CHAPTER 1

THE SMOKY CITY

Picture yourself standing on the sidewalk, looking out on a broad cobblestone street. A row of brick townhomes stands behind you. A man is walking across the street, toward you, wearing a denim shirt buttoned all the way up to his neck. With each step he takes, the rim of his porkpie hat flaps slightly, softened by years of wear. The two sunken breast pockets on his shirt are both stained black with soot from where his fingers reach for tobacco to fill the pipe hanging from his mouth. Soot-strewn suspenders hold up a pair of black-creased dungarees, which hide a pair of tattered leather boots. He steps from the street to the sidewalk, nods to you, and makes his way further into town.

Your intent focus on this man's attire is not due to sartorial interest but rather because the city that surrounds you is cloaked in smoke, as if you are staring at it through goggles made of sea glass.

The view is not entirely obscured, though. As the man walks away, you can easily make out the outlines of a large factory, with a forest of chimneys rising forty or fifty feet in the air, the ones closest to you producing smoke of a light gray, while the ones farther away seem to belch pure black. If the wind kicks up and clears the air, you will see a five-hundred-foot-tall wall of dirt on the other side of the Monongahela River, now known as Mount Washington, but that the old-timers still call Coal Hill.

This is Pittsburgh in 1878. The "Smoky City," as it was known colloquially, was industrializing at a rapid clip. As such, it was the newfound home of many thousands of immigrants, chiefly from Central and Eastern Europe. Germans and Poles would lend Pittsburgh much of its unique linguistic and culinary character; it was just two years earlier, in 1876, when Henry John Heinz sold his first jar of Pittsburgh-made ketchup, after going bankrupt trying to sell horseradish, pickles, and sauerkraut. A less numerous, but equally important, group of immigrants came from England—many from Sheffield—which had, since the time of Chaucer, been the steel capital of the world. If vinegar defined Pittsburgh's culinary character, steel defined its economy.

By 1878 Pittsburgh was home to 150,000 people and hundreds of factories that accounted for roughly 50 percent of the United States' production of glass, 40 percent of its iron, and 15 percent of its steel (but almost 70 percent of its higher-quality crucible steel—the variety in which Sheffield had long held a monopoly).[1] Indeed, 1870 to 1910 is considered Pittsburgh's golden age, as its population swelled from 86,000 to more than 500,000—more than double the national average rate of growth, and almost totally on the back of heavy industry.

This was a frenetic period of technological advancement and economic growth. Just twenty years prior, Pittsburgh's first blast furnace for making pig iron was completed,[2] but now the Bessemer process had been commercialized and Andrew Carnegie, the Star-Spangled Scotsman, was turning Pittsburgh into the world's preeminent steel city. Carnegie's first Bessemer mill, the Edgar Thomson Steel Works, produced its first steel in 1875 in a town called Braddock, just outside Pittsburgh.

Pittsburgh was a natural home for the emergent US steel industry, both because of its geography and its geology. The Allegheny and Monongahela Rivers join in downtown Pittsburgh to form the Ohio, the main tributary of the Mississippi. This made it the easternmost city with access to the Mississippi, and earned it the moniker "Gateway to the West" by the early 1800s. Pork, corn, and whiskey flowed to Pittsburgh from the east, where it was loaded onto barges bound for markets to the south and west, and often as far away as the Caribbean. Indeed, Pittsburgh's earliest industry was shipbuilding, and it was from Pittsburgh docks that the first steamship, Robert Fulton's *New Orleans*, made the journey to its namesake city.

Probably more important even than the Ohio River to Pittsburgh's eventual status as an industrial powerhouse, though, was the Pittsburgh Coal Seam. The summit of Mount Washington looms only about five hundred feet above downtown Pittsburgh, so it is really more of a large hill than a small mountain. It would, of course, have been unthinkable to affix George Washington's great name to a mere hill. But before the area began to be developed as a residential community in the 1860s, it had a more befitting name: Coal Hill.

Today, the neighborhood atop Mount Washington is affluent, encircled by green spaces and home to many restaurants and bars that capitalize on the beautiful views. Beginning around 1830, though, and continuing until city officials began allowing the trees lining Mount Washington's slopes to grow back in the 1920s, the area was so devoid of life that there would hardly have been a difference if the following black-and-white photograph had been taken in color.

Settlers began exploiting Coal Hill as early as the 1760s, and by the early 1800s coal production had grown so much that Pittsburgh had become

FIGURE 1.1: Mount Washington (aka Coal Hill) in the 1920s

the only US city of any note where coal, rather than wood, served as the primary fuel source. The coal bed that gave Coal Hill its name was part of a much larger formation called the Pittsburgh Coal Seam, which actually underlies over eleven thousand square miles in Pennsylvania, West Virginia, and Ohio.

G. Follansbee, who was superintendent of the Pittsburgh Chamber of Commerce in 1882, wrote quite lyrically about the city's bounty:

> Coal is the sunshine of long past ages stored in an ebon[y] casket awaiting man's unlocking to serve his purposes. It is the lever of most potent energy; driving the wheels of manufactures and of commerce; rescuing the metals of the world from the baser mold which surrounds and contaminates them: dispelling the gloom of night and melting the severity of winter. Its possession by State or community is, then, of primary and inestimable importance.
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> The wonderful prosperity of Pittsburgh as manufacturing center is chiefly due to its possession of a vast vein of bituminous coal, unexcelled in quality for gas, steam, and domestic purposes.[3]

Not only was coal from the Pittsburgh Coal Seam ubiquitous and cheap to mine, with much of it lying practically on the surface, it was also well suited for producing something called coke. It was this, more than anything else, that earned Pittsburgh the moniker "Steel City."

COAL, COKE, IRON, STEEL, AND BEER

A few sentences must be devoted to the process by which iron ore and coal are made into steel. We will start first with coal—more precisely, the

high-quality metallurgical coal needed for producing iron and steel, which was found throughout the Pittsburgh Coal Seam.

Coal itself is incidental to ironmaking, except that it can be used as a heat source. Coke, however, is essential. Producing coke is very simple—if coal is heated to around 1,100 degrees Celsius in the absence of oxygen, you get two things: coke and coke oven gas. For our intents and purposes, coke is basically pure carbon, and coke oven gas is a by-product that can also be burned for heat.

Iron ore is mined from the earth. The "iron" in the ore is not pure, metallic iron but rather an oxide of iron. To create metallic iron, the oxygen must be removed, and that is what coke does. During the smelting process, iron ore and coke are combined in a blast furnace, air is blown in to introduce oxygen, and the coke combusts. The coke's carbon combines with oxygen from the air to form carbon monoxide, which in turn steals oxygen away from the iron oxide, yielding pig iron. To make steel via the Bessemer process, air is basically just blasted through molten pig iron. Easy.

However, not all coals can be used to make coke. The conditions inside a blast furnace are extraordinarily violent, and coke needs to withstand the enormous stresses without breaking. If it disintegrates, the ash blocks the flow of oxygen that drives the entire reaction. Coals that are too soft can function effectively as a heat source, but are structurally worthless. But coal from the Pittsburgh Coal Seam was very hard, and thus well suited for ironmaking. The abundance of this hard coal made Pittsburgh a natural home for iron and steel manufacture.

While coke's most essential role is certainly in ironmaking, where it is irreplaceable, it also boasts certain advantages over coal as a fuel for heat. It is cleaner burning, as it has been stripped of the volatile components that boil off as coke oven gas during the coking process. This meant less smoke inside the Pittsburgh homes and businesses that burned coke instead of wood. It is also what allowed coke to replace wood-derived charcoal in a brewery in Derbyshire, England, in 1642. The brewmasters had experimented with burning coal to roast the malt, but this imparted in the beer foul, sulfurous taste. Coke, however, burned cleanly, and, unlike charcoal, it imparted no brownness to the malt, producing instead a golden, pale brew. Coke is what gave the world pale ale.[4]

Back to 1878, and our man with the dirty shirt and pork pie hat. On the other side of the steel mill he is walking toward are its rail facilities, which bring in iron ore from Michigan and Wisconsin. Indeed, Pittsburgh actually imports most of its iron ore. Its competitive advantage in iron and steelmaking stems wholly from its great seams of hard coal.

The locomotive turns around and carries away finished steel, which is turned into ships, bridges, railroad tracks, and more locomotives. Only

after the 1890s does steel-framed building construction become common, and the first Ford Model T does not roll off the assembly line until 1908. The steel that the trains do not take are loaded onto barges and steamed down the Ohio River, to markets foreign and domestic.

THE HAYMAKER WELL

While Pittsburgh's economic growth had been impressive throughout the 1870s, and would continue to be for several more decades, a highly industrial economy fueled exclusively by coal suffers on many quality-of-life measures. The Smoky City was not so named for an innocuous morning fog as it was for the black soot that occupied every cupboard corner, floorboard crack, and fingernail bed. In 1846 the *Pittsburgh Gazette* wrote of Coal Hill, clearly visible from much of downtown Pittsburgh:

> In the days of its glory, which covered with trees from summit down to the edge of the water, it was the fairest portion of our surrounding scenery. But, now how changed! At its base vast furnaces belch forth dense clouds of flame and smoke, its steep side has been cut down by large quarries, and all along near its top a dozen yawning throats pour down a dozen railroads its rich treasures. Tree and shrub have been reft from their fast hold, and the old hill now stands before us with scarred sides and almost shaven crown.[5]

In 1866 a travel essayist for the *Atlantic Monthly*, James Parton, ventured to the top of Coal Hill, which had only just been recently rechristened Mount Washington, and famously described the city as "hell with the lid taken off." Records show that the smoke had only gotten worse in the twelve years between Parton's essay and 1878—not surprising, as the population had doubled, pig iron production had more than doubled, and steel output had risen by a whopping 50 percent per year.[6] The man with the sooty shirt pockets, then, is not unsanitary—he's merely a typical late nineteenth-century working-class Pittsburgher.

The year 1878 was going by much like 1877, as far as most Pittsburghers were concerned—industry continued to grow rapidly, with coal consumption in lockstep. But in the hills about twenty miles east of the city, two brothers who had been tooling around with what they hoped would be an oil well were about to bring in the biggest "gasser" the world had yet seen.

Obadiah and Michael Haymaker might have looked and dressed similarly to our man outside the factory, but they would have been covered in brown dirt rather than black soot, for they had spent months trying to drill a well in the still-forested hills east of Pittsburgh, in Murrysville. They were using outdated equipment, and it took them a full year to reach a depth of just 400 feet. (For context, today's modern rigs drill thousands of feet each day.) By 500 feet, the Haymakers had run out of money, and began selling

interest in the well to speculators and promoters. This gave them the capital that they needed to keep drilling, which they did until they hit 1,400 feet, when the well gave "a terrific roar and rumble that was heard fifteen miles away."[7]

The Haymaker brothers would probably have felt a mix of terror and triumph as the well came to life, after more than a year of dogged effort. A good oil well would make them rich. But their jubilation was cut short when, instead of the gentle gurgle of oil, they heard only the deafening hiss of gas.

After the blowout of November 3, 1878, the Haymaker well began producing an estimated thirty to forty million cubic feet of natural gas per day. This well, on its own, would have supplied the entire East Coast with gas. But instead, lacking a pipeline and a market, it vented its gas straight into the sky.

It was, perhaps, inevitable that such a spectacle would attract curious onlookers, even in the evening hours, when lanterns were needed to light the way through the woods. One such lantern-wielding onlooker inadvertently caught the gas stream on fire, leading to a conflagration of biblical proportions. The well burned for four years straight, a lighthouse in the Alleghenies. A historian wrote, some years later: "Its flaming fire, issuing from the earth could be seen at night at a distance of eight or ten miles, and its roaring sound was distinctly heard for five or six miles."[8]

The Haymaker and other wells to be drilled in the Murrysville gas field had the potential to clean up the smog that had become Pittsburgh's trademark, inasmuch as they could displace coal with natural gas, which is free from soot. But the Haymaker well burned uncontrollably in the woods, without a pipeline through which to market its production.

Eventually, the well was brought under control. Then came the fight over who owned its bounties. In 1882 one of the Haymakers's outside investors, H. J. Brunot, invited Joseph Pew to come to Murrysville to see the still-burning well. A deal was negotiated to sell the well to Pew and his business partner, Edward Octavius Emerson, who was a cousin of Ralph Waldo Emerson (the family apparently had a penchant for outlandish middle names). Pew and Emerson wanted to build a pipeline to connect the well to Pittsburgh, where they would sell its gas to factories that burnt coal for heat. Complicating matters, though, was the well's contested ownership. A "promoter" from Chicago had offered to purchase the well for $20,000 earlier that same year, and sent a down payment of $1,000. While initially keen, Brunot and the Haymakers had given up on him after no more payments arrived. After making more solid arrangements with Pew and Emerson, Brunot tried to refund the $1,000 to the Chicago promoter, but the promoter would not cash the check and give up his supposed ownership

of the well. Brunot then deposited the money directly in the promoter's account, and thought the matter resolved.

The events of November 26, 1883, proved that it was not. That day, fifty men armed with rifles and bayonets, representing the Chicago promoter, came to take the well by force. The Haymakers then arrived with a posse of ten. Cooler heads, in this case, did not prevail, and when the battle was over, Obadiah Haymaker had been bayoneted four times and died before reaching home. His brother Michael escaped unharmed. He moved to San Antonio, Texas, where he died an old man in his nineties. The Chicago promoter served time in jail. Pew and Emerson became the uncontested owners of the Haymaker well.[9]

NATURAL GAS IS KING IN PITTSBURGH

Pew and Emerson's company, which they called Penn Fuel Gas Company, delivered the first molecule of natural gas to Pittsburgh's Sixteenth Street station in January 1883. Penn Fuel had bought the Haymaker well and additional acreage in Murrysville and constructed a 5 5/8 inch iron pipeline into the city. When Pittsburgh received its first natural gas, the *New York Times* heralded its arrival as panacea to Pittsburgh's pollution problems, writing that "the place will lose its world-renowned title of 'Smoky City.' The inhabitants are rejoicing at the prospect."[10]

While Pittsburgh was not the first American city to receive natural gas, it was the first that mattered. (The writer apologizes to the good people of Fredonia and Barcelona, New York, and Titusville, Pennsylvania.) This was so not only because it boasted a larger population than the small towns that had used limited volumes of natural gas before, but because it had such a ready displacement market. Enter the story of manufactured gas.

Recall that heating coal in the absence of oxygen yields two products: coke and coke oven gas. Coke is very nearly pure carbon. Coke oven gas is about one-half hydrogen and one-third methane, with the remainder consisting of inert gases with no heating value. Until the 1870s, coke oven gas and manufactured gas were virtually synonymous. Then, a major technological improvement added oil to increase the heating value and somewhat purify the coke oven gas. The resultant product—still known as manufactured gas[11]—quickly became ubiquitous, while natural gas remained rare. Natural gas burned more cleanly, and boasted more energy per cubic foot, but was only used near to where it happened to be found.

The natural gas industry was in its infancy in the 1880s, but manufactured gas had been around since the early 1800s. American engineers brought the technology over from England, who would argue that they had invented it and not the French, which is open to debate. Squabbling over the genesis aside, manufactured gas got its start in the United States when

a portrait painter fittingly named Rembrandt Peale nearly went bankrupt after opening a museum in Baltimore.

The Peale family were artists of note: both Rembrandt and his father, Charles, had painted portraits of George Washington, who was a close acquaintance of the family. Charles diversified his earnings when he opened a museum in Philadelphia around 1790, which featured not portraits nor even paintings, as one might expect, but animal specimens. The first two exhibits were of a dried paddlefish from the Allegheny River and a badly preserved Angora cat.[12] Eventually, more collections were added, and the museum grew successful enough to support the entire Peale family. Aging Charles turned the reins over to one of his sons, Rubens, in 1810.

Rubens was the only Peale who did *not* wish to become an artist, striving instead to deftly manage the family's museum business. Impressed with the gas streetlights he had seen on a trip to Europe some years earlier, he decided to install gaslights in the Philadelphia museum in 1814 in order to draw larger crowds. The gimmick worked, and museum attendance skyrocketed, with the gaslights becoming as much of an attraction as the exhibits.

Rubens's brother, Rembrandt, was an artist, and a talented one at that. He completed more than six hundred paintings in his lifetime, which are still displayed at museums across the United States, and was just as prolific a father as a painter, siring nine children with his wife. His large family required more cash than his art could provide, so Rembrandt took a cue from the Peale playbook and opened a museum in Baltimore in 1814.

Rembrandt's superior credentials notwithstanding, business at the museum was less than brisk. Much of this was due to poor timing: the British had attacked Baltimore in September 1814 as part of the War of 1812, keeping many Baltimoreans otherwise preoccupied. Having spent a princely sum to get the museum up and running, Rembrandt began looking for a way to drum up business. Once again, Rembrandt chose to mimic in Baltimore what his father and brother had done in Philadelphia, and installed gaslights in his museum. Once again, the gimmick worked—the museum began to prosper.

Where Rembrandt's path diverged from his father and brother's was in his realization that gaslight was more than a novelty. He wanted to light the streets and homes of Baltimore, not just the hallways of his museum. To this end, in 1816 Rembrandt and some associates founded the Gas Light Company of Baltimore, and in 1817 the company lit its first municipal streetlamp.[13]

They thought that gaslights would be adopted quickly, but the uptake was painfully slow. The incumbent whale oil and tallow industries mounted a hostile public relations campaign, charging that running gas lines through the streets was sure to lead to explosions and deaths, and the company laid

less than two miles of pipelines over its first twenty years.[14] Despite his museum's popularity, Rembrandt could not afford to wait even a few years; he had always had a poor mind when it came to his finances, and held considerable debt. Rembrandt quickly began bickering with his associates, who grew weary of his histrionics and used his precarious financial position to force him out of the business after just a few years. Rembrandt ceded control of the Baltimore museum to Rubens several years later, which let him focus fully on his true passion: portrait painting.

Even with Rembrandt Peale gone, the Gas Light Company of Baltimore did not add customers at a rapid clip for some time. The gasification drive, though, spread across the country regardless, not from a home base in Baltimore but rather from London, where the technology had a firm seat. The next major city to install municipal gas lighting was New York City in 1823, where a group of "men of standing and means" formed the New York Gas Light Company and beat back negative publicity from the whale oil and tallow men. Unlike in Baltimore, gaslight was adopted rapidly in New York, perhaps because of its greater wealth and larger population, and Broadway quickly became the brightest street in the country. The other major US cities fell like dominoes over the years: Chicago got manufactured gas in 1850, San Francisco in 1854, and by the 1870s manufactured gas illuminated virtually every thoroughfare worthy of mention.[15]

Across the United States, manufactured gas was already an entrenched industry, and by the time that Pittsburgh received natural gas in 1883, an early incarnation of a business model that prevails to this day had already been established. This business model is referred to by academics and practitioners alike as the *utility compact*.

Utilities—in this case gas utilities—would receive a franchise from the city granting them the right to dig up streets and otherwise use public spaces in return for providing service at a "just and reasonable" rate. The franchise agreement was a contract, and terms varied, especially in the early days of the industry. Most importantly, some cities granted utilities an exclusive franchise—monopoly power—within their service territory, while others did not, leaving markets open for competition.

It is thus unsurprising that executives from a Pittsburgh–based manufactured gas utility called Fuel Gas Company, which had been granted an exclusive franchise under Pennsylvania's Manufactured Gas Act to supply the city with "heat from gas," felt betrayed when in 1883 Pew and Emerson's competing Penn Fuel began to pipe natural gas from the Haymaker well into Pittsburgh. Fuel Gas Company had raised capital to build a facility to turn coal into coke and coke oven gas, lay gas distribution lines, and sign up customers based on the guarantee that their exclusive franchise would shield them from competition. They immediately sued, but Penn

Fuel argued that the former's exclusive franchise only applied to sales of manufactured gas, while Penn Fuel sought to distribute natural gas. The protection afforded to utilities under exclusive franchise agreements, Penn Fuel argued, was only from lookalike competitors.

Ultimately, the battle went to the Pennsylvania Supreme Court, which agreed with Penn Fuel that Fuel Gas Company's charter granted them a monopoly only in the distribution of manufactured gas, and that Penn Fuel was marketing a wholly different commodity. This, in turn, led to Pennsylvania passing the Natural Gas Companies Act in 1885, which expressly allowed natural gas firms to compete for business with manufactured gas firms and also with each other—natural gas companies were not initially given a monopoly within their service territory. Penn Fuel was the first to file for a charter, and Fuel Gas Company was not far behind.[16]

In fact, Fuel Gas Company had tried to buy the Haymaker well some years before, but was beaten to the punch by Pew and Emerson. Fuel Gas Company executives realized that natural gas was a superior alternative to manufactured gas; they did not want to block its introduction to Pittsburgh, they just wanted to be the ones who introduced it, and to retain their monopoly.

THE UTILITY COMPACT AND REGULATED MONOPOLY

The theme of entrenched interests, like Fuel Gas Company, pressuring lawmakers, administrators, and the courts to block potential competitors from entering the market is repeated ad infinitum in the history of regulated industries. Often justifiably, as regulatory barriers to entry are an essential part of the utility compact.

The basic logic of the utility compact is as follows: Certain industries are inherently suited to be best operated as monopolies. These "natural monopolies" are generally industries characterized by high upfront costs and low variable costs, which offer increasing returns to scale. The market is most efficiently satisfied by one, and only one, firm—to the naturally monopolistic victor goes the spoils. This is in contrast with markets where competition improves efficiency. The ice cream truck business, for example, is not a natural monopoly. Each truck is fairly inexpensive, but requires a high amount of labor and fuel to operate. Nothing would be gained by dispensing ice cream cones from an eighteen-wheeled tractor-trailer, and children would probably be quite scared. The gas pipeline business, however, is a natural monopoly. After a large initial outlay, the pipeline is cheap to operate, and larger pipelines have lower costs per unit of gas transported. This means that building a second pipeline where only one is needed is wasteful.

If competition is unworkable in a naturally monopolistic industry, then how to control for a monopoly's tendency to exploit its dominance? How

to, and whether to, for in a capitalist economy like the United States, some monopolies are allowed to exploit their dominance without intervention.

The term *affected with a public interest* is a phrase that has been applied to certain industries since it was coined in medieval England, except that it was then spelled *publick*. When an industry is deemed public, the government protects consumers by regulating the rates that the monopoly is allowed to charge. This protectional regulation against exploitation is the more visible side of public utility regulation. Equally, however, the government is interested in the long-term health of public industries and in preventing duplicative wastefulness. Natural monopolies are subject to outside "raids." Wasteful though it may be to build a second pipeline parallel to the first, the raiding company may be willing to incur losses while it bankrupts the incumbent. Left alone, unprotected by any regulation, the risks of competition would be too high to raise the large amount of upfront capital required, so no industry would develop, or would develop chaotically. This, too, is an unacceptable outcome for a public industry.

The government thus offers public industries a quid pro quo: protective regulation, designed to ensure just and reasonable prices for consumers, alongside promotional regulation, designed to spur investment and shield against competition.

In the utility world, rate setting serves both promotional and protective purposes. The regulator authorizes the utility to charge a rate high enough and for a period long enough to fully amortize its substantial upfront investments, plus a reasonable margin, but no more. This is known as a "cost-plus" rate structure. An additional dimension of promotional regulation is achieved by granting franchise exclusivity, or partial exclusivity—entry control shields the natural monopoly from competition.

This model both encourages the formation and stability of the industry and, when properly implemented, ensures that consumers receive the lowest cost of service possible. Not only is duplication avoided, promotional regulations translate into low risk, meaning that capital is raised at low rates. And that cheap, ever-ready capital translates into low and stable costs for consumers. This is what makes the utility compact a win-win for both the company and the regulator.

Over the past two centuries, entrenched utility interests have scored major regulatory victories: cases where the government acted as a savior to their interests. They have also suffered major losses: cases where the government has acted, willingly or unwillingly, against them. By and large, though, the history of the utilities' political capitalism has been defined by minor losses: cases where the government did not agree to set policy to protect them fully from competitive forces but also did not expose them to "ruinous competition" from would-be raiders. In these minor losses, such

as the one Fuel Gas Company suffered in 1884, utilities are spared from lookalike competitors but are not insulated from broader market dynamics.

Since 1884 gas market regulators in the United States have hewed to a mostly pragmatic application of the tenets underlying the utility compact. This has spared us from the underlying logic's most important flaw—namely, that complete monopoly protection would stifle the competition that leads to "disruptive" improvements from nonlookalike competitors, and ultimately into lower rates for consumers.