Monthly Review

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The Current Business Situation in Perspective

THE sidewise drift of the economy during the summer months has, with the onset of winter, been replaced by a slide downward in economic activity. According to preliminary estimates for the fourth quarter of 1958, Gross National Product—our most comprehensive measure of total output—was down about $6 billion at an annual rate from the third quarter. Thus, we have slipped back to a little below second quarter total output levels in dollar terms and, since prices have risen somewhat, even further below in terms of physical volume. Both consumption and investment appear to have fallen in the fourth quarter, and most individual business indicators have also turned down or continued down.

It is not clear at present whether the decline in business activity is accelerating, and, in fact, there are some areas where such large adjustments have already occurred that present levels of activity may at least be stable. It may be useful in this unclear situation to compare the changes which have occurred so far in the current adjustment with those of the two prior postwar recessions. Such an assessment is best made after a downturn has run its course, all of the data are in, and the objectivity of history may be brought to bear. A quick and necessarily summary review of recent developments does, however, suggest the following tentative conclusion: the current decline is proceeding at a rate roughly similar to the prior two postwar recessions but with significant differences in the behavior of the various sectors of the economy. Plant and equipment expenditures, for example, which have been at extremely high levels for an extended period, may decline longer and farther during the current recession than in 1948-49 or 1953-54. Inventory investment and government spending appear as somewhat more favorable factors than in the earlier recessions. Consumer spending, the largest single component of total outlays, continues to be an enigma. If the present decline does turn out to be of roughly the same magnitude as the previous recessions, however, some business indicators should show improvement before the middle of 1958.

Most indicators down in recent months

Industrial production, which slumped a little more than 10 percent in each of the two previous postwar recessions, has sagged about 7 percent from its peak 12 months ago. Most of the drop, however, has occurred since August; and no upturn is yet in sight. The backlog of unfilled orders at manufacturing firms, which are almost entirely for durable goods, continued to fall in October and November, although new orders received did not decline further in November. In addition,

THE PRESENT RECESSION COMPARED WITH 1948-49 AND 1953-54

	1948-49			1953-54			1957-?			
	Turning point[1]	Duration of decline	Percent change	Turning point[1]	Duration of decline	Percent change	Turning point[1]	Decline thus far	Percent change	Latest period available
General Business Cycle[2]	Sept. 1948	13 mos.		July 1953	8 mos.		(?)			
Total Nonagricultural Employment	Nov. 1948	12 mos.	— 4.5	June 1953	14 mos.	— 3.5	Aug. 1957	4 mos.	— 1.7	Dec.
Unemployment as a Percent of the Civilian Labor Force	July 1948	rose 16 mos.	3.2 to 7.0	Aug. 1953	rose 9 mos.	2.1 to 5.4	April 1957	has risen 8 mos.	3.9 to 5.2[3]	Dec.
Gross National Product	4th qtr. 1948	4 qtrs.	— 3.2	2nd qtr. 1953	2 qtrs.	— 2.7	3rd qtr. 1957	1 qtr.	— 1.4	4th qtr. 1957
Personal Consumption Expenditures	4th qtr. 1948	1 qtr.	— 0.9	3rd qtr. 1953	1 qtr.	— 0.8	3rd qtr. 1957	1 qtr.	— 0.4	4th qtr. 1957
Gross Private Domestic Investment	3rd qtr. 1948	5 qtrs.	—31.5	2nd qtr. 1953	5 qtrs.	—12.5	4th qtr. 1956	4 qtrs.	—10.9	4th qtr. 1957
Government Expenditures	2nd qtr. 1949	4 qtrs.	— 9.7	2nd qtr. 1953	6 qtrs.	—13.0	Rising			4th qtr. 1957
Plant and Equipment Expenditures	4th qtr. 1948	4 qtrs.	—20.0	3rd qtr. 1953	6 qtrs.	—11.0	3rd qtr. 1957	2 qtrs.	— 5.9[4]	1st qtr. 1958
Industrial Production	June 1948	12 mos.	—10.5	May 1953	11 mos.	—10.2	Dec. 1956	12 mos.	— 8.0	Dec.
Wholesale Prices	Aug. 1948	16 mos.	— 8.0	Sept. 1953	15 mos.	— 1.4	Aug. 1957	4 mos.	— 0.2	Dec.
Consumer Prices	Aug. 1948	18 mos.	— 4.2	Oct. 1953	19 mos.	— 1.0	No decline			Dec.

[1] Turning point represents highest peak reached prior to decline.
[2] Using turning points determined by the National Bureau of Economic Research for 1948-49 and 1953-54.
[3] Current estimates of unemployment as a percent of the labor force are about 0.4 of 2 percent higher than under the definition in effect before January 1957.
[4] First quarter 1958 data are estimated by U. S. Department of Commerce and Securities and Exchange Commission.
Note: All except price data have been adjusted for seasonal variation.

reductions in activity have recently occurred in nondurable goods manufacturing and mineral production so that cutbacks in output now appear to be fairly widespread.

The decline in plant and equipment expenditures, amounting to 6 percent from the realized level in the third quarter of 1957 to the estimated level for the first quarter of 1958, has been another factor tending to reduce aggregate demand. The slower rate of capital outlays has sharply reduced the flow of orders for machine tools and other types of machinery and equipment. In addition, contract awards for factory buildings have been declining since early in 1957.

The downturn in business activity and production has also occasioned a contraction of employment and income. Total nonfarm employment fell 0.6 of 1 percent from November to December, about the same as the October-November decline. The rise in unemployment continued, but at a reduced rate. In December 5.2 percent of the civilian labor force (including workers on farms as well as those in nonagricultural pursuits) were unemployed compared to 5.1 percent in November and 4.6 in October. Recent developments also included the fourth successive monthly decline in personal income. The drop from November to December amounted to $2.6 billion at a seasonally adjusted annual rate which was the largest decline that has occurred in recent months. Thus, nearly all measures of business activity indicate that a recession is in progress. The reduction in total demand has not, as yet, been transmitted into declines in the over-all price indexes. As of mid-December wholesale prices were at approximately the November level, about equal to the high point reached in August. Meanwhile, consumer prices recorded another rise from October to November and then leveled in December. The latest increase resulted primarily from price hikes for new model cars, although all major categories except food and home furnishings showed minor increases.

Investment declines most sharply

The largest single factor operating to depress statistical measures of business activity in the fourth quarter was a sharp turnabout in business spending for inventories. Inventory investment, which had measured a plus $2 billion at a seasonally adjusted annual rate in the third quarter, fell, according to preliminary estimates, to a minus $3 billion in the closing period of the year. The drop in inventory investment from the third to the fourth quarter thus amounts to a net change of $5 billion. This reflects in part the increased pessimism with which the economic outlook has been viewed in recent months. The switch from accumulation to liquidation can also be associated with lower requirements for purchased materials and goods-in-process as industrial production fell steadily.

Business firms also moderately decreased their spending for durable equipment. However, construction outlays, the remaining portion of Gross Private Domestic Investment, rose by about $1 billion to a record level in the fourth quarter. The net result of the changes in inventory investment, durable equipment expenditures, and construction outlays was a decline of $4.5 billion—about three-fourths of the drop in Gross National Product from the third to the fourth quarter.

The relatively large decline of 11 percent in Gross Private Domestic Investment from its peak in 1956 is due entirely to the fact that inventory investment during the fourth quarter of that year proceeded at an annual rate of $5 billion compared to a disinvestment of $3 billion in the fourth quarter of 1957. With the exception of residential housing and inventories, other components of Gross Private Domestic Investment increased from the fourth quarter of 1956 to the fourth quarter of 1957. Construction activity dipped in the early part of 1957 but reached a record level in the fourth quarter. The gain in construction expenditures partially offset the drop in spending for durable equipment and the reduction in inventory investment.

The Department of Commerce estimates that the value of new construction put in place in 1958 will rise 5 percent above the 1957 level. Increases of 4 and 7 percent, respectively, are predicted for private and public construction. In addition to the favorable outlook for construction, it appears unlikely that further reductions in inventory investment will be as large as those which occurred in the 1948-49 recession.

Some inventory adjustment occurring in the first quarter of 1957, the moderate rate of accumulation in the second and third quarters, and the liquidation of inventories in the fourth quarter probably pave the way for relatively moderate changes in coming months.

The decline in plant and equipment expenditures, calculated from the third quarter of 1957 to the current 1958 quarter (estimated), already measures about 6 percent. Some observers believe this decline will continue for a longer period than in the two previous postwar recessions even without a further weakening in business confidence. In 1948-49 and, to a lesser extent, in 1953-54 a considerable quantity of fixed investment was still necessary to compensate for replacement not made during war years. Moreover, neither recession was preceded by a bulge in capital outlays comparable to that which has taken place in the recent boom. In other words, we have entered the present recession with a relatively larger amount of capacity than was the case before. Investment in other industrialized countries has been at record volumes also, and supplies of most raw materials and primary products are more readily available than at any time since World War II.

Consumer expenditures show only a small drop

The turndown in retail trade, first apparent in September, has continued; and it is estimated that consumer spending fell at an annual rate of about $1 billion from the third to the fourth quarter. Purchases of nondurables declined more sharply, and spending for durables fell by a smaller amount. These losses outweighed a further advance in spending for consumer services. Preliminary estimates of department store sales for December indicate that buying in the final week of the Christmas season was up sharply—about 30 percent—from the same week in 1956. Although there were large losses from year-ago weeks in late November and the first three weeks in December, Christmas trade at department stores over the two months was only a little below the record volume of 1956.

New automobiles, on the other hand, are moving at a rate considerably below expectations. The news that major producers began cutting production in mid-December and that dealers' stocks rose during the month suggests that automobile sales in December were down from levels reached during the earlier model clean-up period and slightly lower than those of December 1956.

The drop in personal consumption expenditures that took place from the third to the fourth quarter was small compared to the brief consumption declines in either the 1948-49 or the 1953-54 adjustments. However, there is no reason to believe that consumer spending will immediately begin to increase. In the absence of a pent-up demand for durable goods that is said to have existed in the years following World War II, and to a lesser extent in the period after the Korean War, it is quite possible that consumer spending will show less stability for the duration of the current recession than it has during most of the postwar period. Although fluctuations in consumer spending are usually small in percentage terms, they can be important in terms of dollars, for consumer purchases of goods and services ordinarily represent at least two-thirds of total GNP.

In each of the two previous postwar recessions the growth of consumer spending for services has slowed but not halted. No consistent pattern, however, has occurred in the movement of spending for durables and nondurables. While purchases of durables recorded percentage declines that were larger than those for nondurables in both previous postwar downturns, the drop for durables in 1948-49 was smaller in dollar terms than that which took place for nondurables. In 1953-54, however, durable expenditures showed a larger dollar drop than spending for nondurables. While no such unusual factor as a large backlog of unsatisfied demand for durables can be said to exist at the present time, it is possible that the expected improvement in residential housing activity will provide some lift to sales of home appliances during 1958. The future trend of automobile sales, which is of crucial importance, cannot be foreseen with any degree of accuracy; but the industry already is lowering its estimates for 1958 which were set just a month or two ago.

In the two previous postwar recessions, savings as a percent of disposable income fell as

consumers strove to maintain living standards even though income declined. At the same time, there occurred reductions in personal income tax rates in 1948 and 1954 which also helped to sustain high consumption levels. Another factor which sustained consumption, particularly in the 1953-54 recession, was a substantial liberalization of consumer credit terms. While there may be room again for some reduction in the rate of saving, there appears now to be a smaller possibility of further liberalization of terms or of an early cut in taxes.

Changes in government spending have been important in other recessions

State and local government purchases of goods and services jumped nearly $1 billion at an annual rate in the fourth quarter of 1957, but this gain was partly offset by a drop of about $600 million in outlays of the Federal government. The cutback in spending by the Defense Department was a significant minus factor affecting durable goods manufacturing industries in the last half of 1957 and may also have played a significant role in the inventory adjustment evident in the fourth quarter. Contract cancellations, production stretch-outs, and a curtailed flow of orders for military hardware led to widespread employment cutbacks particularly in aircraft and supporting industries.

Fluctuations in total government spending and in the fiscal operations of the Federal government have played complex roles in each of the past post-World War II recessions. State and local government expenditures have trended steadily upward with the exception of a minor drop in the second quarter of 1953. All declines occurring in government spending have been centered in spending of the Federal government.

Federal government outlays for goods and services continued to rise in 1948 and did not turn down until after the second quarter of 1949 —well after the recession had begun. Accompanying the change in outlays was a cash surplus of about $8 billion in fiscal 1948—a significant deflationary development. In the year beginning July 1949, however, fiscal operations resulted in a net deficit of about $2 billion.

By contrast, the drop in Federal outlays for goods and services in 1953 occurred just before the turndown in general business activity—in the second quarter of that year—and was largely centered in national security expenditures as a result of the Korean armistice. However, cash receipts from the public were $6 billion less than cash outlays in calendar year 1953. Another deficit of $1 billion was incurred in 1954.

In the present readjustment, cutbacks in defense expenditures have lowered total Federal government disbursements from an annual rate of $51.1 billion in the second quarter of 1957 to about $50 billion in the fourth quarter. The cash budget surplus in calendar year 1957 is presently reported to be less than $2 billion. It is expected that defense spending will increase in 1958 and that only minor offsetting cuts will be made in nondefense spending. At the same time, tax receipts may fall short of previous estimates so that a deficit may result. Considering that state and local government expenditures are almost certain to continue to trend upward as outlays for education and public construction record further gains, it appears likely that government will represent an expansionary force in the economy in 1958. It is not possible to tell at present, however, whether the impact of the increased defense expenditures will be felt early in 1958.

Foreign demand less likely to offer additional support in the months ahead

The surplus of our exports over imports and grants has shrunk this year from $4.1 billion in the first quarter to an estimated $2.5 billion in the fourth quarter. The earlier figure was not only unusually high because of Suez but also carried with it the prospects of the present decline because of the reductions which occurred at that time in the gold and dollar reserves of foreign countries. Output abroad in most countries appears to be leveling off, and in some important countries actually declining. Little lift, then, can be expected from foreign demand in the months ahead as compared with a year ago. While a larger decline occurred in the 1948-49 recession, it took longer to develop. In the 1953-54 recession, on the other hand, foreign demand was a strong supporting factor as booming foreign economies drew upon our resources.

Location Factors and Aluminum in the Pacific Northwest

ALUMINUM bids fair to become one of mankind's most important and useful primary products. An industry born less than a century ago, it has already assumed major importance in the daily lives of consumers in its myriad uses. It provides employment for well over 100,000 workers, and in output it ranks ahead of all other metals produced except steel. The Pacific Northwest region has been of key importance in the development of aluminum in the United States, particularly during World War II. This article, the third in a series[1], will be concerned mainly in an analysis of factors important to location of the industry, with particular reference to their bearing on the aluminum industry in the Twelfth District.

Since broad economic factors strongly influence the location of any particular stage of aluminum production, the location of no one stage can be considered in isolation from the others. The economic goal of integrated production is to minimize the total cost of producing and delivering aluminum to consumers, not to minimize cost at each stage. Of course, political, military, and institutional factors do not always allow the unhampered resolution of economic forces. Furthermore, since it takes time for economic forces to work themselves out, the spatial distribution of plants at any particular time is not always the optimum.

Production of Alumina from Bauxite

The relative ability of a locality to produce aluminum competitively starts with its access to bauxite of commercial grade. Of the major aluminum consuming nations, only France has domestic bauxite deposits sufficient to supply its aluminum industry. In recent years, almost 80 percent of the bauxite used in the United States has been imported from South America and Jamaica. At present, principal bauxite sources for the United States in order of importance are Surinam (Dutch Guiana), Jamaica, Arkansas, and British Guiana. Thus, with the exception of the bauxite produced in Arkansas, sizable transportation costs are incurred by American aluminum producers in bringing bauxite to their alumina plants. Although users of domestic bauxite save on the transportation cost, this is largely offset by the greater expense in refining the relatively low-grade bauxite mined in Arkansas. Bauxite consists essentially of aluminum in chemical combination with oxygen and water plus other materials regarded as impurities. The grade of bauxite depends on the alumina (aluminum oxide) content and the type of impurities present. The Bayer process of refining requires bauxite with a low silica content. A maximum of 7 percent silica can be handled, but anything over 3 percent is not considered desirable because silica combines with alumina and soda which are thus lost. For each pound of silica in the bauxite, approximately 1 pound of soda and 1 pound of alumina are lost in red mud residue. A modified Bayer process handles bauxite with up to 15 percent silica, but it is more expensive.

No bauxite is shipped to the Pacific Northwest for conversion to alumina. Of the five alumina plants in the country which refine bauxite, three are located on the Gulf Coast and two in Arkansas. Three additional plants on the Gulf Coast are currently under construction. All of the alumina used by aluminum smelting plants in the United States is presently produced at these five plants in this country. However, some alumina will be imported directly from Japan for the Harvey Machine Company plant that is nearing completion at The Dalles in Oregon.

Inspection of their principal raw materials indicates why alumina plants would be most likely to locate in the Gulf region. For every ton of alumina produced from high grade Surinam bauxite, for example, 4,000 pounds of bauxite, 160 pounds of soda ash, 120 pounds of lime, and

[1] For the first two articles, see "The Aluminum Industry—Part I: Development of Production," this *Review*, August 1957, pp. 97-109. "The Aluminum Industry—Part II: Growth of the Market," this *Review*, October 1957, pp. 145-152.

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9,000 cubic feet of natural gas or about 0.7 tons of coal are needed.[1] Location of alumina plants in this region capitalizes on the shortest water transportation of bauxite from foreign sources as well as ready availability of all other principal raw materials, including large reserves of natural gas. Although bauxite could be delivered to Northwest ports, the other raw materials are not available in sufficient volume to allow refining to compete in this area.

The alumina plants in Arkansas, in towns called Hurricane Creek and Bauxite, utilize the bauxite ore found in Arkansas and are also able to draw on lime and gas supplies in the region. Northwest aluminum plants must therefore import their alumina supplies from this region and from the Gulf Coast either by rail or water carrier.

The main activity in aluminum production in the Pacific Northwest is in the smelting of aluminum oxide to aluminum ingot. Although the integrated producers also operate major facilities in the area to process aluminum into sheet, plate, rod, wire, cable, extrusions, and alloyed fabricating ingot, about one-half of the ingot produced in the region in 1956 was shipped to California or Eastern industrial centers for further processing.

Aluminum Smelting in the Pacific Northwest

Three main cost categories stand out in the location of aluminum smelting facilities: transportation costs incurred in bringing needed raw materials to the plants, electric power costs at the plant sites, and, finally, transportation costs incurred in delivering aluminum to the consumers.

For every pound of aluminum metal produced, the following main ingredients are needed:[2]

1.91 pounds of alumina
.60 pounds of carbon paste
.03 pounds of cryolite
8-10 kwh of electric energy

Because of the fact that the proportions of these inputs are held constant in the production of aluminum, a comparison of the delivered costs of these raw materials in plants throughout the country would yield accurate comparisons of direct production costs by producing region. Unfortunately, the paucity of cost data available from the aluminum industry precludes a complete discussion of these items, so comparisons must of necessity be restricted to rather general qualitative terms.

Relative power costs

Power costs have traditionally been the major factor determining the location of smelting plants. Aluminum, in the early days particularly, was tied to hydroelectric sites because of their relatively cheap power. The aluminum industry in the United States has migrated from the Northeast to Tennessee and North Carolina and to the Pacific Northwest seeking low-cost hydroelectric power. Since World War II, a new move has been made to the gas fields of the Texas Gulf region and the lignite fields of Texas and now, most recently, to the coal producing regions of the Ohio Valley. What iron and coal are to steel, bauxite and electricity are to aluminum at the smelting stage. The consumption of power by the aluminum industry in 1955 in the United States, for example, was in excess of 30 billion kilowatt hours. This was almost 5 percent of the total electricity generated within the United States. Although electricity is used in alumina and fabricating plants, smelting plants are much heavier users. The relative importance of electricity in the production of aluminum, however, is understated by expressing power costs as a proportion of total costs. Power rates vary widely from one region to another, and most aluminum plants are already located near sources of relatively low-cost power. For the other inputs, price differentials among areas are based on transportation costs. Such differentials can also be quite high, but large differences in power costs probably are the more important element in the location of aluminum smelting plants.

Just as bauxite mines are tied to bauxite deposits, electrical power plants are tied to hydroelectric sites or to large deposits of primary energy like coal or natural gas. The radius around a generating plant to which electricity can be delivered is limited by the heavy transmission

[1] United States Department of Commerce and the Business and Defense Services Administration, compiled for the Office of Defense Mobilization, *Materials Survey—Aluminum*, Nov. 1956, p. v-5, Table v-1.

[2] *Ibid.*, pp. v-6 through v-8.

losses suffered beyond certain distances. Coal-fueled steam plants are limited in their spatial distribution by the transport costs of shipping coal, especially by rail. The result is that power costs vary considerably from region to region.

Although precise data are not available for power costs in all the aluminum producing regions, some crude comparisons may be made. The Pacific Northwest probably provides the largest block of low-cost electric power to the aluminum industry in the United States. The average cost per kwh for firm power to the aluminum industry in the Northwest for 1955 was slightly in excess of 0.21 cents. Rates close to 0.4 cents per kwh have been reported in the Tennessee Valley and Texas Gulf area. Trade reports on the new facilities being erected in the Ohio Valley place electric power costs from 0.31 cents to 0.4 cents per kwh.

Calculated at 9 kwh per pound of aluminum, a rate of 0.21 cents per kwh, the prevailing rate in the Pacific Northwest, would amount to a power cost of 1.89 cents per pound. With a cost of 0.4 cents elsewhere there would be a differential in favor of the Northwest of close to 2 cents per pound. Recent trade reports indicate that the new coal-fueled steam plants in the Ohio Valley can produce as cheaply as 0.31 cents per kwh. This would constitute a differential of 0.9 cents per pound in favor of the Northwest. These sketchy comparisons of power cost figures indicate a considerable present advantage for the Northwest. With the increase in efficiency of coal-fueled steam plants and the limitations on hydro expansion, however, a tendency is arising to narrow power cost differentials among several regions, with the result that more points have a reasonable potential as aluminum smelting sites.

Transportation cost differences

Although transportation costs on any specific input may not exceed the importance of power costs, the aggregate of transportation costs incurred in assembling raw material inputs and in the marketing of the aluminum ingot is a very significant element in the location of aluminum smelting plants. For every pound of aluminum produced, 2 pounds of alumina and 0.58 to 0.65 pounds of carbon paste must be assembled along with small amounts of cryolite and aluminum fluoride. The Bonneville Power Administration estimates that the freight cost on alumina alone to the Northwest amounts to slightly over 1 cent per pound for each pound of aluminum. Freight costs incurred in assembling carbon paste, aluminum fluoride, and cryolite would add approximately another 0.4 cents per pound to the cost of producing aluminum in the Pacific Northwest.

The location of fabricating plants in relation to markets and smelting plants is also to the disadvantage of the Pacific Northwest. The bulk of the non-integrated fabricators and users of aluminum in this country are concentrated in the populous New England, Middle Atlantic, and North Central states, and freight rates for shipping ingot to the East amount to over 1 cent per pound.

Results of combining costs

Tennessee Valley plants appear to have the most economical cost for assembly of raw materials and some advantage relative to the Pacific Northwest in shipping aluminum to fabricating plants. Power costs of Tennessee Valley producers may be sufficiently greater than for Pacific Northwest plants so that on balance the Pacific Northwest still has a slight net advantage in total delivered cost of aluminum. Ohio plants appear to be better off on assembly costs than the Pacific Northwest because of cheaper transportation for alumina. They also save on transporting aluminum to fabricating points. However, their higher power costs partly offset their other cost advantages. Texas Gulf area plants have a prominent advantage in the assembly of raw materials because of low alumina transportation cost. Delivery costs for aluminum approximate those for Pacific Northwest plants. Power charges vary widely from plant to plant.

These relationships are based on inferential analysis. Firm reliance upon them could be misleading. Perhaps the most valid statement that can be made is that the Pacific Northwest advantage has narrowed if not disappeared. Power costs in areas outside of the Pacific Northwest may still be sufficiently higher so that even for those plants with the largest assembly and deliv-

ery advantage, total costs may fall only slightly below the delivered cost of Northwest aluminum. In any event differentials are probably not so large as to induce established plants in the Pacific Northwest to leave. To do so, a firm would have to demonstrate that the average total cost in the new plants was lower than the average out-of-pocket cost in the old plants. Slightly lower total costs in new plants will only affect the location of additional capacity. Changing technology could modify the present situation, however, just as it has reduced the importance of power in determining smelting plant location by narrowing the spreads between power rates throughout the country.

Prospects for Changes in Relative Costs

Regardless of how valid comparisons are on a current basis, technological changes in both the field of electricity generation and aluminum smelting are rapidly changing the economic structure and locational relationships within the industry. Changes in the demand for aluminum inputs, primarily from competing industries, also upset the feasibility of the current geographic distribution of the processes in aluminum production. Finally, military, foreign policy, and political considerations preclude exact measurement of these factors because of the unpredictability of developments and the inaccessibility of available data. Recent developments, however, provide some rough guide to the future.

Possible bauxite substitutes

Bauxite is the only source of aluminum that is considered economically feasible at present. Practically all of the bauxite mined in the United States comes from two counties in Arkansas. These deposits are rapidly running toward lower grade ore and depletion. As a result, the bulk of our bauxite supplies must come from Surinam, Jamaica, and British Guiana. This development may be viewed with some concern because our shipping links could be cut in time of war. In addition, the considerable transport cost substantially increases the cost of bauxite.

The current methods of producing aluminum from bauxite date back to the late 1880's. Increased use of aluminum and the pressure of war fears and needs have caused other ores to be investigated. Other aluminum-bearing materials are available in large supply. Although the only plants constructed to use these materials have been of pilot-plant size, the rate of technical progress, particularly in the last 17 years, suggests that these ores can be future sources of aluminum. Aluminous clays in one form or another occur practically everywhere in the world. The Pacific Northwest, for example, is well endowed with aluminum-bearing clays. The Bureau of Mines has estimated that there is a minimum of 10 million tons and a maximum of 20 million tons of laterite in northwest Oregon. Laterite ore samples have averaged about 31 percent alumina, 23 percent iron, and 11 percent silica. Washington also possesses large deposits of laterite. The Bureau of Mines estimates there are 71 million tons of clay containing 24 percent alumina at Olson, Idaho; 15 million tons of 30 percent alumina at Castle Rock, Washington; and 103 million tons of 25 and 27 percent grade in Oregon. In addition, in Wyoming along the Union Pacific Railroad anorthosite deposits with 28 percent alumina amount to billions of tons. Although the use of these deposits is not economic currently, technological improvements or wartime necessity could make these deposits useful. Assembly costs of alumina would be substantially reduced for the Northwest if these ores could be refined to alumina economically. However, over fifteen other states also possess large deposits of aluminous clays, and some of these deposits exist in areas that already have smelting capacity. It is currently impossible to say whether an aluminum industry based on these clays would locate in the Pacific Northwest or in another area. As long as the United States has access to high-grade bauxite deposits containing up to 59 percent alumina in South America and the Caribbean Islands, these clay deposits are not likely to be of much importance in the foreseeable future.

Prospects for changing power costs

Electric power generation has been doubling about every ten years. The point is now being reached where additional expansion must be based on more expensive processes than were available in the past. The number of extremely

low-cost hydro power sites is now near exhaustion, with a consequent trend toward thermal power generation based on petroleum, natural gas, and coal. It is also possible that Federal agencies will raise the power costs at multi-purpose dams, as power demands may warrant this move. Despite improvements in the efficiency of thermal plants, the cost of providing more power has been increasing. Meanwhile, however, the amount of electricity used per pound of aluminum has been reduced from 14 kwh to an industry average of 8.5 kwh per pound. This huge reduction in the need for power tends to compensate for the increasing cost of electric power.

Generation from coal

Improvements in the efficiency of coal-fueled steam plants have lowered considerably the cost of power in coal-producing areas. The coal requirement per kwh has dropped from 3.20 pounds in 1919 to under 0.95 pounds in 1955. Increased demands for electricity and lower cost due to improved efficiency have resulted in a 250 percent increase in coal consumption by electric utilities during the past 30 years, from 40 to 140 million tons. The increase from 1950 to 1955 alone was 59 percent.

Only recently has the aluminum industry joined this trend to coal-fueled steam plants in the generation of electricity. Three new plants with a combined annual capacity of 550,000 tons are planned or nearing completion in the Ohio River Valley region that will use power generated from coal-fueled steam plants located practically on the mine mouths. Alcoa started its lignite plant at Rockdale, Texas in 1951. Some reports indicate that the long-run average cost of electricity to the aluminum producers will be about 0.40 cents per kwh. This compares with 0.21 cents per kwh currently charged in the Northwest. The relevant comparison, however, is with the cost of additional electricity in the Pacific Northwest. According to studies made by the Federal Power Commission for the Army Corps of Engineers, the cost of providing additional power in the Northwest will increase average power rates considerably.[1]

[1]Army Corps of Engineers, Department of the Army, *Revision to House Document 531, Columbia River* (Unpublished).

Lignite coal

The first stage in the metamorphosis of vegetable matter to coal is peat. Lignite in turn is the coalified product of peat and in the United States is the lowest rank of combustible matter that is used for burning, gasifying, and coking—the normal large scale outlets for coal. Lignite contains 30 to 40 percent water. Lignite deposits in the United States are of tremendous size with the principal concentrations in the Northern Great Plains, the Rocky Mountains, and the Gulf and Pacific areas. Industrial exploitation of lignite as a fuel in the United States has been limited because of the abundance of higher rank coals close to points of usage and a lack of industry and markets in the area of lignite deposits. Active development has been underway by Alcoa at its Rockdale plant in Texas, however, with electric generation based on lignite as a power source for a 150,000-ton annual capacity aluminum plant. Chemical by-products from the lignite process developed by Alcoa may reduce power costs as markets are developed for them. Lignite is tied rather closely to its region of production because of its low heat content per unit volume and its tendency to deteriorate in storage and transit. One of the features of lignite that has served as a barrier to its use could conceivably become an asset in the case of aluminum smelting, and that is its location in areas of limited industrial activity. The Gulf Coast, which is conveniently located to the source of bauxite, has huge lignite deposits that could well attract an industry that cannot afford to bid competitively for power with other industries that use relatively much less power. How realistic this assumption is can only be known in light of what the costs really are. Aluminum Company of America's decision to expand the original capacity of its Texas plant by 50 percent indicates some success with lignite.

Possible impact of atomic energy

The whole spatial distribution and organization of the United States aluminum industry could be radically altered by the advent of low-cost atomic energy; but, as in the case of other changes, the adjustment would not be instantaneous. One of the features of atomic energy will

be the insignificance of uranium transport costs since a pound of uranium possesses the B.T.U. equivalent of 1,500 tons of coal. In essence, this means that atomic energy can be utilized anywhere. Therefore, atomic energy could be used in the Northwest as economically as anywhere else. What would then determine the actual location of aluminum plants would be factors other than power costs. No longer would industries be attracted to an area because of relatively low power costs despite other disadvantages. At present, electric power based on atomic energy is not competitive with electricity generated from traditional energy sources in most power consuming areas throughout the world.

Review of the Aluminum Position in the Pacific Northwest

The aluminum industry developed in the Pacific Northwest largely in response to military needs for the metal and the availability of unsold or uncommitted power from the newly completed Federal hydroelectric projects in the areas. Almost overnight the Pacific Northwest became the leading center of aluminum production in the United States. In 1939, no aluminum was produced in the region; by 1941, 22 percent of the national output came from the Pacific Northwest. National production quadrupled from 1939 to 1943 after which it began to decline. Aluminum production in the Northwest continued to increase through 1944 when it accounted for 36 percent of the national output. When the war was ended military needs for aluminum were sharply reduced with the result that aluminum production contracted in both the Pacific Northwest and the United States. Since production declined less in the Pacific Northwest, its relative share of the national output increased to a new high of 41 percent in 1945.

By 1947 civilian demand for aluminum began to increase in literally hundreds of uses. Production was stepped up in the converted war plants throughout the country. The Pacific Northwest increased its production faster than the rest of the country as the wartime aluminum plants there were reactivated by Kaiser and Reynolds. By 1948 the Pacific Northwest had not only exceeded its wartime peak production but had raised its relative share of aluminum production to 47 percent. In 1949 its relative share actually rose to 52 percent. (See Table 1) Production continued to expand in the Pacific Northwest with only a slight setback in 1952 due to power curtailment by the Bonneville Power Administration because of low water flow in the Columbia River. National output since 1949, however, has increased even faster than that in the Pacific Northwest.

TABLE 1

PRIMARY ALUMINUM PRODUCTION
UNITED STATES AND PACIFIC NORTHWEST
(000 tons)

Year	United States	Pacific Northwest	Pacific Northwest as percent of U. S.
1939	163.5	....	..
1940	206.3	5.0	2
1941	309.1	67.0	22
1942	521.1	148.0	28
1943	920.2	252.0	27
1944	776.4	281.0	36
1945	495.1	203.0	41
1946	409.6	148.0	36
1947	571.8	265.0	46
1948	623.5	295.0	47
1949	603.5	311.4	52
1950	718.6	343.0	48
1951	836.9	364.1	44
1952	937.3	350.0	37
1953	1,252.0	480.8	38
1954	1,460.6	512.0	35
1955	1,554.3	546.5	35
1956	1,679.0	623.6	37

Source: United States Department of Interior, Bonneville Power Administration, *Columbia River Power and the Aluminum Industry*, July 1953, p. 20.

Upon the outbreak of the Korean War, national production of aluminum was approaching the wartime peak of 1943. But even more new capacity was needed to satisfy the sudden spurt in military needs in addition to the large and rapidly growing civilian demand. Although it was felt that the Pacific Northwest would have surplus power after World War II, it soon became evident with the increase in residential and industrial needs that it would be difficult to satisfy the demands of existing aluminum capacity without curtailing the expansion of other demands. As a result there was no power surplus to draw upon when the need for new aluminum capacity arose. The Southwest with its large gas supplies and proximity to bauxite from the Caribbean area was the most satisfactory alternative.

Of all the electric power contracts negotiated for aluminum production by the Bonneville Power Administration after World War II, only three

were for new aluminum plants; namely, a 108,-500-ton plant at Wenatchee completed in 1952, a 60,000-ton plant at Columbia Falls, Montana, and a 60,000-ton plant yet to be completed at The Dalles in Oregon. (Table 2)

TABLE 2
ALUMINUM INDUSTRY POWER REQUIREMENTS FROM BONNEVILLE POWER ADMINISTRATION IN THE PACIFIC NORTHWEST—1957
(000 kwh)

Plant and location	Contract firm	Normal interruptible[2]	Date of execution	Date of termination
Alcoa				
Vancouver[1]	136	59	10/30/51	10/31/71
Wenatchee[1]	120	65	5/22/51	5/22/71
Anaconda				
Columbia Falls	111	16	6/14/55	2/21/75
Reynolds				
Troutdale	142	45	10/ 2/50	10/ 2/70
Longview	60	65	10/ 2/50	10/ 2/70
Kaiser				
Spokane	189	178	1/ 7/54	9/30/73
Tacoma	50	35	1/ 7/54	9/30/73
Trentwood (rolling)	35	11	1 /7/54	9/30/73
Total	843	474		
Requirements 1958:				
Harvey—The Dalles	41	82	9/13/55	9/13/75

[1] In addition, at each plant—Vancouver and Wenatchee—Alcoa purchases 15,000 kw from the City of Seattle. The Vancouver plant includes rod, wire, cable, and extrusions.

[2] Not included in contracts. Refers only to amounts normally used.

Source: Bonneville Power Administration, *Power Sales and Related Contracts in Effect July 1, 1956.*

These contracts supplied electric power to the aluminum companies at rates lower than anywhere else in the country. The unavailability of more low-cost power in the Pacific Northwest caused aluminum producers to locate new capacity in higher cost power areas that had other cost advantages. In view of power cost advantages in the Pacific Northwest, however, aluminum capacity and output will not be likely to decline there as long as the rates prevailing under the contracts currently in effect continue. If aluminum producers should feel it advisable to cut utilization of capacity from time to time because of temporary overexpansion, the Northwest probably would not be affected more than other areas. The aluminum companies would be prone possibly to cut their large consumption of interruptible power which is more costly to use than firm power.

Prospects for expansion in the Pacific Northwest

If, on the other hand, the demand for aluminum continues to expand, it is not likely that the Pacific Northwest will share as much as other areas in expanding capacity. This is based on rising marginal costs of new electric power in the Pacific Northwest and a narrowing of the power cost advantage for the Pacific Northwest as improvements continue in coal-fueled steam plants. Increases in freight rates also tend to lower the Pacific Northwest advantage. The increase in western markets has expanded nearby markets for Northwest ingot, but the bulk of the output must still be shipped to the industrial centers of the Midwest and East so little reduction in freight costs incurred in marketing the ingot can be expected for the Pacific Northwest. The prospects for new capacity in the Pacific Northwest will depend on the availability of markets and on the relationship of the cost of producing and getting the product to customers as compared to other locations.

Although there are eight Federal dams in the process of construction in the Pacific Northwest which, when completed, will add 6,515,000 kilowatts of capacity to an existing Federal capacity of 3,589,000 kilowatts, the share the aluminum industry will get from the expansion of generating facilities will depend on other requirements for electricity in the area, cost of developing new hydro sites, and Government policy with respect to specific industries. Only crude estimates may be made of future power needs in the Northwest, but it is clear that the cost of developing new hydro power will be higher than it was in the past.

With a probable increase in local demand for electric energy combined with an increasing cost of supply, it is doubtful whether the aluminum industry can count on large new blocks of power at the current low rates as a basis for any large expansion of productive capacity in the Northwest. There has been considerable speculation about the impact that natural gas will have on Northwest power rates in the near future, but most indications are that the price of this natural gas will be too high for electrical generation. Natural gas will most likely be priced competitively with petroleum rather than with hydroelectric power, at least initially. This new energy source, then, does not promise to affect markedly the immediate supply or cost of electric power in the Pacific Northwest.

TABLE 3

PRIMARY ALUMINUM INGOT CAPACITY IN UNITED STATES AND CANADA

(In Short Tons)

Company and plant site	Dec. 31, 1957	Under construction	Total 1958-59
Aluminum Co. of America:			
Alcoa, Tenn.	157,100	....	157,100
Badin, N. C.	47,150	....	47,150
Evansville, Ind.	....	150,000	150,000
Massena, N. Y.	112,250	37,500	149,750
Pt. Comfort, Texas	120,000	20,000	140,000
Rockdale, Texas	150,000	....	150,000
Vancouver, Wash.	97,500	....	97,500
Wenatchee, Wash.	108,500	....	108,500
Totals	792,500	207,500	1,000,000
Reynolds Metals Company:			
Arkadelphia, Ark.	55,000	....	55,000
Jones Mills, Ark.	109,000	....	109,000
Listerhill, Ala.	77,500	112,500	190,000
Longview, Wash.	60,500	....	60,500
Massena, N. Y.	....	100,000	100,000
San Patricio, Texas	95,000	....	95,000
Troutdale, Ore.	91,500	....	91,500
Totals	488,500	212,500	701,000
Kaiser Aluminum & Chemical Corporation:			
Chalmette, La.	247,500	....	247,500
Mead, Wash.	176,000	....	176,000
Ravenswood, W. Va.	36,000	109,000	145,000
Tacoma, Wash.	38,500	2,500	41,000
Totals	498,000	111,500	609,500
Anaconda Aluminum Co.:			
Columbia Falls, Mont.	60,000	....	60,000
Harvey Aluminum Co.:			
The Dalles, Ore.	....	54,000	54,000
Ormet Inc. (Olin-Revere)			
Omal, Ohio	....	180,000	180,000
Total others	60,000	234,000	294,000
U. S. totals	1,839,000	765,500	2,604,500
Aluminum Co. of Canada:			
Arvida, Que.	367,000	....	367,000
Beauharnois, Que.	38,000	....	38,000
Isle Maligne, Que.	115,000	....	115,000
Kitimat, B. C.	186,000	90,000	276,000
Shawinigan Falls, Que.	70,000	....	70,000
Totals	776,000	90,000*	866,000
Canadian British Aluminium, Ltd.:			
Baie Comeau, Que.	45,000	45,000	90,000
Canada totals	821,000	135,000	956,000
Total United States and Canada	2,660,000	900,500	3,560,000

Data represents actual installed capacity without regard to state of power supply, additional capacity in various stages of construction, and, with exception of Alcan, projected operable capacity by end of 1959.

*Partially constructed; completion date deferred.

Source: American Metal Market Company, *American Metal Market*, Vol. LXV, No. 3 (January 4, 1958), p. 8.

The outlook

The Pacific Northwest has been losing its relative importance in the aluminum industry since 1950 when a movement took place to the Southwest where aluminum firms could draw on natural gas and lignite supplies. In 1955 the Pacific Northwest produced 35 percent of national output as compared with 48 percent in 1950. This trend is continuing with the recent shift to the Ohio Valley. Alcoa and Kaiser are completing construction of two large plants in that region where they will utilize coal-fueled steam plants as the source of power. Ormet Corporation, a company newly organized by Olin Mathieson, has also announced plans to build a plant in the area. Upon the completion of these plants by 1958, the Ohio Valley will have 475,000 tons of capacity as compared with approximately 629,000 tons capacity in the Pacific Northwest. (Table 3)

A combination of factors, most of which were mentioned earlier, have been responsible for the move to the Ohio Valley. Although the power costs in the Ohio Valley are considerably higher than those existing in the Pacific Northwest, the cost of acquiring additional electricity in the Northwest sufficient to supply the huge current expansion of the United States aluminum industry would probably be higher still. In addition, there is much more uncertainty about future power rates in the Pacific Northwest because rates to some extent are determined by government policy.

One projection about the future of the aluminum industry in the Pacific Northwest can be made with relative certainty. As total aluminum smelting capacity continues to expand, the Pacific Northwest will not share proportionately in its increase. Although present low power rates compensate for a good part of the other cost disadvantages of location in the Pacific Northwest, additions to capacity in this area can only be supplied by higher cost power that will make them higher cost plants than those located more advantageously with respect to assembling raw materials or marketing the finished product. The Pacific Northwest will, however, continue to supply an impressive fraction of the national aluminum output in the foreseeable future.

BUSINESS INDEXES — TWELFTH DISTRICT[1]

(1947-49 average = 100)

Year and month	Industrial production (physical volume)[2]							Total nonagricultural employment	Total mf'g employment	Carloadings (number)[2]	Dep't store sales (value)[2]	Retail food prices[3, 4]	Waterborne foreign trade[3, 5]	
	Lumber	Petroleum[3] Crude	Petroleum[3] Refined	Cement	Lead[3]	Copper[3]	Electric power						Exports	Imports
1929	95	87	78	54	165	105	29	....	....	102	30	64	190	124
1933	40	52	50	27	72	17	26	....	....	52	18	42	110	72
1939	71	67	63	56	93	80	40	....	55	77	31	47	163	95
1948	104	101	100	104	105	101	101	102	102	100	103r	103	86	98
1949	100	99	103	100	101	93	108	99	97	94	98	100	85	121
1950	113	98	103	112	109	113	119	103	105	97	107r	100	91	137
1951	113	106	112	128	89	115	136	112	120	100	112r	113	186	157
1952	116	107	116	124	87	112	144	118	130	101	120r	115	171	200
1953	118	109	122	130	77	111	161	121	137	100	122r	113	140	308
1954	116	106	119	133	71	101	172	120	134	96	122r	113	131	260
1955	124	106	122	145	75	117	192	127	143	104	132r	112	164	308
1956	119	105	129	156	77	118	210	134	152	104	141r	114	195	443
1956														
November	111	104	135	146	79	123	216	137	156	100	143r	116	242	401
December	112	103	132	139	72	123	210	137r	159	106	144r	116	234	436
1957														
January	108	102	131	120	79	125	220	138r	160	105	137r	116	237	421
February	115	102	130	127	88	138	211	138	159	96	141r	117	269	417
March	115	101	132	140	88	133	221	138	159	100	146r	116	267	489
April	111	101	132	154	78	135	228	138	159	103	137r	117	298	534
May	111	101	138	157	82	126	229	138	159	99	141r	117	283	698
June	114	101	131	152	75	130	239	139	160	100	148r	118	252	511
July	109	101	133	162	68	113r	238	138	159	94	141r	118	188	770
August	...	101	137	160	74	116r	233	138	156	97	144r	118	210	572r
September	...	102	135	169	74	127r	217	138	155	93	141r	119	173	607
October	...	101	132	161	75	126r	223	138	153	91	134r	119	....	....
November	...	101	131	...	...	125	...	137	152	95	139	119	....	....

BANKING AND CREDIT STATISTICS — TWELFTH DISTRICT

(amounts in millions of dollars)

Year and month	Condition items of all member banks[6] Loans and discounts	U.S. Gov't securities	Demand deposits adjusted[7]	Total time deposits	Bank rates on short-term business loans[8]	Member bank reserves and related items — Factors affecting reserves: Reserve bank credit[9]	Commercial[10]	Treasury[10]	Money in circulation[9]	Reserves[11]	Bank debits index 31 cities[9, 12] (1947-49 = 100)[3]
1929	2,239	495	1,234	1,790	.....	− 34	0	+ 23	− 6	175	42
1933	1,486	720	951	1,609	.....	− 2	− 110	+ 150	− 18	185	18
1939	1,967	1,450	1,983	2,267	.....	+ 2	− 192	+ 245	+ 31	584	30
1950	7,093	6,415	9,254	6,302	3.35	+ 39	−1,141	+1,198	− 14	2,026	115
1951	7,866	6,463	9,937	6,777	3.66	− 21	−1,582	+1,983	+ 189	2,269	132
1952	8,839	6,619	10,520	7,502	3.95	+ 7	−1,912	+2,265	+ 132	2,514	140
1953	9,220	6,639	10,515	7,997	4 14	− 14	−3,073	+3,158	+ 39	2,551	150
1954	9,418	7,942	11,196	8,699	4.09	+ 2	−2,448	+2,328	− 30	2,505	154
1955	11,124	7,239	11,864	9,120	4.10	+ 38	−2,685	+2,757	+ 100	2,530	172
1956	12,613	6,452	12,169	9,424	4.50	− 52	−3,259	+3,274	− 96	2,654	189
1957	13,236	6,595	11,682	10,530	4.97	+ 31	−4,164	+3,903	− 83	2,686	203
1956											
December	12,804	6,383	12,078	9,356	4.65	− 17	− 303	+ 451	+ 38	2,654	200
1957											
January	12,488	6,505	11,812	9,587	.....	+ 33	− 558	+ 249	− 144	2,548	206
February	12,556	6,356	11,279	9,690	.....	+ 41	− 816	+ 494	− 139	2,517	200
March	12,576	6,177	11,129	9,794	4.74	− 37	− 170	+ 170	− 9	2,495	199
April	12,649	6,520	11,622	9,839	.....	− 35	− 445	+ 430	− 31	2,560	202
May	12,694	6,315	11,210	9,995	.....	+ 56	− 261	+ 209	+ 54	2,526	200
June	12,911	6,249	11,310	10,155	4.81	− 29	− 374	+ 402	+ 20	2,483	203
July	12,912	6,319	11,407	10,188	.....	− 49	− 426	+ 320	+ 6	2,457	205
August	12,945	6,313	11,329	10,220	.....	+ 50	− 145	+ 292	+ 39	2,592	197
September	13,178	6,293	11,561	10,301	5.21	− 109	− 434	+ 480	− 30	2,581	204
October	13,064	6,433	11,570	10,417	.....	+ 76	− 322r	+ 159r	− 8	2,517	200
November	13,185	6,357	11,770	10,304	.....	+ 14	− 298	+ 447	+ 37	2,652	202
December	13,236	6,595	11,862	10,530	5.13	− 18	− 454	+ 480	− 23	2,686	217

[1] Adjusted for seasonal variation, except where indicated. Except for department store statistics, all indexes are based upon data from outside sources, as follows: lumber, California Redwood Association and U.S. Bureau of the Census; petroleum, cement, copper, and lead, U.S. Bureau of Mines; electric power, Federal Power Commission; nonagricultural and manufacturing employment, U.S. Bureau of Labor Statistics and cooperating state agencies; retail food prices, U.S. Bureau of Labor Statistics; carloadings, various railroads and railroad associations; and foreign trade, U.S. Bureau of the Census. [2] Daily average. [3] Not adjusted for seasonal variation. [4] Los Angeles, San Francisco, and Seattle indexes combined. [5] Commercial cargo only, in physical volume, for Los Angeles, San Francisco, San Diego, Oregon, and Washington customs districts; starting with July 1950, "special category" exports are excluded because of security reasons. [6] Annual figures are as of end of year, monthly figures as of last Wednesday in month. [7] Demand deposits, excluding interbank and U.S. Gov't deposits, less cash items in process of collection. Monthly data partly estimated. [8] Average rates on loans made in five major cities. [9] Changes from end of previous month or year. [10] Minus sign indicates flow of funds out of the District in the case of commercial operations, and excess of receipts over disbursements in the case of Treasury operations. [11] End of year and end of month figures. [12] Debits to total deposits except interbank prior to 1942. Debits to demand deposits except U.S. Government and interbank deposits from 1942. *p*—Preliminary. *r*—Revised.