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Potential Influences on Labor Cost; Available Figures

Periods of expanding business activity are periods of rising demand for most commodities. Prices increase and so does the quantity sold. But it may not be possible for an industry to accommodate rising demand for its products without an increase in the cost of supplying them. Managers of enterprises may find it necessary to employ inexperienced or otherwise less efficient workers; in a booming labor market, those already at work may relax their effort; managers may reactivate idle and antiquated plants and equipment. Competition, or the fear of losing business during a strike, may force up wages; more work will be paid for at overtime rates. All these developments tend to increase cost.

On the other hand, at the beginning of an expansion, many of the facilities in use must be working at less than their optimum capacity, and an increase in production up to the most efficient level tends to lower cost. Conversely, in a period of contracting business, management may be able to lay off its less efficient workers, and overtime will decline, but production may fall below the best level.

In each industry for which data can be found, the relation of changes in labor cost to fluctuations in that industry's production will be investigated. Costs are also influenced by what is going on in the economy at large. What must be paid for labor depends in part on conditions in the general labor market. If, as sometimes happens, output in one industry contracts while business at large is expanding, that industry may have to pay higher wages even though its own demand for labor is declining. We shall therefore also investigate the relation between labor cost in each industry and general fluctuations in the nation's business.

Labor cost depends on how many hours must be paid for to produce a unit of product and on how much must be paid for each hour of work.

Man-hours per unit of product times average hourly earnings equals labor cost per unit of product.

We may refer to them briefly as hours per unit, earnings, and labor cost (or simply cost). Occasionally it will be helpful to use mathematical symbols instead. Let h represent aggregate man-hours, c aggregate compensation of labor, and p production. Then

h/p (read "h over p") = man-hours per unit of product
c/h = average hourly earnings
c/p = labor cost per unit of product
$c/p = h/p \cdot c/h$

Cost Figures

In the study of changes over the comparatively short periods of many expansions and contractions in production or business, monthly figures are more instructive than annual data, and have therefore been used whenever it was possible to do so.[1] To make the calculation, statistics on aggregate hours worked, aggregate payroll, and aggregate production are needed. Although there are many industries for which there is no usable information on labor or product, it has been possible to assemble figures for anthracite mining from January 1932, bituminous mining from January 1934, many although by no means all branches of manufacturing, and railroads from July 1921. The manufacturing industries and the periods covered by the monthly data appear in Table 1. For some important industries the figures begin in 1932, for others there are none until 1947, and a few drop out for lack of data after 1949. With these exceptions, the data we use extend through September 1958.

There are no usable monthly data for such major manufacturing industries as machinery, electrical apparatus, automotive and other transportation equipment, nor are there any for wholesale or retail trade, for construction, or for any of the "service" industries. A few industries for which comparable monthly labor and production data were found, but in which there was little or no cyclical fluctuation of production, were excluded from the study. For railroads, data on aggregate hours and earnings, as well as production (i.e., traffic) come from Interstate Commerce Commission publications. The Bureau of Labor Statistics provides the basic labor data for other industries. The BLS data include hours paid for but not worked; it was possible to exclude these from the ICC data and we did so.

For the week nearest the middle of each month, the Bureau reports the estimated number of "production and related workers," the average hours they worked, and their average hourly earnings. Roughly one-fourth of all

[1] Industry characteristics and sources of figures are described in more detail in the Appendix.

TABLE 1

Manufacturing Industries with Monthly Data and Cycles in Production, 1932-58; Weights of Industries in Federal Reserve Industrial Production Index, 1947-49 Average

	1932	1933	1934	1935-38	1939-40	1941-46	1947-58
Meat [a]	1.48	1.48	1.48	1.48	1.48	1.48	...
Confectionery [b]	...	...	...	...	.71	.71	...
Cigars	...	...	...	...	.17	.17	.17
Cotton [b]	2.30	2.30	2.30	2.30	2.30	2.30	...
Wool [b]	.97 [c]	.97 [c]	1.28	1.28	1.28	1.28	...
Textiles	...	...	...	...	...	...	4.69
Hosiery [b]	...	...	.65	.65	.65	.65	...
Suits and coats	...	...	...	...	...	...	.73
Outerwear	...	...	...	...	...	...	1.85
Lumber	...	...	...	...	...	...	2.05
Millwork and plywood	...	...	...	...	...	...	.60
Paper and pulp	1.76	1.76	1.76	1.76	1.76	1.76	1.76
Petroleum refining	...	...	...	...	...	...	1.97
Tires and tubes	.70	.70	.70	.70	.70	...	.70
Shoes	...	...	...	.90	.90	.90	.90
Cement	...	.32	.32	.32	.32	.32	.32
Steel	3.51	3.51	3.51	3.51	3.51	3.51	3.51
Iron and steel foundries	...	...	...	...	...	...	1.29
Aluminum and copper	...	...	...	...	...	...	.83
Nonferrous foundries	...	...	...	...	...	...	.33
Total weight	10.72	11.04	12.00	12.90	13.78	13.08	21.70
Percentage of all manufacturing [d]	11.91	12.26	13.33	14.33	15.31	14.53	24.11
Number of industries	6	7	8	9	11	10	15

[a] Data extend through December 1949.
[b] Data extend through May 1949.
[c] Excluding carpets and rugs.
[d] Total divided by weight of all manufacturing, 90.02, in industrial production index.

workers in manufacturing are not included in that category, but there are unfortunately no data on their hours. Before 1939 the data refer to "wage earners," apparently a somewhat more comprehensive group. The railroad figures are for all workers for whom hours were reported, which includes over 90 per cent of all employees through 1950, and all employees there-

after. Whenever necessary, we adjust the successive kinds of figures for an industry to make them comparable from one date to another. Roughly, the entire body of information on hours may be described as referring to "production" workers and as excluding "non-production" workers.

The compensation figures likewise pertain to production workers only. They include payments not only for regular time worked but also for overtime or other premium time, sick leave, holidays, and vacations. They do not include contributions of employers toward social security, pensions, health, welfare, and so on. However, it is possible to make allowances for the effect of these omissions on our conclusions.

For production in some industries, simple aggregates expressed in ordinary physical units are used: tons of anthracite or bituminous coal mined, cigars or shoes produced, barrels of cement shipped. In two instances we use the input of materials, assuming that output is proportional. We measure production of cotton textiles by bales of cotton consumed. Mindful of the saying that the meat-packing industry uses every part of the hog except the squeal, we take the total live weight of livestock slaughtered as an indication of production. The figures come from the Bureau of Mines, the Collector of Internal Revenue, trade associations, the *Survey of Current Business,* the Census Bureau, and the Department of Agriculture. For railroads traffic units—namely, revenue ton-miles plus 2.4 times revenue passenger miles—are used. The factor 2.4 is the ratio of revenue per passenger mile to revenue per ton mile over a long period of years.

For all the industries not mentioned so far, one or another of the indexes of production constructed by the Federal Reserve Board and published in the *Federal Reserve Bulletin* is used.[2]

[2] Some of the Federal Reserve indexes are not useful for our purpose. For industries where there are no data on monthly production, the Board estimates the latter from indexes of man-hours, most of which are corrected to allow for changes in output per man-hour as indicated by annual data on actual production as well as hours. The change is assumed to occur at approximately the same rate per month from near the middle of one year to the middle of the next. The procedure could easily obscure cyclical variation in hours per unit. Suppose, for example, that production in a particular industry expanded from month to month during all of one year and declined during all of the following year, but averaged higher in the second year than in the first. If there was a strong inverse relation between hours per unit and production in the industry, hours per unit would decline in the first year and rise in the second, but would be lower on the average in the second. Monthly interpolation between annual indexes, however, would indicate that product per man-hour rose, i.e., hours per unit declined, from the middle of the first year to the middle of the second. The index of production would rise more rapidly than the index of hours in the last half of the first year and fall less rapidly than the index of hours in the first half of the second year. Dividing the index of hours by the index of production would create the illusion that hours per unit fell in both half-years. The amplitude of decline in hours per unit would be underestimated in the earlier half, and the direction of change incorrectly indicated in the later half.

These remarks should not be interpreted as impugning the usefulness of the Reserve

The first step in every industry, except railroads, has been to multiply the number of workers by the hours per week. The result is the aggregate man-hours worked in the middle week of the month. From this point onward, the procedure depends on whether or not we use a production measure in ordinary physical units. If so, aggregate man-hours in the middle week are multiplied by 4.3333 to get man-hours in the month and then divided by production to get man-hours per unit of product. To arrive at the payroll for the month, we multiply the man-hours by average hourly earnings. Dividing the payroll by production gives labor cost per unit. In the case of bituminous coal, for example, the procedure might yield, for recent years, figures such as 0.950 man-hours and $2.30 per ton mined.

When we use an index number of production, all other work is put in index-number form. The step of multiplying by 4.3333 is unnecessary. Instead, an index number of aggregate man-hours in the middle week on the same base as the production index, usually 1947-49 = 100, is constructed. Dividing this by the index of production yields an index of man-hours per unit. Similarly, the reported average hourly earnings are turned into an index. Multiplying the index of aggregate man-hours by that of earnings gives an index of payrolls; dividing this by the index of output gives the index of labor cost per unit of product.

Finally, all the ratios—hours per unit, earnings per hour, cost per hour—are adjusted for seasonal variation. In one industry, for example, it may usually take more man-hours to turn out a unit of product in December than in other months. If, on the average, hours per unit in all months are only 90 per cent of hours per unit in December, the December figure is in effect multiplied by .90. The production figures are adjusted in the same way.[3]

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index for its intended purpose, which is to provide the best practicable index of manufacturing production. Including man-hour data with adjustments for productivity presumably yields a better monthly index of total production than leaving out the important segments of industry for which there are no direct data. But one cannot investigate the true short-run relation of man-hours to output by using figures for the latter in which the short-run change is largely based on assumptions about the very matter to be investigated. Errors in these assumptions, minor for the first purpose, could be fatal for the second.

[3] Some readers may question the multiplication of all weekly aggregates for man-hours by 4.3333, since the number of working weeks in a month varies. Seasonal adjustment corrects for the irregularity in the figures of hours and cost per unit produced by the constant multiplier.

In practice, the figures used in this paper for hourly earnings were computed from seasonally adjusted hours per unit and labor cost.