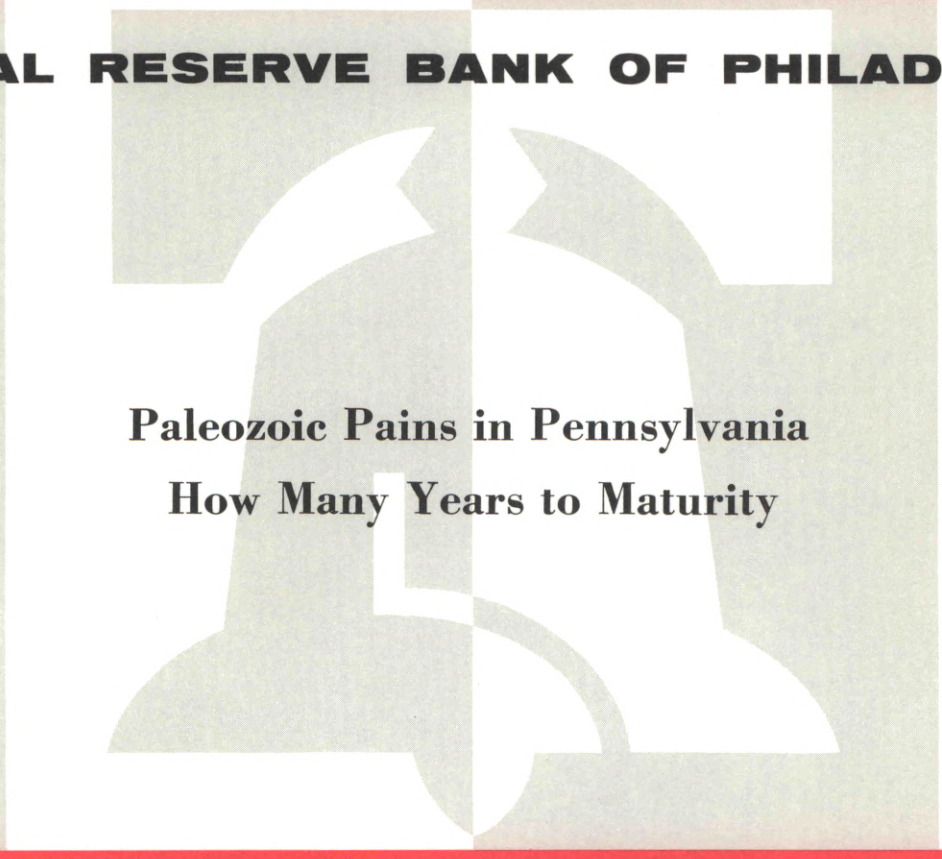
BUSINESS REVIEW

FEDERAL RESERVE BANK OF PHILADELPHIA



Paleozoic Pains in Pennsylvania

How Many Years to Maturity

FEBRUARY 1963

BUSINESS REVIEW is produced in the Department of Research. Evan B. Alderfer was primarily responsible for the article, "Paleozoic Pains in Pennsylvania" and Jack C. Rothwell for "How Many Years to Maturity." The authors will be glad to receive comments on their articles.

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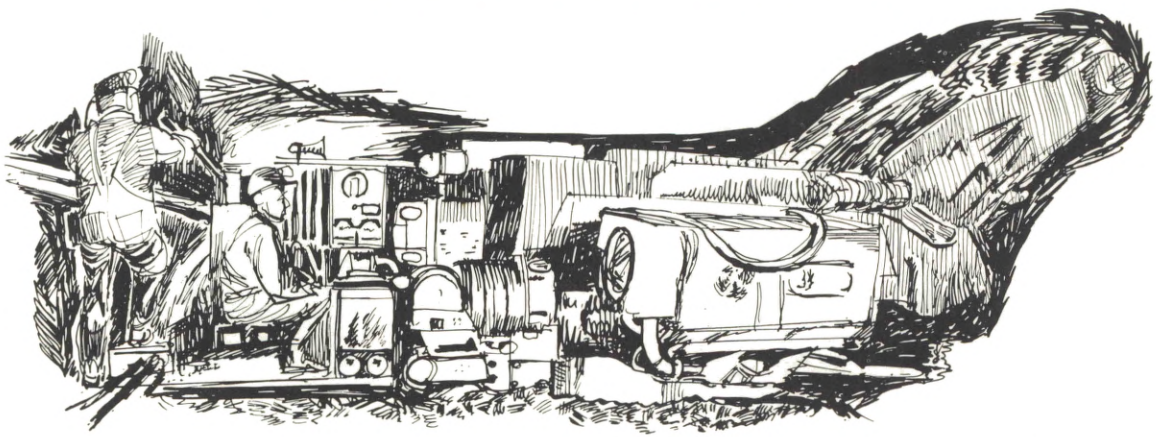
PALEOZOIC PAINS IN PENNSYLVANIA



Approximately 285,000,000 years ago Pennsylvania was in worse shape than it is today. Of course there were no budgetary problems, no urban congestion, no worries about growth, no excess capacity, no unemployment, and no labor-management discord. Yet, these present-day difficulties of the Commonwealth have roots 285 million years deep.

By the geologist's calendar, the Paleozoic Era had just begun to dawn. The climate was damp and the landscape was bleak and dreary. Land contended with water for domination. Leviathans infested the seas and primitive reptiles made their appearance on land. Great ferns and forests flourished, and Pennsylvania resembled the Great Dismal Swamp.

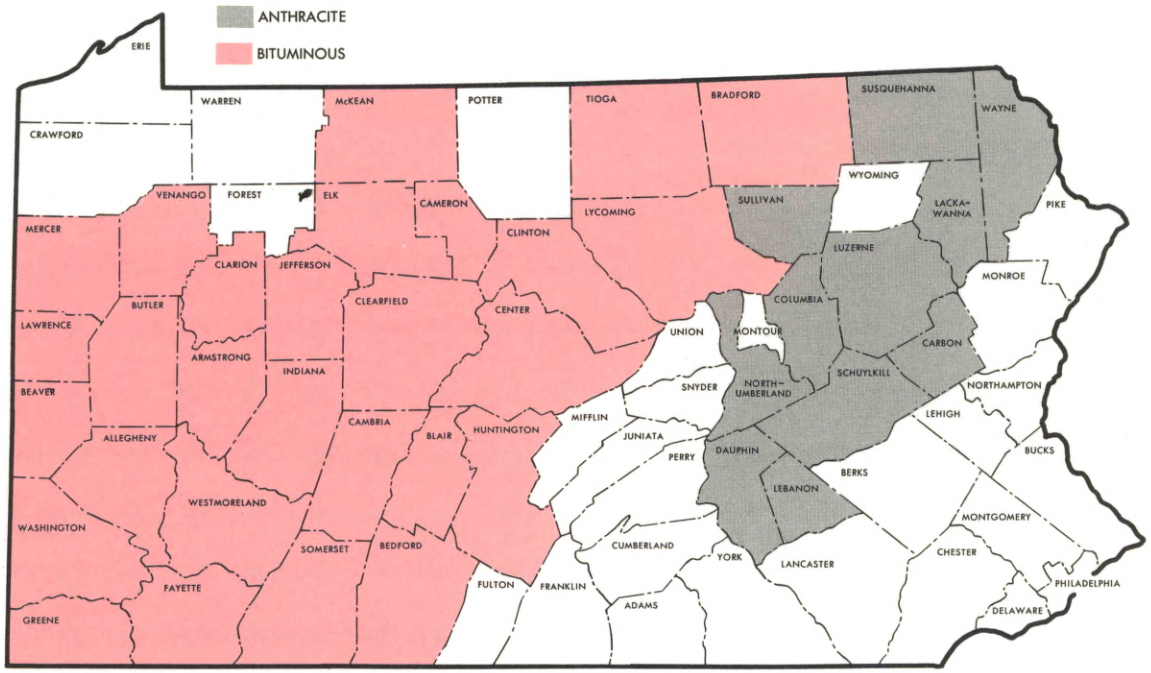
Time went on and on and on. Through cycles and seasons, plant life grew and decayed. Over inconceivably long periods of time the accumulation of roots, tree trunks, leaves, twigs, shrubs, grasses, and mosses that had been covered with water so that decomposition had been retarded formed deep layers of black muck and peat. Periodically, the encroaching ocean covered the accumulated muck with sand and silt, so that the swamp lay buried thousands of feet deep by sediment from the receding land surface.

At various times during the 80 million-year carboniferous or coal-forming period the land heaved and at other times it sank to form alternate layers of coal beds, interspersed with layers of shale and sandstone. Under great pressure through milleniums of build-up, the original deep peat beds of ancient swamps were compressed into shallower seams of true coal, ranging in thickness from four feet or less to ten feet or more. So it came to pass that Pennsylvania, as part of the Appalachian coal fields, was endowed with a rich understructure of energy which predestined the Commonwealth to become a great industrial empire.

Paleozoic pattern of industrial Pennsylvania

Over half the counties of Pennsylvania have coal deposits—anthracite in the east and bituminous in the west. Hard coal was to play a minor role in the state's industrialization, but bituminous

COAL PRODUCING COUNTIES OF PENNSYLVANIA



deposits were a storehouse packed with power.

Before coal became indispensable in the making of iron and steel, Pennsylvania's rich forest resources supplied the fuel in the form of charcoal for the early forges and furnaces. Pennsylvania, loaded with energy above and below ground, was doubly destined for an iron and steel economy. As early as 1750, colonial Pennsylvania was the leader in iron manufacture. Early furnaces in the Lebanon, Lehigh, Schuylkill, and Susquehanna valleys were known as iron plantations because of the vast forest acreage required to supply the charcoal for smelting local ores.

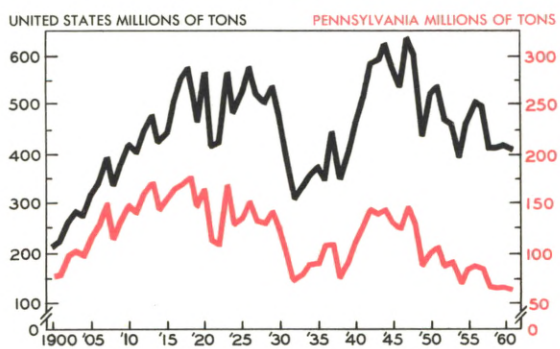
As charcoal became scarcer in the early 19th century, ironmasters shifted to anthracite—a more compact fuel. Hard coal, better adapted for space heating, was soon replaced by a superior metallurgical fuel—coke—made from bituminous coal. The shift to coke began about the time of the Civil War, when furnace operators found that coke burns well without caking, leaves less ash than coal, and is strong enough to carry the furnace load of ore and limestone. Connellsville coke soon became the standard blast furnace fuel, because bituminous coal from that area made the best metallurgical coke.

Other developments that contributed to the rise of Pennsylvania's industrial empire are more familiar history: the invention of the Bessemer process which ushered in steel, a low-cost industrial metal; the appearance of the open hearth furnace to make quality steels; the discovery of the fabulously rich iron ore deposits at the western end of the Great Lakes, which afforded cheap water transportation eastward; the rise of Pittsburgh as a great steelmaking center; the building of the railroads and the

rise of big railway car shops at Altoona; the construction of rolling mills at strategic points throughout Pennsylvania to roll rails for the railways, girders for bridges and skyscrapers, steel plates for shipbuilding and armor for battleships; and the development of iron and steel foundries to make the more intricate shapes indispensable to a machine civilization.

Steel is basic to all industries, and bituminous coal is basic to steel. As the coal industry prospered, Pennsylvania prospered. Pennsylvania built fleets of coal-burning locomotives that hauled trainloads of coal to the manufacturing plants of Pennsylvania and to those of other states. By the time of World War I, Pennsylvania had well earned its sobriquet "the Keystone State." This was also the period when coal

BITUMINOUS AND LIGNITE PRODUCTION



production in the Commonwealth reached its zenith. In 1918, bituminous mining in Pennsylvania attained its peak of 179 million tons, but has since declined to a level of 65 million tons. Anthracite fared worse; annual production which just failed to reach a peak of 100 million tons is now less than 20 million tons.

Pennsylvania in a time of trouble

Today, Pennsylvania is not in the best of health. Industrial growth has slowed down, and much of the slowdown is related to coal. Examples of industries closely related to coal are basic steel, steel fabricating, iron and steel foundries, railroads and railway car shops, shipbuilding, cement, ganister, and other quarry products. Some of these industries have passed their prime, or at least have passed their prime in Pennsylvania. With the westward shift of population, discovery of new mineral resources, development of new technologies, and construction of new plants closer to their rapidly growing local markets, Pennsylvania could not hope to hold its former position in the competitive race—but that doesn't solve her problems.

About 340,000 Pennsylvanians are out of work and looking for jobs. As a percentage of the work force, unemployment in Pennsylvania is considerably above the national average. The burden of unemployment is especially acute in the coal regions. Latest reports show unemployment in excess of 6 per cent in eight of the 11 anthracite counties and in 26 of the 28 bituminous counties. In some of the industrial centers within these counties, unemployment runs as high as 20 per cent. Fundamentally, though not exclusively, the pains in Pennsylvania are Paleozoic.

When the coal business ran into trouble, Pennsylvania ran into a lot of trouble because the Commonwealth was the country's original coal bin. To date, the state has mined over 8 billion tons of bituminous and over 5 billion tons of anthracite. Of hard coal and its hard times, Pennsylvania has had a virtual monopoly. Some of these difficulties have been explored in former issues of the *Business Review*.* Let us now turn our attention to soft coal and its hard times.

* "The Black Diamond Country," June, 1949; "Joe Kosek Looks Ahead," March, April, and May, 1956.

THE BITUMINOUS COAL INDUSTRY OF THE UNITED STATES

The bituminous industry is a complex, carboniferous, competitive colossus. It is a profusion of many producers who use various ways to extract different kinds of bituminous coal under differing but generally difficult conditions for highly cost-conscious markets that buy competitive fuels at the slightest drop of a price. Over the years, the industry has taken some rough bumps and although vulnerable for still more trouble, the bituminous industry is voluble, viable, vigorous, and venturesome. In 1961, more than 7,500 mines dug up 400 million tons of bituminous coal and lignite (a poor relation), and after it was above ground the coal was worth about $2 billion. Formerly, over a half-million workers would have been required to dig that much coal, but in 1961 the industry employed only 150,000 workers and they toiled only 193 days. That comes to an average of about 14 tons of coal a day for each worker. It is well to keep in mind, however, that averages are mythical, especially in an industry like bituminous where everything is different and nothing ever stays the same. The outstanding characteristic of the industry is its complexity, its fearful and wonderful intricacies, most of which may be ascribed to the nature and occurrence of coal—its Paleozoic base.

Bituminous burns, but . . .

Bituminous coal is a generally black, rock-like stuff that burns; but no two lumps are exactly alike in all respects. Chemists who have taken it apart have established various grades ranging from sub-bituminous of low carbon content to semi-bituminous of high carbon content and little volatile matter. (Ranking below sub-bituminous is lignite, which has too much moisture and too many other shortcomings to make the grade; and ranking above semi-bituminous is anthracite, which is almost pure carbon.)

Differences in physical and chemical properties destine different kinds of coal for different uses. Most bituminous is used as a boiler fuel to generate electricity. Other kinds are preferred to make blast furnace or foundry coke or to fire furnaces in cement and other industries. For space heating, bituminous is too smoky to suit most customers.

Geography with tears

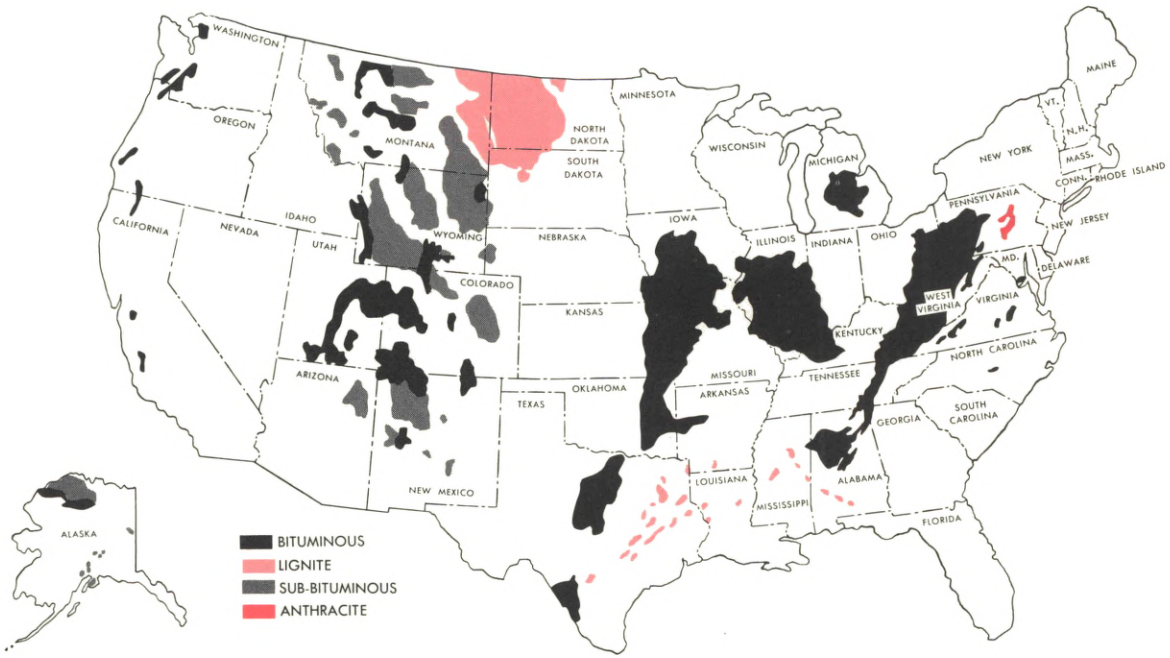
The accompanying map affords an astronaut's-eye-view of the geography of coal in the United States. Note the crazy distribution, the emptiness of New England and New York, as well as the wide coal-less belts flanking the Rockies. Moreover, many of the deposits are in the thinly peopled hinterlands and it costs a lot of money to haul coal. The biggest reserves are not far enough west to be of much use to the swarms of people on the West Coast.

What the map doesn't show is that half the current output comes from three states—West Virginia, Kentucky, and Pennsylvania. If Illinois, Ohio, and Virginia are included, we get what might be called the "Big Six" which account for 86 per cent of the industry's current output. Pennsylvania, the original leader and now running third has been described as being mined out. That's slander. What the coal man who made the statement meant to say was that the most accessible deposits have already been mined—but there is still much coal remaining.

Geology without mules

How coal is dug out of the mines depends largely on the depth, thickness, inclination, and

COAL AREAS IN THE UNITED STATES



regularity or irregularity of the seams. A drift mine is one with a more or less level tunnel from the side of a hill to the coal seam. A slope mine gets to the coal seam with a bore going down a gradual decline. In a shaft mine, you take an elevator—without plush carpet—straight down, usually several hundred feet, to the coal seam where you grope your way with the aid of a lamp on your cap, along a low-ceiling passageway formed by the space formerly occupied by coal to the points where the miners are busily engaged extending the dark and dreary underground tunnels in several directions. En route, you pass no storefronts but perhaps a hole in the coal wall that serves as the supervisor's office where you can see a detailed blueprint of the underground, resembling the street layout of a city; and at another hole in the wall you may notice the first-aid station with stretchers and related emergency equipment, which makes you wonder whether the sightseeing trip was necessary.

Mules are obsolete and pick-and-shovel mining is obsolescent. Coal mining has undergone marvelous mechanization. An astonishing variety of power-driven machinery is used below ground to dislodge the coal from the seam, to load it on conveyor belts or narrow-gauge railways to bring it to the tipple on the surface where other machinery cleans, screens, and prepares the coal for the market. Almost nine-tenths of the coal mined underground is now loaded mechanically.

In open-pit mining (called stripping), power shovels are used to remove the overburden of shale and sandstone to expose the coal seam. Stripping employs power shovels, and some of these monsters are tall as a 15-story building and the operator must take an elevator to get to his cab. The dipper scoops up 175 tons of

dirt and rock in one bite. One of these monsters costs six to eight million dollars. Power-driven augers up to six feet in diameter drill 200 feet into exposed coal seams. About one-third of the current output is now strip and auger production. Careless stripping leaves horrible gashes, destroys fields and streams, and leaves the countryside ugly, desolate, and useless for generations. This adds to the economic pains of Pennsylvania.

About one-fifth of the coal is being mined with continuous mining machines. Called the "pushbutton miner," a continuous mining machine is a self-propelled hippo, with an ugly-looking face full of teeth that rapidly eats its way as far as a thousand feet into a vein of coal.

Mechanization, more than anything else, has saved the coal industry from becoming a museum piece along with dinosaurs and dodo birds that have left fossiliferous footprints in coal. The industry is completely unionized, and wage rates are among the highest in the country. Years ago, miners and operators used to fight each other like the Kilkenny cats; but there has been no major strike for over a decade, during which mechanization has made peaceful and powerful strides. Mechanization performed the miracle of converting high wage rates into low mining costs.

The tipple tally

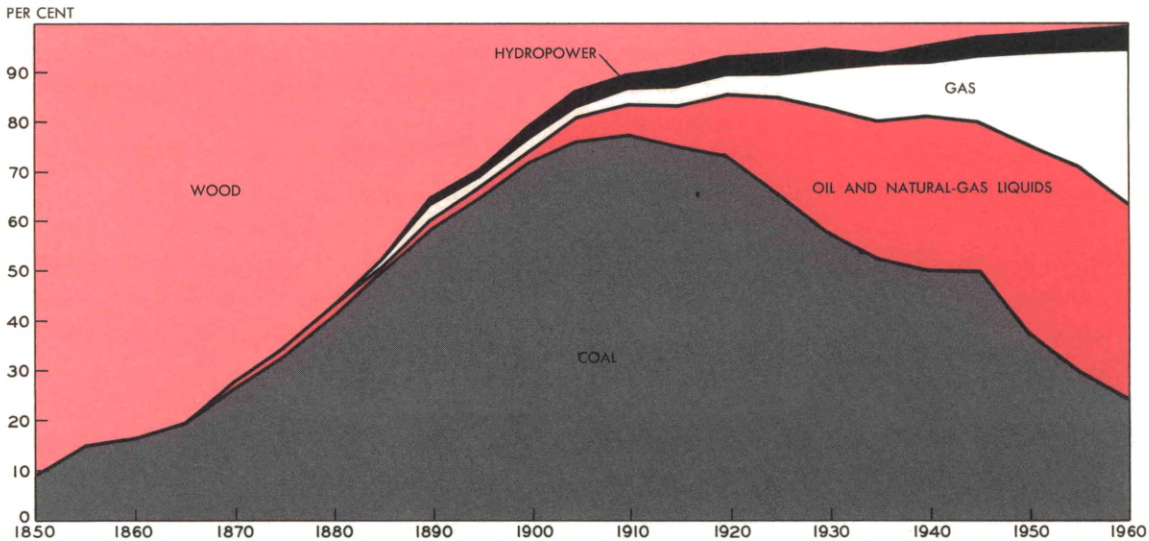
A tipple is a coal mine's surface structure housing the machinery that prepares the coal for market. It got its name from the original simple device for upsetting the little carloads of coal brought up from the depth. Every mine has its tipple whether simple or elaborate. The latest tipple count shows over 7,600 bituminous and lignite mines. At the turn of the century the tipple count was around 3,000, and has since been three times as high. Changes as large as 1,700, up or down, take place from one year to the next. The ever-changing tipple total reflects the ease of entry and exit in the coal business, but it can be misleading. There are a lot of in-and-outers—"snowbirds" who come in when the mercury drops and coal prices rise, only to cease production when the mercury rises and prices drop. Over half of the mines, each producing less than 10,000 tons of coal a year, account for less than 5 per cent of the country's production. At the other extreme are 200 big mines, each turning out over a half-million tons annually, and together they produce half of the country's coal. Between the extremes is an assortment of intermediate-sized mines striving to become giants.

Additional complications are encountered when you consider ownership. Some companies operate more than one mine, and not all companies mine coal for sale. Some of the big coal consumers like iron and steel manufacturers and electric utilities own and operate their own mines. Such mines are called captive mines, and captive coal production accounts for about one-fifth of the total output. The 80 per cent for sale goes to the fuel supermarket.

Marketing—Ay, there's the rub

Extracting coal is hard enough, but once coal is above ground the troubles really begin. Curiously, the marketing difficulties are also of Paleozoic origin; for it was millions and millions of years ago that Nature fabricated competitive fuels to plague coal. The villains of the piece and the damage they have wrought are shown in the accompanying pictograph. Note the big bites that oil and gas have taken out of the coal industry's market. Just as the woodpile was replaced by the coal pile, the

ENERGY SOURCES



Source: Schurr and Netschert; 1960 figures based on Bureau of Mines data.

coal pile is being replaced by oil and gas; and who knows, all three may be replaced by the atomic pile which is the latest threat, though not yet hefty enough to have gotten into the diagram.

When Taft was President and the Standard Oil Trust was legally dissolved, the coal industry was at its peak as a source of energy. Coal, of course, continued to grow but its share of the energy market started downhill a half-century ago. Petroleum, as you see, made the first serious inroads on the coal market; and now gas is giving both coal and petroleum a hard time.

Coal has the misfortune of being a solid and, as such, requires expensive hauling to get it to market. The railroads do most of the hauling—fortunately for them and for us motorists—but the haulage adds considerably to the cost of coal for the user. In 1961 the average value of a ton of coal f.o.b. at the mines was $4.58, but railroad freight charges added another $3.40 to the consumer's cost. Petroleum and gas get to market at considerably less cost through continental networks of pipelines and gas mains.

A high point of coal consumption occurred in 1943 at near 600 million tons, which is indicative of its importance in times of national emergency. Subsequently, one coal market after another has shrunk so that total consumption has declined over one-third to a level of 375 million tons.

Et tu, railway

The railroads, of all industries—so dependent on coal carriage for revenue—have virtually forsaken the coal industry as customers. Railroads have their own troubles and, in their zeal to cut costs and stay alive, they switched from coal-burning steam locomotives to the more efficient Diesels, and thereby the coal industry lost a 130 million-ton customer. The steel industry isn't breaking any production records and has learned to make a ton of steel with less

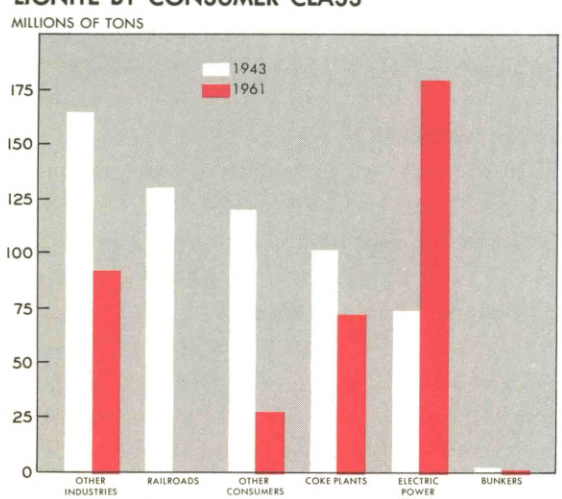
coke than heretofore and is now using only about half as much coal as it did during the war.

Coal consumption by other manufacturing industries has also declined substantially. Marine craft of all kinds used to burn bunker coal but, like the railroads, they too have shifted to oil-burning power plants, so that market has almost dried up. Coal for retail delivery, largely for space-heating purposes, has gone down from 120 million tons in 1943 to 30 million tons or less.

Electric power utilities are the only major bright spot in an otherwise somber market situation. Their consumption of coal has risen from 74 million tons in 1943 to 180 million tons. But even that market for coal is not assured because many of the utilities are equipped to burn oil or gas as well as coal and shift whenever it is to their advantage. The big electric utilities employ sharp pencilpushers and the moment they spy a lower-priced oily or gaseous B.t.u., they forsake Old King Coal.

Exports, we almost forgot to say, are up also, but not phenomenally. Bituminous exports are

CONSUMPTION OF BITUMINOUS COAL AND LIGNITE BY CONSUMER CLASS



erratic; they shot up to 76 million tons during the Suez crisis, after which exports declined again to a 35 million-ton level. The world market is big and rough because there are so many participants in the arena.

A bill of complaints

The bituminous industry feels that it is "a stepchild in the national economy," that the Government's programs and policies "pay little or no heed to the over-all energy welfare of the nation . . ." that "[Governmental policies] are uncoordinated, contradictory, and inconsistent."

The industry points out that its Eastern Seaboard market suffers seriously from imports of foreign residual oil permitted under the Government's quota system. As an example, it estimates the 1962–1963 quota year allowing imports of 185 million barrels of such by-product residual oil deprives Pennsylvania and the Virginias of a market for 44 million tons of coal.

Governmental bodies, it is alleged, condone and promote unfair competition from natural gas. In the summertime, when gas is a drug on the market, the gas people unload "dump gas" at low prices to consumers equipped to switch from one fuel to another. The major part of the country's gas production is piped into areas not served by coal, but one-fourth, or the equivalent of 22 million tons of coal, is in direct competition with coal.

Moreover, the industry maintains that in the name of navigation, irrigation, and other miscellaneous purposes, huge hydroelectric developments have been constructed, largely at Government expense, to displace coal in present or potential markets. Again, in the name of research and development, nuclear power plants—in part subsidized by the Government—have

been and are being constructed in locations served by bituminous coal. In these and other ways the coal industry alleges that the Government has encouraged or permitted unfair competitive practices seriously prejudicial to the coal industry.

When you attend an annual convention of the coal industry and listen to the tales of woe propounded from the podium by one coal operator after another; when you burrow through the statistical tomes and observe the declining curves of production, employment, and consumption, and the part-time operation, and the idle capacity; when you visit a mine and see oil-powered machinery digging coal, or go to seek information at a coal dealer's sales office in a building heated by oil or gas, you may get the impression that the bituminous industry is just about washed up. We do not wish to create that impression—please read on.

Bituminous in the energy complex

Coal, to be sure, is no young Cinderella industry with visions of fanciful growth and a glorious future. It is a battle-scarred veteran with tremendous resources and the will to continue the fight not only to hold but to regain a firmer hold on the ever-growing energy market. The vigor of the veteran was demonstrated in postwar 1947, when the industry established a new record of production of 630 million tons.

Fortified with huge resources of coal reserves, estimated good for several hundred or for several thousand years, depending upon various assumptions, the industry has made and continues to make heroic efforts to stay competitive. We have already observed some of the major strides made in the mechanization of coal mining which have worked wonders in keeping coal prices in the running with competitive fuels.

Larger coal markets are also sought through technological improvements in burning coal. One of these is a medium-sized package boiler unit. A package boiler is a compact coal-burning plant in which boiler, firebox, automatic stoker, all control systems for coal feed, water feed, temperature and pressure, and the like, are assembled and shipped as a single, integrated unit ready to be connected to the coal-supply and ash-disposal systems.

Getting coal to market, as previously stated, is very expensive even after the industry has persuaded the railroads to give them coal rates to specific designations and areas substantially below their former rates. The industry continues to hammer away at the transportation problem. One possibility with promise is pipeline transportation of coal. If coal is pulverized and mixed with water to form a slurry, the mixture can be transported by pipeline. One Ohio coal company pipes its coal over a hundred miles to a public utility in Cleveland at less than one-third of the freight charges formerly paid to the railroads. Naturally, the railroads don't welcome that form of competition and are reluctant to grant rights-of-way to companies seeking to bore under their tracks to lay coal slurry pipelines.

To lick the high cost of transporting coal by rail, Sunday supplement engineers have long advocated construction of electric generating stations at the mine mouth to transport "coal by wire" in the form of kilowatts over high-tension lines. Heretofore, numerous obstacles have prevented the dream from coming true. For example, many a mine mouth lacks the water needed for condensing purposes at a power plant, and high-tension transmission of electricity gets expensive at distances in excess of a few hundred miles.

The dream, however, seems to be coming true,

for late in 1962 the *Wall Street Journal* reported plans of three major Middle Atlantic states power systems to spend $350 million for the construction of two huge power plants and interconnecting transmission lines. Both power stations are to be built right in the coal fields—one in West Virginia, the other in western Pennsylvania near Johnstown. More than 600 miles of half-million volt transmission lines will carry kilowatts to 30 million consumers in metropolitan Philadelphia and New York City. Eighteen utilities will be linked together in the gigantic power pool that is to go into operation upon completion in 1967. The project should be welcome to the coal industry because the estimated costs of getting the energy to market will be cut in half.

On the research frontier

In mid-1962 the coal industry dedicated a new million-dollar laboratory at Monroeville near Pittsburgh. There, white-coated technicians with the best of laboratory and library facilities are engaged in exploring new frontiers for coal.

Most of the coal made into coke is processed in by-product ovens which yield gas and other by-products utilized in the manufacture of fertilizers and a variety of end products. Unfortunately, the same products are also made by the petroleum and petrochemical industries and generally at lower costs. It appears, therefore, that coal research needs to be directed into other channels.

A speaker at the dedication of the new Monroeville laboratory predicted a bright future for the industry. His remarks were based on an extensive study of coal's market potential. According to that study, the best prospects for larger markets should arise from: (1) development of improved coal-fired boilers; (2) introduction of low-cost methods of transportation (such as coal slurry pipelines, extra-high-voltage transmission, and integral trains that specialize in hauling coal from big mines and big markets); (3) expansion of electric space heating; (4) increased manufacture of producer gas (gas made from coal); and (5) application of coal injection into steel blast furnaces.

Considerable research efforts have already been directed toward using coal as a raw material to make essentially new products. Examples are: the gasification of coal, and the transformation of coal into crude oil and then the making of gasoline from the crude oil. There may yet be a major breakthrough whereby coal can be reformed into a liquid or gaseous fuel to compete more effectively with petroleum and natural gas.

Annual expenditures on coal research run to about $20 million, about equally divided between Federal money and industry outlays. By way of contrast, manufacturers of electric and gas utility equipment spend in excess of $100 million annually for research, and the petroleum industry spends about $300 million a year. Government expenditures in the area of fuels and energy, including nuclear energy, total about $500 million a year out of total annual Government research expenditures of around $10 billion. From these data it is apparent that even in the field of research the coal industry encounters formidable competition.

Atomic energy

Atomic energy is not yet a serious threat to the coal industry, but it is steadily making progress. Six reactors are already in operation, seven additional reactors are under construction, and four more are scheduled for completion by 1966. The seventeen together will have total capacity

of over 1½ million kilowatts. Both capital costs and operating costs of a nuclear plant are still comfortably above corresponding costs of extracting kilowatts out of coal. The future of coal and nuclear fuel is directly tied in with electric energy generation, and of course no one can foresee what technical changes may take place. At present, coal accounts for 53 per cent of the electric energy being generated, and nuclear fuel only 0.2 per cent. One energy expert, Philip Sporn, anticipates that by 1975 nuclear fuels will be generating 7½ per cent of the electric energy, but that coal will also make progress and will be generating 63 per cent of the electric energy. Relatively less energy will be generated by oil, hydro, and gas.

In addition to the electric energy market for bituminous coal there are the metallurgical and other markets. Looking at the entire market for coal, Schurr and Netschert, in their "Energy in the American Economy, 1850–1975," foresee a market for bituminous coal of 750 million tons by 1975, which is about double the current consumption. Much of the basis for optimism in the future of coal rests on anticipated advances in continuous mining machinery.

The ramifications and complexities of the bituminous coal industry, sufficient unto themselves, are magnified many times when one contemplates the place of coal in the future of the over-all energy market. There is indeed little doubt about the rapidly growing expansion of our energy requirements. But it is difficult to foresee how coal will fare. To be sure, we have enormous coal reserves but we also have huge reserves of petroleum, natural gas, and uranium, not to mention still untapped reserves of shale oil and tar sands. A major technological advance in any of these fields might set up or upset bituminous coal.

With the Federal Reserve System now engaging in Open Market operations in all maturities it is of interest to know just where corporations finance along the maturity scale. The Federal Reserve Bank of Philadelphia, with the cooperation of the Securities and Exchange Commission, recently collected comprehensive figures on new issues of publicly offered bonds. Here we answer the question who offers what volume of bonds at . . . .

HOW MANY YEARS TO MATURITY

Just where along the maturity scale have corporations offered their new bond issues * since 1950? Is there a great deal of concentration or do corporations spread their offerings fairly evenly throughout the spectrum of maturities?

All corporations

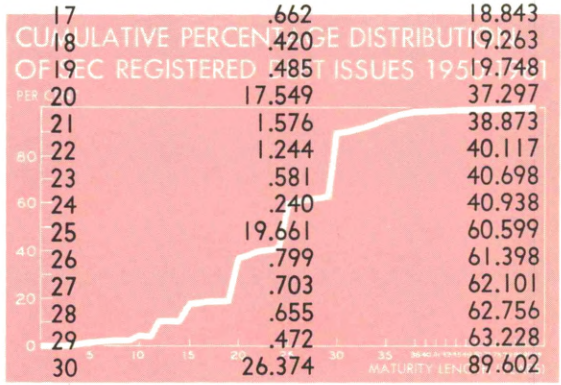
Table 1 shows a maturity breakdown of the total dollar volume of publicly offered corporate securities from 1950 through 1961. The most striking fact about the table is the heavy concentration of new offerings in relatively longer maturities and within a narrow range of maturities. Over 80 per cent of new issues offered are 20 years or more to maturity. Moreover, the cumulative per cent column in Table 1 shows that a little over 70 per cent of the total dollar volume of bonds was issued within an 11 year range, from 20 to 30 years. Beyond 30 years, only 10 per cent of all bonds were issued. Before 20 years to maturity a little less than 20 per cent were issued.

Another interesting fact is the concentration of issues in multiples of five years to maturity. Thus, if we select just three maturity dates—20, 25, and 30 years, to maturity—we have almost

TABLE I

PUBLICLY PLACED DEBT ISSUES 1950–1961

Maturity Length (years)	Per Cent Distribution	Cumulative Per Cent Distribution
1	.062	—
2	.223	.285
3	.031	.316
4	.675	.991
5	.805	1.796
6	.346	2.142
7	.042	2.184
8	.304	2.488
9	.029	2.517
10	1.841	4.358
11	.008	4.366
12	5.993	10.359
13	.212	10.571
14	.318	10.889
15	7.208	18.097
16	.084	18.181
17	.662	18.843
18	.420	19.263
19	.485	19.748
20	17.549	37.297
21	1.576	38.873
22	1.244	40.117
23	.581	40.698
24	.240	40.938
25	19.661	60.599
26	.799	61.398
27	.703	62.101
28	.655	62.756
29	.472	63.228
30	26.374	89.602



* Bond issues referred to throughout this article are publicly offered issues registered with the S.E.C. They exclude private placements. Most are corporate issues, though a relatively small volume of foreign government issues are included.

(*Continued*)

Maturity Length (years)	Per Cent Distribution	Cumulative Per Cent Distribution
31	.975	90.577
32	1.394	91.971
33	.564	92.535
34	1.088	93.623
35	3.242	96.865
36	.381	97.246
37	1.063	98.309
38	.182	98.491
40	.898	99.389
41	.003	99.392
43	.004	99.396
45	.060	99.456
49	.098	99.554
50	.380	99.934
72	.001	99.935
73	.001	99.936
79	.008	99.944
80	.008	99.952
98	.039	99.991
99	.009	100.000

64 per cent of all bonds issued—17.5 per cent issued at 20 years to maturity, 19.7 at 25 years to maturity, and 26.4 per cent at 30 years to maturity. This reflects the conventions of bond underwriting. It is harder to sell issues of over 30 years and under 15 years to maturity.

This heavy concentration of corporate financing in the longer maturities and within a narrow maturity range is still characteristic of corporate bond financing even if we eliminate from our totals the two industries which traditionally finance at longest maturities and which account for the largest proportion of the total dollar volume of financing (electric, gas and sanitary services, and the communications industry—both with average maturities near the end of the maturity spectrum and which account for a combined total of almost 56 per cent of all corporate new issues).

If we eliminate these two industries, still almost 70 per cent of the remaining bond issues fall within an 11 year range of 20 to 30 years.

Industry groups

Table 2 shows the average maturity of publicly offered corporate bonds classified according to the industry of the issues. Maturities range rather widely but of the 51 industries listed only six have average maturities under 16 years and only four have maturities of over 27 years.

TABLE II

AVERAGE MATURITY OF PUBLICLY OFFERED DEBT ISSUES BY INDUSTRY GROUP

Industry Group Name	Weighted Avg. Maturity*	Percentage Share of New Issue
Metal Mining	7.6	.17
Security & commodity brokers, dealers, exchanges, & services	10.0	.0**
Water transportation	10.5	.01
Miscellaneous business services	13.0	.19
Retail trade—furniture, home furnishings & equipment	14.2	.02
Motion pictures	14.8	.02
Personal services	15.0	.0**
Retail trade—miscellaneous retail stores	15.3	.02
Printing, publishing & allied industries	15.4	.13
Amusement & recreation services, except motion pictures	16.5	.08
Holding & other investment companies	16.9	.26

* In this and subsequent tables and charts, maturities are weighted by dollar volume of issues.
** Less than .01 per cent.

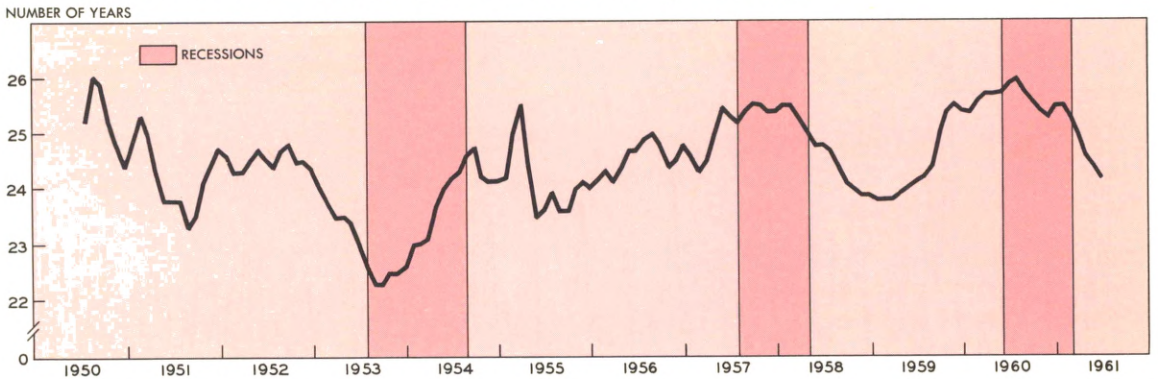
(*Continued on next page*)

(*Continued*)

Industry Group Name	Weighted Avg. Maturity	Percentage Share of New Issue
Real estate	17.3	.60
Credit agencies other than banks	17.6	8.18
Transportation by air	18.0	.54
Foreign governments	18.0	7.55
Crude petroleum & natural gas	18.5	.60
Wholesale trade	18.7	.14
Retail trade—apparel & accessories	18.8	.03
Nonclassifiable establishments	19.1	.43
Retail trade—eating & drinking places	19.6	.02
Retail trade—building materials, hardware and farm equipment	20.0	.03
Motor freight transportation & warehousing	20.0	.01
Retail trade—food	20.1	.31
Miscellaneous manufacturing industries	20.9	.34
Stone, clay and glass products	21.0	.58
Electrical machinery, equipment & supplies	21.0	1.57
Professional, scientific & controlling instruments; photographic & optical goods; watches & clocks	21.3	.19
Hotels, rooming houses, camps & other lodging places	21.3	.31
Paper and allied products	21.4	1.13
Textile mill products	21.6	.32
Retail trade—general merchandise	21.8	1.48
Primary metal industries	21.9	5.40
Leather and leather products	22.0	.04
Transportation services	22.1	.30
Lumber & wood products, except furniture	22.1	.21
Apparel & other finished products made from fabrics & similar materials	22.2	.07
Automobile repair, automobile services & garages	22.4	.10
Automotive dealers & gasoline service stations	22.5	.02
Machinery, except electrical	22.8	1.56
Rubber & miscellaneous plastics products	22.9	.39
Transportation equipment	23.2	1.81
Tobacco manufactures	23.4	.37
Chemicals and allied products	23.9	1.58
Food and kindred products	24.4	1.12
Communication	25.1	17.03
Fabricated metal products, except ordnance, machinery & transportation equipment	25.6	.43
Petroleum refining & related industries	26.6	4.87
Electric, gas & sanitary services	27.2	38.93
Pipeline transportation	27.4	.41
Nonprofit membership organizations	35.4	.01
Banking	99.0	.01
		99.92

CHART 1

AVERAGE MATURITY OF PUBLICLY OFFERED DEBT ISSUES, 1950–1961*



* Moving average.

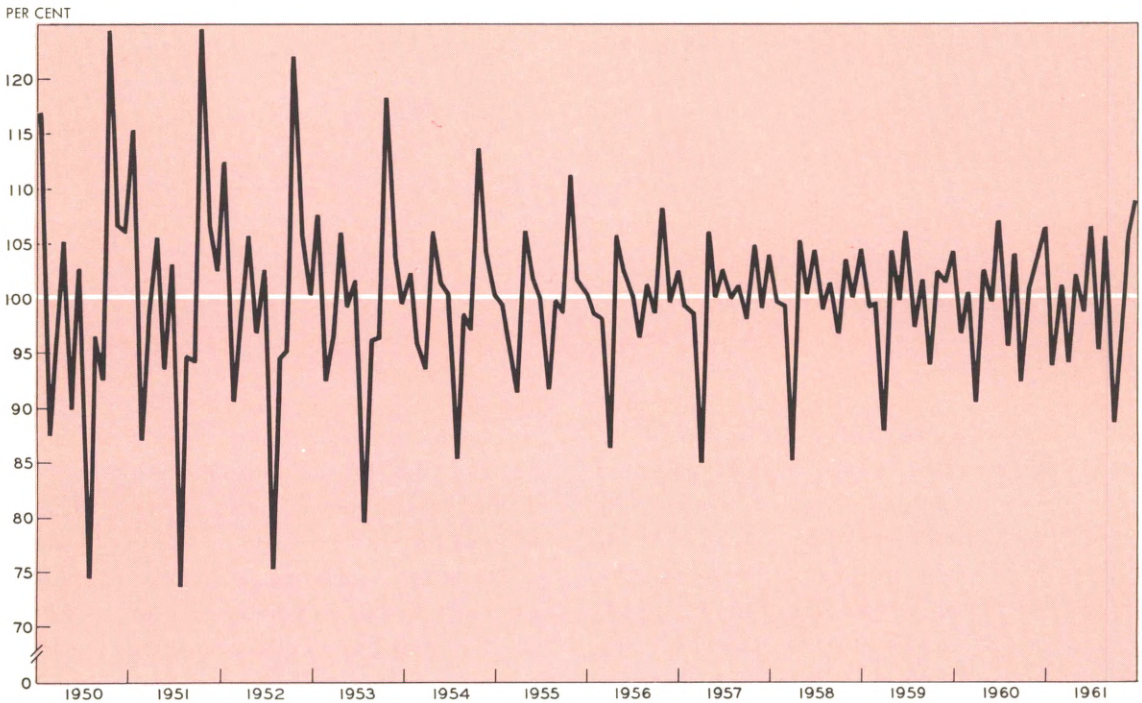
AVERAGE MATURITY OVER TIME

A glance at Chart 1 shows that maturities have shown a tendency to creep upward over time. From 1950 through 1955, average monthly maturities at which new corporate bonds were offered fluctuated around the 24 year mark. After 1955, the series shows a statistically significant upward tendency, remaining above 25 years for relatively longer periods of time and dipping below 24 years for only a short span. This tendency was evident not only in the aggregate but also for major industrial groups including manufacturing, utilities, trade, finance, and service.

One factor which might operate to lengthen maturities would be a rise in the proportionate share in total financing accounted for by large industries such as utilities which traditionally finance long term. This was not, however, found to be a factor of importance in the lengthening trend.

CHART 2

AVERAGE MATURITY OF PUBLICLY OFFERED DEBT ISSUES, SEASONAL INDEX 1950–1961



AVERAGE MATURITY: THE SEASONAL PATTERN

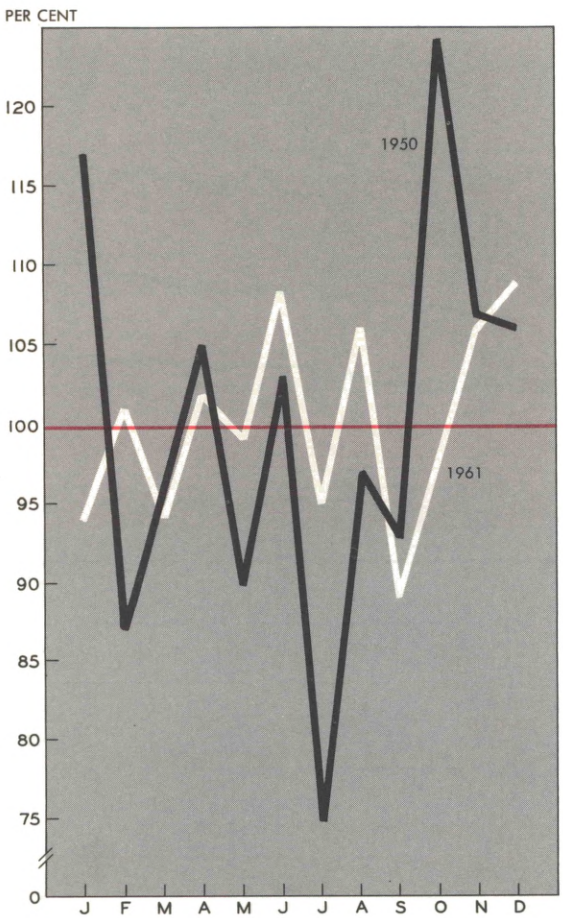
Though one might not expect it, a very pronounced seasonal pattern exists in the maturities of new corporate bonds. Issuance of longer-term securities seems to be concentrated more heavily in certain months, shorter-term issues in others.

The seasonal factors in Chart 2 show the extent of the seasonality in the maturity of new bond offerings. The dark horizontal line through the chart represents the "average" maturity. The rhythmically fluctuating line shows the percentage by which maturities in any particular month are above and below average. In January 1950, for example, the maturities of new issues were 17 per cent above average strictly for seasonal reasons; in July, over 25 per cent below average; and in October, almost 25 per cent above average.

One interesting fact about Chart 2 is the progressive and pronounced decline in the amplitude of the seasonal swing. In January 1950, for example, the swing ranged from 25 per cent below average to 25 per cent above. In 1960, the index swung from 10 per cent below to about 7 per cent above average. Throughout the period, upswings are generally concentrated in the second and fourth quarters, down swings in the first and third quarters.

CHART 3

AVERAGE MATURITY OF PUBLICLY OFFERED DEBT ISSUES, SEASONAL INDEX 1950 AND 1961



Finally, Chart 3 shows another interesting fact about the seasonal swing in maturities of new corporate bond issues. The seasonal seems to be moving. The month in which average maturities is shortest, for example, has moved from July to September. The month in which average maturities are longest has moved from October to December. Moreover, January has moved from a seasonal plus to a minus, February from a minus to a plus.

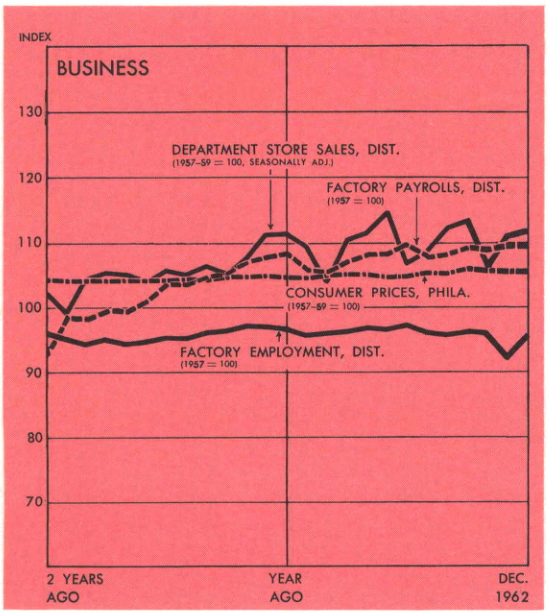
The seasonal swing results largely from the fact that different industries have different preference as to the season of the year in which they float their securities. The industries which typically offer a large volume of long-term securities tend to concentrate these offerings in the second and fourth quarters. Industries which typically finance at shorter maturities concentrate their offerings in the first and third quarters.

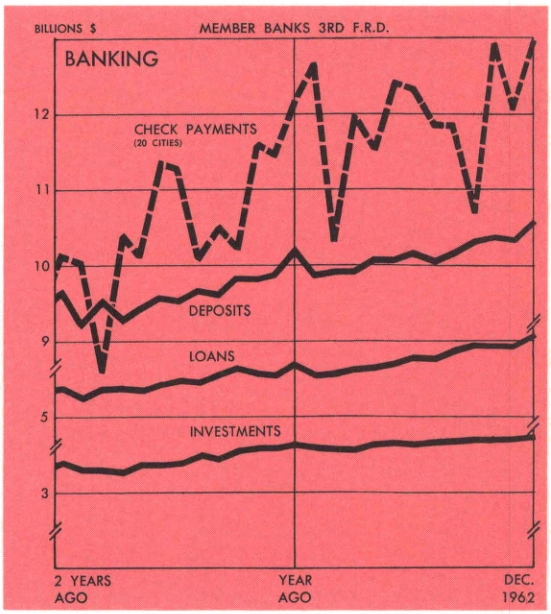
QUARTERLY AVERAGES OF SEASONAL ADJUSTMENT FACTORS FOR INDUSTRY GROUPS WITH VARYING AVERAGE MATURITY LENGTH

Group	1 QTR.	2 QTR.	3 QTR.	4 QTR.
1	127	83	127	64
2	92	133	112	63
3	77	117	87	119

The test used to reach this conclusion was as follows: Industries in a two digit standard industrial classification were broken down into three groups, those whose new security offerings averaged less than 20 years to maturity during the period 1950–61, those whose offerings averaged over 20–25 years to maturity and those whose offerings averaged over 25 years to maturity. Seasonal indices were computed of weighted maturities of each of the three groups and it was noted that industries belonging to group 3 concentrated their financing in the second and fourth quarters. Group 1 concentrated in the first and third quarters.

FOR THE RECORD...





SUMMARY

	Third Federal Reserve District			United States		
	Per cent change			Per cent change		
	Dec. 1962 from		12 mos. 1962 from year ago	Dec. 1962 from		12 mos. 1962 from year ago
	mo. ago	year ago		mo. ago	year ago	
MANUFACTURING						
Production	....	....	....	− 2	+ 4	+ 8
Electric power consumed	− 2	+ 2	+ 7	....	....	....
Man-hours, total*	0	− 1	+ 2	....	....	....
Employment, total	0	− 1	+ 1	− 1	+ 1	+ 3
Wage income*	0	+ 1	+ 5	....	....	....
CONSTRUCTION**	−11	+17	+15	0	+18	+11
COAL PRODUCTION	−10	−10	+ 3	− 7	− 4	+ 5
TRADE***						
Department store sales	+ 1	0	+ 3	− 1	+ 4	+ 4
Department store stocks	0	+ 4	....	− 1	+ 3	....
BANKING						
(All member banks)						
Deposits	+ 2	+ 4	+ 5	+ 3	+ 5	+ 7
Loans	+ 2	+ 7	+ 5	+ 4	+11	+ 9
Investments	+ 1	+ 3	+ 6	+ 1	+ 4	+ 7
U.S. Govt. securities	+ 1	0	+ 5	+ 1	− 3	+ 1
Other	+ 1	+13	+10	+ 2	+24	+23
Check payments	+ 7†	+ 7†	+12†	+11	+12	+10
PRICES						
Wholesale	....	....	....	0	0	0
Consumer	0‡	+ 1‡	+ 1‡	0	+ 1	+ 1

*Production workers only.
**Value of contracts.
***Adjusted for seasonal variation.

†20 Cities
‡Philadelphia

LOCAL CHANGES

	Factory*				Department Store†				
	Employment		Payrolls		Sales		Stocks		Check Payments
	Per cent change Dec. 1962 from								
	mo. ago	year ago	mo. ago	year ago	mo. ago	year ago	mo. ago	year ago	mo. ago	year ago
Lehigh Valley	− 1	− 1	0	+ 1	....	....	....	....	− 4	+ 5
Harrisburg	0	0	+ 1	+ 3	....	....	....	....	− 2	+ 5
Lancaster	0	+ 4	0	+ 5	−10	− 4	− 3	+ 1	− 4	+ 8
Philadelphia	0	− 1	0	+ 1	+ 4	+ 1	0	+ 3	+ 7	+ 5
Reading	− 1	0	− 1	0	− 3	+ 1	+ 4	+21	− 3	+ 7
Scranton	− 1	− 4	− 2	− 3	− 3	+ 1	+ 5	+ 8	0	+ 7
Trenton	0	0	0	− 2	− 2	+ 2	− 7	+ 5	+ 3	+10
Wilkes-Barre	+ 1	+ 1	− 1	+ 3	0	0	− 3	+ 1	+ 5	+11
Wilmington	0	− 2	+ 5	+ 9	− 2	− 2	− 1	0	+25	+15
York	− 1	− 2	− 1	− 1	− 4	− 5	− 5	+ 5	− 2	+ 5

*Not restricted to corporate limits of cities but covers areas of one or more counties.
†Adjusted for seasonal variation.