Inflation stabilization and normal utilization

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August 23, 2023

*Corresponding address: Thomas Michl (tmichl@colgate.edu). Paper forthcoming in the Journal of Post Keynesian Economics. The author thanks two referees of that journal for their comments and Peter Skott for raising the question the paper addresses in a seminar at UMass-Amherst.
This paper presents a model of inflation and distribution that examines the relationship between the employment of labor and the utilization of capital. It features a structural difference between the wage Phillips curve and the price Phillips curve that gives rise to persistent changes in the real wage whenever the inflation-neutral level of activity fails to utilize the existing capital stock at its normal level. Assuming an inflation-targeting central bank that is obliged to run the system around its inflation-neutral level, these changes will reduce the gap between the inflation-neutral level and normal utilization by moving the system along a stable wage curve. In the end this implies that the inflation-neutral level of employment and full or normal utilization of capital will tendentially coincide, lending some support to the Duménil-Lévy thesis that monetary policy makes normal utilization a long-run center of gravity.
Models of capitalist economies typically include some measure of the intensity with which capital resources are deployed (utilization) or the degree to which the available labor force is employed (employment) but the relationship between the two remains relatively unresolved. The Goodwin (1967) model, for example, simply assumes full utilization and focuses on employment.\(^1\)

One influential formulation (Duménil and Lévy, 1999) of the relationship between neo-Kaleckian models with a variable utilization rate and classical-Marxian models that operate at full or normal levels of utilization exploits a putative relationship between utilization and prices to argue that a central bank stabilizing the price level or value of money will also stabilize the utilization rate around its normal level. There are other mechanisms available that could make normal utilization a center of gravity\(^2\) but an approach that includes central bank policy has the added appeal that it offers an important point of contact with the reality of modern capitalism—the role of the state in regulating demand. Indeed, Bob Rowthorn, one of the originators of the neo-Kaleckian model, regards such an approach as an “elegant reconciliation of the Kaleckian and Classical models” (Rowthorn, 2020, p. 16). This note offers one answer to critics (Hein et al., 2011) of the Duménil-Lévy formulation who point out that it fails to integrate the labor market and capacity utilization in the inflation-generating process, in particular by demonstrating why inflation stabilizes around normal utilization rather than, say, around some employment-based metric.\(^3\)

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\(^1\) As do most of the classical models in Foley et al. (2019) and hybrid Keynesian-classical models such as Michl (2016). For a recent survey of literature on the role of capacity utilization in the long run, see Blecker and Setterfield (2019, Ch. 6).

\(^2\) Michl (2008a) extends the Duménil-Lévy argument to the inflation rate. Examples of other mechanisms that restore normal utilization are the Harrodian investment equations proffered by Skott (1989) and the variable rate of business saving suggested by Shaikh (2009). Normal utilization also plays a central role in Sraffian supermultiplier growth models where capacity adapts to demand in fully adjusted states as demonstrated by Freitas and Serrano (2015).

\(^3\) It deserves to be said that Hein et al. (2011) and other critics of the Duménil-Lévy formulation do not confine their criticism to this central point. A comprehensive reply to the full bill of particulars they raise is beyond the scope of this paper.
1 Accounting and basic assumptions

The roster of key variables and definitions is presented in Table 1 for easy reference. Time subscripts on variables are suppressed, so that $z_{-1}$ represents $z$ at time $t - 1$ and $z$ at time $t$.

To keep the argument clear and the arithmetic uncluttered, we will make some simplifying assumptions. First, we will take the labor force, $L$, and the capital stock, $K$, to be constant. The modeling will be limited to a Marshallian short run, with a focus on how inflation-stabilizing demand management will affect the equilibrium level of activity. Second, we will ignore the option of declining to participate in the labor force so that workers are either employed or unemployed. The labor force and population are identical and $E$ measures employment. The employment rate, $e$, will be defined as $e = E/L$, with the unemployment rate implicitly measured as its complement to one. The capital-population ratio, $\kappa = K/L$, defines the scale of the economy at full utilization. The actual scale of the economy depends on the utilization rate, $u = X/\bar{X}$, where $\bar{X}$ is output at normal utilization. For simplicity, we have defined full or normal utilization to be unity, $\bar{u} = 1$.

The technique of production obeys a Leontief production function with coefficients $x$, $k$, and $\rho$ being the familiar output-worker, capital-worker, and output-capital ratios. To make them fade out of the equations, let us set them all equal to unity: $x = k = \rho = 1$. Letting $\bar{E}$ denote employment at normal utilization, this means that we have three handy equivalencies to work with, $E = X, \bar{E} = \bar{X}$, and $K = \bar{E}$. The employment rate can thus be expressed as

$$e = \frac{E}{L} = \frac{E}{\bar{E}} \frac{\bar{E}}{\bar{X}} \frac{X}{\bar{X}} \frac{K}{L}$$

which simplifies to a compact accounting identity\footnote{Relaxing the assumption that $k = 1$ leads to $e = (u/k)\kappa$.} connecting the employment rate, capital-population ratio, and utilization rate:

\footnote{There are several models of normal utilization available. Some define it by cost minimization. Petach and Tavani (2019) treat normal capacity as the solution to a social coordination problem in which firms optimize the user cost of capital. Skott (1989) appeals to the use of excess capacity as an entry deterrent. The current paper can be interpreted as an explanation of how demand management will achieve normal utilization, at least tendentially.}
We will treat variations in the utilization rate as equivalent to Solow-neutral technical changes in the sense that they leave labor productivity constant and alter the observed capital-labor and output-capital ratios, $k/u$ and $up$. This is a standard assumption; see Foley et al. (2019, ch. 12). The level of employment will be equal to the level of output ($E = X$) subject to a dimensional constant so we will generally use the employment rate to describe the level of activity.

Firms set prices, $P$, and incur labor costs driven by the money wage, $W$. The price and wage inflation rates and growth rates for other variables will be indicated by a circumflex, (e.g., $\hat{P}$). The mark-up is an accounting measure of the profit share, defined by

$$\mu = \frac{P}{W} - 1$$

or more familiarly by

$$P = (1 + \mu)W.$$

The real wage and wage share are identical (subject to a dimensional constant) and defined by

$$w = \frac{W}{P} = \frac{1}{1 + \mu}.$$ 

The real wage, wage share, and mark-up can be used interchangeably. An increase in the real wage (wage share) is equivalent to a reduction in the mark-up.

1.1 Prices

One approach to the mark-up is to treat it as a parameter determined by the degree of monopoly, to use Kalecki's term. In this approach, the real wage is effectively determined in the product market, by the prevailing elasticities of demand facing imperfectly competitive firms which practice mark-up pricing over marginal costs. Even Kalecki regarded this interpretation as overly restrictive, since it prevents workers' struggles from affecting distribution, and we will not pursue it. Instead, we will treat the mark-up as part of the
structure of the whole system, reflecting worker bargaining power, competitive conditions in product markets, and perhaps even norms established by experience.\footnote{Skott (2015) has argued from a neo-Harrodian perspective that prices and profit margins are actually quite flexible in practice, which is consistent with the treatment here. Another possible influence is the idea of “real competition” advocated by Shaikh (2016). Finally, a reader commented that since the profit margin adjusts (see below) to generate full utilization, the approach bears a family resemblance to neo-Keynesian writing, such as Robinson (1962).}

One way of capturing this is to treat the current mark-up as a reflection of past outcomes. In this case, firms set prices one period ahead based on current conditions discussed below. Wages are also set one period ahead based on current conditions, also discussed below. As a result the mark-up prevailing in any period will be given by these predetermined prices and wages. Workers will receive the pre-set real wage, $w^{PS}$, where\footnote{The pre-set real wage is basically a state variable that is predetermined by conditions in the temporal past.}

$$w^{PS} = \frac{1}{1+\mu}.$$  

In this approach, firms are not practicing mark-up pricing \textit{per se}. Rather, they are pricing to the market, and the mark-up emerges as a kind of residual.

\section*{1.2 Wages and the labor market}

Firms set money wages through some kind of bargaining process, either with individual workers as in efficiency wage models or with trade unions. The real wage which resolves conflict between firms and workers will be called the wage-setting real wage, $w^{WS}$. There is wide agreement among a variety of macroeconomic models that an increase in the employment rate puts workers in a stronger bargaining position so we will assume

$$w^{WS} = f(e; z_w) \quad f' > 0$$

where $z_w$ is a vector of exogenous or predetermined factors (e.g., wage aspirations, the structural bargaining strength of workers, policy factors) that we include as a placeholder here, as it plays only a minor role in the paper.

This relationship between real wages and (un)employment has been called the \textit{wage curve} by Blanchflower and Oswald (1994), and it appears to be
among the most reliable empirical facts in macroeconomics. As there is an obvious limit on the employment rate \( e \leq 1 \), which suggests a sharply nonlinear form for the wage curve, we focus on interior solutions that do not involve large positive or perhaps unbounded values for the second derivative.

In conjunction with our assumptions about price-setting, this approach to the product and labor markets establishes the existence of a level of employment, \( e^* \), that resolves the conflict over income distribution in the sense that workers receive the real wage appropriate to their bargaining power and firms receive the price they expect:

\[
e^* = f^{-1}(w^{PS}; z_w).
\]  

We will call \( e^* \) the labor market conflict-resolving employment rate (shortened to just conflict-resolving employment rate) for want of a better term. This rate is a moving target in this paper, and does not generally function as an attractor or equilibrium as it would in some textbook treatments (Carlin and Soskice, 2015) as discussed briefly below. For example, an increase in the pre-set real wage creates space for class conflict to resolve itself at a higher level of employment. Another potential source of multiple equilibria is changes in the position of the wage curve. For instance, Stockhammer (2008) and Michl (2018) argue that when the real wage lies above (below) the wage-setting real wage, workers will revise their aspirations upward (downward). Either one or both of these mechanisms create potential hysteresis in the labor market equilibrium. For simplicity, we will set aside the possibility that wage aspirations (which could be included as an element in \( z_w \)) are a factor in the labor market, and take the exogenous labor market factors to be constant.

We now have an accounting and behavioral system that links the employment rate to capacity utilization, and defines a level of the employment rate, \( \bar{e} \), which fully utilizes the capital stock:

\[
\bar{e} = \kappa.
\]

The issue before us is to clarify the relationship between \( e^* \) and \( \bar{e} \) or (equivalently) \( \kappa \), for which we need a model. One final point is that under the assumptions listed above it is clear that we can also define a unique real wage, \( \bar{w} \), that will prevail at \( \bar{e} \): \( \bar{w} = f(\bar{e}) \).\(^8\)

\(^8\)If we included a mechanism like wage aspirations in the wage curve, this would prob-
2 Inflation and distribution

Wage setting involves bargaining between workers (individually or collectively) and firms and is sensitive to conditions in the labor market. Price setting involves capitalist firms competing for market shares and is sensitive to conditions in the product market. Therefore, let us distinguish between the wage Phillips curve describing wage inflation and the price Phillips curve describing inflation.

2.1 The wage Phillips curve

Firms and workers set nominal wages dynamically with reference to some underlying trend in prices. We will call this reference rate \( R^w \). The most common interpretation of \( R^w \) is that it reflects expectations of price inflation. In practice, the relevant price index would reference consumer prices since the real consumption wage is what matters to workers but our model does not distinguish among prices. An alternative interpretation offered by Carlin and Soskice (2018) is that bargaining relies on a focal point, since it would be costly for firms and trade unions to find agreement about the expected rate of inflation before they open negotiations over wages. To economize, bargainers use the observed past rate of inflation as their reference rate. Firms and workers could, and probably do, each have different expectations about inflation. If expectations are formed adaptively (as is likely) or if the reference rate represents a bargaining focal point, the inflation process will have the inertial quality observed in empirical studies of the Phillips curve.

Under either interpretation, it makes some sense to treat the reference rate as a weighted average of a long-term rate and the actual realization of inflation in the last period. The long-term rate could simply be the central bank’s preannounced target inflation rate, \( \hat{P}^T \), assuming the central bank has been successful enough to establish credibility, often referred to as anchoring. In this case, we can model the reference rate as

\[
R^w = \chi \hat{P}^T + (1 - \chi) \hat{P}_{-1}
\]

where \( 0 \leq \chi \leq 1 \). This formalization has become standard in the literature and in some textbook presentations (Carlin and Soskice, 2015). The main ably attenuate the changes in the real wage in the thought experiments we run through in the rest of the paper, and affect the value of \( \bar{w} \).
supporting role it plays is to define a stationary rate of inflation by the condition that the reference rate equals the actual inflation rate.

Wage inflation emerges from conflict over the distribution of income, as reflected in the gap between the preset real wage and the wage-setting real wage. We can formalize the wage Phillips curve as

$$\hat{W} = R^w + \alpha_w (e - e^*).$$  \hspace{1cm} (2)$$

Here $\alpha_w > 0$ reflects a linearization of the parameters of the wage (setting) curve above.

This modeling choice reflects the theory that workers and firms (capitalists) bargain over real wages such that at the conflict-resolving employment rate they agree to wage increases that exactly match the reference rate of price inflation, thus preserving the real wage that prevails at its conflict-resolving level.

### 2.2 The price Phillips curve

Price inflation emerges from the competitive pricing of firms, and thus will be oriented to conditions in the product market. We can take the utilization rate to be an indicator of the level of demand for products, and hypothesize that firms are willing to adjust their future mark-ups, for example to defend or extend market share. Price setting requires some reference to underlying trends in prices and wage costs, which we will formalize as a function of firms’ expected price inflation ($\hat{P}^e$) and actual wage inflation. The price setting reference rate is $R^p(\hat{P}^e, \hat{W})$. This formalization imposes a timing assumption: firms observe the outcome of wage negotiations and then decide how much to raise their prices.

The price Phillips curve is then

$$\hat{P} = R^p + \alpha_p (u - 1).$$  \hspace{1cm} (3)$$

Here $\alpha_p \geq 0$ represents the sensitivity of price-setting to product market conditions normalized by the stock of capital. The basic idea (elaborated below) is that strong demand as captured by utilization emboldens firms to set their prices above the path they think their competitors might choose.

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9 Something like this theoretical foundation for the wage Phillips curve was originally proposed by Rowthorn (1977) but it is not inconsistent with much of Kalecki’s writing.
taking wage costs into account, while weak demand forces them to lower their sights in order to defend their market share. The mark-up they realize will emerge after the fact.

These Phillips curves determine the growth rate of the real wage (wage share) since by definition (using exponential growth rates)

\[ \dot{w} = \dot{W} - \dot{P}. \]

This model potentially describes the behavior of inflation and distribution but to be of any use in this regard we need to specify the behavior of the price-setting reference rate with greater precision.

### 2.3 The Phillips curve and distribution

We have already proposed a specific formalization of the wage-related reference rate, \( R^w \). In general, we argued above that the price-setting reference rate depends on both labor costs and expectations about price inflation. There is no inherent reason that firms’ expectations about price inflation should be formed in the same way as the wage reference rate, but let us consider the possibility that firms’ inflation expectations are identical to the wage reference rate as a benchmark case, and identify these common inflation expectations by \( R \) (i.e., \( \dot{P}^e = R^w = R \)).

With this in mind, let us also consider the reference rate to be indexed, assigning a weight, \( \delta \), to the expected prices of their competitors, and a complementary weight, \( 1 - \delta \), to their labor costs.\(^{10}\) Then we can define the price setting reference rate as

\[ R^p = \delta R + (1 - \delta) \dot{W} \]

where \( \delta \) is in the closed interval \([0, 1]\) so that we can consider the polar extremes as limiting cases.

With this formalization, the reduced-form Phillips curve derived by substituting the wage Phillips curve, Equation (2), into the price Phillips curve, Equation (3), is

\(^{10}\)These weights might also be conceptualized as the proportion of firms oriented toward their competitors’ prices (flex-price firms), and the proportion of firms following strict mark-up pricing oriented toward their labor costs (fixed-price firms), but our model makes no allowance for heterogeneity among firms.
\[ \hat{P} = R + \alpha_p(e^*/\kappa - 1) + \alpha(e - e^*) \]  \hspace{1cm} (4)

where

\[ \alpha = (1 - \delta)\alpha_w + \alpha_p/\kappa \]

is a consolidating parameter. Note that \( \alpha_p/\kappa \) is the sensitivity of inflation to employment in the price Phillips curve (using \( u = e/\kappa \)).

If either \( \alpha_p = 0 \) or \( e^* = \kappa \), this Phillips curve takes the standard textbook form, in which the inflation-neutral level of activity is defined by the conflict-resolving employment rate, \( e^* \). Since the relationship between \( e^* \) and \( \kappa \) is the object of the paper, we can put that possibility aside for the time being.

Setting \( \hat{P} = R \) in Equation (4) reveals that the inflation-neutral level of employment, \( e_n \), will typically be displaced from \( e^* \):

\[ e_n = e^* + \frac{\alpha_p}{\alpha}(1 - e^*/\kappa). \]  \hspace{1cm} (5)

This is important for understanding the role of an inflation-targeting central bank, which will orient its policies toward this level of activity.\footnote{There is some empirical support for the idea that the inflation-neutral level of activity cannot be easily tied to one measure of slack, which is one way of interpreting \( e_n \). Forbes (2019) estimates national and global Phillips curves using the principal component of seven separate measures of slack to model the output gap.}

[Figure 1 goes around here]

Figure 1 visually summarizes what we have learned about the three benchmark employment rates. It shows the configuration when \( e^* < \kappa \) and \( \delta < 1 \). As the weight assigned to inflation expectations in the price Phillips curve rises, it will widen the gap between the labor market conflict-resolving employment rate and the inflation-neutral employment rate. When \( \delta = 1 \), the inflation-neutral rate will coincide with full utilization at \( \bar{e} = \kappa \).

Finally, we can characterize real wage growth:

\[ \hat{w} = \alpha_p(1 - e^*/\kappa) + (\delta\alpha_w - \alpha_p/\kappa)(e - e^*). \]  \hspace{1cm} (6)

From this expression, we see that when \( \delta = 0 \) (the price reference rate is cost-driven), wage growth will be countercyclical since the slope term will be negative. At the other extreme when \( \delta = 1 \) (the price reference rate
is expectations-driven), the slope term will be positive if \( \alpha_w > \alpha_p/\kappa \). As this latter condition seems likely to hold—wages are more sensitive to labor market slack than prices (Flaschel et al., 2007)—this framework is agnostic on the question of whether real wages are pro- or countercyclical presuming the real economy lies somewhere between these limiting cases. Empirical evidence suggests some degree of procyclicality, but this is not firmly established (Abraham and Haltiwanger, 1995; Messina et al., 2009). With a positive slope, this equation bears more than a passing resemblance to the "real wage Phillips curve" deployed in the celebrated Goodwin model.

It is also clear that real wage growth will be positive or negative when the labor market is in balance at \( e = e^* \), depending on the capital-population ratio. When \( e^* < \kappa \), real wage growth will be positive (\( \hat{w} > 0 \)) there, and conversely when \( e^* > \kappa \). But the more significant question, to which we can now turn, concerns the behavior of real wages when inflation stabilizes since this will bear directly on the main issue at hand, the relationship between the employment of labor and the utilization of capital.

### 3 A partial equilibrium model

To evaluate the mechanisms that might make \( \kappa \) an attractor for \( e^* \) in a fully specified model, we can draw on the workhorse 3-equation model to add some general structure to the determinants of aggregate demand. Let us assume that the central bank policy framework stabilizes inflation around its target, \( \hat{P}_T \), through its ability to control the complex of interest rates. There must clearly be some interest-sensitive spending, typically taken to be investment, for this to work. A Taylor Rule or perhaps the weaker Taylor Principle\(^{12}\) would then suffice.

In what follows, we will characterize the current temporary position of the system, taking as given any predetermined variables like the pre-set real wage, and identify the tendencies inherent in states of the world where \( e^* \neq \kappa \) given the presence of an inflation-targeting central bank. In a sense, the methodology hearkens back to Marshall’s short run by taking the per capita stock of capital as given in order to concentrate on its utilization, with the usual jus-

\(^{12}\)This specifies that the central bank should raise the nominal interest rate by more than the positive deviation of the inflation rate from its target, thus creating a negative feedback that will create disinflation (and vice versa for a negative deviation). The assumption is that it is the real, not the nominal, interest rate that regulates spending.
tification that the inflation and output dynamics operate more quickly than capital stock adjustments. Any homeostatic tendencies we discover should be present in a fully-specified model in which these temporary positions might lie along the transients.

3.1 General case

It is clear that a central bank that targets the inflation-neutral level of activity, $e_n$, will create gravitational tendencies that give rise to real wage dynamics. The question is whether these will tend to align employment and capacity utilization, or further alienate them. We will assume that price-setting is sensitive to demand conditions ($\alpha_p > 0$) for reasons that will be made clear, and focus on the situation with $e^* < \kappa$.

We have already shown that with a labor market conflict-resolving employment rate below $\kappa$, real wages will be growing but this does not establish their behavior at the inflation-neutral level, recalling that real wages are potentially countercyclical. To attack this question, we evaluate the real wage Phillips curve above, Equation (6), at the inflation-neutral level of employment given by Equation (5). Setting $e = e_n$, we find that

$$\dot{w} = \frac{\alpha_p}{\alpha} \omega (1 - e^*/\kappa)$$

which is unambiguously positive given $e^* < \kappa$. Thus we can conclude that in general (assuming $\alpha_p > 0$) at the inflation-neutral level of demand, $e = e_n$,

$$e^* < \kappa \Rightarrow \dot{w} > 0.$$

The intuition behind this result is straightforward. When the system achieves a stationary rate of inflation but firms are operating with underutilized capacity, they are in a weak bargaining position by virtue of competition amongst themselves. This inter-capitalist rivalry depresses price inflation below wage inflation and workers enjoy rising real wages commensurate with the bargaining power in the labor market they derive when employment exceeds the conflict-resolving level. This explanation makes our assumption that $\alpha_p > 0$ comprehensible, since without some effect from excess capacity on price formation real wages will be stationary when inflation stabilizes ($e = e_n = e^*$).

Given the symmetry of the model it is clear that $e^* > \kappa$ implies that real wage growth is negative at the inflation-neutral level of demand. In this
case, it is workers who lack relative bargaining power since employment falls below the conflict-resolving level while firms enjoy strong demand with high utilization.

In this way a central bank targeting inflation will generate a homeostatic mechanism that will close the gap between $e^*$ and $\kappa$ at least tendentially. If we begin with $e^* < \kappa$, real wages will tend to grow as the result of the demand management policy. The growth of real wages will increase the pre-set real wage over time, and relax the employment constraint as represented by the wage curve; $e^*(w)$ will increase, closing the gap. This mechanism will switch off when $e^* = \bar{e} = \kappa$ and $w = \bar{w}$. Figure 2 illustrates.

This argument can be illustrated more formally by a hypothetical thought experiment giving the central bank the power to fully stabilize inflation. In this case, employment will track the inflation-neutral employment rate perfectly: $e = e_n$. The dynamics are then characterized by a first-order difference equation for the wage whose exact form depends on the wage curve. A common empirical objective, estimating the elasticity of the wage curve with respect to (un)employment, suggests the semi-log form used by Blanchflower and Oswald (1994) such as $\log w^{S} = a + b \cdot e$, but a simpler linear form would do as well. Starting from some initial condition, $w(0)$, we can consult Equation (1) to find $e^*(0)$, Equation (5) to determine $e(0) (= e_n(0))$ and Equation (6) to find the growth of real wages, $\hat{w}(w(0))$. Since we can repeat this procedure in any period, we can use $w_{+1} = w \exp(\hat{w})$, to write the controlling non-linear difference equation as

$$\log w_{+1} = \log w + \hat{w}(w).$$

Beginning from some initial condition with $w(0) < \bar{w}$ and thus $e^* < \kappa$ and assuming parameter values are reasonable, the system will converge monotonically from below on its long-run equilibrium given by

$$e = e^* = e_n = \bar{e} = \kappa$$

with full capacity utilization, $u = 1$, and $w = \bar{w}$.

This position with full utilization of capital and a conflict-resolving employment rate represents a possible long-run center of gravity for a capitalist economic system. When $e^* \approx \kappa$, the traditional workhorse Phillips curve
will closely approximate the behavior of the system (ignoring complications from shock-induced changes in the real wage). Moreover, it can be written out in terms of employment (as above), output (since labor productivity is constant), or utilization (since \( u = \frac{e}{\kappa} \)).

In addition, the causal structure of the homeostatic mechanism runs from the capital-population ratio to a long-run equilibrium employment rate, \( \bar{e} \). This result at least potentially underwrites theories of hysteresis or path dependence that emphasize the role of capital accumulation (Soskice and Carlin, 1989; Rowthorn, 1995; Michl, 2008b). A corollary is that it is somewhat misleading (albeit unavoidable) to refer to \( \bar{e} \) as the equilibrium, since it could be only one among many. This potential for path dependence would assume importance in a more complete model of growth, which we discuss briefly in the penultimate section.

All that is left are some brief comments on the limiting cases with \( \delta = 0 \) or \( \delta = 1 \).

### 3.2 Cost-driven reference rate

If we take \( R^p = \hat{W} \), and exclude price expectations (\( \delta = 0 \)), we have a standard textbook treatment of the Phillips curve. To see this, we can use the price and wage Phillips curves to derive

\[
\hat{P} = R + \alpha e - (\alpha_w e^* + \alpha_p) = R + \alpha e - (\alpha e^* + \alpha_p(1 - e^*/\kappa)).
\]

Then using Equation (5) to replace the last term on the right-hand side we arrive at this familiar equation:

\[
\hat{P} = \chi \hat{P}^T + (1 - \chi) \hat{P}_{-1} + \alpha(e - e_n).
\]

If we took the further step of assuming that \( \alpha_p = 0 \), we would have a standard textbook model in which distribution is parametric (Carlin and Soskice, 2015). In this case, the inflation-neutral employment rate would be equivalent to the conflict-resolving employment rate (\( e_n = e^* \)) and the system

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13 Some staff economists at the Federal Reserve System consider the utilization rate a valid measure of economic slack, and refer to the “non-accelerating inflation rate of capacity utilization” based on personal conversations with the author.

14 The step across the second equal sign uses the trick of adding \( e^* \alpha_p/\kappa - e^* \alpha_p/\kappa \) (i.e., 0) to the term in parenthesis and then rearranging.
would achieve \( e^* = \bar{e} \) only by accident. In other words, interpreted through the present framework, barring a fluke the textbook model implies the persistence of under- or overutilization of capital since inflation will stabilize around the target rate at \( e^* \).

The price Phillips curve in this limiting case governs the behavior of real wages. If utilization rises above 1, or equivalently if \( e > \bar{e} \), price inflation will exceed wage inflation and real wages will decline; the converse is also true. Thus, in this case real wages are countercyclical in the sense that their growth rate moves against the level of employment. We have

\[
\dot{w} = -\alpha_p (u - 1)
\]

which means that real wages stabilize at normal utilization, and rise (fall) at levels of utilization below (above) normal, thus providing the long-run equilibrating mechanism elaborated above. The textbook assumption noted above, \( \alpha_p = 0 \), would disarm this homeostatic mechanism, confirming the persistence of over- or underutilization in this treatment, as interpreted through the current framework.

### 3.3 Expectations-driven reference rate

The other extreme assumption takes the price reference rate to represent price inflation expectations, or \( \delta = 1 \). With the price Phillips curve cut off from the influence of labor costs, the inflation-neutral level of activity will be defined by normal utilization which is achieved when \( e = \kappa = e_n \).

At normal utilization \((u = 1)\), the expression for wage growth, Equation 6, simplifies to

\[
\dot{w} = \alpha_w (\kappa - e^*)
\]

which shows that wages will be growing at normal utilization when \( \kappa \) exceeds \( e^* \), and conversely. Interestingly, the price sensitivity to demand does not influence wage growth at normal utilization.

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\[15\]This case bears resemblance to an economy under a gold standard in which the long-term price level evolves according to the relative costs of producing gold. Absent a complete model, one might speculate that if the gold standard operates like a central bank with a price level target, it could create gravitational forces that stabilize inflation, albeit around some slowly moving value, making normal utilization a center of gravity.
To rehearse what we learned above, in this special case an inflation-targeting central bank will be obligated to make $\kappa$ (equivalently $u = 1$) the center of gravity since that is where inflation stabilizes. If it happens that $e^* < \kappa$, this will require a high enough employment rate that real wages will tend to rise over time, thus eventually closing the gap between $e^*$ and $\kappa$.

In this case, the intuition developed above needs to be qualified. Even though inter-capitalist rivalry has been brought under control, workers are still in a strong enough bargaining position to increase their money wages faster than prices. This limiting case illustrates the role that $\delta$ plays in mediating the relative importance of class conflict in the labor market versus inter-capitalist rivalry in regulating real wages.

4 Some shreds of evidence

Despite the fact that the main objective of this paper is to provide a theoretical account, the adjustment mechanisms highlighted here invite at least some interrogation of the statistical record. The implication in Figure 2 is that periods in which the inflation-neutral rate of employment falls short of normal capacity utilization should see a tendency toward rising real wages. The converse case (not shown) would involve adjustment with the inflation-neutral rate of employment exceeding normal capacity utilization, which should lead to a tendency toward falling real wages.

The recoveries in the U.S. economy before and after the Covid recession offer a kind of natural experiment to test out these predictions. The recovery after the 2008-2009 recession might represent the configuration in Figure 2, with excess capacity appearing alongside inflation stabilization. The recovery after the Covid recession of 2020, on the other hand, led ultimately to inflation that has widely been attributed to capacity constraints caused by a shift in the composition of demand from services to goods.

In an implementation of the model the proper measure of real wages is arguably the wage share, since that is effectively the real wage adjusted for labor productivity growth (sometimes called the real wage in effective labor units). The model has been intentionally set up for simplicity by taking the wage share and real wage rate to be the same (labor productivity has been normalized to unity). Table 2 presents some data on the growth rate of the wage share, the adult employment-population ratio, and the rate of capacity utilization in manufacturing industry. The data have been averaged over
recovery periods, leaving out the Covid recession (peak-to-trough quarters). The comparison between the pre- and post-Covid recovery periods supports the basic predictions of the model. In particular, the simultaneous appearance of high employment, high capacity utilization, and falling wages in the post-Covid recovery provides suggestive evidence for the basic hypothesis on offer here.

5 Implications for future research

We have achieved our limited purpose–demonstrating a long-run tendency for inflation to stabilize at normal levels of utilization–by deliberately abstracting from the deeper question of how distribution and the employment rate are determined in a more satisfactory model. In particular, we have simply assumed a stable per capita stock of capital in order to establish the fast short-run mechanisms that effectuate its normal utilization. In a more complete model at least some of the gap between the inflation-neutral employment rate and the capital-population ratio would be closed by capital stock adjustments that presumably operate at a lower frequency.

The main result arguably validates an intellectual division of labor that attacks these low-frequency issues in a growth model with normal utilization. For example, in the Goodwin model it is well known that the average wage share and employment rate (around which the system orbits) cannot deviate from values determined by the saving/investment function and the real wage Phillips curve. In this case, causation would run from the required employment rate to the per capita stock of capital; in effect, the long-run Phillips curve would be vertical. However, other modelling choices could lead to different conclusions. Michl and Tavani (2022) propose a classical model with endogenous technical change in which the employment rate displays path dependence and is not restricted to one unique position on the wage curve as it is in the Goodwin model. And, as we have already mentioned, it is possible that the wage curve could play a role in generating path dependence in the employment rate through changes in wage aspirations which could also operate at higher frequencies. Either way, path dependence would mean that the long-run Phillips curve is effectively horizontal.

\(^{16}\)I am indebted to an anonymous referee of this journal for suggesting the need for supporting evidence.
The basic approach developed here also offers a skeletal framework that could be fleshed out in a model that combines more Keynesian features to capture the short-run dynamics with a long run characterized by normal utilization, as in the original Duménil and Lévy (1999) contribution. Moreover, the brief excursion into empirical evidence above suggests that a more rigorous investigation would be potentially rewarding. The main result opens up multiple branches for a structuralist research agenda.

6 Summary

This paper presents a partial model of inflation and distribution that illuminates the relationship between the employment of labor and the utilization of capital. It features a structural difference between wage-setting behavior (the wage Phillips curve) and price-setting behavior (the price Phillips curve) that gives rise to persistent increases in the real wage whenever the inflation-neutral level of activity fails to fully utilize the existing capital stock and conversely creates decreases in wages with over-utilization. Assuming an inflation-targeting central bank that maintains demand around its inflation-neutral level on average, these changes will tend to eliminate the gap between the inflation-neutral level of activity and full (normal) utilization by moving the system along a stable wage curve that captures the theoretically and empirically established relationship between the employment rate and workers’ bargaining power over the real wage. In the end this implies that the conflict-resolving employment rate, the inflation-neutral level of employment, and full or normal utilization of capital will coincide. A reduced-form Phillips curve that takes normal utilization to be inflation-neutral makes some sense, lending support to the Duménil-Lévy claim that capitalist economies are Keynesian in the short run but operate more classically at normal utilization in the long run.\textsuperscript{17} This conclusion motivates the use of long-run models that specialize by assuming full utilization of capital such as the Goodwin model, other classical growth models, or hybrid models that combine Keynesian and classical elements.

\textsuperscript{17}Keynes did not actually support Kalecki’s emphasis on underutilized capital, so the term Keynesian is being used here in its modern context. Also, just to be clear, long-run normal utilization does not necessarily mean that aggregate demand has no role in the long run.
References


<table>
<thead>
<tr>
<th>Variable or Parameter</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L$</td>
<td>population (labor force)</td>
</tr>
<tr>
<td>$E$</td>
<td>employment</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>capital-population ratio, $K/L$</td>
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<tr>
<td>$u$</td>
<td>utilization rate</td>
</tr>
<tr>
<td>$e$</td>
<td>employment rate, $E/L$</td>
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<tr>
<td>$e^*$</td>
<td>labor market conflict-resolving employment rate</td>
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<tr>
<td>$e_n$</td>
<td>inflation-neutral employment rate</td>
</tr>
<tr>
<td>$\bar{e}$</td>
<td>full utilization ($u = 1$) employment rate</td>
</tr>
<tr>
<td>$w$</td>
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</tr>
<tr>
<td>$\bar{w}$</td>
<td>real wage when $e = \bar{e}$</td>
</tr>
<tr>
<td>$\hat{Z}$</td>
<td>growth rate of variable $Z$</td>
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<tr>
<td>$\hat{P}_e$</td>
<td>firms’ expected rate of inflation</td>
</tr>
<tr>
<td>$\hat{P}_T$</td>
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</tr>
<tr>
<td>$R^w$</td>
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<tr>
<td>$R^p$</td>
<td>reference rate of inflation, price-setting</td>
</tr>
<tr>
<td>$R$</td>
<td>expected inflation rate ($= R^w$), wage and price setting</td>
</tr>
<tr>
<td>$\delta$</td>
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</tr>
<tr>
<td>$(1 - \delta)$</td>
<td>weight assigned to wage costs</td>
</tr>
<tr>
<td>$\alpha_w$</td>
<td>sensitivity of wage-setting to employment</td>
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<tr>
<td>$\alpha_p$</td>
<td>sensitivity of price-setting to utilization</td>
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<tr>
<td>$\alpha_p/\kappa$</td>
<td>sensitivity of price-setting to employment</td>
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<tr>
<td>$\alpha$</td>
<td>consolidating parameter $= \delta \alpha_w + \alpha_p/\kappa$</td>
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Table 1: Definitions of Selected Variables and Parameters
Table 2: Quarterly averages of selected U.S. data pre- and post-Covid recession.
Source: FRED, St. Louis Federal Reserve Bank

Notes: Wage share is Labor Share for All Workers, Nonfarm Business Sector; the growth rate is least-squares estimate of time coefficient in a quarterly log regression; employment rate is Employment-Population Ratio, 25-55 years; utilization is Capacity Utilization, Manufacturing.

<table>
<thead>
<tr>
<th>Year.Quarter</th>
<th>$\hat{w}$</th>
<th>$e$</th>
<th>$u$</th>
</tr>
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<tbody>
<tr>
<td>2009.4–2020.1</td>
<td>+0.002</td>
<td>0.771</td>
<td>0.750</td>
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<tr>
<td>2020.3–2023.1</td>
<td>–0.005</td>
<td>0.783</td>
<td>0.775</td>
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Figure 1: The inflation-neutral employment rate ($e_n$) lies above the labor market conflict-resolving employment rate ($e^*$) when it is less than the capital-population ratio ($e^* < \kappa$). An increase in the weight assigned to inflation expectations ($\delta$) would shift $e_n$ to the right. In the limiting case $\delta = 1$, $e_n = \bar{e} = \kappa$. 
Figure 2: At point A, the economy has achieved the inflation-neutral level of employment $e_n$ but capital is underutilized. Real wages are rising, shifting the $w^{PS}$ curve upward in the next period and raising both the conflict-resolving employment rate $e^*$ and $e_n$. Central bank policy (stabilizing inflation) will thus tend to move the system to point B with normal utilization and $e^* = e_n = \kappa$. (The wage curve, $w^{WS}$, is shown in its linear form for visual clarity.)