real wage growth is determined by exogenous real factors such as technological progress, (5) implies a relationship between expected future real activity and the expected value of the distant-future price *level*:

$$E_t\left[p_{t+T}\right] = p_{t-1} - (E_t[\zeta^T] - \zeta_{t-1}) + TE_t[\Delta w_{t+T}] + \frac{1}{1-\beta} E_t\left[\sum_{\tau=0}^{T} (1-\beta^{1+\tau})\theta s (x - x^n)_{t+\tau}\right] \tag{6}$$

where $(E_t[\zeta^T] - \zeta_{t-1})$ is expected long-run growth in real wages. Note that, for given

$E_t[\Delta w]_{t+T}$, an increase in $E_t[p_{t+T}]$ must be associated with an increase in the expected value of the real-activity gap for some future period or periods: that is the only way to generate a path for future wage inflation that will deliver a higher future price level.

Many studies find that the most sophisticated forecasting methods usually give expected values for future unemployment rates or real GDP that are close to simple autoregressive forecasts (Chauvet and Potter 2013). Thus the public's expected values for future real-activity gaps can be described as:

$$E_t\left[(x-x^n)_{t+\tau}\right] = \rho^\tau (x-x^n)_t + e^{x-x^n}_{t+\tau} \tag{7}$$

where ρ is the serial correlation coefficient from an AR(1) forecast. $e^{x-x^n}_{t+\tau}$ is the difference between the AR(1) forecast and wagesetting agents' *actual* forecast for the real-activity gap in period $(t+\tau)$. Most of the time $e^{x-x^n}_{t+\tau}$ must be small relative to fluctuations in real activity - otherwise AR forecasts would not work as well as they do. But an event that changes expectations of future real activity in an extraordinary, substantial way would be associated with relatively large values of $e^{x-x^n}_{t+\tau}$.

Now suppose one has a time series that is usually well-correlated with a real-activity gap, such as an unemployment rate estimate or deviation of IP from a long-run trend. Let $(\tilde{x}-\tilde{x}^n)$ denote this series. Then:

$$\begin{aligned} &\Delta w_t = \phi(\tilde{x}-\tilde{x}^n)_t + E_t[\Delta w_{t+T}] + \epsilon_{1t} + \epsilon_{2t} \quad \textit{where} \quad \phi = \theta s/(1-\beta\rho) \\ &\epsilon_{1t} = \theta s \sum_{\tau=1}^{\infty} \beta^\tau e^{x-x^n}_{t+\tau} \qquad \epsilon_{2t} = \phi[(x-x^n)-(\tilde{x}-\tilde{x}^n)]_t \end{aligned} \tag{8}$$

(8) shows how the new Keynesian Phillips curve can generate empirical Phillips curves. The accelerationist form appears in samples where $E_t[\Delta w_{t+T}]$ varies and is correlated with recent inflation. The original form appears in samples where $E_t[\Delta w_{t+T}]$ is stable. ϵ_1 and

ϵ_2 represent possible disturbances to the empirical relationship. ϵ_1 reflects $e_{t+\tau}^{x-x^n}$, that is the difference between wagesetters' current forecast of future real activity gaps and simple autoregressive forecasts. ϵ_2 reflects errors in the real-activity indicator series as a measure of the true real-activity gap.

To describe the 1920s-1930s it is plausible to assume $E_t[\Delta w_{t+T}]$ was always close to zero. Recall AHE inflation was close to zero prior to the 1929 downturn. As detailed below, Roosevelt promised to "reflate" prices, that is to restore the pre-Depression price level, not to create permanently higher inflation. Thus, the model implies 1930s data should show an empirical Phillips curve of the original form, subject to the possible disturbances.

Roosevelt's announcements and actions to reflate the price level could create anomalously high wage inflation by creating positive values of ϵ_1. From (6), an increase in the expected long-run future price level must be associated with an increase in the expected future real-activity gap for some future period(s). In (7), an extraordinary increase in expected future real activity means large values of $e_{t+\tau}^{x-x^n}$. Thus in (8) ϵ_1 rises above zero.

New Deal labor policies that increased workers' bargaining power could create anomalously high inflation by creating positive values of ϵ_2, as they increase μ_j for at least some groups, hence the average desired markup μ. That raises the natural rate of unemployment (expression 2) and lowers the natural rate of output. If the available real-activity time series fails to fully account for this, in (8) ϵ_2 rises above zero.

What about New Deal policies that raise some wages by fiat, such as minimum wage rates? New Keynesian literature has not analysed effects of such policies in a model of wage inflation.[10] However, (1) and (3) imply that imposition of a minimum wage binding

[10] Glover (forthcoming) analyses effects of a minimum wage in a model where product prices, but not wages,

for a substantial fraction of worker groups could tend to raise wage inflation generally, not just for groups whose wage rates were previously below the new minimum, as it directly raises the average wage level *w*. An increase in the average wage indirectly raises w_j^* for higher-paid groups (that is, groups with higher wage markups μ_j). Thus, imposition of minimum wage rates may boost aggregate wage inflation to a greater degree than would be implied by the direct effect on low-wage workers.

3) The monthly timing and nature of 1930s wage inflation anomalies

Which explanation is most consistent with the facts? I begin to answer that question by identifying the timing of the anomalies at a monthly frequency. To do that I estimate empirical Phillips curves of various forms on monthly postwar series for which there are directly comparable 1930s counterparts: that means the IP gap for real activity, and the manufacturing AHE series described above which can be continued up to March 2003.[11] My goal is not to choose among the specifications but merely to get estimates consistent with a variety of models for the relationship between AHE inflation and IP gaps. I apply each estimated specification to IP gaps from 1929 through 1939 and compare the resulting projected "normal" paths for AHE inflation with actual inflation. All specifications give similar results. From 1929 through July 1933 actual AHE inflation is in line with or below projected paths. Anomalously high inflation first appears in August 1933. From August 1933 through June 1934 inflation soars above projected paths. Then it drops back down

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are subject to new Keynesian nominal rigidities.

[11]Up to March 2003 BLS AHE series come in SIC categories that can be matched to industries in 1930s data. After that AHE series are only available in broad ISIC categories which cannot be matched to 1930s industries. To define IP trends, the last benchmark year chosen by Romer (1989) and Balke and Gordon (1989) is 1981. I must choose additional benchmark years to define trends for 1982-2003. Romer (1989: 18) says her benchmark years "correspond to points of midexpansion in the business cycle. When possible, I also use data on the unemployment rate to confirm that the years chosen do correspond to conventional estiates of full, rather than overfull, employment." To match this procedure I chose midexpansion years (between trough and peak) in which the average unemployment rate was equal to the (long-run) NAIRU estimate of the Congressional Budget Office (taken from the CBO website in summer 2018): 1987, 1997, 2005.

toward the projections. Starting in November 1936 inflation again soars above projections. These are the anomalies to be explained.

Next I compare manufacturing AHE with a unique series from the 1930s that indicates changes in manufacturing *wage rates*, as distinct from AHE. Together, the two series show that the first spell of anomalous AHE inflation, from August 1933 through 1934, mainly reflects an enormous hike in wage rates over August-September 1933, followed by increases in AHE *relative to* wage rates from September 1933 through May 1934. The second spell of anomalous AHE inflation, from November 1936 to late 1937, reflects another round of hikes in AHE that began in November 1936 and ended around August 1937.

3.1) Estimated Phillips curve specifications

Figures 4a) - 4f) give specifications, postwar samples used for estimation, and estimated coefficients. In all cases the LHS variable is the change in log manufacturing AHE from the same month of the previous year, so that I do not have to quantify seasonals in AHE. It would be easy to confuse changes in seasonals with Phillips curve anomalies. There are *a priori* reasons to believe seasonals were unstable across the 1930s.[12] I specify residuals as MA(12) to account for the overlap of disturbance terms between monthly values of twelve-month inflation. On the RHS is a weighted average of the past twelve months' IP deviations from trend, with weights estimated by a second-degree PDL, separately for each specification. (Coefficients on additional lags of IP gaps were generally not significantly different from zero.) All samples exclude months for which twelve-month

[12]One soruce of seasonals in AHE is interaction between production seasonals and overtime premiums, piece-rate pay, and relative employment of low-wage workers. NRA codes and new union agreements were generally associated with changes in payment systems such as overtime. Some NRA codes changed seasonal patterns in production (MacDonald et al 1934: 34; Cooper and Haltiwanger, 1993).

inflation could be directly affected by wage and price controls.[13]

Specification a), estimated over the entire 1948-2003 span (excluding wage- and price-control periods), is most consistent with the new Keynesian Phillips curve. It is derived from (8) taking a period to be a month and summing across 12 months:

$$(9) \qquad w_t - w_{t-12} = \phi \sum_{\tau=0}^{12} (\tilde{x} - \tilde{x}^n)_{t-\tau} + \sum_{\tau=0}^{12} E_{t-\tau}[\Delta w_{t+T}] + e_t \quad where \quad e_t = \sum_{\tau=0}^{12} (\epsilon_1 + \epsilon_2 + \epsilon_3)_{t-\tau}$$

with an additional term added to the RHS (ϵ_3) to account for unmodeled factors such as unobservable determinants of the difference between inflation in AHE *versus* wage rates. To proxy for $E[\Delta w_{t+T}]$ (the public's expected value for the long-run future wage inflation rate), I use a quarterly series created for the Federal Reserve Board's FRB/US macroeconomic model, which represents the public's forecast for the long-run future rate of consumer price inflation.[14] Several studies (including Fuhrer 2012, Blanchard, Cerutti and Summers 2015, Ball and Mazumder 2018) have used this series to control for expected long-term price inflation in estimated Phillips curves. Here, to control for changes in expected *wage* inflation I include the four-quarter average of the series on the RHS (π^e in 4a) along with a quadratic time trend to allow for trend changes in the spread between expected wage inflation and expected price inflation (real wage growth).

Specification b) is an original-form Phillips curve, estimated on a sample ending with December 1965, the earliest point anyone dates the shift to an accelerationist Phillips

[13]World War II controls removed at the end of June 1946. Korean War controls imposed at the end of January 1950, removed in March 1953. 1970s controls began in August 1971, ended in April 1974 (Rockoff 1984).
[14]The series, denoted PTR in the FRB/US database at https://www.federalreserve.gov/econres/us-models-package.htm (Brayton and Tinsley 1996), represents a forecast for the PCE inflation rate that will prevail in the long-run future. Values for 1980-1991 are derived from surveys of financial market participants or professional forecasters; values for prior years are from a model of financial market participants' long-run inflation forecast (Kozicki and Tinsley 2001) which derives the forecast from time series on actual inflation rates and closely reproduces survey results for overlapping years. The first value produced by this model, for January 1968, is 1.68 percent. For my estimation I assume the same value prevailed before that. That is consistent with the average value of actual PCE inflation over 1960-1967 (1.63 percent).

curve. c) is an accelerationist Phillips curve estimated over the span from January 1970 (the latest point anyone dates the shift to the accelerationist Phillips curve) to December 1989 (a relatively early date for the shift back to the original-form Phillips curve). The lagged inflation term is a weighted average (estimated by second-degree PDL) of twelve lags of the twelve-month change in log AHE. d) is an accelerationist Phillips curve with lagged wage inflation replaced by lagged price inflation. e) and f) are accelerationist Phillips curves estimated over 1948-2003 (excluding wage and price control periods).

3.2) Projections and anomalies to be explained

To create projected "normal" paths for inflation in the 1930s, I apply estimated postwar coefficients to actual IP gaps starting with January 1929. I set the other RHS variables to match an assumption that expected long-run future wage inflation rate remained zero throughout the 1930s. Thus for a) I set to zero the terms for expected long-run future price inflation and the time trends. For c)-f) I set lagged inflation terms to zero. For all specifications I adjust constants so that projections match *actual* average inflation from January through September 1929, just prior to the cyclical peak. Thus the projections are meaningful starting with October 1929.

Figures 4a-4f plot each specification's projected path, with two-SE bands, along with actual AHE inflation. The timing of turning points is about the same for all (even though relative weights on IP lags were allowed to vary across specifications.) From late 1929 through early 1932 actual inflation remains within the two-SE bands of all projections. In 1932 and early 1933, actual inflation falls below projections. Starting in August 1933 actual inflation soars far above all of the projections. Thus I take August 1933 to be the month when AHE inflation first became anomalously high. The largest difference between actual inflation and projected paths appears over the twelve-month span ending June 1934.

After that the difference narrows. By mid-1936 actual 12-month inflation is much closer to projections though still above the two-SE bands. Starting in November 1936, inflation again soars above the projected paths, peaking in the twelve months ending October 1937. Then actual inflation falls back toward projections. All of these patterns are consistent with the results from annual data on IP or unemployment in Figure 3.

3.3) Movements in wage rates versus AHE

The AHE series I use here, with fixed industry weights, could be affected by many factors other than changes in wage rates including changes in the nature of overtime pay, piece rates and relative employment at high- versus low- wage rates within industries. A unique series from the 1930s indicates changes in manufacturing wage rates *per se*. From the early 1920s through October 1935, the BLS asked respondents to its monthly survey of manufacturing establishments to report changes in wage rates - piece as well as time rates - and the number of employees affected by each change. From published summaries of these reports Creamer (1950) constructed a "wage rate index." Changes in the index number indicate average changes in straight-time or piece-rate wages paid for nonmanagerial jobs in reporting establishments (averaging in zeros for jobs in which wages were held fixed). The index has a number of shortcomings. It may fail to indicate small monthly changes in average wage rates.[15] There are no comparable data for months subsequent to October 1935, or from other eras. But it is the only indicator of changes in wage rates as distinct from AHE in a large sample of manufacturing establishments in the 1930s.

Figure 5 plots the wage rate index alongside the manufacturing AHE series. Figure 6 plots monthly percent changes (not twelve-month inflation). Both figures also plot the

[15]It does not cover exactly the same mix of manufacturing industries, with the same weights, as the AHE series. It cannot be reweighted to match the AHE series (or vice-versa). It may fail to indicate all wage changes because some surveyed establishments may have failed to report some wage-rate changes (Creamer 1950: 34).

inflation anomaly (the difference between actual inflation and the center of the projected path) defined by specification a). Recall all specifications gave similar timing of anomalies. The figures show that the spell of anomalous AHE inflation beginning in August 1933 was at first due to wage hikes in August and September 1933 (the increase from July to September observations was 14 percent in AHE, 11 percent in the wage rate index). Anomalous AHE inflation from September 1933 through spring 1934 mainly reflects growth in AHE *relative to* wage rates (from September 1933 to May 1934 AHE increased about 10 percent, the wage index just about 2 1/2). AHE grew slowly from May 1934 to November 1936, then very rapidly again from November 1936 to October 1937, fastest in April 1937. (Recall the wage index is not available for 1936-37.)

4. What best explains these movements in wages and AHE?

So far I have shown that explaining 1930s wage inflation anomalies means accounting for large wage hikes in August and September 1933, increases in AHE relative to wage rates from September 1933 through May 1934, and a second round of AHE hikes that began in November 1936 and ended around August 1937. Neither the hysteresis model of Blanchard and Summers (1986) nor the downward nominal wage rigidity (DNWR) model of Akerlof, Dickens and Perry (1996) can do this. In the latter model recovering profits could reactivate a DNWR constraint that would block nominal wage cuts. But the inflation anomalies reflect massive *hikes* in wages or AHE. The former model implies wage inflation could pick up as soon as employment began to grow steadily even if unemployment remained high relative to pre-Depression levels. It cannot explain why wage growth occurred in such short, sudden leaps across August-September 1933 and after November 1936.

That leaves New Deal labor policies and the new Keynesian policy expectations

mechanism, which I examine in the remainder of this section. I find the wage hikes of August-September 1933 coincided with the effective dates of the first NRA codes. Minimum wages and other provisions of these codes can plausibly account for the magnitude of AHE growth over these months. Increases in AHE relative to wage rates from September 1933 to April 1934 coincided with the spread of NRA industry codes which did not further raise wages minimums but did impose labor standards such as premium pay for overtime which would tend to raise AHE relative to straight-time wages. Hikes in AHE from November 1936 to October 1937 coincided with a wave of union organization and strikes supported by New Deal labor policies that forced employers to begin bargaining with unions or raise wages to forestall union threats. I show that together the first NRA codes in August-September 1933, the spread of NRA industry codes from September 1933 through May 1934, and union activity indicated by strikes, appear to *fully account* for AHE inflation anomalies over 1933-39.

Turning to the expectations mechanism, I find the wage hikes of August-September 1933 coincided with policy news that could have raised the expected long-run future price level. But other, apparently similar news came in months *prior* to August 1933, when inflation was not anomalously high. The second round of extraordinary hikes in AHE from November 1936 to October 1937 occurred while monetary policy was being tightened in ways that should have, if anything, *lowered* the expected future price level.

4.1 New Deal labor policies

In July 1933 the NRA approved industry codes for cotton textiles, woolen textiles (both covered in my manufacturing AHE series), and shipbuilding (not covered). All three codes set industry-specific wage minimums and hiked wages of *all* industry workers by requiring universal cuts in weekly hours with no cuts in weekly pay. The cotton and

shipbuilding codes also required wage hikes for higher-paid jobs to maintain differentials over jobs directly affected by wage minimums.[16] In late July 1933 Roosevelt "invited" nearly all nonagricultural employers in other industries to sign the "President's Re-Employment Agreement" or "blanket code" to regulate employment until their own industry codes were approved. The blanket code forbade wage cuts for any workers, set wage minimums (the rate applying to an establishment depended on the local municipality's population and the establishment's wage level back in 1929) and called for hikes in above-minimum wages "by an equitable readjustment of all pay schedules."

The effective dates of the blanket code and the first industry codes were *precisely coincident* with the extraordinary increases in the manufacturing AHE series in August and September 1933.[17] It is plausible that these codes were responsible for most, perhaps all of the 14 percent increase in manufacturing AHE across those months. For four industries covered by the AHE series, NRA staff estimated the direct effect of the industry or blanket code minimums, based on information no longer available. The estimates imply percent increases in industry average wages or AHE ranging from 10 to 30 percent.[18] According to

[16]Details of industry codes and their effective dates are described in a series of pamphlets publshed by the NRA titled *Code of Fair Competition for the...Industry as Approved on* [approval date]*..by President Roosevelt*. I refer to these by the name of the industry. The codes approved in July are *Cotton Textile Industry,..Shipbuilding and Ship Repair,* and *Wool Textile Industry.*

[17]Over 1933-34 the AHE series is constructed from NICB data. NICB survey respondents were asked to report wage bills and employment as of "the first full week in each month, unless a generally recognized holiday falls in that week, in which event the succeeding week is indicated" (Beney 1936: 17). The cotton code's effective date fell between the dates of the July and August AHE surveys. The woolen code's fell between the August and September surveys. (The code for shipbuilding, not covered by the AHE series, became effective in early August.) The blanket code became effective for some employers between the July and August surveys, for others between August and September. Its effective date was August 1st, but many employers did not sign on until the later weeks of August (Taylor 2011: 137).

[18]The four industries are chemicals, cotton textiles, leather, and boots and shoes. For cotton, NRA staff estimated that just the direct effect on wages previously below the minimum would raise average industry wages about 30 percent (*Cotton Textile Industry:* 11). For leather, the effect of the industry code, which had minimum wage rates at the same level as the blanket code, would increase average hourly earnings by 30-35 percent (*Leather Industry*: VI). For chemicals, which also had minimums at the same level as the blanket code, staff estimated that the code would raise average hourly wage rates "to the 1929 level or better" (*Chemical Manufacturing Industry*: 394) which means an increase of more than 20 percent from July 1933 (juding from

contemporary observers, wages in higher-paid jobs were in fact usually raised when, or shortly after, minimums came into force (Lyon et. al. 1935: 318; Roos 1937: 193). By themselves, the cotton and woolen textile code provisions that required cuts in weekly hours with no cuts in weekly pay raised those industries' hourly wages by 20 percent.[19]

Beginning in September 1933 most industries adopted their own industry codes.[20] Like the first codes, they banned wage cuts for any workers, set wage minimums and had clauses requiring maintenance of wage differentials for higher-paid workers. But the minimum wages they specified were usually no higher, and sometimes lower, than those already in the blanket code.[21] On the other hand, nearly all of these later codes required overtime premium pay which had *not* been required by the blanket code or the first three industry codes (they were later revised to require it) (Schoenfeld 1935: 575). Thus, it is plausible that the industry codes coming into effect beginning in September 1933 affected AHE more than wage rates.

Adoption of these later industry codes was *precisely coincident* with growth in AHE

NICB AHE data). For boots and shoes, "The minimum wage provisions of this code will affect directly over 60 percent of the wage earners in the South and over 30 percent of the wage earners in the North. Increases from the level in the first quarter of 1932 will be required of as much as 50 percent in the South and over 30 percent in the North. On account of the further decline in wages in the latter half of 1932 it is evident that the increase from the early 1933 levels will be even greater" (*Boot and Shoe Manufacturing Industry*: 543). The numbers given for the North imply an increase in average wages of around 10 percent from the level of 1932:1 (the Southern increase would be bigger). The increase from the July 1933 level must be about the same: AHE in the industry (NICB data) was almost exactly the same in July 1933 as in the first quarter of 1932. Certainly, the minimum wages imposed by these industry codes and the blanket code were much higher, relative to pre-existing wages, than those imposed by later Federal legislation. The first federal minimum wage came into effect in October 1938. It was less than 32 percent of the value of the manufacturing AHE series for September 1938 (25 versus 79 cents and hour). The blanket code's minimums (30-40 cents per hour) were 64 to 86 percent of the value of the July 1933 manufacturing AHE observation. The woolen code's minimums (32.5-35 cents) were about equal to industry AHE (35.2 cents according to BLS surveys), and the cotton code's minimums (30-32.5 cents per hour) were higher than industry AHE (23.1 cents), in July 1933.

[19]Both codes cut weekly hours from 48 to 40 (*Cotton Textile Industry*: 22; *Wool Textile Industry*:2).

[20]The blanket code remained in effect for the few industries (including meat packing, electric light and power) that never adopted industry codes (Schoenfeld 1935: 575).

[21]Marshall (1935), Table B and pp. 22-29 summarizes wage provisions of each code. Only two industries in my AHE series had codes that set minimum wages above the blanket code's 40 cent minimum (for establishments located in larger towns). These were rayon (45 cents) and auto manufacturing (43 cents).

relative to wage rates from September 1933 to April 1934. This is shown by Figure 7 which plots a monthly estimate of industry code coverage prepared by NRA staff: "the number of wage earners..who would have been covered by the codes [excluding those covered by the blanket code alone] if 1929 levels of employment had prevailed" (NRA Research and Planning Division 1935, p. 45). NRA staff relied on 1929 employment (from the 1930 census) because comprehensive up-to-date data on industry employment were collected in the early 1930s. For my purposes, the estimate indicates the timing of the exogenous shock from adoption of industry codes in a way that is unaffected by effects of the codes on current industry employment.[22] It shows that industries representing the bulk of employment adopted their codes between September 1933 and March 1934. The last set of codes covering industries within my manufacturing AHE series probably came into effect just before the April 1934 AHE observation.[23]

The NIRA had required every industry code to include a provision "That employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint or coercion of employers..no employee..shall be required as a condition of employment..to refrain from joining, organizing or assisting a labor organization of his own choosing.." When the NIRA was passed in June 1933 this requirement appeared to promise new opportunity for unions. At the time few employers, and none in large-scale manufacturing industries, negotiated with unions. Many routinely fired employees for union involvement.[24] Contemporaries observed that "The fear of employers which had long kept workers from joining trade

[22]It could not be reconstructed as accurately today. NRA staff knew more about the match between coded industries and census data categories than we do.
[23]These were the code for the Machinery and Allied Products Industry (probably within the AHE series "Foundry and Machine shops"), supposed to come into effect on March 28 1934, and two codes for paper products supposed to come into effect on April 9 1934 (probably within the AHE series "Paper products"): Open Paper Drinking Cup and Round Nesting Food Container; Expanding and Specialty Paper Products.
[24]State laws meant to protect workers against such policies were rarely enforced (Fishback 2018: 3, 4, 27, 36).

unions was for the time being overcome" (Lyon et. al. 1935: p. 489). Unions immediately began membership drives in “Feverish efforts at organization” (MacDonald et al 1934: 13; see also Wolman 1936:59-61; Roberts 1944: 95; Bernstein 1969: 37-38; Fine 1969:66; Rose 1997:98). There was a wave of strikes (MacDonald 1934: 16; Bernstein 1969: 96, 99, 106). "Some of these strikes were strategic maneuvers undertaken by the unions to influence the formulation of the labor provisions of the codes..Others were primarily strikes for union 'recognition'.." (Lyon et. al. 1935: 490). In a "recognition" or “organizing” strike, a union demanded that the employer negotiate with the union and stop firing workers for union involvement. "In most of these cases other matters, especially wages, were also major issues" (BLS *Monthly Labor Review* January 1936, p. 161).

The strike wave beginning in June 1933 can be seen in Figure 7, which plots BLS estimates of the number of workers involved in strikes beginning in a given month in manufacturing industries. Also plotted are monthly estimates for workers involved in recognition strikes, available starting with September 1934; for prior months I plot the average monthly rate implied by annual BLS estimates, which start earlier.[25] Unfortunately, the BLS never published estimates for recognition strikes in manufacturing only.

The strike wave ebbed in late 1934. While some employers had responded to strikes

[25] Recognition-related strikes are the sum of these categories in BLS publications: recognition; recognition and wages; recognition and hours; recognition, wages and hours; recognition and other causes. Annual figures from Peterson (1937: Table 28); monthly figures from "Industrial Disputes" section of BLS *Monthly Labor Review* starting with January 1935 issue. Striking workers in manufacturing are calculated as workers in all strikes from Peterson (1937: Table 21) and U.S. BLS, Handbook of Labor Statistics 1941 Edition (BLS Bulletin 694), p. 321, *minus* striking workers in listed nonmanufacturing industries from "Industrial Disputes" section of BLS *Monthly Labor Review*. The only industry-specific, monthly-frequency strike estimates published by the BLS (in the *Monthly Labor Review*) were somewhat preliminary, lacking some of the corrections made in the later-published figures for all industries aggregated. In two months (October 1930, October 1935) the all-industries figure was inconsistent with the industry-specific figures. For those months my number for manufacturing strikes was the sum of preliminary figures for strikes in listed manufacturing industries published in the *Monthly Labor Review*.

by recognizing unions and raising wages (Fine 1963: 208; Bernstein 1969: 217-317; 226, 228, 250), others raised wages but did not recognize a union (MacDonald et al 1934: 41-42; Roos 1937: 215; Fine 1963:105,125). Many set up employer-controlled "Employee Representation Plans" (ERPs or "company unions") to serve as the collective bargaining representative called for by the NIRA (Brooks 1940: 75; Roberts 1944: 100-104; Ozanne 1967: 146; Rose 1997: 115); some gave wage increases "negotiated" by an ERP to draw employee support away from outside, independent unions (Brooks 1940: 99; Rose 1997: 163, 236; Ozanne 1967: 147-149). Employers continued to fire employees involved with unions (Roos 1937:233; Terborg et al 1935: 490). They generally ignored, or tied up in court, rulings of the National Labor Relations Board (NLRB) which had been set up to enforce the NIRA's collective bargaining provisions (Terborg 1935: 482-486; Roos 1937: 223-226; Rose 1997: 123, 137).

In May 1935 the Supreme Court ruled that the NIRA was unconstitutional. Two months later, in July 1935, the National Labor Relations Act (Wagner Act) reinstated and strengthened the NIRA's labor provisions. It banned ERPs and gave the NLRB new enforcement powers in federal courts (Bernstein 1969: 322-330). However, employers continued to litigate against, or simply ignore, NLRB rulings. They believed Roosevelt and the Democrats were likely to lose the election of 1936, in which case the Wagner Act would be eliminated, or the Supreme Court would rule the Wagner Act, like the NIRA, unconstitutional (Ozanne 1967:151; Fine 1969: 182; Rose 1997: 240).

In November 1936 the victories of Roosevelt in the presidential election, and pro-union Democratic governors in several industrial states, set off another wave of union membership drives and strikes, especially recognition strikes (BLS *Monthly Labor Review* May 1937, May 1938; Slichter 1938:98; Fine 1969). This time the result was different. By

the end of March 1934, after suffering strikes (including “sit-down” strikes, later ruled illegal by the Supreme Court [Bernstein 1969: 678]), employers in large-scale manufacturing industries including automobiles, steel, chemicals, electrical equipment and rubber gave in, recognized unions and entered into written agreements with them which usually involved immediate pay hikes and more generous overtime provisions (Bernstein 1969: 464-468; 481-620; Fine 1969: 302-328; in 1969: 464-68; Rose 1997: 258). In April 1937 the Supreme Court ruled the Wagner Act constitutional. Between April and September 1937 "Wage rates were influenced by the large number of industrial disputes and by the efforts of employers to forestall unions by making concessions" (Slichter 1938: 99). Annual union density estimates show an enormous increase from 1936 to 1937 (Freeman 1998). The strike wave ended around October 1937. Recognition strikes became rare and remained so in the post-World War II era. NLRB-overseen elections had become the mechanism by which unions won recognition (Bernstein 1969: 788; Carter et. al 2006: series Ba4965-4970).

The strike wave beginning in November 1936 was *precisely coincident* with the growth of AHE from that month to October 1937 which constitutes the second anomaly in AHE inflation. In fact, practically *all* anomalous inflation in manufacturing AHE that was not coincident with the advent of the first NRA codes (August-September 1933) or with the spread of later NRA industry codes (September 1933 through May 1934) was correlated with strikes in manufacturing. This is shown by Figure 8, which gives results of regressing the 12-month inflation anomaly defined by Phillips curve specification a), starting October 1929, on the number of manufacturing workers involved in strikes averaged over the past twelve months, the 12-month change in NRA-code covered employment (from Figure 7), and dummies marking 12-month spans containing August 1933 or September 1933. The

lower portion of the figure plots the anomaly "projected" by the estimated coefficients. It is remarkably close to the actual inflation anomaly throughout the 1930s. The anomalies defined by the other empirical Phillips curve specifications give similar results.

The correlation between strikes and inflation anomalies is consistent with new Keynesian wage-inflation models. The strike waves of the 1930s, largely due to recognition strikes, appear to have been associated with increases in workers' bargaining power.[26] The models imply that increases in workers' bargaining power can cause wage inflation anomalies in estimated Philips curves if available measures of the real-activity gap fail to capture sudden increases in the natural rate of unemployment. This would be true for the IP gaps and unemployment rate estimates that are our real-activity gap measures from the 1930s.

4.2 The new Keynesian expectations mechanism and Roosevelt's monetary policies

In new Keynesian models, anomalously high wage inflation can also be caused by credible news about economic policy that raises the public's expected value for the long-run future price level. Arguably, such news came thick and fast soon after Roosevelt took office in March 1933.

Entering the Great Depression, currencies of most countries active in international trade and finance could be freely exchanged for gold at a fixed rate, creating the international gold standard. A country's long-run equilibrium price level was largely determined by its currency's gold exchange rate - its “gold price” - and the world gold price level of tradable goods. In the U.S., the Federal Reserve system was legally required to exchange its notes and Federal Reserve bank balances for gold at a fixed price. Economists and business writers assumed the dollar gold price would remain fixed in the future and

[26]Fishback (2018) presents other evidence consistent with a positive correlation between strikes and union bargainng power in the interwar era, as he shows that over 1919-1931 the presence of state laws tending to reduce (promote) union bargaining power was associated with low (higher) strike rates.

forecast a stable or slightly decreasing U.S. price level based on the balance of world gold supply and demand (Nelson 1991: 6-7).

In March 1933 foreign withdrawals of gold from the Federal Reserve system forced Roosevelt to suspend gold payment by the Federal Reserve. For several weeks dollar foreign exchnage rates, mainly determined by expectations of the dollar's *future* gold value, remained stable. In the past many countries, including the United States itself, had suspended gold payment for a while before resuming payment at the old price. In late April, however, Roosevelt issued an executive order extending the suspension and "made it clear that the administration intended to permit the dollar to depreciate in terms of foreign currencies as a means of achieving a rise in domestic prices" (Friedman and Schwartz 1963: 464). The dollar began to depreciate, as shown in Figure 9 which plots dollar foreign exchange rates against the French franc (fixed to gold until late 1936) and the British pound (devalued in 1932 but kept at a tightly controlled gold price over 1933-36).

In early May Roosevelt announced in a national radio broadcast ("fireside chat" May 7, 1933) that "The Administration has the definite objective of raising commodity prices to such an extent that those who have borrowed money will, on the average, be able to repay that money in the same kind of dollar which they borrowed." Also in early May Congress passed the Thomas amendment to the Agricultural Adjustment Act, which was "explictly directed at achieving a price rise through expansion of the money stock" and "contained a provision authorizing the president to reduce the gold content of the dollar to as low as 50 per cent of its former weight" (Friedman and Schwartz 1963: 465). In June 1933 Congress passed legislation abrogating financial contracts that required payment in gold at the old dollar-gold rate. At the beginning of July 1933 Roosevelt publicly disavowed the aims of an international economic conference dedicated to a general restoration of gold

convertibility at 1929 exchange rates (Friedman and Schwartz, 1963: 469). In late October 1933 Roosevelt stated in another radio broadcast:

> I repeat what I have said on many occasions, that the definite policy of the Government has been to restore commodity price levels. The object ...has been to make possible the payment of public and private debts more nearly at the price level at which they were incurred...It has been and is also the purpose to prevent prices from rising beyond the point necessary to attain those ends...When we have restored the price level, we shall seek to establish and maintain a dollar which will not change its purchasing and debt paying power during the succeeding generation (Fireside chat, October 22, 1933).

In January 1934 Roosevelt fixed a new permanent gold price which devalued the dollar about 40 percent from its pre-1933 rate. At the new price American monetary authorities sold gold to foreign monetary authorities and bought gold from anyone. The U.S. was back on the gold standard at a rate which depreciated the dollar against foreign currencies.

It is plausible that Roosevelt's announcements and exchange-rate policies raised the public's expected future price level. Certainly, Roosevelt's advisers who advocated devaluation of the dollar against gold did so because they believed it must necessarily raise the American price level in the long run.[27] Before the dollar was relinked to gold in January 1934, well-respected economists warned that Roosevelt's policies might bring *uncontrollable* inflation (Romasco 1983: 130; Wilcox, Fraser and Malin 1934: 17). In August 1933 a New York Fed staff economist observed "The public has apparently learned

[27] Roosevelt took counsel from many economists and financiers. His actions were most consistent with the ideas of Cornell economist George F. Warren, who understood that a gold-standard country's price level was determined by its gold price and that prices of internationally-traded agricultural commodities were set in world markets so their prices in any one country would respond immediately to a change in the currency's gold value (Warren and Pearson, 1933). Warren believed that the structure of relative prices had been disturbed after 1929 because prices of internationally traded agricultural commodities had plummeted but "sticky" prices of domestic manufactured goods had not. In the words of Warren's colleague and co-author, Frank Pearson (1957: 5671), "The problem..was to deflate the high, sticky prices down to the level of the low, flexible prices or to inflate the low, flexible prices up to the high, sticky prices...Dr. Warren had the correct remedy: the equilibrium should be restored by inflating the flexible relative to the sticky prices by raising the price of gold."

that discussion of the currency means 'devaluation' which means 'inflation'" (quoted in Romasco 1983: 95). At the same time, Roosevelt's reflationary policies were strongly opposed by Republicans (Romasco 1983:49-50), who might be expected to reverse the policies if they regained power. While most economists believed devaluation caused inflation, some believed that "there is only a minor relationship between the official prices of gold or silver and the general price level" (Paris, 1938: 9).

The first spell of anomalous AHE inflation starting in August 1933 was coincident with news events that could have raised the expected future price level. But many such news events also occurred *prior* to August 1933, as wage inflation was well within its normal relationship to the IP gap. Unfortunately, there are no surveys from the 1930s that could indicate the timing of changes in inflation expectations.[28] But economic historians who have argued that Roosevelt's policies raised expected inflation generally date the shift in expectations *prior* to July 1933. According to Temin and Wigmore (1990), "the real change in policy became evident when FDR announced on April 18 that he would support the Thomas Amendment." From analysis of contemporary newspaper articles and business publications, Jalil and Rua (2016: 33) conclude that expected future inflation rose sharply over the first six months of 1933 and "moderated" after July 1933. From a similar analysis, Taylor and Neumann (2016: 58) conclude "a jump in inflationary expectations occurred in the spring of 1933 - specifically it appears that this jump began in late April and accelerated

[28] Two studies attempt to infer inflation expectations in the 1929-32 downturn of the Great Depression indirectly. Cecchetti (1992) produces statistical forecasts based on lagged inflation and nominal interest rates. Hamilton (1992) uses agricultural commodity futures prices from the period. Their methods are obviously inappropriate for 1933-34. Cecchetti's forecasts are based on an assumption that the real interest rate was stationary. If the new Keynesian policy expectations mechanism was present, that condition did not hold. Hamilton's procedure assumes both rational expectations and a stable (stochastic) relationship between commodity prices and the overall price level. But that relationship would have been changed by dollar devaluation and the Roosevelt administration's agricultural programs. (That was the point of the programs!)

in May." Figure 9 plots an index number constructed by Binder (2016) which measures the frequency of articles in the *New York Times* mentioning inflation (or reflation) *versus* deflation through the end of 1934. Higher values indicate a relatively higher frequency of articles mentioning inflation. The index number increases around July 1933. But it increases more from 1932 to March 1933.

The second spell of anomalous AHE inflation, beginning in November 1936, cannot possibly be accounted for by the policy expectations mechanism. It occurred during a monetary policy tightening that should have, if anything, *lowered* the expected long-run future price level.

From January 1934 on the U.S. was usually running a balance of payments surplus. American monetary authorities were buying gold. From 1934 through the first half of 1936 gold purchases were allowed to boost the high-powered money supply, following through on Roosevelt's commitment to inflation. But during 1936 Federal Reserve policymakers came to fear that high-powered money growth resulting from gold inflows must eventually create a burst of uncontrollable inflation. They pushed for an increase in regulatory reserve requirements to forestall it (by boosting high-powered money demand). In July 1936 the Fed announced a reserve-requirement hike to take effect in August. In December 1936 the Treasury (responsible for dollar-gold exchange under new arrangements adopted in January 1934) announced it would sterilize gold inflows and began to do so immediately. High-powered money growth ceased. In January 1937 the Fed announced more hikes in reserve requirements to occur in March and May 1937. These policy-tightening actions were not reversed until late 1937 when it became apparent that the economy had entered a second downturn. The second spell of anomalous inflation began between the first hike in reserve requirements and the adoption of gold sterilization. It continued through

announcement of further reserve-requirement hikes. Eggertsson and Pugsley (2006) argue that these policy actions, and many statements of policymakers in early 1937, caused the public to *revise downward* their expected value for the long-run future price level and hence caused the recession of 1937 through the policy expectations mechanism. They do not discuss the contradictory behavior of wage inflation.

5. Conclusion

Sometimes the obvious explanation is correct. New Deal labor policies can explain practically all 1930s wage inflation anomalies. Any proposed alternative explanation should be explicitly tested against this one. The apparent relationship between wage inflation anomalies and New Deal labor policies is consistent with the theoretical new Keynesian Phillips curve, as the policies may have constituted wage mark-up shocks. But the 1930s U.S. should *not* be cited as evidence that the policy expectations mechanism as depicted in standard new Keynesian models can work in the real world. One might argue that the mechanism was at work over 1933-34 but its effects were obscured by labor policies. To test this, one could quantify the contribution of each possible factor in a calibrated model. But the persuasiveness of such an exercise would depend on whether other plausible models give the same answer. Perhaps the mechanism can work in the real world but it was not tested in the 1930s because the American political system's commitment to future inflation was not sufficiently credible or understood by the public. But new monetary policy strategies such as price level targeting might also lack universal political support and/or understanding on the part of the public. It is hard to see how the American political system could make a commitment to future inflation stronger than Roosevelt's.

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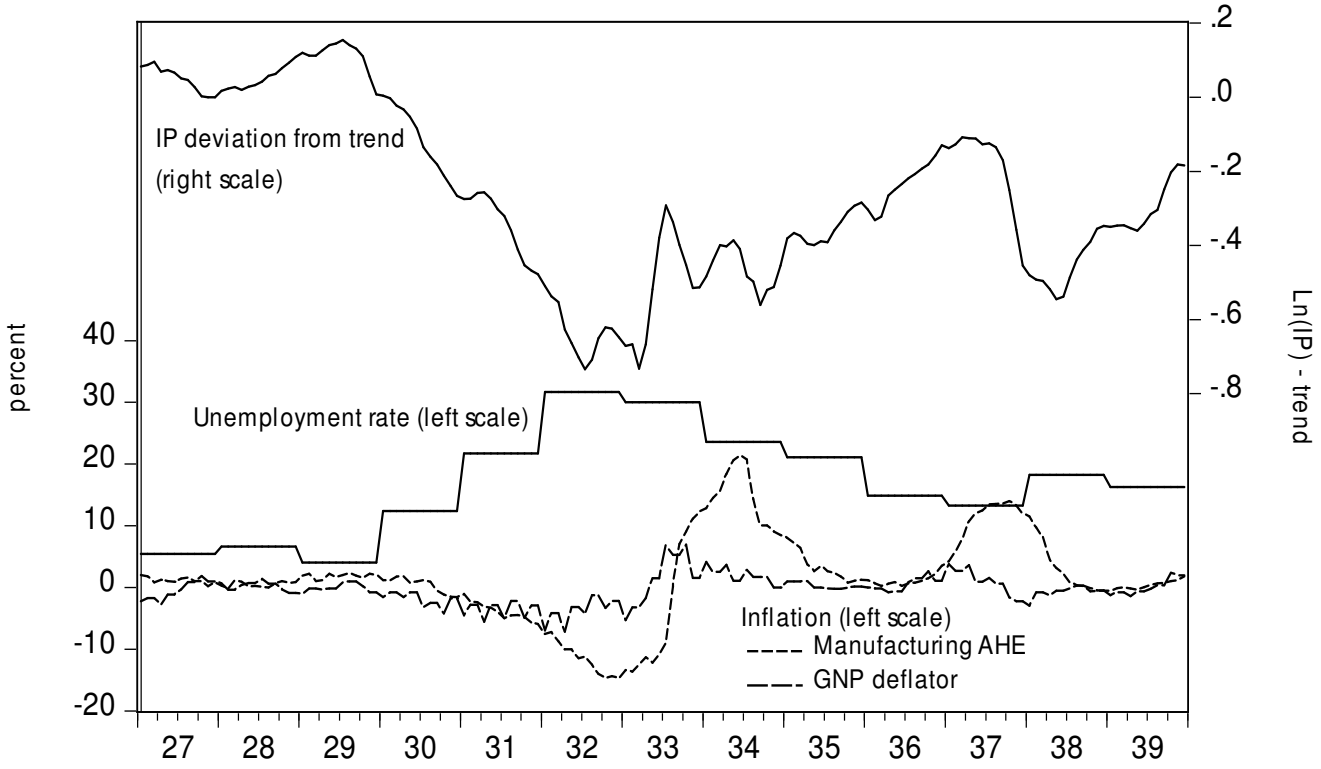
Figures

Figure 1 Unemployment rate (annual), deviation from trend in log industrial production (SA, monthly), twelve-month inflation in manufacturing AHE (monthly) and GNP deflator (quarterly). 1927-1939



Sources: unemployment rate, private nonfarm, Weir (1992); IP, Federal Reserve Board Index of Industrial Production, Federal Reserve Bank of St. Louis FRED (https://fred.stlouisfed.org/series/INDPRO); Manufacturing AHE Hanes (1996), GNP deflator Balke and Gordon (1986) Appendix Table 2 .

Figure 2 Annual Manufacturing AHE inflation and unemployment rate

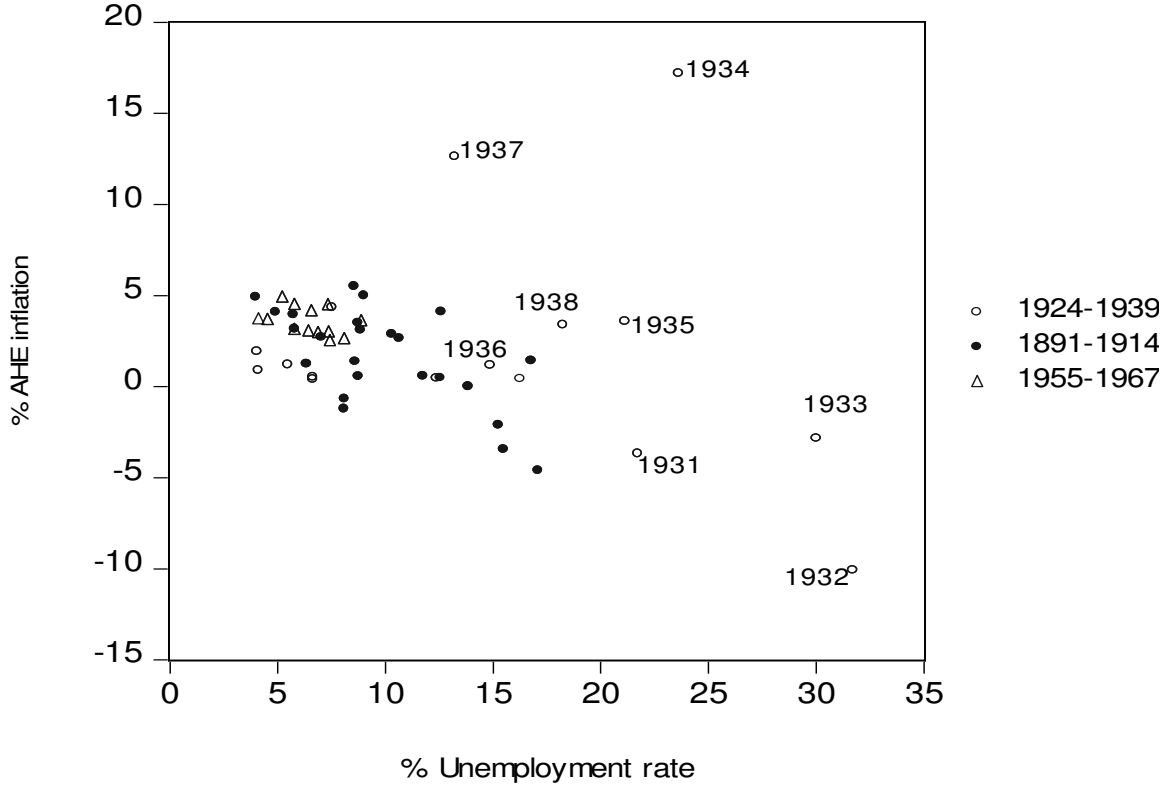


Figure 3 Deviation from forecast AHE inflation, 1891-1914, 1924-1939, 1955-1967

*AHE inflation = 6.74** - 0.47 Prewar - 0.43** Unemployment - 0.03 Unemployment(-1)*

SE [0.93] [0.73] [0.14] [0.15] R^2: 0.49

*AHE inflation = 3.74** - 2.42** Prewar + 10.79** IP gap - 6.74 IP gap(-1)*

SE [0.52] [0.64] [4.15] [4.17] R^2: 0.54

***significantly different from zero at one percent level*

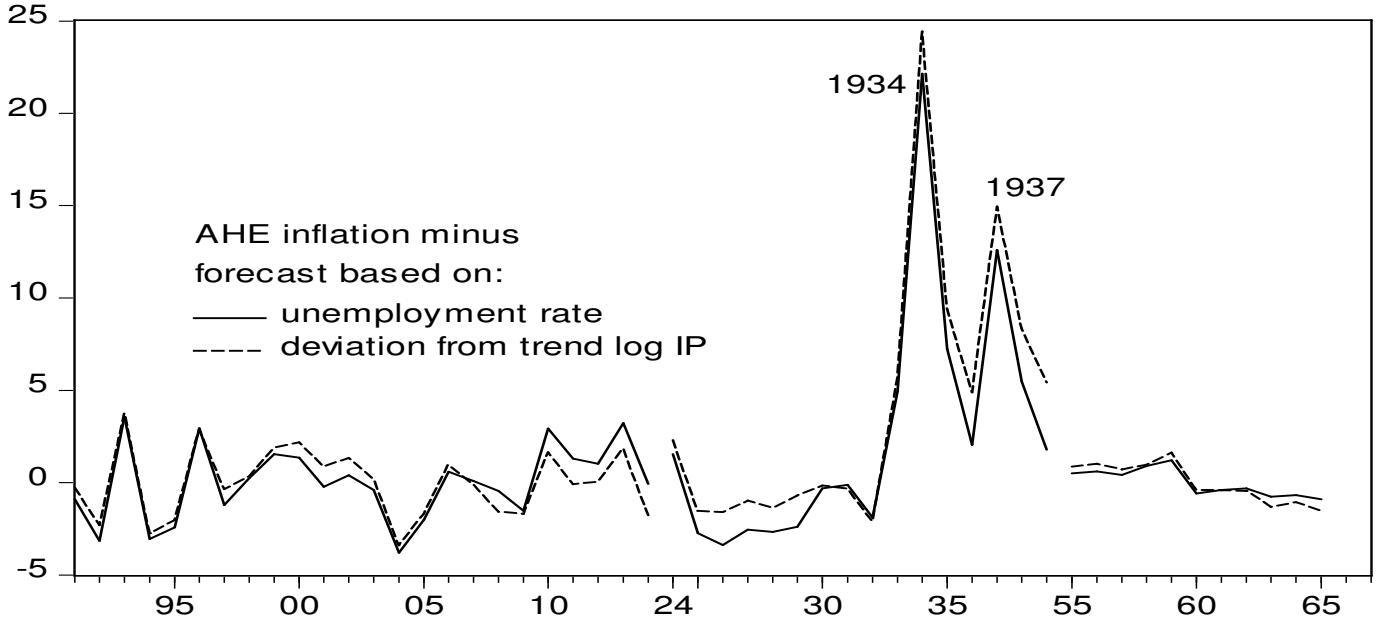
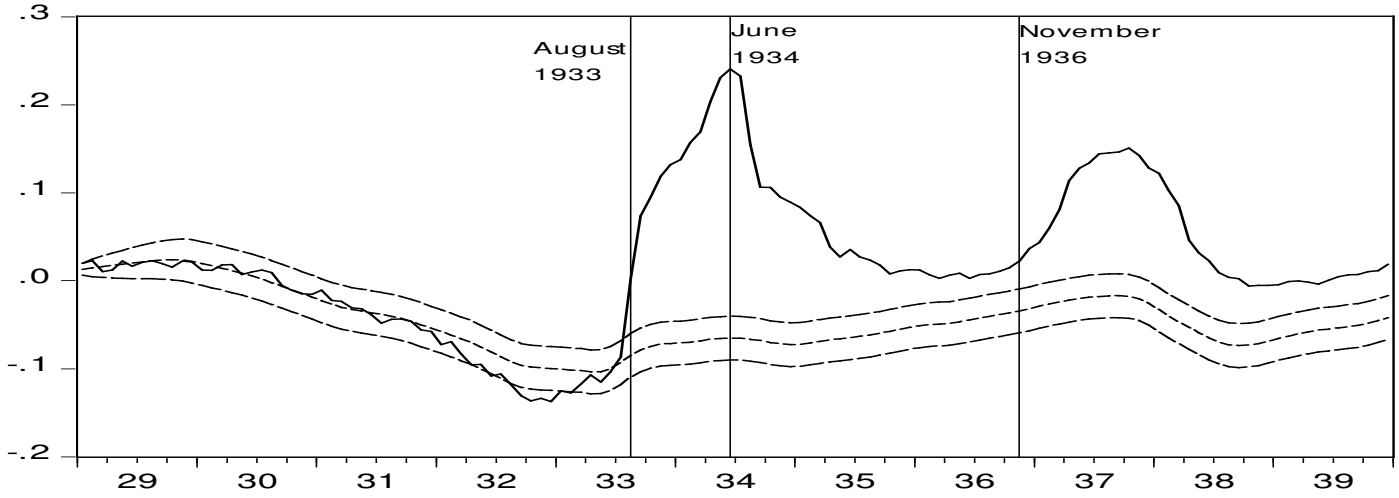


Figure 4 Projected and actual AHE inflation

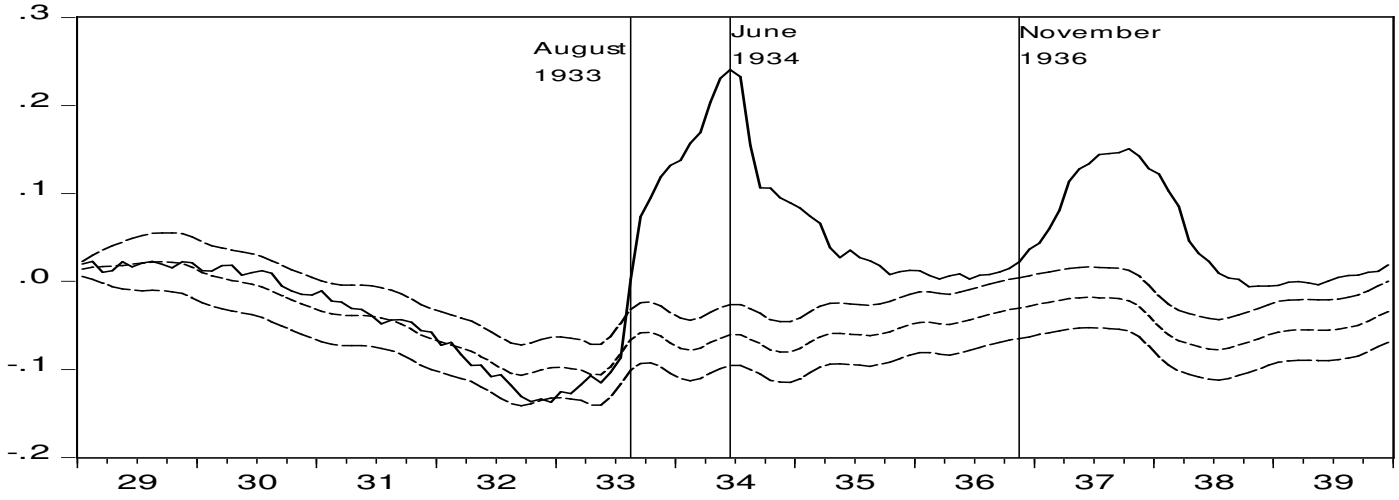
**** Coefficient significant at 1 percent level **5 percent *10 percent level*

a) $\Delta w_t = 0.300^{***} + 0.161^{***} \sum_{\tau=t-12}^{t} a_\tau (IP - \overline{IP})_\tau + 0.011^{***} \pi^e - 0.409^{***} T + 0.002^{***} T^2 + e_t$

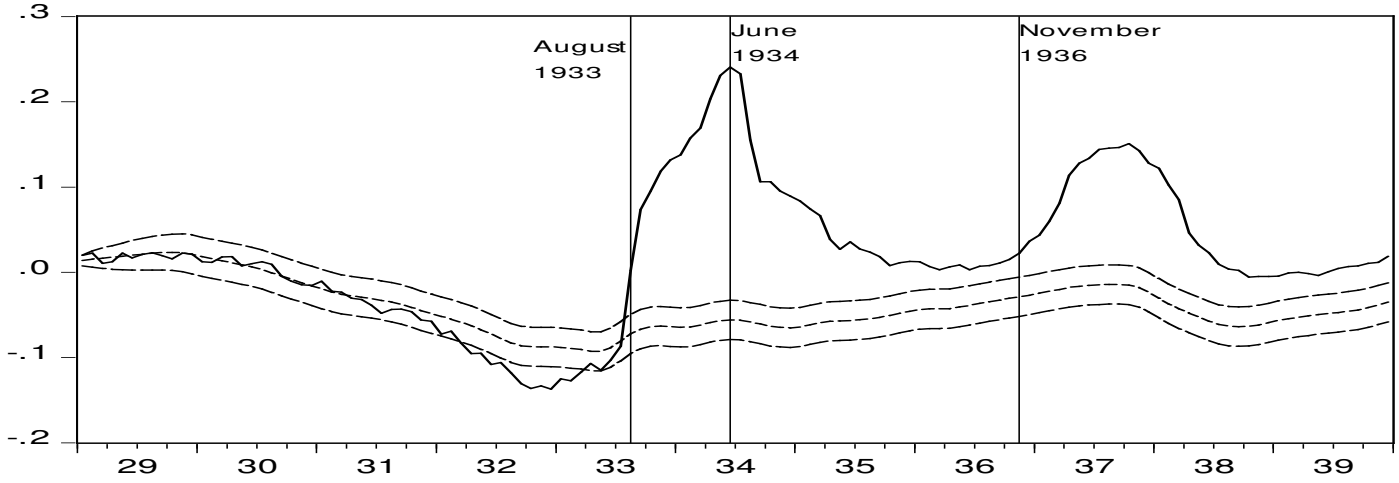
1948:1-1950:12, 1954:12-1971:7, 1975:5-2003:3



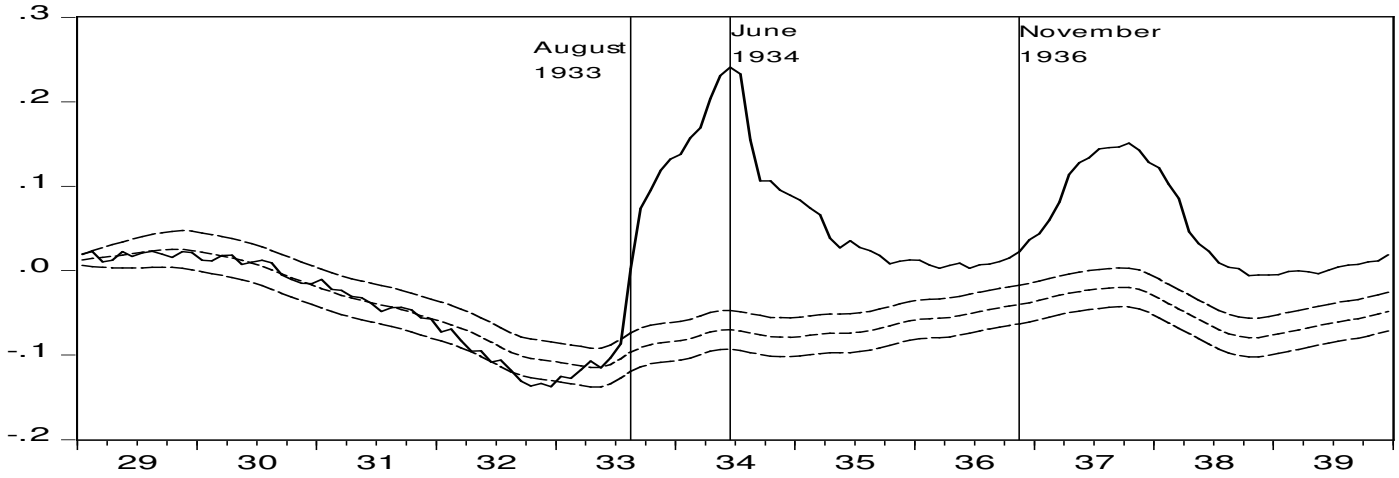
b) $\Delta w_t = 0.044^{***} + 0.173^{*} \sum_{\tau=t-12}^{t} a_\tau (IP - \overline{IP})_\tau + e_t$ 1948:1-1950:12,1955:4 - 1965:12



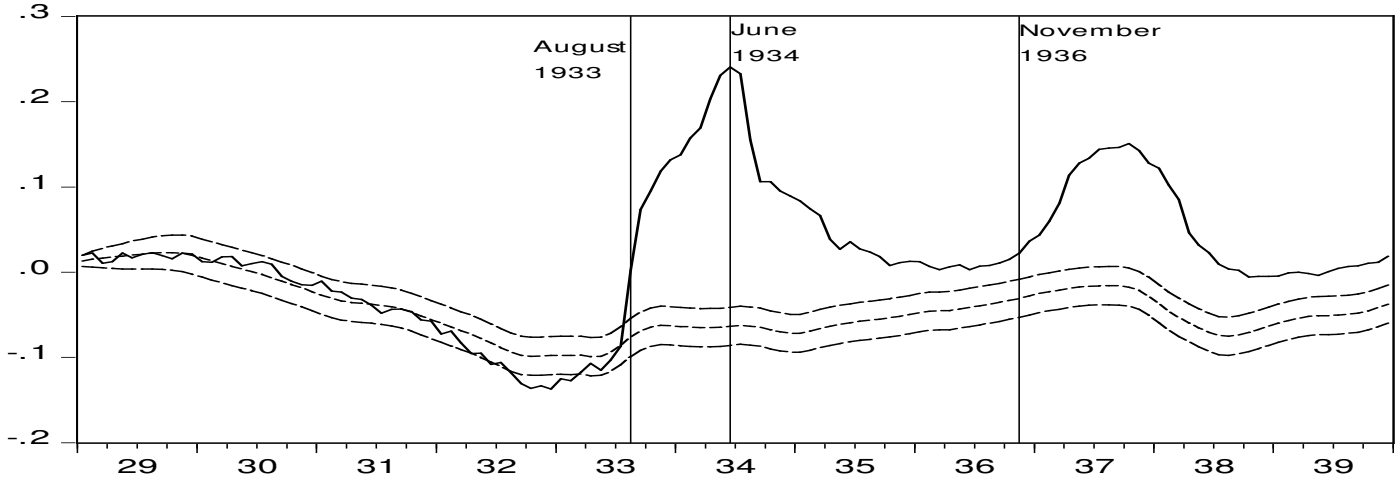
c) $\Delta w_t = 0.006 + 0.189^{**} \sum_{\tau=t-12}^{t} a_\tau (IP - \overline{IP})_\tau + 0.891^{***} \sum_{\tau=t-24}^{t-12} b_\tau \Delta p_\tau + e_t$ 1970:1-1971:7, 1976:5-1989:12



d) $\Delta w_t = 0.006 + 0.189^{**} \sum_{\tau=t-12}^{t} a_\tau (IP - \overline{IP})_\tau + 0.891^{***} \sum_{\tau=t-24}^{t-12} b_\tau \Delta p_\tau + e_t$ 1970:1-1971:7, 1976:5-1989:12



e) $\Delta w_t = 0.015^{***} + 0.143^{**} \sum_{\tau=t-12}^{t} a_\tau (IP - \overline{IP})_\tau + 0.640^{***} \sum_{\tau=t-24}^{t-12} b_\tau \Delta w_\tau + e_t$ 1948:1-1950:12. 1955:5-1971:7, 1976:5-2003:3



f) $\Delta w_t = 0.014^{***} + 0.146^{***} \sum_{\tau=t-12}^{t} a_\tau (IP - \overline{IP})_\tau + 0.762^{***} \sum_{\tau=t-24}^{t-12} b_\tau \Delta w_\tau + e_t$ 1948:1-1950:12,1955:5-1971:7, 1976:5-2003:3

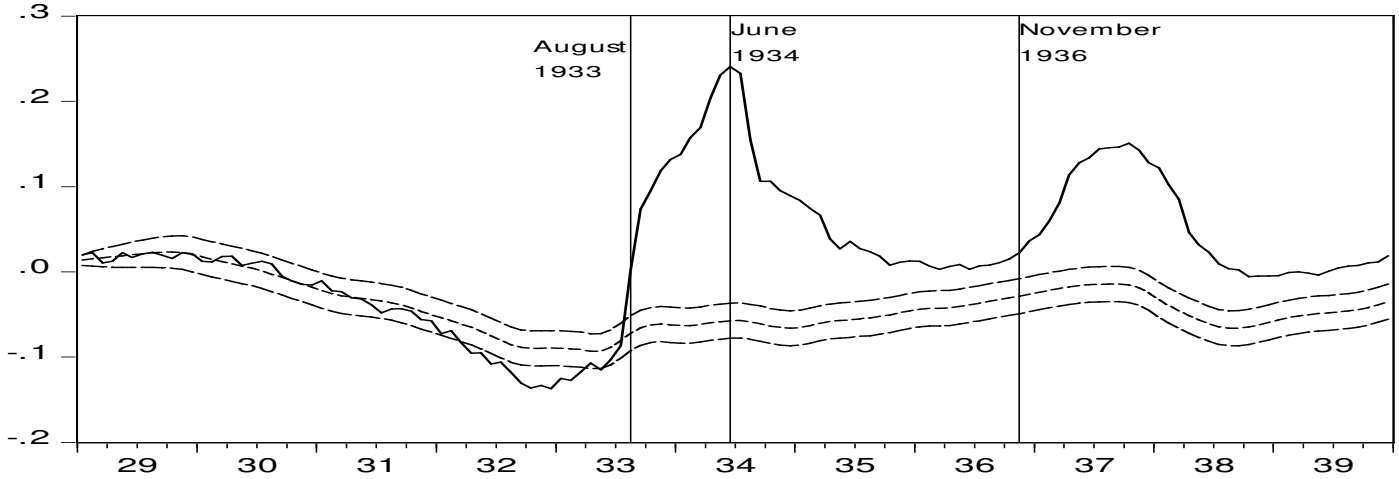


Figure 5 Levels of AHE series and wage rate index, AHE inflation anomaly

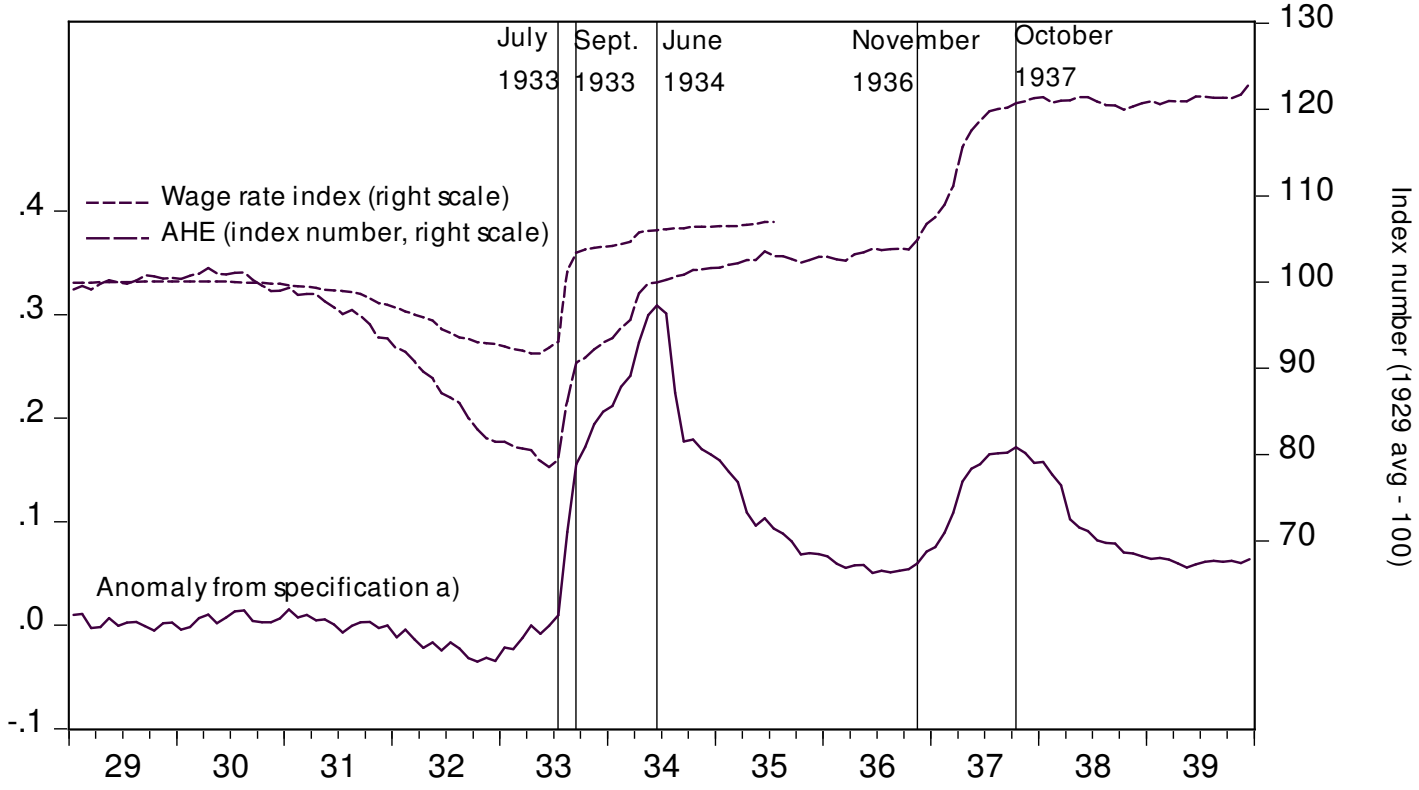


Figure 6 Month-to-month percent changes in AHE and wage rate index, AHE inflation anomaly

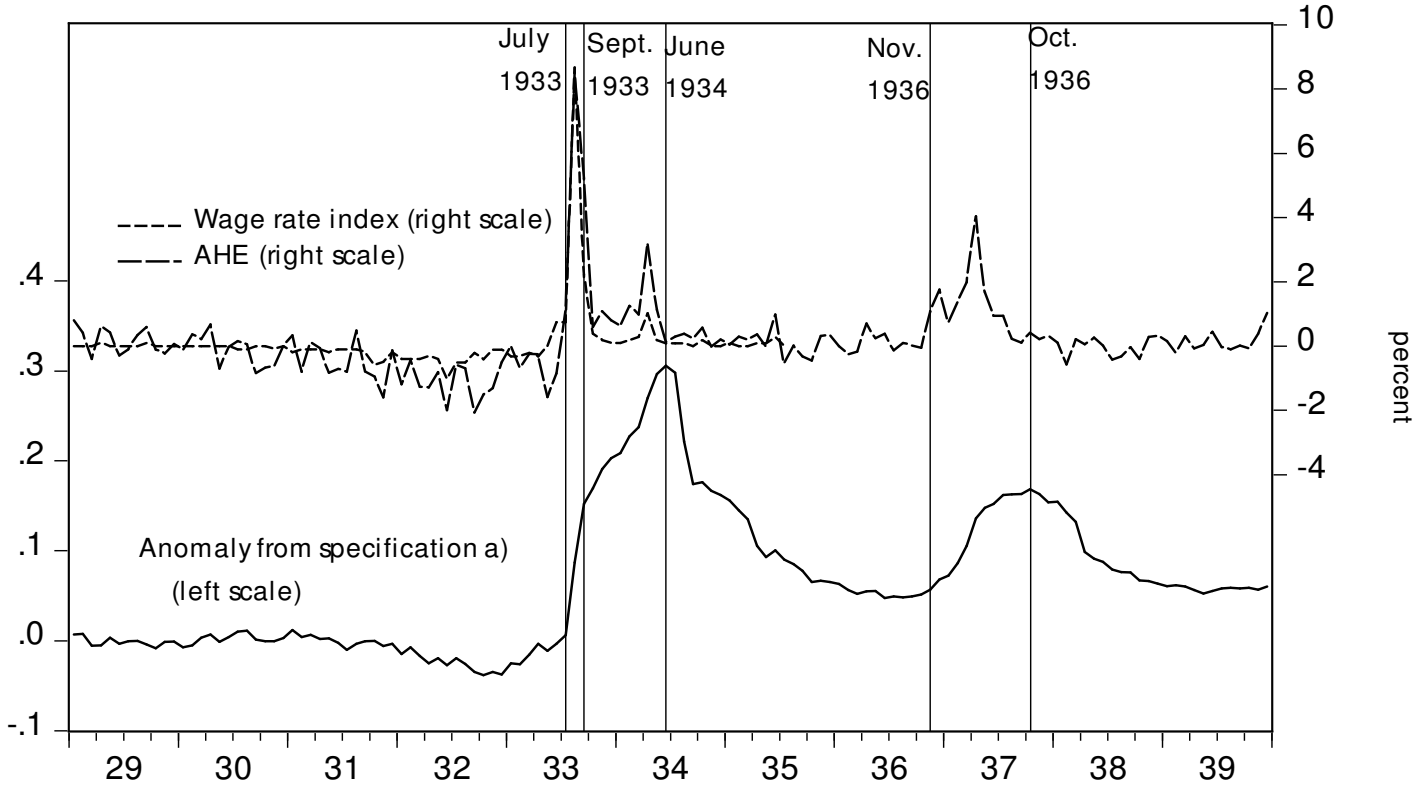
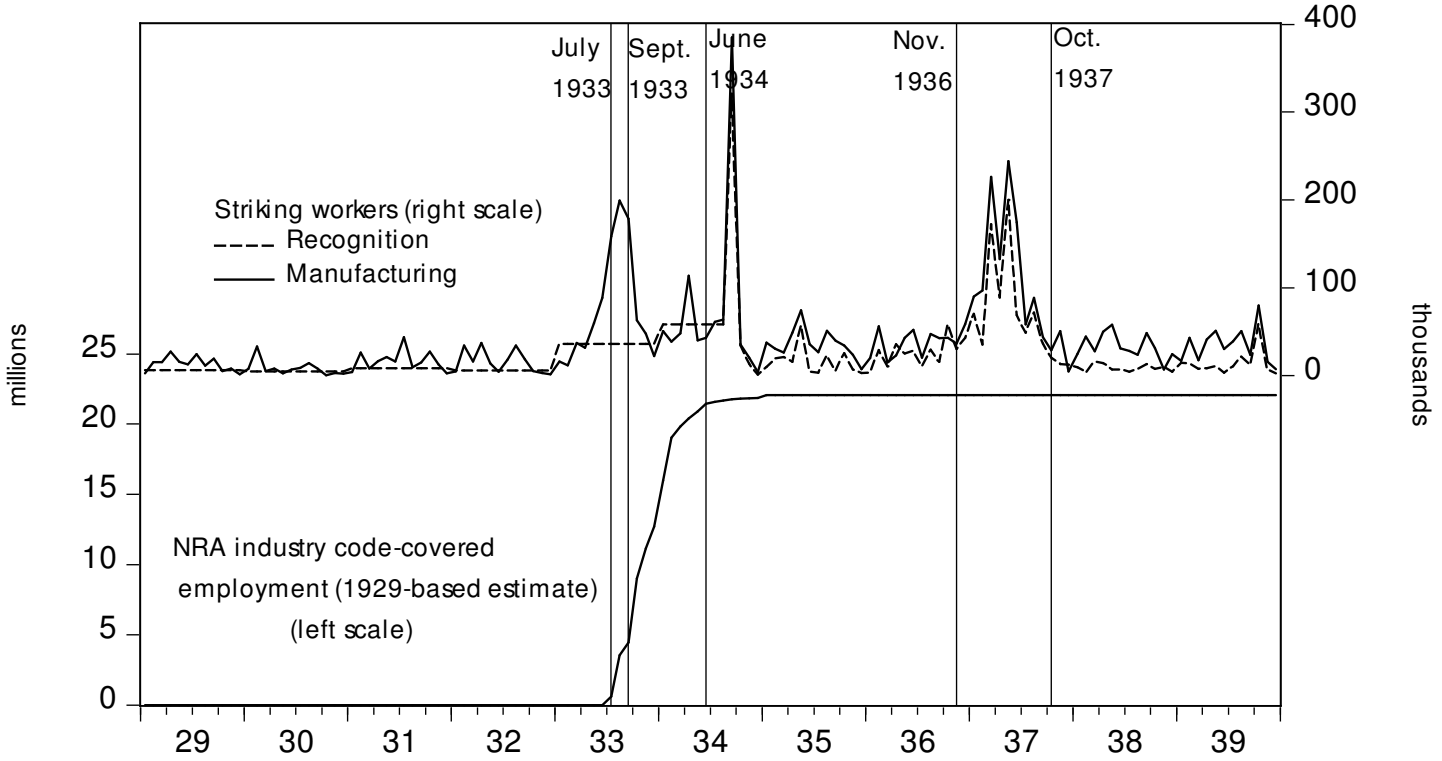


Figure 7 Employment (1929) in industries covered by NRA industry codes, Workers involved in strikes beginning in month



Source: NRA code-covered employment from National Recovery Administration (1935) Exhibit II p. 45.

Figure 8 AHE inflation anomaly and projection on measures of New Deal labor policies

*AHE anomaly = 0.010**August 1933 + 0.039***September 1933 + 0.004*** ΔNRACodeCoverage + 0.002*** Strikes*

Robust SE [0.005] [0.009] [0.001] [0.000] $R^2 = 0.93$

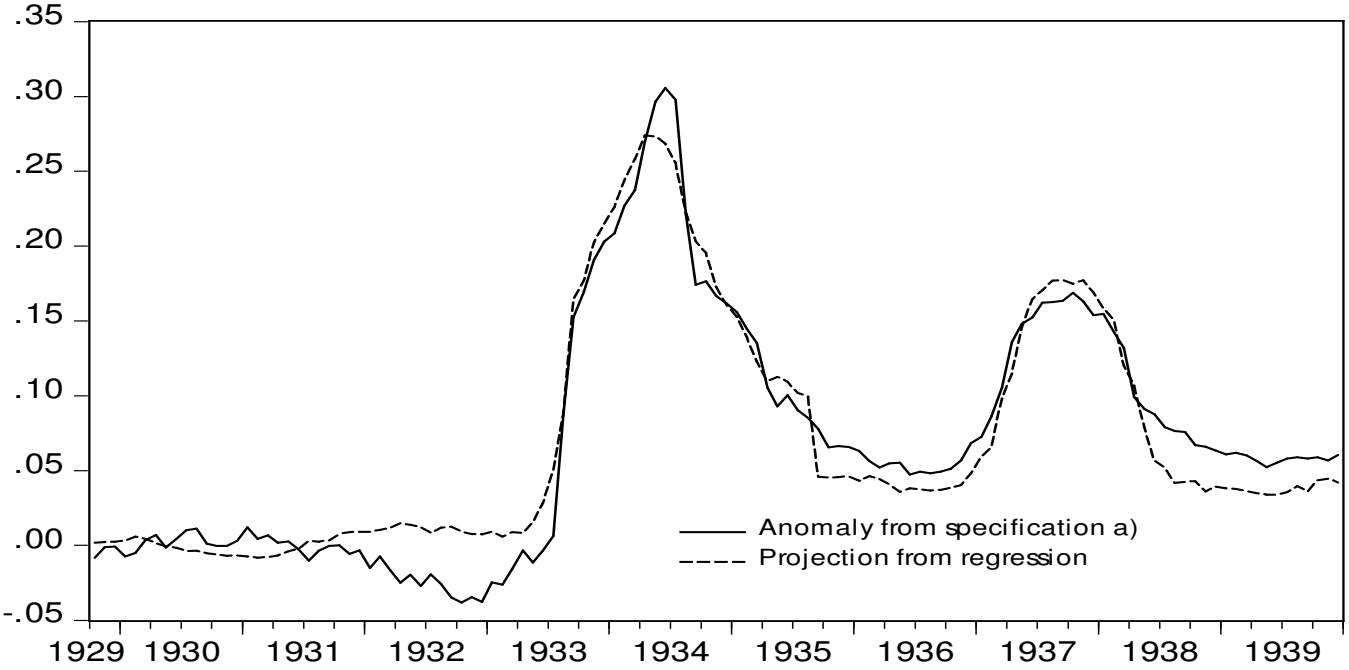
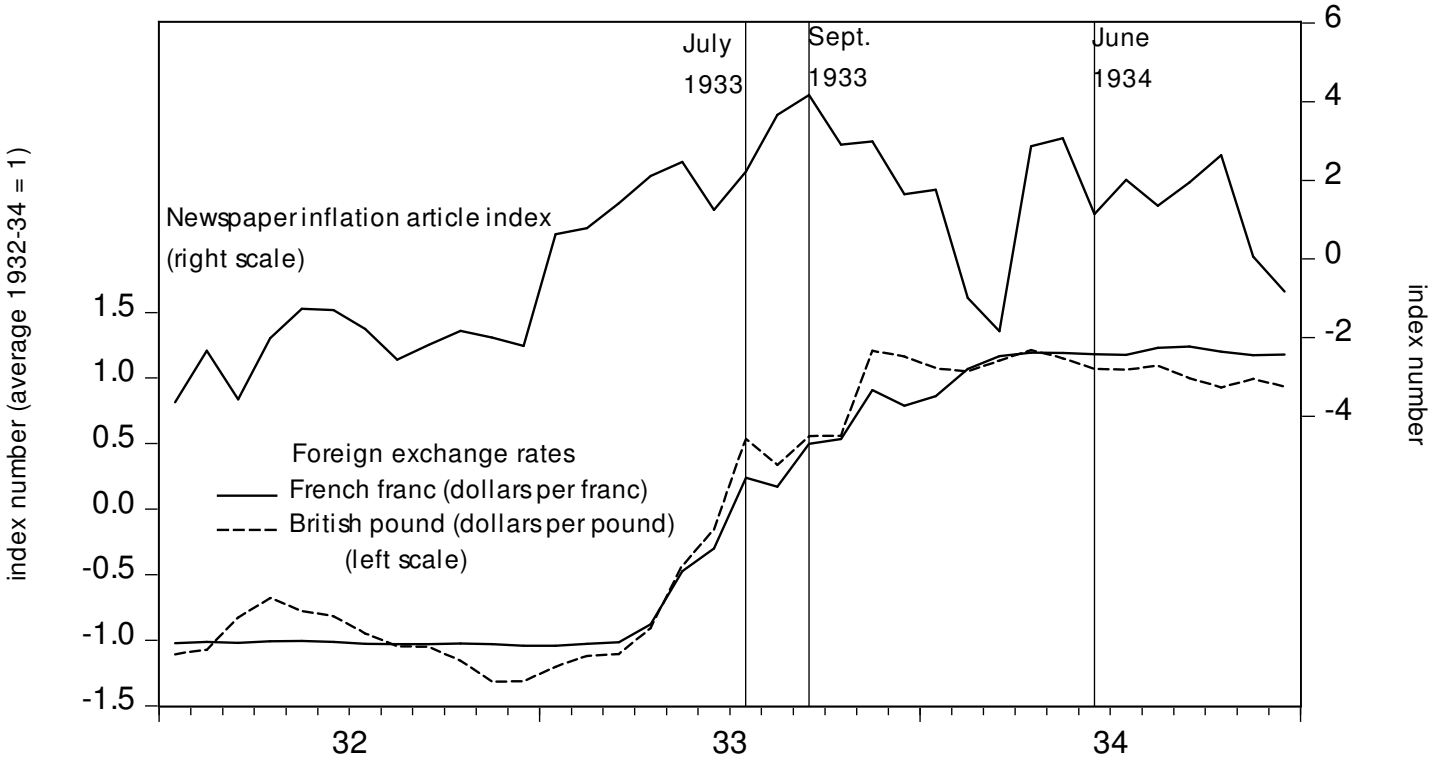


Figure 9 Exchange rates and newspaper inflation article index, January 1932--December 1934



Sources: Exchange rates from U.S. Federal Reserve Board (1943), newspaper inflation article index from Binder (2016)