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SHORTCOMINGS OF MARGINAL ANALYSIS FOR WAGE-EMPLOYMENT PROBLEMS

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The conventional explanation of the output and employment policies of individual firms runs in terms of maximizing profits by equating marginal revenue and marginal cost. Student protests that their entrepreneural parents claim not to operate on the marginal principle have apparently failed to shake the confidence of the textbook writers in the validity of the marginal analysis. Indeed, the trend over the past decade has been to devote more and more space in elementary textbooks to complicated graphs illustrating marginal relationships and to detailed discussions of marginal analysis under a variety of assumed circumstances.[1]

A gap, however, exists between marginal theory of the firm and general theories concerning employment, money, and the business cycle.[2] Textbooks that spend so much of the students' time on the mathematics of profit maximization according to marginal analysis may not mention that principle at all in chapters dealing with the price level, the business cycle, national income, etc. The respective rôles of markets and costs in determining output and employment are not clearly explained. The hiatus exists in Keynes's *General Theory*, despite his efforts to avoid inhabiting two separate theoretical worlds. He fails to reconcile his continued adherence to the marginal-productivity theory with his new theories of employment determination, based on effective demand.[3]

This paper does not pretend to bridge the gap between individual-firm theory and general theory. In examining the relationship between wages and employment from the point of view of the individual firm and investigating the shortcomings of marginal analysis for wage-

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[1] The minutiae of marginalism consume, for example, approximately half of the pages of K. E. Boulding, *Economic Analysis* (1941) and A. M. McIsaac and J. G. Smith, *Introduction to Economic Analysis* (1937), and about one-third of the pages of M. J. Bowman and G. L. Bach, *Economic Analysis and Public Policy* (1943) and A. L. Myers, *Elements of Modern Economics* (1937).

[2] For a similar opinion see Jacob Marschak, "A Cross Section of Business Cycle Discussion," *Am. Econ. Rev.*, Vol. XXXV, No. 3 (June, 1945), pp. 371-72.

[3] See *The General Theory of Employment, Interest and Money* (1936), Pp. 5, 17-18, and 77.

employment matters, it does, however, represent a step in that direction. Much more evidence must be accumulated before definitive conclusions can be drawn regarding wage-employment relationships. The tentative conclusions of this paper are based on scattered evidence, including new material collected by the author, partly from discussions with numerous Southern business executives but mainly in the form of written replies by 50-odd concerns to questions concerning the relative rôle of different factors in determining their employment, alterations in their variable costs per unit with changes in rate of output, and their probable adjustments to an increase in wages relative to those paid by competing producers.[4]

As much of the evidence in the paper rests on the written replies of 58 Southern concerns, a brief explanation of the selection and collection procedures used is given at this point. A detailed questionnaire was mailed in June, 1945, to the presidents or executive officers of 430 Southern manufacturing firms in industries known to have a significant North-South wage differential. Anonymous reply was possible and most answers were not identified. A total of 68 replies were received. However, 10 firms answered that most of the questions were too difficult or would require too much time to answer, so that only 58 of the replies contain answers to two or more of the questions. The 58 replies are distributed as follows by industry: 17 furniture producers, 13 metal-working firms (foundry, machinery and valve producers), 11 cotton clothing manufacturers (producing work clothes, men's shirts, women's dresses, and cotton underwear), 4 full-fashioned hosiery manufacturers, 3 producers of shoes and leather, 3 paint producers, 4 chemical manufacturers, and 3 stove producers.[5] Employment in these 58 firms averaged 600 (range 8[6] to 8,200).

I

The relative importance of various factors (market demand, wage rates, non-labor costs, profits, production techniques, etc.) in determining the volume of employment offered by a firm constituted the subject matter of the first set of questions in the questionnaire. The objective was to obtain the judgment or opinion of the business executives, partly

[4] Financial support for this study has been supplied by the General Education Board.

[5] The 430 companies to which questionnaires were sent were distributed as follows: 103 furniture, 59 metal-working, 146 cotton clothing, 23 full-fashioned hosiery, 19 shoes and leather, 25 paint and varnish, 17 chemicals, and 30 stoves. Only companies located entirely in the South were selected, and practically all of them were located in only one community. Geographically the replying firms are confined to the following states: Alabama, Arkansas, Florida, Georgia, Louisiana, North Carolina, Tennessee, Texas, and Virginia.

[6] The next smallest firms are two with 25 employees each.

because policy decisions in those firms presumably are based largely upon such opinions.

The executives were asked: "What factors have generally been the most important ones in determining the volume of employment in your firm during peacetime?" They were requested to rate the factors in terms of the percentage of importance of each; the total was not to exceed a rating of 100 per cent, and, if one factor alone was important, it was to be marked 100 per cent. The listing of the factors was as follows:

a. Present and prospective market demand (sales) for your products, including seasonal fluctuations in demand.
b. The level of wage rates or changes in the level of wages.
c. The level of material costs and other non-wage costs and changes in the level of such non-labor costs.
d. Variations in profits or losses of the firm.
e. New techniques, equipment, and production methods.
f. Other factors (please specify).

The answers gave overwhelming emphasis to current and prospective market demand for products of the firm as the important factor in determining its volume of employment. Out of 56 usable replies, 28 (or one-half) rated factor *a* (market demand) at 100 per cent. Both shoe producers, 3 out of the 4 full-fashioned hosiery firms, and 11 out of the 16 furniture manufacturers were in that category; on the other hand, only 3 out of the 11 cotton clothing concerns and none of the 3 paint companies rated market demand 100 per cent.

The replies of the other 28 firms that rated two or more factors as important are summarized in Table I.

Factor *b* (wages and changes in wage levels) and factor *d* (profits) are rated surprisingly low by the executive officers of these 56 firms in view of the emphasis placed on those two factors by marginal analysis. On the other hand, the relative stress placed on materials and other

TABLE I.—RELATIVE IMPORTANCE OF FACTORS INFLUENCING A FIRM'S EMPLOYMENT AS INDICATED BY WEIGHTING GIVEN BY 28 FIRMS RATING 2 OR MORE FACTORS

	a (Market)	b (Wages)	c (Non-labor) costs	d (Profits)	e (Technique)	f (Others)
Number of times mentioned	28	13	18	11	16	5
Average weight per time mentioned	65%	15%	14%	13%	17%	16%
Average for all 28 replies	65.0%	7.6%	9.5%	5.1%	9.7%	3.1%

non-labor costs as a factor in determining the firm's volume of employment is surprisingly high. Non-labor costs are mentioned more frequently than wages, and they are considered more important than wages in determining the volume of employment by the replying firms in the furniture, cotton clothing, paint, and chemical industries. Indeed, wages are not given a rating at all by any of the replying paint or chemical concerns, and only one out of 6 metal-working firms marking two or more factors gave any weight to wage item *b*. Yet labor costs were an important element in the total costs of practically all of these firms.[7]

The relative rating of item *e* (new techniques and changes in production methods) is not unexpected. The other factors mentioned under item *f* included "competition" and "management," which might perhaps have been properly included under items *a* and *e*. Replies of at least two firms indicated a realization that the various factors listed were not completely independent. That was, of course, correct.[8]

The failure to lay more stress on wages as a factor in determining the volume of employment is all the more surprising in view of the relatively high ratio of labor to total cost in most of the replying firms. Indeed, the correlation is remarkably low between the stress placed on wages as an employment factor and the percentage that labor costs are of the firm's total costs. True, 5 out of the 11 concerns with labor costs constituting from 40 to 60 per cent of total costs marked wages as an important item in determining the firm's employment,[9] whereas only one of the 10 firms with wages from 12 to 20 per cent of total costs did so. However, only one-tenth of the firms with wages ranging from 30 to 39 per cent of the total cost mentioned wages as an important employment factor, whereas one-third of the firms with labor costs ranging from 21 to 29 per cent of total costs marked wages along with one or more other factors.

In qualifying or elaborating their answers regarding the rôle of present and prospective demand for the firm's product, 8 concerns explained that they manufacture for stock during dull seasons, 3 others said that demand for their products had been stable or steadily increas-

[7] Each firm was requested to state the percentage that labor costs are of its total costs. The average for all replying firms was labor costs 29.3 per cent of total costs (range 12 to 60 per cent). The average was 23 per cent for shoes and leather, 24 per cent for paint, 25 per cent for furniture, 31 per cent for chemicals, 33 per cent for cotton clothing, full-fashioned hosiery, and stoves, and 39 per cent for metal-working concerns. Judging by census data, the average for all manufacturing is around 20 per cent.

[8] For example, wages affect profits and may influence the introduction of new techniques.

[9] The top firm, with labor costs at 60 per cent of total cost, was not, however, one of the 5.

ing before the war, and 2 others replied that the operation of their equipment requires "just so many men," so that "during peacetime employment is more or less permanent."

It is clear from numerous interviews that most business executives do not think of employment as a function of wage rates but as a function of output.[10] When questioned regarding the employment effects of increased or reduced wages they usually end up by stating that orders, not wage changes, are the important factor in output and employment. As explained in Section III below, business executives generally do not think of deliberate curtailment of operations and employment as an adjustment to wage increases, partly because some plants and operations require fixed crews under existing techniques of production and partly because, as indicated under Section II below, business men believe that variable costs per unit of production increase as production and employment are curtailed.

II

In recent years a number of attempts have been made to discover the way costs vary with changes in output. Individual-firm studies by Joel Dean and Theodore O. Yntema indicate that average variable costs (and marginal costs) tend to be constant per unit of product over the usual range of output, which includes up to practically full capacity.[11] Other statistical studies suggest that a great number of American manufacturing firms operate under increasing average

[10] That our business men are no different in this regard from business men abroad seems to be indicated by experience in Germany under the "Papen Plan" for economic recovery introduced in September, 1932. Through tax subsidies and other concessions, German entrepreneurs were able to hire additional workers, on the average, for about half the existing wage rates. Although such wage reduction for additional employees might have been expected to increase employment, employers hesitated to increase employment and output without an increase in orders, so that unemployment in Germany increased about 20 per cent during the 5 months following introduction of the plan. See Gerhard Colm, "Why the 'Papen Plan' for Economic Recovery Failed," *Social Research,* Vol. I (Feb., 1934), especially pp. 90-91.

See also E. Ronald Walker's opinion based on Australia's experience during the 1930's in *From Economic Theory to Policy* (Chicago, Univ. of Chicago Press, 1943), pp. 73-74.

[11] See Joel Dean, *Statistical Determination of Costs With Special Reference to Marginal Costs* (Chicago, Univ. of Chicago Press, 1936), *Statistical Cost Functions of a Hosiery Mill* (Chicago, Univ. of Chicago Press, 1941), and *The Relation of Cost to Output for a Leather Belt Shop* (New York, Nat. Bur. of Econ. Research, 1941); and United States Steel Corporation, *T.N.E.C. Papers,* Vol. I, pp. 223-302. For criticisms, see Hans Staehle, "Statistical Cost Functions: Appraisal of Recent Contributions" *Am. Econ. Rev.,* Vol. XXXII, No. 2 (June, 1942), pp. 321-32; Caleb Smith, "The Cost-Outpost Relation for the U.S. Steel Corporation," *Rev. Econ. Stat.,* Vol. XXIV (Nov., 1942), pp. 166-76; and Everet Straus, "Cost Accounting and Statistical Cost Functions," *Am. Econ. Rev.,* Vol. XXXV, No. 3 (June, 1945), pp. 430-31.

variable labor returns, primarily because marginal labor requirements decrease per unit as output rises toward full capacity.[12] Some studies indicate a definite tendency, especially in the durable goods industries, toward decreasing marginal cost of production, at least until almost full capacity is reached.[13]

In the present study, a series of questions was asked regarding unit variable costs and profits at various rates of output. In reply to the question, "At what level of operations are your profits generally greatest under peacetime conditions?" 42 firms answered 100 per cent of plant capacity. The remaining 11 replies ranged from 75 to 95 per cent of capacity.[14] Six of the 11 did not answer succeeding questions that would have supplied substantiating data. Some of them said these succeeding questions were "too theoretical" or "too technical," or that "data were not available for an exact answer." One simply stated: "Our cost is based on 90 per cent of capacity." Of the 5 firms that did offer substantiating material, 3 gave cost estimates and 2 gave the following reasons: "Assuming that if we were at 100% we would have to pay considerable overtime wages," and "Theoretical 100% is likely to produce too many strains."

The executives were also asked how, in peacetime, their factory operating costs (excluding overhead or fixed charges) per unit of output are usually affected by an increase or a decrease in the company's rate of operations. More specifically they were asked the percentage by which an increase in operations from 95 to 100 per cent (also 90 to 95 per cent, 80 to 90 per cent, and 70 to 80 per cent) would tend to result in a rise or fall in operating or variable costs per unit of output. The answers are summarized in Table II for 32 firms giving data indicating they have decreasing marginal variable costs up to 100 per cent capacity,[15] along with 3 firms giving data showing increasing marginal

[12] See, for example, B. H. Topkis, "Labor Requirements in Cement Production," *Mo. Lab. Rev.*, Vol. XLII (March, 1936), p. 575; B. H. Topkis and H. O. Rogers, "Man-Hours of Labor per Unit of Output in Steel," *Mo. Lab. Rev.*, Vol. XL (May, 1935), p. 1161; and M. Ezekiel, *$2,500 a Year* (New York, Harcourt Brace, 1936), pp. 180-82.

→ Henry M. Oliver, Jr., "The Relationship between Total Output and Man-Hour Output in Manufacturing Industry," *Quart. Jour. Econ.*, Vol. LV (Feb., 1941), pp. 239-54; ε→ M. Ezekiel and K. H. Wylie, "Cost Functions for the Steel Industry," *Jour. Am. Stat. Assoc.*, Vol. XXXVI (March, 1941), pp. 91-99.

[14] These 11 firms were distributed as follows: 1 in furniture, 3 in cotton clothing, 2 in paint, 1 in chemicals, 1 in stoves, and 3 in metal-working.

[15] An additional firm stated that its variable costs per unit decreased with increased operations from 70 to 100 per cent of capacity but it did not offer any percentage figures.

A study by the Oxford economists indicated that 13 firms were operating under conditions of decreasing costs, 4 under conditions of constant cost, and 2 under increasing costs. See R. L. Hall and C. J. Hitch, "Price Theory and Business Behaviour," *Oxford Economic Papers*, No. 2 (May, 1939), p. 20, footnote 1.

costs beginning at 90, 80, and 75 per cent of capacity.[16] Firms reporting decreasing unit costs up to 100 per cent of capacity have also been classified according to the percentage that their labor costs are of total costs, and averages for 4 categories of labor-cost ratios are given.

The following table indicates some differences in the slope of the average decreasing unit cost curve for different industries. The decline is especially sharp for the metal-working firms and for others (full-fashioned hosiery, shoes, and chemicals) at operations between 70 and 90 per cent of plant capacity. For furniture firms, on the other hand, the rate of decrease in unit variable costs is reported to be higher from 95 to 100 per cent or from 90 to 95 per cent of capacity than it is from 70 to 80 per cent or 80 to 90 per cent of capacity.

The answers seem to indicate that the percentage of labor to total cost of production has little direct influence upon the slope of the decreasing unit cost curve at operations between 70 and 100 per cent

TABLE II.—DECLINE IN UNIT VARIABLE COST WITH INCREASE IN SCALE OF OUTPUT

	Increase of operations (in % of plant capacity)			
	95 to 100%	90 to 95%	80 to 90%	70 to 80%
Average for 33 firms with maximum profits at 100% capacity	5.5%	5.7%	7.7%	9.5%
14 furniture firms	6.4	5.9	4.6	5.2
7 cotton-clothing firms	5.6	4.9	6.9	7.5
6 metal-working firms	4.8	7.9	12.5	15.9
6 others	4.7	5.4	9.6	13.9
Average for decreasing cost firms with labor-to-total-cost ratios from				
40 to 60% (6 firms)	4.1%	4.4%	6.6%	8.1%
30 to 39% (6 firms)	2.1	2.3	4.3	5.2
21 to 29% (13 firms)	8.1	7.2	5.8	5.5
12 to 20% (6 firms)	1.9	2.0	4.2	6.2
3 firms with maximum profits at 90, 80 and 75% of capacity				
1 cotton-clothing firm	1.0% rise	1.0% drop	1.5% drop	4.0% drop
1 paint producer	25.0% rise	25.0% rise	10.0% rise	0.0%
1 chemical concern	10.0% rise	? rise	? rise	0.0%

of capacity. The average slope of the unit cost curve for firms with labor-cost ratios from 40 to 60 per cent resembles that of the curve

[16] A total of 17 firms that answered the other questions declined to attempt answers to this one, giving such reasons as "don't know," "no accurate figures," "no exact answers," and "too much theory." In addition, 4 firms gave non-numerical answers that roughly indicated the character of their cost-output relations; their answers are referred to in the text.

for firms with ratios from 12 to 20 per cent. The peculiar slope of the average curve for firms with labor-cost ratios from 21 to 29 per cent apparently is largely explained by the fact that furniture firms predominate, representing 9 of the 13 firms in that classification.

Constant unit variable costs between the range of 70 and 100-per cent capacity operations were reported by 3 firms.[17] In addition, 2 concerns[18] reported such constant costs between 90 and 100 per cent of capacity, and 6 others[19] gave figures showing a per unit cost variation of no more than from 1 to 8 per cent over the whole range from 70 to 100 per cent of capacity. The president of one chemical firm, not included in the above data, replied: "I am not in a position to estimate exact answers, but believe that operating costs in the brackets you outline would vary little. Of course, costs would fall if we increased our operations from 70 to 100 per cent."

As further checks on the replies of the executives, they were asked: "Under normal peacetime conditions, is it possible at times to reduce your operating costs per unit of output by lowering your rate of operations?" Of 44 replies, 43 were "no" and one was "yes." Some replying "no" qualified their answers. One said, "By reducing from more than 100% of capacity to 100%, costs are likely to fall." Another added, "If we work regular hours 100% capacity is point of greatest efficiency and lowest cost but may not be if that involves a great deal of overtime." A number remarked that plant efficiency tends to fall as operations are reduced, that payroll costs do not increase in direct proportion to the volume of operations so that operating costs per unit are lower at higher levels of output, or that operating costs per unit always are lower as 100-per-cent capacity production is approached. The firm answering "yes" gave as its explanation of how lowered operations would permit lower unit variable costs: "Get rid of all incompetent employees, cease selling to chiselers and risky accounts, do more of work instead of paying some one else to do it."

A few of the answers to this question raise doubts as to the validity of the replies of some firms to previous cost questions, particularly those reporting increasing marginal variable costs beginning at 75 to 95 per cent of capacity. Two of the replies may also indicate a failure to distinguish clearly between fixed and variable costs. Nine of the firms reporting maximum profits at 75 to 95 per cent of capacity answered "no" to this question as to whether it was possible to reduce

[17] Two in furniture and one in clothing. To quote from the explanation of two of them: "Our unit cost remains the same if you exclude overhead and fixed charges," and "As long as overhead and fixed charges are excluded, the unit cost would not vary much either way, if any."

[18] One in furniture and one in metal-working.

[19] Three in furniture, two in shoes, and one in metal-working.

unit variable costs by lowering the rate of operations.[20] Those 9 included the 3 firms that reported U-shaped cost curves, with rising unit variable costs beginning at 75, 80, and 90 per cent of capacity. Two of them were the only replying firms in their industries that reported such cost curves below 100 per cent of capacity.[21]

The significant conclusion from the data in this section is that most of the manufacturing firms in the industries covered by this survey apparently have decreasing unit variable costs within the range of 70 to 100 per cent of capacity production—or at least their executive officials believe that to be the case, which is the important factor in determining company policy, whatever the actual facts may be.[22]

If company output and employment policies are based on the assumption of decreasing marginal variable cost up to full capacity operations, much of the economic reasoning on company employment adjustments to increases or decreases in wage rates is invalid, and a new theory of wage-employment relationships for the individual firm must be developed.

The Oxford economists found that a great majority of the business entrepreneurs they questioned[23] "were in profound ignorance" regarding the elasticity of demand for their products and that "answers to questions about increasing or decreasing marginal prime costs were seldom given with confidence."[24] Their sample "erred, if at all, by being biased in favor of well-organized and efficiently conducted businesses," and the entrepreneurs convinced the economists that uncertainty concerning elasticities of demand and marginal prime cost were "'due not to any negligence or lack of zeal for knowledge" on the part of the business men "but to the nature of the case."[25] The economists concluded that the results of their study "seem to vitiate any attempts to analyse normal entrepreneurial behaviour in the short period in terms of marginal curves. They also make it impossible to assume that wages in the short run will bear any close relation to the

[20] The other two of the 11 firms in that category failed to answer this question.

[21] Seven other cotton-clothing firms and 3 other chemical concerns definitely reported decreasing unit costs. The two other paint companies gave no detailed cost figures. One reported maximum profits at 100 per cent of capacity and the other at 80 per cent of capacity.

[22] The T.N.E.C. study of *Industrial Wage Rates, Labor Costs and Price Policies* (monog. no. 5, 1940) revealed that unit labor costs increased as volume fell and declined as rate of operations expanded in the International Harvester Company's plants and in the plants of two paper companies; operating efficiency was lower when volume was small, partly because of more frequent shifting with shorter runs (see pp. xix, xx, 35-37, and 117-19).

[23] Apparently the statements quoted in this paragraph rest primarily on the evidence of 38 of the entrepreneurs interviewed.

[24] R. F. Harrod, "Price and Cost in Entrepreneurs' Policy," *Oxford Economic Papers*, No. 2 (May, 1939), pp. 4, 5.

[25] *Ibid.*, p. 5.

marginal product (or marginal revenue) of the labour employed."[26]

The present author's interviews with business men indicate that most entrepreneurs do not tend to think in terms of marginal variable cost. The heads of manufacturing concerns hiring, say, 50 or more workers consider such a procedure both unnecessary and impractical because (1) they seem convinced that their profits increase as the rate of operations rises, at least until full plant capacity is reached—they have no faith in the validity of U-shaped marginal variable cost curves unless, perhaps, overtime pay is involved; (2) they consider repeated shifts in the size of a plant's working force, or in its equipment, with changes in the relative costs of different productive factors to be impractical, their adjustments to cost changes taking most frequently the form of product shifts that require little, if any, alteration in equipment; and (3) they see the extreme difficulty of calculating marginal variable costs and the marginal productivity of factors, especially in multiprocess industries and under present accounting methods. In thinking about employment in their firm, therefore, they tend to emphasize current and prospective demand for their products and the full-crew requirements for their existing facilities, rather than the current level of wage rates.

III

The practical and technical difficulties involved in attempting to apply the marginal analysis to wage-employment matters deserve more attention than can be given them here. This discussion only indicates some of the problems involved in shifting the proportion of factors in manufacturing plants or in calculating the marginal contributions of factors, and, at the same time, points to certain disturbing data.

There is a lack of good case material on the redistribution of factors purely in response to increases or decreases in wage rates. The very existence of unused plant capacity indicates that it is not feasible to substitute capital equipment for labor; otherwise that would have been done because the use of such idle equipment is practically "costless" in view of the fact that fixed charges on it cannot be avoided.

Most industrial plants are designed and equipped for a certain output, requiring a certain work force. Often effective operation of the plant involves a work force of a given size.[27] Certain techniques of

[26] R. L. Hall and C. J. Hitch, "Price Theory and Business Behaviour," *Oxford Economic Papers*, No. 2, p. 32.

[27] That, for example, is largely true of automatic-machine tending (such as is characteristic of pulp and paper plants, metal and oil refineries, chemical plants, textile mills, etc.) and of assembly-line operations. It is also true that the size of the work force is largely fixed in service lines like banks, rail and bus transportation, theaters, postal delivery, etc.

production, allowing little variation in the use of labor, may be the only practical means of manufacturing the product. Under such circumstances, management does not and cannot think in terms of adding or subtracting increments of labor except perhaps when it is a question of expanding the plant and equipment, changing the equipment, or redesigning the plant. The flexibility of many plants is, however, extremely limited, especially those designed for early stages of manufacturing, such as the smelting, refining, compounding, and rolling of materials.

From much of the literature the reader receives the impression that methods of manufacture readily adjust to changes in the relative costs of productive factors. But the decision to shift a manufacturing plant to a method of production requiring less or more labor per unit of output because of a variation in wages is not one that the management would make frequently or lightly. Such action involves the sale (at a loss?) of existing facilities not usable under the new method and the purchase of new facilities and equipment to replace those discarded, to say nothing of retraining workers and readapting the whole organization.[28] Such new investment presumably would not be undertaken simply to reduce a current and expected net loss, or if there was a likelihood that the wage change would only be temporary or that the cost relationships between factors would be considerably altered again in the near future.[29]

Those who argue for wage reductions on the grounds that a certain relationship exists between wage rates and employment tend to overlook the fact that a shift to less capitalistic or more labor-consuming method may be impractical not only for reasons given above but also because the skilled workers necessary to operate the antiquated equipment are no longer available. Indeed, as Randall Hinshaw points out, writers who believe a wage reduction will tend to stimulate new investment often appear to assume that the investment will be in the form of the most up-to-date equipment, which would require less rather than more labor per unit of output.[30] That, of course, would be contrary to what one might expect from marginal analysis.

That industry does not adapt its plants and processes to varying wage rates in the manner assumed by marginalists seems to be in-

[28] Not to mention countless other problems like the effect of any lay-offs on the company's unemployment tax under experience rating, possible changes in its property-tax assessment, or resulting changes in employee or community attitudes.

[29] The management might also hesitate to take such action if the market value of facilities and equipment to be sold was expected to rise, or if the market value of the equipment to be bought was expected to fall, or if marked improvements in technique were in the offing.

[30] See his unpublished Ph.D. thesis, *Wages and Unemployment, A Preliminary Analysis* (Princeton University Library, 1944), p. 122.

dicated by data recently collected by the author.[31] Executives of 112 firms with plants in both the North and the South were asked in January, 1945, the following question: "Have lower wages in the South *themselves* caused your company to use production techniques or methods in its Southern plant(s) that require more labor and less machinery than the proportions of labor to machinery used in its Northern plant(s)?" Of 44 replies, one was vaguely affirmative, one was indefinite, and 42 answered "no." Of the 42, a total of 35 stated that, for all comparable jobs, average wages in their Southern plants were below the average for their Northern plants. On that basis, the wages in the Southern plants averaged per firm from 5 to 30 per cent below the Northern plants, with the average North-South differential for all 35 firms at 15 per cent. Those 35 replying firms represent a wide variety of industries[32] and had a total of over half a million employees in 150 plants in the South and 491 plants in the North. Some of them stated that the existence of lower wages in the South did not influence the type of machinery installed nor the processes used there, that "the most efficient equipment available" is used in every plant regardless of location or relative wage levels.

The sample probably contains offsetting biases: in favor of concerns in a good position to make close comparative cost calculations and in favor of large firms with relatively low labor-to-total-cost ratios. Nevertheless, it should be pointed out that included in the 35 concerns are 15 in industries that, on the average, have labor costs amounting to 25 to 40 per cent of total production costs[33] and 11 that were paying wage rates in the South from 20 to 30 per cent below their comparable Northern rates. Surely, if wage rates were as important in determining the proportion of factors or a firm's employment as the textbooks imply, the completely negative results from this test would not have been possible.

A T.N.E.C. study of wage rates, labor costs, and technological change in two shoe companies, two paper companies, two mills of a textile company, and plants of the International Harvester Company in the 1930's indicated that increases in wage rates were not the most important or decisive factor—in fact may have no significant influence—in the determination and timing of technological changes.

[31] These data are more fully discussed and explained in a forthcoming article in the *Journal of Political Economy* entitled, "Effectiveness of Factory Labor, South-North Comparisons."

[32] Including 7 cotton and rayon textile firms, 5 building materials producers, 4 food companies, 3 rubber companies, and 2 firms in each of the following industries: clothing, hosiery, oil, chemicals, paper and pulp, metals, furniture and plywood, and aircraft and construction equipment.

[33] Cotton textiles, full-fashioned hosiery, furniture, cotton clothing, and rubber.

For the most part there appeared to be little casual connection between increased labor costs and the introduction of capital improvements.[34]

There is no need to discuss at length in this paper the technical difficulties involved in any attempt to discover the marginal product of an added unit of labor in large-scale industry and to impute to that unit of labor its value contribution to a joint, multi-processed product. Such difficulties have been discussed elsewhere in detail by the author.[35] More recently W. J. Eiteman has succinctly explained the "hopeless complexity" that would attend any attempt to apply marginal analysis to modern manufacturing establishments.[36] His demonstration leaves no doubt that it would be utterly impractical under present conditions for the manager of a multi-process plant[37] to attempt, by means of repeated variation in the number of men employed, to work out and equate marginal costs and marginal returns for each productive factor.

IV

The foregoing discussion and data throw light on experience under the Fair Labor Standards act that has been difficult to explain by conventional marginal theory, and they also help to illuminate the answers of Southern business executives to a group of questions on probable adjustments to an increase in their wage rates relative to those paid by competitors in other regions.

For example, the South-North wage differential in the men's cotton garment industry (shirts, collars, nightwear, work clothes, and pants) was reduced, on the average, by one-third between March, 1939, and March, 1941, primarily as a result of the establishment of a statutory minimum of 30 cents in October, 1939, under the Fair Labor Standards act and an industry wage order setting minimum wages in the industry at 32½ to 40 cents (depending on the product), effective in July, 1940; yet between March, 1939, and March, 1941, employment in 180 identical plants increased more than one and a half times as fast in the South as in the North.[38]

[34] See *Industrial Wage Rates, Labor Costs and Price Policies,* T.N.E.C. monog. No. 5, pp. xxv, 25, 42, 53, and 136.

[35] *Economics of Labor* (1941), pp. 175-84.

[36] "The Equilibrium of the Firm in Multi-Process Industries," *Quart. Jour. Econ.* Vol. LIX (February, 1945), pp. 280-86.

[37] A plant in which more than one type of operation or process is performed and which has, therefore, more than one "cost center."

[38] Separate figures for branches of the industry show somewhat varying results. Employment did decrease slightly in Southern plants producing shirts, collars, and nightwear, where the North-South wage differential was being practically eliminated, but in the work clothing and cotton pants branch employment increased more than twice as fast in the South as in the North despite a reduction of more than 50 per cent in the North-South wage differential. See "Earnings in the Men's Cotton-Garment Industries, 1939 and 1941," *Mo. Lab. Rev.,* Vol. LV (August, 1942), p. 349.

The same pressure of minimum wages had similar results in the wood furniture industry. Between October, 1937, and February, 1941, the South-North wage differential was reduced about 7 per cent for 72 identical wood furniture plants, with the establishment of a statutory minimum of 25 cents in October, 1938, and 30 cents in October, 1939, and the setting of minima from 32½ to 40 cents in the principal industries competing with Southern furniture manufacturers for labor.[39] Not only did employment for the industry as a whole increase the most in firms with the lowest average hourly earnings in 1937, where the statutory minima obviously had the greatest direct and immediate effect; but employment in the Southern plants increased 26 per cent, whereas it decreased slightly in competing Northern firms during the period (October, 1937 to February, 1941); and, within the South, employment expanded more than twice as fast in the lower-wage firms[40] whose wages were increased 10 per cent as it did in the higher-wage firms where the increase in wages was less than 2 per cent.[41]

Various factors were, of course, responsible for employment results so contrary to the presuppositions of conventional marginalism in such industries as men's cotton clothing and wood furniture. For the purposes of this paper there is no need to analyze individual cases where the results are so opposite to the expectations of marginal analysis and to assess the responsibility of each factor for those results.[42] Such data

[39] Seamless and full-fashioned hosiery, men's cotton clothing, and cotton textiles.

[40] Averaging under 35 cents an hour in 1937.

[41] The actual changes in hourly earnings and employment in 72 wood furniture plants from October, 1937 to February, 1941, were as follows:

Plants with average hourly earnings in 1937	*Percentage increase in average hourly earnings, 1937 to 1941*		*Percentage increase in employment, 1937 to 1941*	
	U.S.	*South*	*U.S.*	*South*
Under 32.5 cents	11.2%	10.2%	26.3%	29.1%
32.5 and under 35.0 cents	7.6	9.9	38.1	38.1
35.0 and under 37.5 cents	8.3	1.7	30.7	18.5
37.5 cents and over	2.4	1.7	0.4	16.8

Sources of data: *Earnings and Hours in the Furniture Industry, February 1941*, U. S. Bur. of Lab. Stat., Serial No. R. 1330, 1941, Table 3, p. 11, and *Minimum Wages in the Wood Furniture Manufacturing Industry*, Wage and Hour Division of U.S. Dept. of Labor, June, 1941, pp. 24–28. The employment increase for the South of 16.8 per cent was calculated from data in the latter publication on p. 28.

[42] The notion that variations in geographic wage differentials and changes therein fairly accurately reflect geographic differences in labor effectiveness so that "efficiency-wages" are approximately the same for all regions or areas seems to be disproved by a North-South comparison that the author made between wages and labor efficiency in 41 firms with

have been mentioned here merely to indicate that the replies of the Southern business executives discussed in this section do have some basis in fact and experience. Furthermore, furniture and men's cotton clothing concerns constitute half of the 43 Southern firms that gave full answers to a group of questions concerning the adjustments they would make to a sharp narrowing of the North-South wage differential in their industry.[43] The basic question was as follows:

> Suppose that during the first 3 years after the defeat of Japan the average North-South wage differential in your industry should be cut in half, causing Southern wage rates in your line to rise relative to those of your competitors in the North. Assuming no other change in your costs and no decline in the nation's demand for the type of products you manufacture, how would your firm be likely to adjust to such a permanent 50-per-cent reduction in the North-South wage differential?

The executives were requested to rate each factor in terms of the relative importance or share in the total adjustment for which it would be responsible, the rating being in percentage terms on the basis of a composite of 100 per cent. The following list of factors was provided:

a. Install additional labor-saving machinery.
b. Improve efficiency through better production methods, organization, supervision, incentives, workloads, etc.
c. Change the price, quality, or kind of products manufactured.
d. Increase sales efforts so as to expand sales and production.
e. Reduce production by deliberately curtailing output.
f. Other adjustments (please specify).

The replying firms estimated their wage rates to be from 5 to 40 per cent under the average for comparable jobs in the North. The average for all replying was 18.2 per cent, so that the question involves, on the average, an increase of 11 per cent in the wage scale of replying firms in the South, assuming no change in the wage level of their Northern competitors.

As the replying firms are mostly in industries that experienced some narrowing of the North-South wage differential under the National Recovery act and Fair Labor Standards act, their answers are founded on recent experience. Indeed, the replies are extremely helpful in interpreting that experience. They are summarized and classified by

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plants in both regions. See a forthcoming article, "Effectiveness of Factory Labor, South-North Comparisons," in the *Journal of Political Economy*.

[43] Ten firms declined to answer this set of questions on the ground that there was at present no differential, or only a negligible one, between their wage rates and average rates for comparable jobs in the North. Four of the 10 were in men's cotton clothing, in which previous figures have shown the North-South differential was rapidly reduced between 1939 and 1941.

industry and labor-cost ratios in Table III. Also, Table III contains a summary for the 11 firms that estimate their wage rates to be from 25 to 40 per cent under the average rates of their Northern competitors for comparable jobs, and it is significant that the averages for those 11 firms (for which the question posits a selected wage increase of 17 to 33 per cent) are very similar to the averages for all 43 firms.[44]

TABLE III.—ADJUSTMENTS OF 43 SOUTHERN FIRMS TO SHARP NARROWING OF NORTH-SOUTH WAGE DIFFERENTIALS, FACTORS WEIGHTED ACCORDING TO PERCENTAGE OF IMPORTANCE

Classification of firms	a (labor-saving machinery)	b (improved methods and efficiency)	c (price-product changes)	d (increased sales efforts)	e (curtail output)	f (other)
Number of firms giving factor weight	35	36	19	31	4	4
Average weight per stressing firm	33%	36%	41%	29%	43%	20%
43-firm average of weights	26.1%	29.6%	17.5%	20.7%	4.1%	20%
Average for 14 furniture firms	19.6	23.2	34.3	17.9	.7	4.3
Average for 7 men's cotton clothing firms	24.3	40.0	17.1	18.6	—	—
Average for 10 metal-working firms	35.0	28.5	5.5	20.0	11.0	—
Average for 12 other firms	27.5	32.4	8.8	24.3	5.0	2.0
Average for 11 firms with North-South wage differential of 25 to 40%	25.0	30.5	10.9	20.0	10.0	3.6
Average for firms with labor-to-total cost ratios from						
40 to 60% (8 firms)	41.9	23.1	19.4	13.1	1.2	1.3
30 to 39% (8 firms)	33.1	28.7	14.4	15.0	6.3	2.5
21 to 29% (10 firms)	17.8	32.8	31.1	18.3	—	—
12 to 20% (9 firms)	22.8	36.2	7.8	26.7	1.0	5.5

The adjustment most frequently mentioned by the 43 firms was factor *b*, improvements in efficiency through better management, incentives, etc. Introduction of labor-saving machinery is the second most significant adjustment according to the results in Table III, and increased sales efforts ranks third. Price-product changes are considered the most important adjustment by some furniture concerns (3 of them

[44] The principal exception is that the factor of curtailing output has an average of 10 per cent for the 11 firms compared with an average of 4.1 per cent for all 43 firms. Responsibility for that result rests on one metal-working firm with a North-South wage differential estimated at 25 per cent, which rated this factor 100 per cent. Elimination of that firm would reduce the average for the factor of curtailing output to one per cent for the remaining 10 firms with large North-South wage differentials. The firm, subsequently discussed, failed to report its ratio of labor costs to total costs so it is not included in the last group of figures in Table III.

placing sole stress on that factor),[45] but for the other firms such changes are considered of minor significance.[46]

It is especially noteworthy that deliberate curtailment of output, an adjustment stressed by conventional marginal theory, is mentioned by only 4 of the 43 firms.[47] Two of them, rating it at 10 per cent, had reported decreasing unit variable costs up to 100 per cent of plant capacity; however, their percentage decreases in moving from 70 to 100 per cent of plant capacity totaled only 8 per cent in each instance. The third firm, rating this factor 50 per cent, is the chemical concern in Table II that reported sharply increasing unit variable costs between 95 and 100 per cent of capacity and maximum profits in peacetime at 75 per cent of capacity. The fourth firm, a fabricator of steel structures and tanks with 125 employees, although reporting maximum profits at 100 per cent of capacity and decreasing unit variable costs between 70 and 100 per cent of capacity, places sole stress on this factor, making the following statement: "Volume of production would be reduced to small sales for a local market. The only reason we can now compete with the large Northern firms is due to the difference in wage scale. They have enormous advantages in freight rates and more skilled type of workman."

That business concerns stress item *b*, improved management and efficiency, may seem surprising to economists, who have generally reasoned as one replying executive, who stated: "Doing all these things is a continuous process with us. I don't see what the wage level has to do with it." Nevertheless, experience under the N.R.A. and the Fair Labor Standards act indicates that the spur of increased wages does lead to improved plant organization. An executive of one of the largest cotton-textile concerns in the South has testified that, under the N.R.A. requirement that the same wages be paid for 40 hours of work as formerly were paid for 55 hours, the firm's actual increase in labor

[45] One furniture executive said he would enter a new field of manufacture of advanced products in furniture and veneers. However, another furniture manufacturer reported: "Such a change would affect us but very little as 90% of our market is in the South."

[46] "Other" adjustments were: "Use only higher skilled employees," "Replace inefficient labor with efficient labor," and "Several."

[47] Yet, reasoning on the basis of conventional theory, D. K. McKamy and John V. Van Sickle argue that elimination of the North-South wage differential by government action would result in "an enormous and legislated growth of unemployment," because "those enterprises in the areas of labor surplus which are unable to earn enough money to pay the imposed wage would have to go out of business or reduce employment to the point where the last workers employed were worth as much as the imposed minimum." See *Statement of D. K. McKamy and Dr. John V. Van Sickle with Regard to the Demand of the Union for Elimination of Geographical Wage Differentials,* Company's Exhibit No. 28, In the Matter of Carnegie-Illinois Steel Corporation, et al., and United Steelworkers of America, Before the Steel Panel of the National War Labor Board, Case No. 111-6230-D (14-1, et al.), June 7, 1944, p. 51.

costs was less than one-third of the expected or calculated increase, the difference being explained by "the utilization of improved machinery, better arrangement of processes and application of skilled labor, and the more adequate scheduling of the flow of production and better selection of raw materials."[48]

Greatest stress on factor *b*, better management and work procedures, is understandable in men's cotton clothing, where the possibilities of making savings through labor-reducing equipment are generally less than in metal-working plants, which gave the factor of additional labor-saving machinery the primary weight.[49] Also, as might be expected the firms with the highest rates of labor to total cost are the ones that place the most emphasis on new labor-saving machinery. Indeed, there is a notable inverse correlation between stress on that factor and the relative importance of labor in total costs. Exactly the reverse is true of the factor of increased sales efforts. Less stress is placed on sales efforts the larger is the percentage of labor in total costs. The implication is that large non-labor costs and increasing returns up to full capacity production bring to the fore the importance of keeping sales up when profits begin to be squeezed.

Economists brought up on the conventional theory may discount the stress placed by the business executives on increased sales efforts, considering it to be an irrational and uneconomic reaction to a wage increase. Previous data on the relationship between rates of output and unit variable costs indicate, however, that such stress on increased sales efforts may have some rationality. It may help to raise and retain output near capacity operations. Data at the beginning of this section indicate that expanding sales, output, and employment may, at times, be one of the results in firms most affected by wage increases. Business men are acutely aware of the fact that unit costs vary with output, that wage rates which seem extremely burdensome at half-capacity operations may not seem unduly high as full-capacity production is

[48] *Textile Industry, Findings and Opinion of the Administrator,* Wage and Hour Division, U.S. Dept. of Labor, September 29, 1939, p. 35.

[49] The possibilities of better management practices have frequently been emphasized in discussions of minimum-wage experience. See, for example, John F. Moloney, "Some Effects of the Federal Fair Labor Standards Act upon Southern Industry," *Southern Econ. Jour.,* Vol. IX (July, 1942), p. 22, and H. M. Douty, "Minimum Wage Regulation in the Seamless Hosiery Industry," *Southern Econ. Jour.,* Vol. VIII (October, 1941) p. 186.

In the seamless hosiery industry, with the introduction of 25-cent and 32½-cent minima in 1938 and 1940, respectively, employment declined more in the firms with average hourly earnings in the lowest wage classifications, largely due to increased use of labor-saving equipment in those firms (see Douty, *Southern Econ. Jour.,* Vol. VIII, pp. 183-89). However, there is no evidence that total output or sales of those low-wage firms, most affected by the wage minima, experienced any decline relative to the average for the industry.

approached. Unlike economists, business executives tend to think of costs and profits as dependent upon the rate of output, rather than the reverse (the rate of output as dependent upon the level of cost).

V

This paper raises grave doubts as to the validity of conventional marginal theory and the assumptions on which it rests. Admittedly the data used are imperfect and are based, for the most part, on opinions of business executives. Many of the replying executives are, however, heads of "small" businesses in highly competitive industries, so that they are good test cases for the theory. There may, of course, be questions concerning the representativeness of the samples, the completeness of the data, the content and character of the questions asked, etc. It may be argued, if somewhat unconvincingly, that business executives as a group do not learn from past experience and do not know their own businesses. Nevertheless, the answers of the replying executives are sufficiently consistent, firm by firm, and so overwhelmingly support certain reasonable conclusions that there can be little doubt about the correctness of the general results.

While awaiting the fruits of further investigation and analysis, the following tentative conclusions can be drawn from the data contained in this paper:

1. Market demand is far more important than wage rates in determining a firm's volume of employment.[50] Indeed, for employment determination, market demand is considered by business executives to be almost five times as important as all other factors combined,[51] and the wage level or changes in wages are considered to be no more important in determining a firm's employment than the level of non-labor costs and changes in such non-labor costs.

2. Most manufacturing concerns apparently are considered by their executives to be operating at decreasing unit variable costs all along the scale between 70 and 100 per cent of plant capacity. Consequently, it is seldom practical for a firm to curtail output (and, therefore, employment) simply in response to an increase in wage rates.

3. In modern manufacturing, a firm's level of costs per unit of product is influenced considerably by its scale of output; the reverse, as assumed by conventional marginalism, is not generally true.

[50] The 56 replying firms gave market demand an average rating of 87.5 compared with an average of 3.8 for the level of wages or changes therein, which, taken literally, would mean that market demand is more than 26 times as important as wage rates in determining the volume of employment of a firm.

[51] The relative importance of market demand was assessed by the executives of 56 firms at 82.5 compared with 17.5 for all other factors influencing a firm's employment. The ratio is 65 to 35 for the 28 firms rating two or more factors (see Table I).

4. Interregional firms, except in rare cases, do not adjust their use of labor and capital equipment to compensate for sectional differences in wage rates. For many manufacturing concerns it is not feasible, or would prove too costly, to shift the proportion of productive factors in response to current changes in wages, in the manner suggested by marginal analysis.

5. The practical problems involved in applying marginal analysis to the multi-process operations of a modern plant seem insuperable, and business excutives rightly consider marginalism impractical as an operating principle in such manufacturing establishments.

6. Of the three adjustments stressed by business executives to meet a rise in wages relative to those paid by competitors, two—better management practices and increased sales efforts—are neglected by conventional marginalism; whereas the adjustment stressed by marginalism—curtailment of output—is considered so unimportant and exceptional as to be mentioned in only one out of every 11 replies. Indeed, experience seems to indicate that, on an individual-firm basis, the adjustments considered important by the business executives may, at times, even result in larger firm employment at a higher wage level.

These tentative conclusions indicate a new direction for investigations of employment relationships and equilibrating adjustments, in individual firms.