Productivity, unemployment and the Rule of Eight

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Abstract
Productivity is a central issue in the economy, but its causes are very poorly understood. The term "multi-factor productivity," for example, is attached to the greatest part of productivity gains year after year, but its definition remains amorphous. In this paper, we display the clear correlation between the unemployment rate and changes in productivity in the medium and longer term. We distill this relationship to the "Rule of Eight" — Eight minus the unemployment rate equals the change in productivity. We then contend that the causation runs from unemployment to productivity and discuss why this must be so, particularly focusing on two considerations: (1) In the real world, as a factor becomes more scarce, its use is husbanded, so when labor is scarce, its use is optimized, and (2) the rising marginal cost curve (which is the idea underlying the orthodox belief in declining productivity as labor is increased) does not correctly describe the real world of most firms. Finally we look at how the inverse relationship between the unemployment rate and productivity changes affects how we think about inflation, and in particular, the use of orthodox analytical tools of NAIRU and the Phillips Curve. That is, because productivity growth is higher during periods of low unemployment , and goods and services are being produced with fewer hours of labor, the price of goods (all other things equal) should tend to fall. This should reduce inflationary pressure, rather than exacerbate it as the two conceptual tools predict.
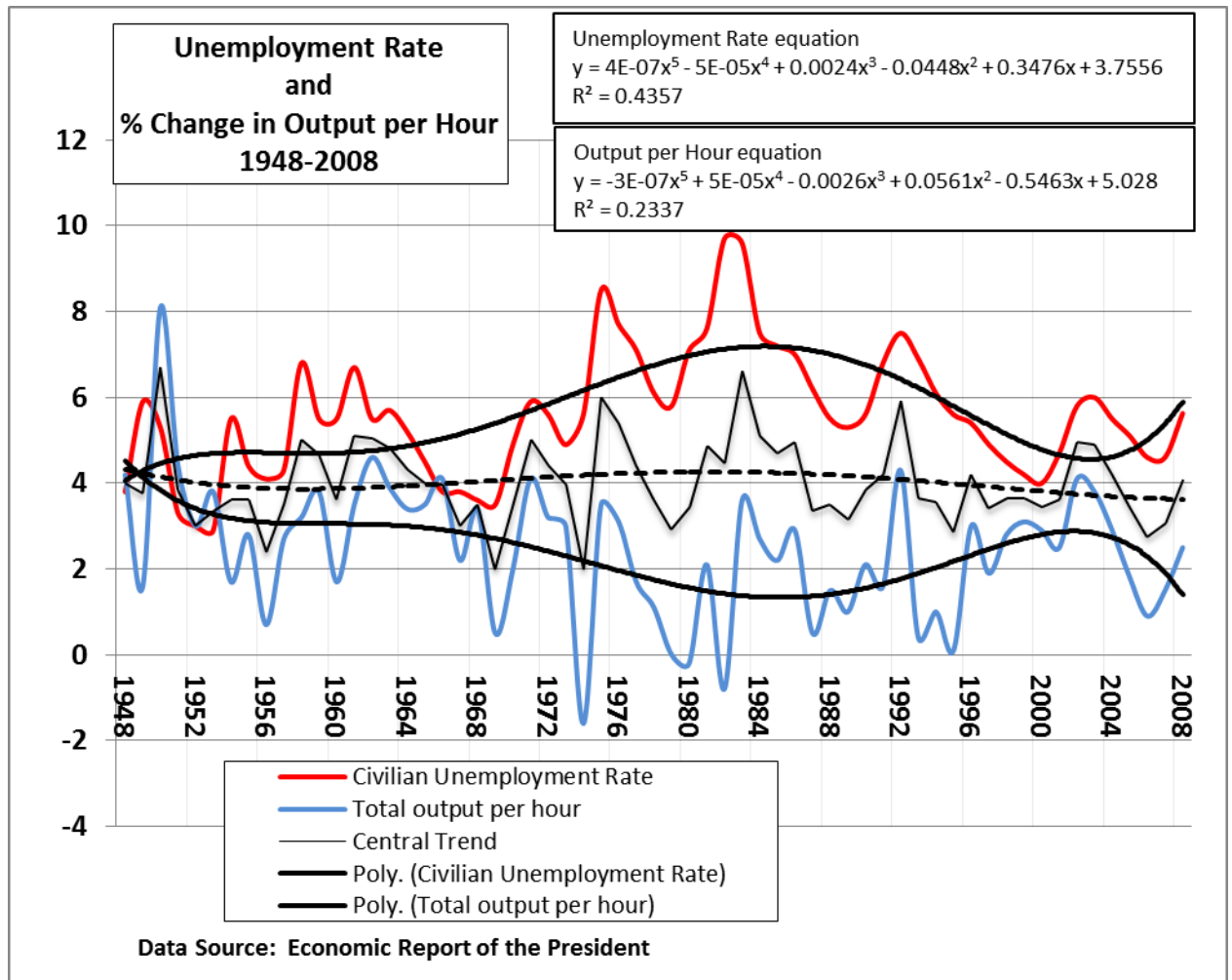
The Rule of Eight

Eight minus the unemployment rate equals the change in productivity over the medium and long terms.

Graphing the civilian unemployment rate against the annual change in productivity, then applying the most complex polynomial function available on Excel creates the Figure 1 (below) for the period 1948-2008.

We are using here the most commonly cited data for each of these variables. For unemployment, the unemployment rate of all civilian workers, and for productivity, the changes in output per hour of all persons in the business sector, as reported in the "Economic Report of the President". (Tables B-38 or B-42 for unemployment and Tables B-44 or B-50 for productivity, depending on the years.) We see the two functions are virtual mirror images of each other around a central trend of 4. At any point in time, the change in productivity will equal approximately eight minus the unemployment rate and *vice versa*. As productivity rises, unemployment falls. As unemployment falls, productivity rises. The correlation between the two smoothed lines is virtually complete.

Figure 1.

Unemployment Rate and % Change in Output per Hour 1948-2008

Unemployment Rate equation
$y = 4E{-}07x^5 - 5E{-}05x^4 + 0.0024x^3 - 0.0448x^2 + 0.3476x + 3.7556$
$R^2 = 0.4357$

Output per Hour equation
$y = -3E{-}07x^5 + 5E{-}05x^4 - 0.0026x^3 + 0.0561x^2 - 0.5463x + 5.028$
$R^2 = 0.2337$

Civilian Unemployment Rate
Total output per hour
Central Trend
Poly. (Civilian Unemployment Rate)
Poly. (Total output per hour)

Data Source: Economic Report of the President

This relationship is likely more intuitive to real world economic actors than to academics or theorists. When labor is tight, managers manage, workers are shifted to more productive tasks, tools improve, capital is used more efficiently, processes are streamlined. Exploring the many ways this is done is beyond the scope of the present work, but this is in essence no different than the first law of economics, restated simply: When something is more scarce, less of it used.

It is important to acknowledge here that contemporaneous and short-term data often belie the medium- and long-term trend described by our polynomial functions. That is, for any particular quarter, when unemployment spikes higher, productivity may rise as well. A close look at the individual years in the graph above, for example, will show many examples where there is a short-term contradiction to the long-term relationship. Popular commentary often runs to the idea that workers work harder for fear of losing their jobs, or the least productive workers are fired; but so far as we are aware, there is no formal validation of this relationship.

We offer here two potential alternative explanations for these contemporaneous contradictions to the long-term relationship:

(1) When workers are laid off (i.e., unemployment rises), their contribution to subsequent production does not immediately leave with them. For example, an accountant may have developed procedures or methods which are used after he or she leaves the company, but the output of the company attributable to those methods does not immediately decline with his or her leaving. Thus – since the productivity statistic considers only currently employed individuals – the output per hour of a business unit may be calculated using fewer workers than are actually responsible for that output. The corollary is that, as businesses ramp up production, they hire and train workers, which may for a period of time depress the productivity   statistic.

(2) Managers may not react to changes in labor availability immediately, either by reason of incompetence or oversight, or because adaptation is more complex, and changes in equipment or processes or work rules may not easily or quickly be accomplished.

In any event, the point remains that the stable correlation in the data is that suggested by the Rule of Eight, and the unemployment rate and the change in productivity are inversely proportional.

Causation

Three logical possibilities present themselves: (1) a change in productivity influences unemployment, (2) productivity and unemployment are both determined by a separate factor, or (3) productivity gains follow and are caused by drops in unemployment. We will accept by assertion the third of these alternatives, so as to focus on the most likely dynamics.

The theory is straightforward, but bears repeating: In the real world, as a factor becomes more scarce, its use is husbanded, so when labor is scarce, its use is optimized. The incentives are in place to motivate optimizing labor. But why, if it is so obvious, has this not been observed to this point? We suggest that it is because economic education, Neoclassical theory, has obscured the connection. A rising marginal cost curve is assumed, which by assumption mandates declining productivity as labor is added. That is, if costs per unit are going up, productivity per unit of the factors of production must be going down. The assumption of a rising marginal cost curve is the assumption that additional labor added results in lower output per unit of labor.

Although this is institutionalized in the "Big X" supply and demand curve taught to virtually every undergraduate, this construct of the Neoclassical theory does not generally hold in the real world. Rather, a more classical view applies: Prices are set by the cost of production and output is determined by demand. Empirically, it has been demonstrated that the marginal cost curve does not really rise as assumed in the view of decreasing marginal productivity. Surveys of actual businesses have shown, rather, a flat or falling marginal cost curve.[1]

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[1] Eiteman, W.J. and G.E. Guthrie (1952), "The shape of the average cost curve," American Economic Review, 42(5) 832-8. (As cited in Keen, 2011)

NAIRU and the Phillips Curve

Finally, it is interesting to address the implications of the clear correlation described by the Rule of Eight on the Phillips Curve and NAIRU, two commonly used devices that relate unemployment and inflation. Neither of these conceptual devices produces the clarity of the Rule of Eight. The Phillips Curve produces a sequence of corkscrews when graphed. NAIRU — the Non-Accelerating Inflation Rate of Unemployment — fails to show any sturdy relationship. Both rely on the fervor of well-placed advocates rather than empirical validations.

The weakness NAIRU and the Phillips Curve have in describing and predicting the real world lies in part in the relationship to productivity we have been exploring here. That is, because lower unemployment leads to increases in productivity, it actually mitigates price rises, rather than encourages them, all other things equal. A second weakness is that both NAIRU and the Phillips Curve, in fact, have as the implicit causal factor not unemployment itself, but the incomes and related demand pressure associated with more or less full employment. That is, incomes are assumed to be bid up as unemployment falls, and it is these incomes which then lead to prices being bid up. Both also assume that demand pressure is not mitigated by expanding supply. Neither the demand (income) nor the supply (commodities) assumptions is particularly robust, and both depend on other factors.

A simple mathematical description of these relationships might be:

$$\Delta \text{ Prices (Inflation)} = \Delta \text{ Incomes} / \Delta \text{ Output} - \Delta \text{ Productivity}$$

Of course, this representation simplifies away some valid considerations. It assumes all incomes are spent on the commodities in question and all output is in the form of these commodities. In fact, when incomes rise, some will be saved; and when incomes fall, some savings will be used. But this consideration, again, acts again in a manner counter to that assumed by the Phillips Curve and NAIRU. That is, following from Keynes' work on the marginal propensity to consume, as incomes rise, proportionally less of those incomes go to purchasing commodities, since some is saved. Additionally, if output expands in response to increasing prices, as it would in the real world, the denominator here would mitigate against inflation. But the assumption that all output comes in the form of commodities is fundamentally not right, since it ignores investment goods and government services. Inflation in commodities may well rise when investment increases, or as during wartime when more government services are produced, and this may not be a bad thing. There is fruitful inquiry to be had in this direction (informed by the work of Michal Kalecki and Hyman Minsky, among others), but it is beyond the scope of this discussion.

NAIRU goes beyond bad in this arena, because it assumes that drops in unemployment do not only lead to price increases, but that there is a point where inflation actually accelerates. That is, NAIRU predicts an impulse in the opposite direction (with the image "wage-price spiral") that it ascribes directly to employment pressure. The Phillips Curve merely indicates we will observe a direct relationship between unemployment and inflation. Again, neither of these theories is empirically robust, yet both are favorites of orthodox policymakers.

A speculative example for the use of the Rule of Eight

Our current economic times are characterized by no significant investment by households, businesses, or government and no strength in incomes.

If workers decided to limit hours of availability unilaterally, and thus shrink the number of unemployed, as some have suggested (notably Dean Baker's work sharing concept), the unemployment rate would drop and the Rule of Eight would indicate we would expect productivity increases. Both NAIRU and the Phillips Curve would suggest higher inflation, but no additional incomes would (necessarily) be produced and thus we suggest there would be no impact on inflation.

Conclusion

There is a direct, clear correlation between unemployment and changes in productivity in the medium and long terms. There is theoretical consistency and empirical ratification of this relationship. Implications of this relationship illuminate the manifest weaknesses in orthodox assumptions and in analytical concepts such as the Phillips Curve and NAIRU.

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