

# Retrospectives

## The Cyclical Behavior of Labor Productivity and the Emergence of the Labor Hoarding Concept

Jeff E. Biddle

This feature addresses the history of economic terms and ideas. The hope is to deepen the workaday dialogue of economists, while perhaps also casting new light on ongoing questions. If you have suggestions for future topics or authors, please write to Joseph Persky of the University of Illinois at Chicago at [jpersky@uic.edu](mailto:jpersky@uic.edu).

### Introduction

The concept of “labor hoarding,” at least in its modern form, was first fully articulated in the early 1960s by Arthur Okun (1963). By the 1980s, it could be found in undergraduate economics textbooks, where it was presented as a profit-maximizing response by employers to costs of hiring, firing, and training workers, and thus as an explanation of procyclical labor productivity (for example, Dornbusch and Fisher 1981; Hamermesh and Rees 1984; Flanagan, Smith, and Ehrenberg 1984). By the end of the 20th century, the concept of “labor hoarding” had become an accepted part of economists’ explanations of the workings of labor markets and of the relationship between labor productivity and economic fluctuations.

The emergence of this modern concept of labor hoarding involved the conjunction of three key elements: a fact, a perceived contradiction, and an explanation. The *fact* was that measured labor productivity (output per worker or per hour worked) was found to be procyclical, rising during expansions and falling during

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contractions. That fact was perceived to be in *contradiction* with a widely held theory: In the basic neoclassical theory of the firm in a competitive industry, short-run fluctuations in demand are met by increases or decreases in the variable labor input, with the fixed capital stock unchanged. Given the assumption of the diminishing marginal productivity of labor, this should lead average labor productivity to move countercyclically. A possible *explanation*, rooted in optimizing behavior on the part of firms, held that costs of hiring, firing, and training employees make it optimal for employers facing a short-run drop in demand to retain more workers than technically necessary to produce current output. This dampens the amplitude of employment fluctuations in response to demand fluctuations, leading average output per worker to fall when demand falls.

Each of these three elements—fact, contradiction, and explanation—has a history of its own, dating back to at least the opening decades of the 20th century. Telling the story of the emergence of the modern labor hoarding concept requires recounting these three histories, histories that involve the work of economists motivated by diverse purposes and often not mainly, if at all, concerned with the questions that the labor hoarding concept was ultimately used to address. As a final twist to the story, the long-standing positive relationship between labor productivity and output in the US economy began to disappear in the late 1980s; and during the Great Recession, labor productivity rose while the economy contracted. In the conclusion, I offer some observations on how some economists have reacted to this shift.

## The Discovery of Procyclical Labor Productivity

For the first half of the 20th century, the conventional wisdom among economists was that labor productivity was countercyclical. Three main arguments were offered in support of this belief. First, rising demand for labor during expansions would force employers to hire lower-quality workers, reducing average productivity, while during recessions productivity would rise because the least productive workers would be discharged. Second, workers were fatigued by long hours typically demanded during economic expansions, making them less productive on average. Third, workers were motivated to work harder when they feared the prospect of job loss, as in a recession, and tended to slack off when labor markets were tight and good alternative jobs readily available. Wesley Mitchell, in his influential 1913 book *Business Cycles*, phrased the arguments this way (pp. 477–78):

(L)ess efficient employes [sic] are the first to be discharged after a crisis. Hence the relatively small working forces of depression are the picked troops of the industrial army. When a revival has grown into full prosperity, on the contrary, employers are constrained to accept any help to be had . . . A deterioration of the average efficiency of the working force inevitably follows. . . . Now overtime labor is especially expensive to employers, not only because

it often commands extra rates of wages, but because it is tired labor . . . (A)fter a time all hours of every day find the men less alert and less energetic—unable to accomplish as much work per hour as in less busy seasons. . . .

Quite apart from this difficulty of overtime, men cannot be induced to work at so fast a pace when employment is abundant as when it is scarce.

Mitchell's interest in the cyclical behavior of productivity was linked to his desire to construct a theory of the business cycle in which people's economic behavior during contractions sowed the seeds for subsequent expansions, and vice versa. The alleged upward pressure on labor costs during economic expansions as labor efficiency declined, and the corresponding decline in costs during recessions, were potentially important mechanisms in his theory. But Mitchell, although a staunch empiricist, was only able to present anecdotal evidence to support this theory. However, Paul Douglas (1922) presented productivity statistics from a few industries showing labor productivity falling during the World War I expansion and increasing in the subsequent recession, and over the next several decades, other economists would frequently echo Mitchell's reasoning regarding the likely cyclical behavior of labor productivity.

The Bureau of Labor Statistics began compiling industry-level measures of labor productivity in the mid-1920s (Woirol 2006), but by the 1930s the National Bureau of Economic Research (NBER), where Mitchell was Director of Research, had become the center for the study of the accumulating productivity data.<sup>1</sup> However, reliable generalizations about labor productivity over the cycle were difficult to come by, as annual and monthly productivity measures still depended heavily on interpolated data and were considered untrustworthy by NBER researchers (for example, Hultgren 1960, p. xv). As a result, most of the analyses of productivity coming out of the NBER in the 1940s and 1950s dealt with long-term trends. Still, NBER researchers were beginning to see patterns in the data that contradicted the conventional wisdom that labor productivity was countercyclical. Hultgren (1948, p. 182), in his study of the cyclical behavior of the transportation sector, examined rail industry data and concluded: "From 1921 onward, the productivity of labor, defined as traffic units per man-hour, rose in every expansion, fell in every contraction." Hultgren's results led Mitchell to doubt his 1913 hypothesis (Burns 1952). In his posthumously published *What Happens During Business Cycles*, Mitchell (1951, pp. 132–133) acknowledged "two sets of cyclical fluctuations" in labor productivity, "one positively, the other inversely, related to production." The main factor cited as making for a positive relationship was that "modern plants attain their highest technical efficiency when operated steadily at the capacity for which they were designed."

<sup>1</sup> Mills (1933) is one early NBER research project concerned with measuring and analyzing productivity statistics. In 1937, the Bureau received a grant from the Maurice and Laura Falk Foundation to fund a program on the measurement of production and productivity (NBER 1938, p. 29).

The NBER's official announcement of the reality of procyclical labor productivity came in 1959, when NBER Director of Research Solomon Fabricant (1959, p. 10) declared: "Over the whole period since 1889, productivity fluctuated with the state of business. Year-to-year rises in productivity were greater than the long-term rate when business was generally expanding, and less (or often, falling), when business was generally contracting." Fabricant based his conclusion mainly on further research by Hultgren (1960). Using monthly output data from several industries, Hultgren had identified the peaks and troughs of each industry's "specific cycles" and calculated the change in labor hours per unit of output for each peak-to-trough period (contraction) and each trough-to-peak period (expansion). Pooling data across industries, Hultgren (p. 8) reported: "In one industry or another, at one time or another, we have data on ninety expansions of production and ninety-nine contractions. In eighty-three, or 92 percent, of the ninety expansions, there was a net decline in hours per unit. In seventy, or 71 per cent, of the ninety-nine contractions, there was a net rise in hours per unit. The pooled data suggest a strong tendency toward an inverse relation between hours per unit and total output." Hultgren's data also revealed a strong positive relationship between productivity at the industry level and movements of aggregate output.

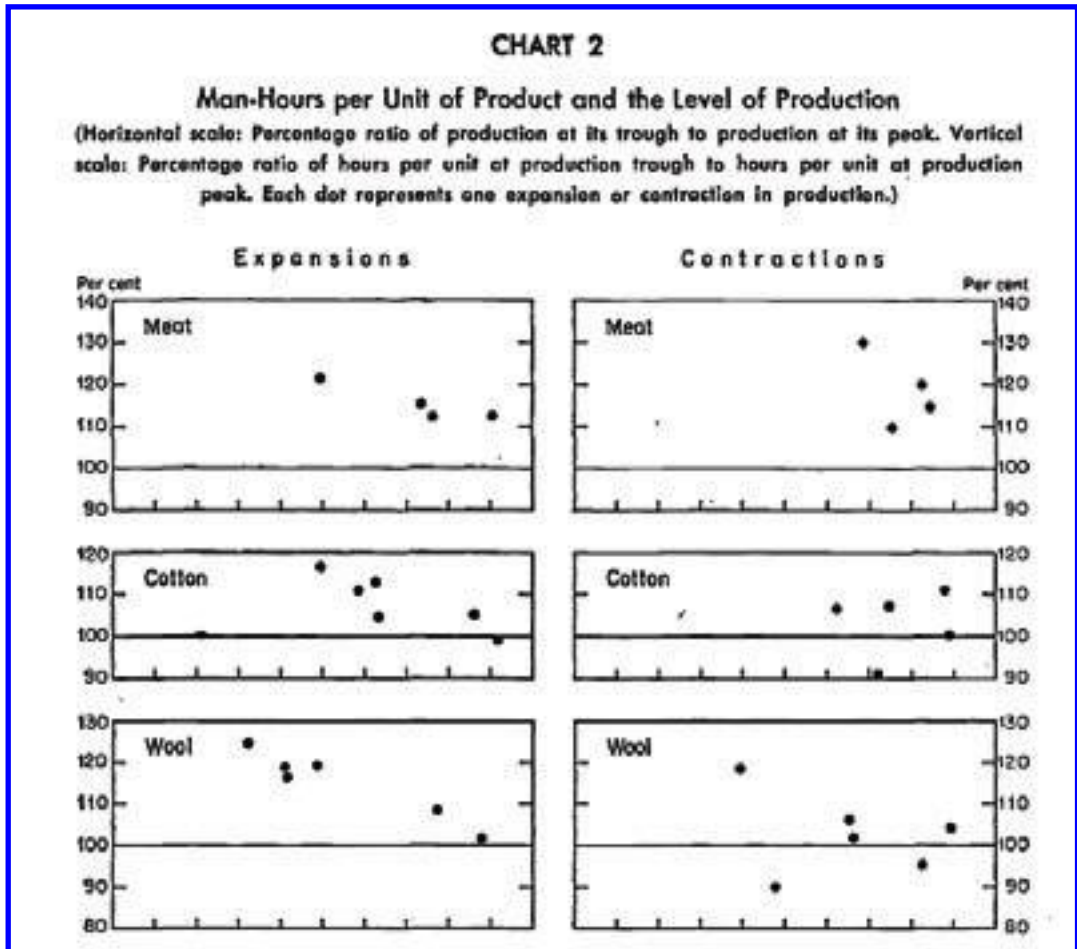
Hultgren represented his evidence of procyclical labor productivity graphically with industry-level scatter plots, some of which are shown in Figure 1. Each point on a plot represents the ratio of hours per unit of output at the trough of a cycle phase to hours per unit at the peak of the phase, from cycles covering the years 1921–32. Since Hultgren measured productivity as hours per unit of output rather than the more conventional output per hour, points above the horizontal 100 percent line represent cases in which productivity moved in the same direction as output.

At the time Hultgren's (1960) book was published, Edwin Kuh (1960) had just completed a report for the Joint Economic Committee of Congress that demonstrated the procyclical behavior of labor productivity using data and methods quite different from Hultgren's. Kuh's output series was value product generated by the corporate sector, quarterly, from 1947 to 1957, and with some estimation and interpolation, Kuh constructed a corresponding man-hour series. He then regressed output per man-hour on the level of output and a trend. The coefficient on output was positive and significant: that is, labor productivity rose with output.

Kuh was one of several economists of the time working on macroeconomic models based on a Keynesian theory, a central purpose of which was to provide a more reliable foundation for economic stabilization policies, and a number of these macroeconomists soon followed Kuh in demonstrating the existence of procyclical labor productivity in both the United States and the United Kingdom, including Soligo (1963), Neild (1963), and Brechling (1965). (These papers circulated for some time prior to publication.) For the most part, these economists did not articulate their motivation in terms of understanding the behavior of productivity over the cycle, but in terms of better modeling the short-run relationship between employment and output, often for the purposes of producing more accurate forecasts. It became common to summarize this relationship using the

Figure 1

Hultgren's Graphical Portrayal of Procyclical Labor Productivity at the Industry Level



Source: Hultgren (1960).

Notes: Each point on a plot represents the ratio of hours per unit of output at the trough of a cycle phase to hours per unit at the peak of the phase, from cycles covering the years 1921–32. Since Hultgren measured productivity as hours per unit of output rather than the more conventional output per hour, points above the horizontal 100 percent line represent cases in which productivity moved in the same direction as output.

estimated short-run elasticity of employment with respect to output (Soligo 1963). These authors understood that a value below 1 for this elasticity implied procyclical labor productivity; but the behavior of labor productivity was not the central focus of their work. Conversely, Hultgren (1960) understood that the patterns he was uncovering in his labor productivity series implied that the cyclical fluctuations of output were greater than the cyclical fluctuations of employment when expressed in percentage terms; for him, it was simply not the more pertinent way to express the finding.

## The Labor Hoarding Concept Emerges

By the early 1960s, then, procyclical labor productivity was a well-accepted fact. As Arthur Okun (1963, p. 6) informed an audience at the American Statistical Association meetings: “The record clearly shows that man-hour productivity is depressed by low levels of utilization, and that periods of movement towards full employment yield considerably above average productivity gains.” Likewise, Robert Solow (1964, p. 6), in his presidential address to the Econometric Society, explained: “Generally speaking, productivity rises most rapidly when output is recovering toward capacity and falls or rises least rapidly during recessions.”

Okun’s (1963) presentation to the American Statistical Association represents the earliest articulation of the labor hoarding concept that I have found involving all three of the components identified in the introduction: an acknowledgement of the fact of procyclical labor productivity, an assertion of the contradiction between that fact and basic neoclassical theory, and a possible explanation of the contradiction rooted in an analysis of how costs of hiring, firing, and training workers affect a firm’s optimal employment strategy. Regarding this third point, Okun noted (p. 6):

[T]he positive relationship between output and labor productivity suggests that much of labor input is essentially a fixed cost for fairly substantial periods. Thus high output levels permit the spread of labor overheads, and low production levels raise unit fixed costs of labor. At times we may take too seriously our textbook examples which view labor as a variable factor, with only capital costs as fixed. Even the most casual empiricism points to an overhead component in labor costs.

Okun’s (p. 7) reasons why employment “may not be easily variable” included “Transaction costs associated with laying off labor and then, in the future, doing new hiring . . .” and “Acquired skills that existing employees have learned on the job may make them particularly valuable to the firm, so that it pays to stockpile underemployed labor . . .”

Solow’s (1964) acknowledgement of the procyclicality of labor productivity was also accompanied by the two other components of the labor hoarding concept. Solow (pp. 5–6) linked the cyclical movements of productivity to earlier demonstrations that real wages moved procyclically (Dunlop 1938; Tarshis 1939), noting that both phenomena contradicted the neoclassical view of labor markets, in which applying more labor to a fixed stock of capital led to the prediction that “output per man must fall—or rise slower than trend—during business cycle upswings and rise—or rise faster than trend—during downswings or decelerations.” He described three mechanisms that had been proposed to explain what he called the “perverse behavior of productivity in the short run,” explicitly giving one of them the “labor hoarding” label (pp. 7–8, emphasis in the original):

The labor hoarding mechanism operates on the assumption that important costs are associated with *changes* in the level of employment and with the risk

that trained workers laid off as output falls may not be available as output rises again. It can be shown that a long run cost-minimization policy may require that even if *labor-requirements* per unit of output fall with output, *employment* per unit of output may well increase as recession sets in.<sup>2</sup>

## Reconciling Procyclical Labor Productivity and Neoclassical Theory

Solow (1964) labeled procyclical labor productivity “perverse,” because it contradicted the basic neoclassical theory of the firm. Solow’s perception of the relationship between the cyclical behavior of labor productivity and economic theory, however, was not shared by most of the economists doing research during the 1950s and early 1960s on the cyclical behavior of productivity. Neither Fabricant nor Hultgren had pointed out the contradiction between the NBER’s findings regarding labor productivity and the implications of neoclassical theory, but this is not surprising. Fabricant had no particular commitment to neoclassical theory, and in this he was following Wesley Mitchell, for whom the neoclassical tradition represented just one of many potentially useful types of economic theory. Indeed, Mitchell’s analysis of the business cycle, which had provided the framework for Hultgren’s empirical study of productivity, eclectically combined elements derived from several theoretical traditions.

The macroeconometric model builders who helped establish the procyclicality of labor productivity displayed a range of attitudes regarding the theoretical implications of their results. For example, Neild’s (1963) first priority was to produce better forecasts for policymakers. Both “traditional” and “imperfect competition” theories, he argued, assumed that employment would fall proportionately with output; but that was not what happened. “We do not want to prove or disprove any theory,” Neild (p. 1) explained, “but to find relationships which work.” In a similar vein, Kuh (1965) estimated short-run and long-run elasticities of employment with respect to output. In summarizing his results, Kuh commented (p. 9) that although many of his estimates seemed to contradict neoclassical reasoning, this fact “should be a cause of neither congratulation nor concern since the business cycle has been excluded by choice from that domain of analysis.” From this perspective, procyclical labor productivity was not to be regarded as a challenge to or contradiction of neoclassical theory, but as irrelevant to it.

Indeed, many economists in the 1960s took the view that the domain of neoclassical analysis was properly limited to some subset of economic activity, with

<sup>2</sup> Solow (1964, p. 8) also cited what he called the “decreasing cost” mechanism, which “rests on the hypothesis that much labor in modern industry is ‘overhead’ in character, and can be thought of as a fixed factor in the short run.” But he argued that since “many of the characteristics which lead employers to hoard labor are precisely those which give some labor its quality as overhead,” he would “use the term labor-hoarding as a catch-phrase to stand for all the frictions involved in meeting transitory variations in output with variations in employment.”



alternative theoretical frameworks required to understand phenomena outside that subset.<sup>3</sup> Brechling (1965, p. 188), for instance, began constructing his model of the short-run employment–output relationship by assuming “imperfect competition and administered prices” and commented that he did not believe that cost minimization “or any other motivation” could be assumed over the short periods he was studying.

Solow’s (1964) address, however, clearly framed procyclical labor productivity as a challenge to economic theory, explicitly rejecting both the attitude that “finding relationships that work” for forecasting was more important than resolving such challenges and the arguments that sidestepped the apparent challenge with appeals to theoretical pluralism in economics. Solow (pp. 29–30) wrote:

I know it will be as obvious to you as it is to me that I have not solved the problem of giving a good theoretical explanation of short-run productivity behavior. I hope it will be as obvious to you as it is to me that this is a problem worth solving. Its importance goes far beyond the desirability of being able to predict how output per man-hour will change from this quarter to the next. . . . What I am looking for is a way to unify the economics we teach our students and the economics we use when we advise governments and analyze passing economic events, and do it in a way amenable to econometric treatment. This patching up of theory to explain experimental or statistical uniformities is the way science usually proceeds.

That Solow considered a “good theoretical explanation” of the behavior of labor productivity to be one consistent with the neoclassical framework is apparent from the fact that all the models he proposed in his address involved the assumption of optimization and a long-run production function with standard neoclassical properties.

### **Costs of Hiring, Firing, and Training Workers**

By 1964, speculation was prevalent that the recently discovered procyclical labor productivity was a manifestation of various “fixed” or “overhead” costs associated with labor.<sup>4</sup> As one example, Okun’s (1963, pp. 6–7) list of such costs included

<sup>3</sup>For example, some believed that neoclassical models were the best tools for understanding the behavior of market- and industry-level variables, while a Keynesian approach was better for the analysis of aggregate variables. Others limited the domain of neoclassical theory to the analysis of long-run trends in those markets and industries that closely approached the competitive ideal.

<sup>4</sup>The analysis of the costs associated with the labor input is an important part of the development of this element of the labor hoarding concept. Over the period examined, authors suggested various categorization schemes for labor costs to facilitate such analyses. Only in the late 1980s did a standard terminology for labor costs begin to emerge, with “variable” labor costs referring to costs that change with work time, holding constant the number of employees (for example, the hourly wage rate); “fixed” costs being those that depend on the number of employees on the payroll; and “adjustment costs” being those associated with changing the size of the labor force but not included in these



“contractual commitments” (contractual terms of employment, severance pay); “technological factors” (indivisibilities that prevented certain types of labor input from being varied proportionately with the variation in output); “transaction costs” associated with laying off labor, and then doing new hiring in the future; and “acquired skills” that might be lost if the worker could not be rehired after layoff. But discussions of such costs, and assertions that they would or should influence the response of the profit-maximizing employer to variations in product demand, actually had a history in economics going back at least to the scientific management movement of the early 20th century.

The rhetoric of scientific management envisioned the amelioration of many of the problems facing the industrial worker via the voluntary adoption by enlightened business owners of personnel management policies that were rational, fair, and also beneficial to the bottom line. In the early 1920s, then-Commerce Secretary Herbert Hoover convened a “Conference on Unemployment,” one component of which was a study by the NBER of the facts regarding business cycles and unemployment. It included research into the policies being adopted by firms to “stabilize” employment in the face of seasonal and cyclical fluctuations, as it was hoped that wider knowledge of such policies would spur wider adoption. One chapter in the NBER study was written by N. I. Stone, a Columbia-trained economist and statistician then serving as an executive for clothing manufacturer Hickey Freeman. Stone (1923, p. 117) wrote:

Apart from the social injury which intermittent production causes, a broad view of the ultimate interests of the individual manufacturing concern discloses the disadvantages of intermittent production and the gains that would flow from continuous operation . . . Business men now recognize the wastefulness of a large labor turnover, the expensiveness of training new help, and their inefficiency and resultant high cost . . . Added to these is the loss of the more capable and ambitious workers who drift away during periods of idleness to more steady occupations unless held by the inducement of higher rates of wages . . .

Stone also described methods employed by various firms to stabilize employment, which included labor hoarding strategies during economic downturns like “manufacturing to stock” and transferring “surplus help from one operation or department to another.”

These ideas were discussed in a neoclassical framework in J. M. Clark’s (1923) book *Studies in the Economics of Overhead Cost*. A central theme of Clark’s book was

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first two categories—for example, the cost of hiring a worker (search costs, paperwork) or the cost of training a new worker. These adjustment costs are also associated with labor turnover, as they are incurred each time an employee leaves and is replaced. Rather than employing technical terms that are/were specific to a particular author or time period, the exposition here uses the phrases “costs of hiring, firing, and training workers” or “costs of adjusting the labor force” to speak of the sorts of labor costs that were central to all discussions of this aspect of the labor hoarding concept.

that overhead costs often led to situations in which private costs and benefits of various business decisions deviated from their social costs and benefits. A chapter on “labor as an overhead cost” developed the concept of a social overhead cost to maintaining a healthy and properly trained labor force, highlighting the social waste associated with unemployment. Clark also explained, however, that some labor costs were overhead costs from the employer’s point of view as well. For example, it was often desirable to “keep a nucleus of the working force together through a period of depression” so as to avoid “the cost of building up the force again when business revived” because “when new men are taken on, there is waste in teaching them.” Clark (pp. 43–44, 50–51, 92, 94, 160, 184–186) used numerical examples and marginal analysis to show how these considerations affected the profit maximizing businessman’s responses to fluctuations in demand. Clark’s book went through seven printings over the next 25 years, helping to keep alive among economists the idea that employment adjustment costs mattered for hiring policies.

### **Formalization and Acceptance of the Labor Hoarding Concept**

The acceptance by economists of the proposition that costs associated with adjusting the labor input were a likely reason for procyclical labor productivity owed much to the appearance in the early 1960s of a pair of formal models characterizing the firm’s demand for labor over a multiperiod time horizon. One was in the book *Planning Production, Inventories, and Work Force* by Charles Holt, Franco Modigliani, John Muth, and Herbert Simon (1960); the other in Walter Oi’s 1962 article “Labor as a Quasi-Fixed Factor,” based on his 1961 doctoral dissertation. Each model represented the firm’s employment decision as a mathematical optimization problem, and both implied that changes in product demand would not be met by proportional changes in employment.

The Holt–Modigliani–Muth–Simon (1960) model was presented as a tool for managers trying to make production plans in the presence of uncertainty regarding future demand. By the standards of the economics profession of the time, the model and the regression-based statistical methods recommended for implementing it were quite technically demanding. In deriving the cost function to be minimized when selecting employment and production levels, and describing the sorts of information needed by managers to estimate that function, the authors mentioned several items that had become common in discussions of overhead or fixed costs of labor, listing them under the broad headings Hiring and Training Costs, Layoff Costs, Overtime Costs, and Idle Time costs, and argued that the aggregate impact of these items on labor cost could be approximated by a quadratic cost function.<sup>5</sup> They also showed that the implementation of the model’s optimal decisions rules would lead to a reduction in the fluctuations of both output and employment, but made

<sup>5</sup> The authors indicated that they were summarizing a discussion found in a 1956 issue of the *Journal of Industrial Engineering*, thus linking their work to the scientific management tradition discussed above.

no mention of the relationship between this fact and the cyclical behavior of labor productivity (Holt et al. 1960, pp. 18–20).

The Holt–Modigliani–Muth–Simon (1960) model was picked up quickly by the leading contributors to the macroeconomic literature dealing with the short-run behavior of employment, in which it was established that the assumption that individual firms faced costs of adjusting the labor force led to an econometrically tractable partial adjustment equation describing movements of aggregate employment (Soligo 1963; Kuh 1965; Solow 1964). Thus, Holt, Modigliani, Muth, and Simon provided the macroeconomic research community with a model expressed in a mathematical form that portrayed optimizing behavior, and that, when combined with a neoclassical production function, would lead to a short-run elasticity of aggregate employment with respect to output of less than unity.

Walter Oi (1962) developed his model of the demand for labor in the presence of fixed costs of employment in order to explain certain anomalies in the cyclical behavior of labor markets for which there were “no truly satisfying explanations,” by which he meant explanations that assumed optimizing behavior by firms. Among the puzzles that motivated Oi were occupational differences in the stability of employment and earnings and certain discriminatory hiring and firing practices, but not procyclical labor productivity. In Oi’s model, a firm with a standard neoclassical production function maximized profit per worker over a multiperiod time horizon. There were fixed costs of hiring and training each type of worker. The firm also had expectations regarding future wages and product demand. Solving the firm’s optimization problem led to Oi’s first important result: “Even under perfect competition wages would be equated to marginal products if and only if labor is a completely variable factor”—that is, if there were no fixed costs of hiring or training. In a long-run competitive equilibrium, each type of worker’s value of marginal product would equal the worker’s wage plus the amortized value of the cost of hiring and training that worker.

Oi then considered a firm in long-run equilibrium that learned of a drop in future product demand. Since, for current employees, the costs of hiring and training were sunk, the firm would retain a worker as long as the per-period marginal product was greater than the per-period wage. This led to the result that could be used to explain procyclical labor productivity: The employment of a labor type would only be reduced if its value marginal product, set above its wage in long-run equilibrium, fell below its wage. Thus, the employment of some labor types might not fall at all with a decline in product demand.

As a general matter, Oi’s (1962) approach to using his model for analysis was less formal than that of Holt, Modigliani, Muth, and Simon (1960), as were his empirical methods. Rather than attempting to estimate structural parameters of a stochastic version of his model, Oi’s approach to empirical testing involved identifying the correlations among observable variables implied by his model, then looking for those correlations in the data using chi-square tests and simple regressions.

While Oi (1962) did not discuss procyclical labor productivity, the relevance of his model to that topic was quickly recognized (for example, in Kuh 1965). The major impact of Oi’s model, however, was to serve as a component in neoclassical

models developed to explain seemingly anomalous labor market phenomena. Also, many economists whose theoretical priors led them to view procyclical labor productivity as a “puzzle” readily accepted Oi’s model as a solution to the puzzle: procyclical labor productivity arose from labor hoarding, which arose from optimizing behavior by firms operating in a competitive environment and facing fixed costs of hiring, firing, and training workers (for example, Rosen 1969, p. 257).

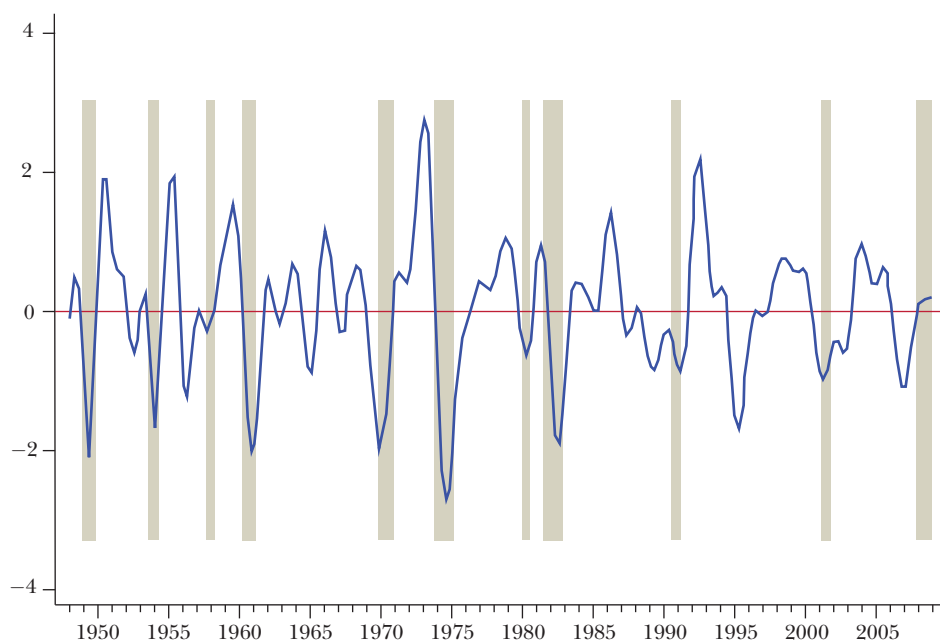
While a number of the macroeconometric models of the early 1960s incorporated the partial employment adjustment mechanism implied by the labor hoarding models, others incorporated an additional mechanism to explain procyclical labor productivity that was rooted in the technology of production rather than the costs associated with hiring labor (Soligo 1963, pp. 19, 30–31; Wilson and Eckstein 1964). This second type of explanation was related to the idea, mentioned by Mitchell in 1951, that modern plants were built to operate optimally at a particular capacity level of output, and that deviations from this level of output in either direction would lead to inefficiency.

Ray Fair, in his doctoral dissertation on *The Short Run Demand for Workers and Hours*, surveyed the relevant literature as of 1968 and expressed his unease with the technology-based explanation, arguing that an econometric model that attributed the positive correlation between productivity and output to increasing returns to labor was probably misspecified (Fair 1969, p. 31). Fair instead assumed a fixed-proportions short-run production function that led to constant returns to labor, and then, to account for procyclical labor productivity, argued that because of the fixed costs associated with the labor input, employers usually paid for more labor than they utilized. He also developed a procedure for constructing an empirical index of the implied “excess labor.”

In 1985, Fay and Medoff published a paper that further bolstered the credibility of the modern labor hoarding concept. They sent questionnaires to managers of manufacturing plants asking about the size of the workforce maintained during the most recent recession. The authors’ chief conclusion from their survey data was that at the trough of the business cycle, the typical plant employed 8 percent more labor than was technically necessary to produce its measured output, but that half of that labor was employed in other useful tasks, leaving 4 percent of the labor to be classified as truly “hoarded.” Fair reacted to Fay and Medoff’s data by applying his indirect method of measuring excess labor to aggregate data, “to see if the quantitative estimates of Medoff and Fay are consistent with the aggregate evidence,” and found a similar answer. Fair (1985, p. 239) wrote: “If this is the case, which the results in this paper show, it provides a strong argument in favor of the excess labor hypothesis. Essentially the same conclusion has been reached using two very different data sets. This is one of the few examples in macroeconomics where a hypothesis has been so strongly confirmed using detailed micro data.”

The argument that increasing returns in production play a role along with labor hoarding in generating procyclical labor productivity remained alive in the 1980s and 1990s (for example, Hall 1986). Also, discussions of labor hoarding began to include the suggestion that hoarded workers would be employed in tasks, such as

Figure 2

**The Vanishing Procyclicality of Labor Productivity***(output per hour)*

Source: Gali and van Rens (2010).

Notes: Figure shows output per hour in the US private sector, rendered stationary with a bandpass filter. Shaded areas are NBER-dated recessions.

maintenance, that did not show up in the firm's measured output, so that at least some of the observed positive correlation between labor productivity and output was due to measurement error (McConnell, Brue, and McPherson 1999; p. 545; Fay and Medoff 1985, p. 639). Still, as of the 1990s, the existence of labor hoarding as a response to costs of hiring, firing, and training workers was widely accepted and believed to be a likely explanation of the observed procyclicality of labor productivity.

**Afterword: Labor Productivity Turns Countercyclical?**

Although this fact has only recently become apparent, the procyclical tendency of labor productivity began to weaken in the US economy in the 1980s, culminating in the trend-adjusted increase in labor productivity that occurred during the Great Recession. Various authors have demonstrated this development econometrically and graphically, including Barnichon (2010), Mulligan (2011), and Gordon (2011). Figure 2 shows a recent visual representation from Gali and van Rens (2010) in which the upward movement of productivity during the last two recessions can be seen.

The change in the cyclical behavior of US labor productivity poses a challenge for macroeconomists. It is not necessarily inconsistent with the model of employer behavior underlying the labor hoarding hypothesis: for example, if the procyclical labor productivity that prevailed during most of the 20th century resulted from costs of adjusting employment levels, then the disappearance of procyclical labor productivity may be due to reductions in the costs of adjusting employment levels. This line of attack is suggested by Ohanian (2010) and developed by Gali and van Rens (2010) and Gordon (2011). The countercyclical move of labor productivity is perhaps a greater puzzle from the perspective of real business cycle models, which, since their introduction in the 1980s, have accounted for procyclical labor productivity by means of their fundamental assumption that business cycles are driven by shocks to productivity (Plosser 1989). However, those working in this tradition, like McGratten and Prescott (2012), are now exploring mechanisms by which exogenous shocks to productivity might generate countercyclical movements of measured labor productivity. Taking yet another approach, Mulligan (2011) argues that productivity increase during the Great Recession arose from a dampening effect on labor supply of rising marginal tax rates.

A half-century ago, the results of Hultgren (1960) and Kuh (1960) convinced economists that labor productivity was procyclical. This fact was perceived to be a puzzle and led to a revised account of the operation of labor markets, neoclassical in spirit but synthesized out of disparate ideas, and then built into macroeconomic models. The recent countercyclical behavior of US labor productivity is likewise a puzzle, and seems to be stimulating a rethinking of how labor markets and the macroeconomy function during cyclical downturns.

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