

# Working Agreements: The Use of Subcontracting in the Pennsylvania Iron Industry 1725-1789

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Over the past twenty years, many historians of labor and business have questioned the validity of the concept of an industrial “revolution” in nineteenth-century America. They have recognized that industrialization was a slowly-evolving process that stretched back into the eighteenth century. Thomas C. Cochran, for example, asserted that the industrial surge of the second third of the nineteenth century had its roots in the business practices of the 1780s. Paul Paskoff termed the century from 1750 to 1850 one of industrial evolution, as investors in ironworks reduced labor and material costs while making technological advances. In fact, practices including hierarchical levels of management, division of labor, resource management, and double-entry bookkeeping evolved over the entire eighteenth century.<sup>1</sup>

Complex labor arrangements usually associated with nineteenth-century business practices certainly characterized eighteenth-century Pennsylvania’s iron industry, as free wage earners worked side-by-side with indentured servants and slaves.<sup>2</sup> One labor system that has received no attention in the historiography of pre-nineteenth-century iron manufacture is subcontracting. This hierarchical form of task division and distribution, in general use at iron manufactories in Pennsylvania, Delaware, Maryland, and New Jersey by the 1740s, is an integral part of the evolution of colonial industry.<sup>3</sup> It reveals a widespread understanding of labor management, the seasonality of agricultural and industrial work, the availability of job opportunities, and the existence of a hierarchy among skilled and unskilled workers. The existence of subcontracting by the 1720s indicates that industrial labor arrangements were in place much earlier than many historians have claimed.<sup>4</sup>

Ironworks’ managers and employees negotiated labor arrangements with contracts, many of them written. These contracts, together with descriptions of labor and wage payment schedules in company account books, reveal the routine use of subcontracting.<sup>5</sup> Many people, such as farmers, colliers, and miners, contracted to complete large jobs or to provide large amounts of material over short periods. These contractors subcontracted much of the necessary labor, and profited by the production of their subcontractors.<sup>6</sup>

Subcontractors—full-time or part-time laborers who worked indirectly for manufacturers—are usually overlooked in eighteenth-century industry. At least eighteen of the twenty-two Pennsylvania ironworks with extant records from 1725 to 1789 used contractors and subcontractors. Table 1 demonstrates that ten percent of the workers in the Pennsylvania iron industry dur-

**TABLE 1: Percentages of Contractors and Subcontractors in Total Workforce at Pennsylvania Ironworks, 1725-1789 (N=8682)**

Works	Years	Contractors	Subcontractors	Helpers
Pool	1725-27	5%	11%	13%
Coventry	1726-89	6%	16%	7%
Pine	1733-81	12%	26%	15%
Colebr'dale	1735-67	12%	32%	16%
Mount Pleas	1737-44	7%	18%	6%
Hopewell-B	1741-61	9%	22%	10%
Durham	1744-89	11%	30%	15%
New Pine	1744-63	8%	21%	4%
Warwick	1747-89	11%	24%	14%
Tulp/Charm	1755-88	12%	30%	18%
Pottsgrove	1755-65	7%	14%	12%
Rox/Berks	1756-74	12%	35%	11%
Mount Joy	1757-68	10%	30%	12%
Mary Ann	1762-73	10%	26%	12%
Cornwall	1764-88	8%	23%	9%
Hopewell-L	1765-86	7%	18%	12%
Elizabeth	1766-74	14%	29%	12%
Sarum	1767-71	10%	22%	15%
<b>Average</b>		<b>10%</b>	<b>24%</b>	<b>12%</b>

ing the six decades of this study *hired* subcontractors and twenty- four percent worked *as* subcontractors. Eighteenth-century subcontracting arrangements benefited contractors and left subcontractors with freedom and flexibility in their relationships with ironworks' owners and managers. It enabled people in search of work, who were not willing or able to make long-term commitments to industry, to supplement their incomes.<sup>7</sup>

In eighteenth-century Pennsylvania, subcontractors worked on ironworks' property, their own property, or on that of a third party. They used some of their own tools and some of the company's. Contractors sometimes conformed to company work schedules, and sometimes acted according to their own preferences. Companies hired them to perform specific tasks and paid them for their completion. The contractors then hired and paid others to fulfill a certain portion of those tasks. Eighteenth-century subcontractors then worked under the contractor's general supervision until the job was finished. The contractor was responsible to the company for the contract's fulfillment; subcontractors were responsible to the contractor for their schedule, produc-

tion, and the quality of their work. They were obliged to work until their portion of the original contract was completed and no longer, and could work on or off company property. Subcontracting was evident in almost every aspect of iron production in Pennsylvania between 1725 and the beginning of the republican period in 1789. Local labor forces (overwhelmingly agricultural) surrounding ironworks were clearly familiar with this system by the second quarter of the eighteenth century. They participated in it whenever it benefited them.

Iron companies paid contractors wages that were ten to fifteen percent higher than average for workers, plus a piece rate for production, for several reasons. First, they often served as employment agents. A large minority of the subcontractors hired were either newly arrived in a locality, or lived more than five miles from the works. In either case, they typically had few connections with the company and were solicited by the contractors. If they needed work, they usually accepted slightly lower than normal wages. Many of these workers were younger sons of farmers adding to the family income or earning some cash for themselves. Few men in this group, however, continued to subcontract for many years. If they continued to work for the company, they usually hired on directly for higher wages.<sup>8</sup>

Second, most subcontractors were not willing to make a full-time commitment to the company. Farmers and members of farm families surrounding ironworks had their own work to occupy them much of the year. Therefore, only at certain times during the agricultural year did many rural people offer to work for a few weeks or months at a local ironworks. By the late 1740s, however, most companies had found sufficient sources of both full and part-time labor, and were looking for employees who would work for at least several months, if not for a year at a time. Companies became willing to contract with individuals or partnerships who took on large jobs in order to avoid the constant hiring of temporary workers. Contractors, therefore, assumed the problem of subcontracting small parts of jobs to large numbers of people. Men seeking part-time employment increasingly found it easier to subcontract a small part of an ongoing job, such as woodcutting, coaling, or mining. They were willing to accept less than common wages because they were not absolutely dependent on this income to survive.

Third, companies with limited managerial hierarchies were willing to delegate to contractors the responsibility of acquiring a sufficient number of workers. As noted above, twenty-four percent of those who worked at some phase of iron production in Pennsylvania were subcontractors. At least an additional twelve percent were helpers or apprentices of other workers and not true subcontractors. More than one-third of the iron industry's workforce in the eighteenth century, therefore, were supervised by men who were not, strictly speaking, ironworks' managers.

Fourth, companies paid many of their contractors more than other employees for their expertise and supervisory ability. Colliers and skilled miners particularly were hired not only for their craft knowledge, but for their conscientiousness as well. Their jobs were often done far from the ironmaster's house or the furnace and forge buildings. They were expected to have the initiative to hire a sufficient number of workers and keep production moving.

Fifth, companies paid contractors for access to resources. This is most obviously true in the case of cutting cordwood for charcoal. Most iron manufactories were dependent, or in a short time became dependent, on local farmers for their wood. By the early 1730s, many ironworks paid farmers to allow company woodcutters on their land. Many farmers, however, discovered that it was more lucrative to contract to supply large lots of cut cordwood, to subcontract out most of the cutting, and collect a higher price from the company both for the resource and the work.<sup>9</sup>

Sixth, when the company hired workers, it usually supplied them with the tools of the job. Most contractors, however, were expected to either hire people who had the own tools or to supply tools themselves. Colliers, carpenters and masons, when engaged in subcontracting arrangements, usually supplied their own tools. Only master miners among skilled workers typically did not supply their own tools, although they were responsible for tools borrowed from the company.<sup>10</sup>

The system of subcontracting was flexible enough to work within the seasonality of agriculture, convenient for those who wanted to supplement their income temporarily, important to companies trying to ensure that work was completed, and profitable to all concerned, particularly to the contractors who utilized it. Subcontracting increased the number of people who worked for part of their lives in the Pennsylvania iron industry, and proved to be an entrepot for men who eventually chose to work steadily for the companies. Both contractors and subcontractors could improve their economic circumstances by engaging in this system.

It is possible to estimate families' economic improvement as a result of members working as contractors or subcontractors, for their land holdings usually increased over time. As Daniel Vickers, Richard Bushman, and others have demonstrated, a significant rationale for increased involvement in commercial and labor markets in colonial America was the desire to achieve a competency, a level of comfort and security which provided both for one's own future and helped children establish themselves as adults. This competency quite often involved acquiring more land. There are many examples of families first acquiring land or adding to existing holdings after members worked as contractors or subcontractors in the Pennsylvania iron industry.<sup>11</sup>

Subcontracting was particularly important in supplying cordwood to colliers, although the source of wood and the method of payment in these

arrangements varied. Jacob Hershey and Emmanuel Sees, both contracting to provide Cornwall Furnace with wood in the 1770s, increased their land holdings from 113 acres and 100 acres respectively to 150 acres each by 1780. Hershey and Sees profited not only from the sale of wood, but from the cutting, which they subcontracted to woodcutters.<sup>12</sup>

Blacksmith William Roberts contracted with the Cornwall Furnace in 1777 to deliver 300 cords of wood in three months at two shillings six pence per cord; the was wood to be cut on company land. Roberts subcontracted the cutting of 200 cords to Robert Leech and William Maypowder. Roberts supplied axes and paid the men two shillings three pence for each cord they cut. At the end of three months, Roberts delivered 280 cords to Cornwall, three of which were rejected as unsuitable for charcoal. Roberts received £34 12 shillings 6 pence and paid Leech and Maypowder approximately £10 each, retaining £14 12 shillings 6 pence for himself. Roberts engaged in similar arrangements at the Durham Ironworks between 1779 and 1788. After 1785, however, some of the wood came from his own land; he had moved from tenancy in the 1770s to owning twenty-five acres in Durham Township.<sup>13</sup>

George Eichelberger and Christian Grall subcontracted to cut wood for others on several occasions in the 1770s at Cornwall and Elizabeth Furnaces. Eichelberger subsequently increased his land holdings from fifty acres in 1771 to one hundred by 1782, while Grall increased his fifty acres to one hundred and twenty in the same period. Both men sold their own wood in the early 1780s, and hired subcontractors to do some of the cutting.<sup>14</sup>

While rural Pennsylvanians did not acquire nor increase their average solely through subcontracting, earnings from this system increased their ability to improve their economic circumstances and build toward a competency. Nor was land their only goal. Many contractors and subcontractors bought larger amounts of food and dry goods at company stores over time. The ability to buy more groceries and luxury items, such as ribbons, combs, and mirrors, came from wages earned in this system.

In December 1768, woodcutter John Cullagan contracted with the Berkshire Furnace to cut 400 cords on company land by March 1769, a full-time job for four men. Cullagan subcontracted small job lots to at least six other men, and allowed them to charge goods to his account at the company store as part or all of their pay. Exactly how much Cullagan agreed to pay these men, and how much he eventually earned is unknown, but the arrangement obviously benefited him, the other woodcutters, and the company store.<sup>15</sup>

Durham Ironworks regularly advertised in the late 1770s and 1780s for contractors who would produce 100 or more cords of wood. Thirty-three local farmers agreed to supply large amounts of cordwood from their own lands to the furnace, and subcontracted much of the cutting. Most agreed to deliver 100 cords per month, although some promised much more. On De-

cember 20, 1779, John Miller contracted to deliver 300 cords to the ironworks within one month. He hired eight men to cut between thirty and forty cords each to fulfill the contract. As Miller also supplied the wood, he made approximately £17 profit on his subcontractors' output.<sup>16</sup>

Contractors also arranged to supply cordwood cut from their own land. Alexander Lyon and Charles Boyle each agreed to supply the Coventry Ironworks with 250 cords of wood over four months in 1731. They were paid 2 shillings 9 pence per cord for the wood and the cutting. Each man hired two subcontractors, paying them 1 shilling 10 pence per cord. The subcontractors charged purchases at the company store on the contractors' accounts. Both Lyon and Boyle made approximately £18 for their own wood and cutting, and £5 6 shillings profit after paying their subcontractors. The subcontractors made varying amounts; James Dean £5, 19 shillings, 2 pence earned for sixty-five cords, both Peter Middlecraft and John Sarfoot £4, 11 shillings, 8 pence earned for fifty cords, and Thomas Humphreys £6, 8 shillings, 4 pence for seventy cords.<sup>17</sup>

More complex subcontracting arrangements involved cutting wood on a third party's land. For example, in 1732, collier Thomas Housley contracted with Coventry to supply cordwood for charcoal. Housley agreed to cut wood on carpenter Thomas Cloward's land near the ironworks. Housley and his helpers, Patrick Barron and Richard Shute, cut 250 cords, but Housley also subcontracted the cutting of another 250 cords to Andrew Conn. Conn cut and delivered 258 cords to Housley over the ensuing eight months. During this time (approximately three coaling seasons), Cloward, Barron, Shute, and Conn all bought goods at the company store on Housley's account. The company paid Housley for wood, for cut cords, and for all the charcoal produced. Housley, in turn, paid Cloward for his wood, Conn for his labor, and Barron and Shute for their making charcoal, less what they charged at the store.<sup>18</sup>

Colliers' contracts typically involved hiring their own help. Charcoal-making is a time-sensitive craft; colliers literally had to tend their pits around the clock for months at a time. Negligent colliers whose pits burned away had to pay the company for the ruined wood and the cost of cutting it, as well as losing their pay for the charcoal. Colliers regularly contracted to set more pits than they could possibly tend themselves, and subcontracted part of the job to others. Colliers often apprenticed their sons to the craft, but other experienced locals built and tended pits.

Eighteenth-century records indicate that many farmers had a basic knowledge of charcoal making, and many sold small amounts of coals to local ironworks for cash or credit in the company stores. These farmers (or their sons) rarely worked as full-time colliers. Subcontracts with colliers were usually of short duration. A collier often made a half dozen or more arrangements to have just two extra pits tended for a full season.

Between 1748 and 1757, collier Reuben Dodderow contracted to work at Pine Forge. Dodderow's sons, Michael and Conrad, had helped him in the 1730s, but they coaled on their own by 1748. Dudderow, therefore, hired between four and eight helpers per year. He typically hired two at a time; each agreed to help build and tend two of Dodderow's eight pits; he tended four himself. Dodderow was paid for the charcoal, and the subcontractors used his credit at the company store until the end of each season when he settled accounts with them.<sup>19</sup>

Collier Humphrey Attcock worked at Coventry in 1729, hired his own help, and cut wood on company land. He hired four men to tend pits, and another four to cut 400 cords of wood over a six-month period. Attcock received 2 shillings per cord for the cutting, and paid his subcontractors 1 shilling 10 pence per cord. He cut eighty cords himself, thereby earning £8 as well as his wages for charcoaling. The subcontractors delivered 420 cords for which Attcock paid them £38, 10 shillings, thereby netting him £3, 10 shillings on the subcontracting arrangement alone.<sup>20</sup>

Mining was also frequently subcontracted. Ironworks hired master miners for their expertise in excavation, in locating and tapping veins of ore, and in gunpowder and blasting. Companies paid master miners a per ton rate for ore they extracted, and the master miners hired and supervised their own help. If the company provided tools—shovels, picks, and pry bars—the master miners had to return all in good condition or pay for those lost or broken.

The average iron furnace in Pennsylvania needed two to three master miners every year to produce of 1000 to 1200 tons of ore between April and November. An eighteenth-century miner could extract about one-half ton of ore per day. In order to fulfill their contracts, therefore, master miners needed eight to ten full-time workers (including themselves). Master miners subcontracted for labor through a combination of monthly wages and piece work. For example, a mining subcontractor might earn £3 per month in wages for a production rate of twelve tons of ore. If he produced less than twelve tons, he would be penalized. Subcontractors who produced more than twelve tons a month steadily could expect to receive a raise.

Colebrookdale Furnace's contract with master miner Thomas Hill in 1733 paid him 7 shillings, 6 pence per ton of ore raised; at year's end he received £300, for 800 tons. During the year, he hired ten subcontractors at monthly wages of £2, 10 shillings to £3. After paying £180 11 pence in wages, and £7 11 shillings 11 pence for blasting powder and broken or lost tools, Hill earned £112, 7 shillings, 1 pence for his work. Alone, he would have made barely £40. By subcontracting out nearly ninety percent of the manual labor, he profited enormously from his skills and supervisory ability.<sup>21</sup>

In 1728 and 1730, Henry Hockley, Jr., the son of a tanner, worked as a subcontractor under master miner Jacob Burkholtz at the Coventry mine. He

obviously learned mining skills, for in 1732, Coventry contracted with him to act as one of two master miners and paid him 7 shillings, 6 pence per ton of ore. Hockley, in turn, hired of eight workers during the year, and paid them £2, 10 shillings to £3 per month for twelve to thirteen tons of ore each. Only four or five subcontractors worked at a time. Each had his area of the mine to tap, and all charged purchases at the company store to Hockley.<sup>22</sup>

By 1746, Hockley had inherited his family's tannery. His experiences as a young man demonstrate, however, that people from varied backgrounds worked for wages, and that subcontracting was part of a flexible hierarchy where upward mobility was possible.

The Durham Ironworks hired partners Christian Gier, Robert Welsh, and George Reiman as master miners in 1781. Each earned £6 per month plus a per ton rate of 7 shillings, 6 pence for ore. During the next three years, their wage rates fluctuated from £6, 10 shillings to £7 per month, while the per ton rate remained constant. The three men hired ten to fourteen workers each year, most of whom worked from three to four months, and about six of whom worked at a time. The three partners paid inexperienced miners £4, 10 shillings to £5 per month, while experienced hands commanded £6.<sup>23</sup>

Reiman arrived at Durham in 1780, and worked for a few months in the mine before negotiating a contract as a master in 1781. In 1780 and 1781 he lived in the company's barracks with other male workers; from 1782 to 1784 he leased one of the company's farms. By 1785, however, he owned twelve acres of land, two horses, and two cows in Durham Township. His earnings from the subcontracting system helped him move from landless status through tenancy to land ownership in five years.<sup>24</sup>

In 1781, Durham's mine, which had been worked for over thirty years, only produced about 600 tons of ore before it was tapped out. Its main shaft was over fifty feet deep, with a maze of framed and palisaded side tunnels. Eighteenth-century technology did not allow for much deeper mines, and so by September operations ceased. Gier, Welsh, and Reiman then contracted individually to sink a new mineshaft, Shaft Number Two. They did not subcontract with other workers; the company paid the wages of all workers on this project. Eleven other workers helped sink the shaft, some for a few days, others for several weeks.<sup>25</sup>

Two factors may have eliminated subcontracting from this project. First, sinking a new shaft required a heavy investment of labor, but did not immediately produce ore. Contractors virtually always assumed responsibility for production that could be measured, and were paid piece rates for their production. This arrangement was impossible in the mineshaft project. Second, many of the contracts for Shaft Number Two were not executed until October, and the shaft had to be sunk before the ground froze. The furnace needed ore before the first blast of 1782 began in March. Richard Backhouse, the



owner-manager of the works, could not wait for the master miners to hire other workers, and moved men from other jobs to the new shaft. Neither workers nor managers, therefore, had an incentive to use subcontracts.

Shaft Number Two was complete by December. In the spring of 1782, mining operations began again with subcontractors. The master miners delivered more than 800 tons of ore that season, and more than 900 tons in 1784. In that year, Gier, Welsh and Reiman paid their subcontractors £163 and Durham £7 for powder and tools. Each earned £112 for the year. The case of Shaft Number Two at Durham illustrates the flexibility of subcontracting. The furnace managers and laborers used the system when all parties could profit from it; when circumstances made it unwieldy or inefficient, they dropped it, only to resume subcontracting again when they could.<sup>26</sup>

Other workers used subcontracting arrangements as well. Hammermen, for example, helped produce worked iron at the great trip hammers at the forges. Most hammermen at Pennsylvania works between 1725 and 1789 were slaves, but many were free white laborers who signed contracts. Occasionally, however, the finers and chafers who operated the company forges, reheating and drawing out iron to purify it further, contracted to be paid for the total output of bar iron. They assumed the responsibility of hiring assistants, including hammermen. For example, in 1764 finer John Hind and chafer Ludwig Hayes at one of Charming's three forges each contracted to hire and pay their own hammerman. The forge paid both Hind and Hayes a per ton rate 10 shillings over the average rate for finers and chafers. Together they hired Peter Blanck, who had worked previously at the forge as a hammerman, and paid him 15 shillings per ton of iron he helped produce. Hind and Hayes, therefore, shared an additional 5 shillings per ton for supervising Blanck.<sup>27</sup>

The founder, who supervised the entire furnace building, contracted to keep it in blast and to smelt iron. Skilled founders were rare and demanded high wages. They prepared the furnace, decided when the blast could begin, judged the furnace temperature, ordered the addition of charcoal, limestone, and ore, assessed the working of the bellows, and decreed when the molten iron could be tapped.

Some large works, like Principio and the Baltimore Works in Maryland, and Cornwall and Pottsgrove in Pennsylvania, had two furnaces and employed at least one founder at each. Because furnaces operated around the clock, founders were always on call. Furnaces were tapped approximately every ten to twelve hours; if a company employed only one founder, the furnace was tapped at the beginning and the end of a fifteen hour shift. Founders, however, usually subcontracted a portion of the work at the blast furnace to one or more keepers; ten of the twelve furnaces in this study were tended by founders who did so. At times, founders employed members of their own families, usually younger brothers or sons, as keepers. For the most part, however,

founders hired keepers for their knowledge and reliability. Founders paid keepers a monthly wage much less than their own salaries; keepers in turn, honed their skills. Some eventually became founders.

Keepers usually maintained the furnace throughout the night until the founder came back on duty about dawn. Some founders also hired keepers for day work, as they occasionally worked in the casting house as potters. They made kettles, pans, stoves, and other ironware. Casting—a highly skilled trade—generated more income for founders who were willing to subcontract the supervision of the furnace to one or two keepers. These founders, then, were only on call when the furnace was tapped.<sup>28</sup> Keepers performed many of the same duties as founders, although they did not start the blast or tap the furnace. Keepers had to know how, when, and with what to charge the furnace. If they erred, the furnace might go out and halt operations for weeks. Keepers had to be diligent, responsible, intelligent, and reliable.

In 1733, John Chapman, one of the founders at Colebrookdale, hired a keeper at £4 per month. Colebrookdale paid Chapman £126, 17 shillings, 6 pence for tending the furnace and making potware. Chapman, in turn, paid his keeper £31, and kept a net of £95, 17 shillings, 6 pence. In 1773, Charles Ridgley, founder at the Mary Ann Furnace, hired two keepers; a day keeper: at £5, 10 shillings a month, and a night keeper at £6 a month. Ridgley made £243, 10 shillings, 9 pence for the year, including his earnings from casting potware. He paid his keepers £96, 15 shillings, and retained £146, 15 shillings, 9 pence. By subcontracting some of the work at the furnace, founders delegated a portion of their responsibility, increased their net incomes through casting, and got to sleep at night.<sup>29</sup>

Part-time craftspeople at Pennsylvania's ironworks rarely subcontracted parts of their jobs. On occasion, however, especially when companies constructed buildings, craftsmen contracted for more work than they could finish, and subcontracted some out. For example, when Pool Forge built its complex in 1725, the works hired masons, carpenters, shinglers, and construction workers. Robert Williams, a house carpenter, contracted to build and shingle the storehouse, the coal house, and two workman's houses. The forge paid Williams for the entire project, but he hired three "jobbing carpenters" to complete some of the work after he had framed the buildings.<sup>30</sup>

Similarly, in 1762, mason Lewis Lewis contracted to build the furnace stack, chimneys, hearth, and forges at the Mary Ann Furnace. Lewis brought his son with him as his apprentice, and hired two other men to help him cart material. He also subcontracted most of the work to three other masons. The company paid Lewis, and Lewis paid the others on a per job basis.<sup>31</sup>

In these instances, companies delegated the responsibility of hiring and supervising additional craftsmen to contractors. The contractors, therefore, made a higher profit than if they had worked alone. Many subcontractors, on the other hand, acquired more work than they would have otherwise.

**TABLE 2: Percentages of Contractors, Subcontractors, and Helpers Among Ironworkers by Decade, 1720-1789**

Decade	Contractors	Subcontractors	Helpers
1720s	5%	11%	10%
1730s	7%	14%	12%
1740s	8%	20%	11%
1750s	9%	23%	12%
1760s	10%	24%	11%
1770s	11%	25%	13%
1780s	11%	28%	14%

Subcontracting was also used occasionally in long-distance hauling. Although most hauling for eighteenth-century ironworks was done by local farmers, about one-fifth was accomplished by teamsters who worked primarily at hauling over long distances. Teamsters were often members of large families, such as the Hulings, the Balls, the Starrs, and the Stovers, who invested in several wagons and hauled as much material as possible. On occasion, however, they subcontracted the hauling of one or more loads. Perhaps a wagon was delayed in returning to Pottsgrove from Philadelphia, or to Durham from Changewater Forge in New Jersey, while another load waited to be shipped. Rather than lose the work or their business reputation, teamsters subcontracted the task to a local farmer. In 1759 and 1760, for instance, Moses Starr and his sons, who hauled for the New Pine works, hired local men on three occasions to fulfill contracts.<sup>32</sup>

Subcontracting was clearly a common labor system in the Pennsylvania iron industry by 1725. Despite the limited number of extant company records, it is possible to trace the growth of subcontracting over the eighteenth century. Table 2 breaks down the available company records by decade, and delineates the percentages of those who worked for the iron companies as contractors, subcontractors, and helpers over time. While the percentage of the workforce who acted as helpers in a non-productive capacity remained relatively constant over seven decades, contractors and subcontractors increased significantly.

These increases reveal several patterns. First, the number of contractors at the same forges increased by 120 percent between the 1720s and the 1780s. This change indicates that companies were more willing to delegate authority to key workers, depend on them to acquire additional labor, and produce sufficient raw materials or saleable products. Second, the number of subcontractors increased by more than 154 percent. This change suggests that the

system was increasingly recognized as a viable and lucrative alternative to full-time work in industry. Subcontracting part of a job brought additional income into a household without a long-term commitment. Third, workers who were indirect hires of various companies—subcontractors and helpers—increased from twenty-one percent of the industry's workforce in the 1720s to forty-two percent in the 1780s, an increase of 100 percent. This growth indicates that, over the course of the eighteenth century, ironworks owners and managers exerted less direct control over their workforces.

It is also possible, at least for the final years of this survey, to examine the extent of subcontracting in a single company. The Durham Company's records from 1778-1789 are remarkably complete. Company clerks kept records for each year in separate ledgers, journals, and day books, for different aspects of the operation. These overlapping sets of records illustrate subcontracting arrangements more clearly than those at most other ironworks.

During the 1780s, an average of eighteen contractors per year subcontracted work out at Durham; an average of sixty-three people per year worked as subcontractors. Another eighteen workers a year were hired by other employees as common helpers. The company itself hired an average of 128 workers annually, from full-time employees to itinerant harvest workers. Out of an annual workforce of 209 people, therefore, thirty percent were subcontractors. Subcontracting clearly increased the number of local families who worked part-time at the company.<sup>33</sup>

Approximately eighty percent of subcontractors at all Pennsylvania ironworks were members of local families. Most were teenage boys or young unmarried men who worked only when their parents could spare them from farm duties. Subcontracting provided work opportunities with limited responsibility and flexible time commitments. The ability to work for only short periods of time enabled these young men to earn extra money for their families, themselves, or toward a competency. About ten percent of subcontractors came from outside the local market areas of a particular ironworks; most were craftspeople of various kinds. The remaining ten percent were usually itinerant workers who remained in the area for a few weeks or a few months, and subcontracted to perform part of a job that was already underway. Most cut wood.

Most subcontractors were paid either when a job was done or at the end of a month's work, although many effectively "borrowed" against their pay by using their contractor's credit at company stores. On rare occasions, subcontractors purchased more goods than their wages could cover, but most companies were wary of extending them too much credit.

Eighteenth-century laborers may or may not have realized that they labored as subcontractors; after all, the term had not yet been coined. Like workers in the seventeenth century and earlier, however, they were clearly

familiar and comfortable with various forms of wage labor. Many sought to supplement their incomes in various ways. Some sought greater independence through building a competency, and worked for wages temporarily when their desire and an opportunity conjoined. The "independence" of Pennsylvania's independent farmers (like most farmers in the British colonies) was qualified. Probably at least forty percent of farm families were tenants, and half of the remainder lived on small properties or marginal lands. Many were indebted, and none totally self-sufficient. For most people in the seventeenth- and eighteenth-century colonies, wage labor forms, such as subcontracting, were not a step down from an ideal independence. These were familiar processes which might lead to a freehold, or to other economic goals.<sup>34</sup>

Some eighteenth-century colonists worked for wages throughout their lives, some laborers earned an acceptable living working for others, and many unskilled workers without property sought wage work simply in order to survive. Subcontracting provided additional work opportunities for such people, while enhancing the continued evolution of industry in the eighteenth century. Throughout British (and European) history, a large proportion of the population worked for other people; in eighteenth-century Pennsylvania, subcontracting involved many laborers in a system of industrial labor. The system was not forced on laborers, but offered to them. The working agreements they made were beneficial to all the parties involved. The full extent of subcontracting arrangements in the British colonies of North America has yet to be explored, but further research will surely reveal ever more complex layers of labor interaction.

## Notes

1. Thomas C. Cochran, *Frontiers of Change: Early Industrialism in America* (New York, 1981), 3-37; Paul F. Paskoff, *Industrial Evolution: Organization, Structure, and Growth of the Pennsylvania Iron Industry, 1750-1860* (Baltimore, 1983), 1-60; Paskoff's argument for gradual industrialization over the eighteenth century is more developed in his dissertation, "Colonial Merchant-Manufacturers and Iron: A Study in Capital Transformation, 1725-1775" (Ph.D. diss., The Johns Hopkins University, 1976). For examples of many of these eighteenth-century business and labor practices, see Michael V. Kennedy, "Furnace to Farm: Capital, Labor and Markets in the Pennsylvania Iron Industry, 1716-1789" (Ph.D. diss., Lehigh University, 1996): chapters 1, 4.
2. Arthur C. Bining, *Pennsylvania Iron Manufacture in the Eighteenth Century* Reprint ed., (Harrisburg, Pa., 1987); Mary Schweitzer, *Custom and Contract: Household, Government, and the Economy in Colonial Pennsylvania* (New York, 1987); Paul G.E. Clemens and Lucy Simler, "Rural Labor and the Farm Household in Chester County, Pennsylvania, 1750-1820," in Stephen Innes, ed., *Work and Labor in Early America* (Chapel Hill, N.C., 1988). Bining's classic study mentions the involvement of servants, slaves, and free workers in the iron industry, but does not examine the complex labor arrangements in which they engaged. Schweitzer's well-developed study reveals the complexities of labor arrangements in eighteenth-century Pennsylvania, particularly the widespread use of wage labor. Because of the breadth of her research, however, iron manufacture, the most developed of all Pennsylvania's industries, receives minimal attention. Clemens and Simler show that wage labor, and the commercial value of work in labor exchanges were in common use in southeastern Pennsylvania by the mid-eighteenth century. Their findings, however, are concentrated on agricultural work. Many of these same people included industrial work at iron plantations in their involved labor arrangements.
3. Irene D. Neu, "The Iron Plantations of Colonial New York," *New York History* 33 (1952), 3-24; Michael W. Robbins, *The Principio Company: Iron-Making in Colonial Maryland 1720-1781* (New York, 1986). There are indications in these studies that subcontracting arrangements were being carried on in the ironworks being researched. This study concentrates on Pennsylvania ironworks exclusively, although evidence from operations such as Elk Forge in Delaware, Greenwich Forge and Ringwood Furnace in New Jersey, and Principio Ironworks in Maryland indicates the routine use of subcontracting. Further research on these other sites is in progress.
4. For the purposes of this paper, and for as clear a distinction of the system of subcontracting as possible, significant sectors of the workforce have been excluded. Family members hired as helpers are not counted, nor are bound servants, apprentices, or slaves. Also excluded are assistants who are hired to help with work, but who never take on any task of their own, or are not paid for the production of some tangible product. For example, potters' or blacksmiths' helpers who stacked material, or did clean-up work are certainly not subcontractors; a woodcutter who agrees to cut 100 cords as part of someone else's contract to produce 500 cords is considered a subcontractor.
5. Most of the extant records of eighteenth-century Pennsylvania ironworks contain examples of written contracts. For the most extensive sets of contracts and their provisions, see the Durham Ironworks Collection 1778-1789, Bucks County Historical Society (hereafter *Bucks*); The Coventry Ironworks Collection 1725-1759, Pine Forge Collection 1733-1757, New Pine Forge Coal Book 1744-1760, and Charming Ironworks Collection 1763-1774, are all at the Historical Society of Pennsylvania (hereafter *HSP*).
6. A subcontract is an agreement to take on at least part of a job originally contracted to someone else, executed between a contractor and one or more people who agree to complete the contract. The *Tenth Edition Merriam Webster Collegiate Dictionary* (Springfield, Mass., 1993) defines a subcontract as "a contract between a party to an original contract

and a third party; *esp*: one to provide all or a specified part of the work or materials required in the original contract." Many historians who examine subcontracting and inside contracting use Dan Clawson's definitions from *Bureaucracy and the Labor Process: The Transformation of U.S. Industry, 1860-1920* (New York, 1980), 71-75. According to Clawson, subcontractors are independent people who work for more than one employer, use their own tools, and create their own schedule; inside contractors work for a single employer on his premises, within his regular schedule, and with his tools and equipment. Subcontracting in the eighteenth century at times incorporated aspects of both of these definitions. Although the word subcontract did not come into common use until the second decade of the nineteenth century, I apply this definition to specific labor arrangements found in ironworks ledgers and account books dating from 1725.

7. Charming Ironworks Ledgers 1782-1788, Berks County Historical Society (hereafter *Berks*); Durham Ironworks Collection 1778-1789, (*Bucks*); Coventry Ironworks Ledgers 1787-1789; Warwick Furnace Ledgers 1788-1792, Chester County Historical Society (Hereafter *Chester*). The following are all at *HSP*: Pool Forge Ledgers, 1725-1783; Pool Forge Day Book 1749-1759; Pottsgrove Ledgers 1755-1765; Mount Pleasant Ledger 1737-1744; Coventry Ironworks Ledgers 1725-1759; Pine Forge Ledgers 1733-1781; Hopewell Forge (Berks County) 1744-1761; Colebrookdale Ironworks Ledgers 1735-1767; Durham Ironworks Ledger 1744-1749; New Pine Forge Ledgers 1744-1763; Warwick Furnace Ledgers 1747-1762; Tulpehocken/Charming Ironworks 1754-1778; Roxborough/Berkshire Furnace Ledgers 1756-1774; Mount Joy Ironworks Ledgers 1757-1768; Mary Ann Furnace Ledgers 1762-1774; Cornwall Furnace Ledgers 1764-1788; Hopewell Forge (Lancaster, now Lebanon County) Ledgers A-I, 1765-1783; Elizabeth Furnace Ledgers 1766-1774; Sarum Forge Ledger 1767-1771, Historical Society of Pennsylvania. In the above records, 843 contractors have been identified, as well as 2081 subcontractors. Approximately ten

percent (201) of the subcontractors later became contractors.

8. *Pennsylvania Archives* v. XI-XV, XVII-XXII (Harrisburg, Pa., 1897), including tax lists from 1765 to 1789; Morton L. Montgomery, *A History of Berks County in Pennsylvania* (Philadelphia, 1886), 932-1186, including tax lists from 1734-1759; Terry A. McNealy and Frances Wise Waite, *Bucks County Tax Records 1693-1778* (Doylestown, Pa., 1982), 3-111. Throughout the eighteenth century, Pennsylvania's ironworks' local markets for both labor and commerce extended over an approximate eight-mile radius, or 200-250 square miles. Many of these markets areas overlapped, and provided competitive work opportunities for local labor. Some operations, like Durham were the only ironworks within a wider area, and drew labor from as far as twelve to fifteen miles away, although most workers came from within eight miles distance. Cross-referencing the company records and tax lists, it is possible to determine new arrivals in a locality, and pinpoint their geographic distance from the ironworks that employs them.

9. Michael Williams, *Americans & Their Forests: A Historical Geography* (New York, 1989), 104-110. All company ledgers include numerous yearly purchases of wood, both cut and uncut. Forges typically consumed between two and three hundred cords of wood per month for charcoal, while some larger furnaces needed more than one thousand cords per month to operate. Despite efforts at replanting wooded areas, most ironworks ran out of wooded lands in less than twenty years, after which they became dependent on local farmers for resources. Between one-quarter and one-third of the yearly workforces at Pennsylvania ironworks were engaged in cutting wood at least part-time.

10. While all companies kept records of tools "borrowed", "broken", or "lost", they are usually not extensive. The Durham Ironworks records contain the best kept records on tools lent, tools returned, and penalties charged for damage or loss.

11. Daniel Vickers, "Competency and Competition: Economic Culture in Early America," *William & Mary Quarterly* 47

(1990), 3-29; idem., *Farmers and Fishermen: Two Centuries of Work in Essex County, Massachusetts, 1630-1850* (Chapel Hill, N.C., 1994); Richard L. Bushman, "The Place of the Eighteenth Century in American Agricultural History," in William G. Shade and Michael V. Kennedy, eds., *The World Turned Upside-Down: Essays on the State of Colonial North-American Studies* (forthcoming, Bethlehem, Pa., 1999).

12. Cornwall Furnace Ledgers 1770-1782, *HSP*; *Pennsylvania Archives* v. XVII.

13. Cornwall Ledger 1776-1782, *HSP*; Durham Ironworks Ledgers 1779-1789, *Bucks*; *Pennsylvania Archives* v. XIII and XVII; Ironworks records and Michael Williams, *Americans & Their Forests*, show that an adult male could cut between one and one and a half cords per day; Lewis C. Gray and Esther K. Thompson, *History of Agriculture in the Southern United States to 1860 v.1* (Gloucester, Mass., 1958), 554-555, states that slave labor cut about one cord per day.

14. Elizabeth Furnace Ledgers 1766-1774 and Cornwall Ledgers 1770-1785, *HSP*; *Pennsylvania Archives* v. XVII.

15. Berkshire Account Book 1768-1771, *HSP*.

16. Durham Miscellaneous Manuscript Papers 1727-1794; Durham Ledgers 1778-1789, *Bucks*.

17. Coventry Ledger 1730-1732, *HSP*. Probably the payments were based on 9d per cord for the wood and 2s per cord for the cutting. It is not clear whether Lyon and Boyle made these agreements as individuals or as a partnership, but Dean and Middlecraft cut wood on Lyons' land and charged on his account exclusively. Sarfoot and Humphreys cut on Boyle's land and charged on his account.

18. Coventry Ledger 1732-1733, *HSP*.

19. Pine Ledger 1748-1757, *HSP*.

20. Coventry Ledger 1726-1729, *HSP*.

21. Pine Ledger 1733-1736, *HSP*.

22. Coventry Ledgers 1727-1733, 1746-1754, *HSP*.

23. Durham Ledgers 1781-1785, *Bucks*.

24. Durham Miscellaneous Manuscript Papers 1778-1794; Durham Ledgers 1780-1786, *Bucks*; *Pennsylvania Archives* v. XIII, 163-164, 220-221, 408-409, 432-433, 567-568.

25. Durham Daybook 1781-1782, *Bucks*. Four

of these workers had been subcontracting at the original mine before closure. Their agreements ended when mining operations were shut down, and subsequently agreed to help with the new shaft.

26. Durham Ledgers 1781-1785, *Bucks*.

27. Charming Daybook 1763-1767, *HSP*. Charming had been paying finers an average of 35s per ton, and chafers 25s per ton. This wage would continue until 1771. Hind made 45s and Hayes 35s per ton in 1764.

28. Bining, *Pennsylvania Iron Manufacture*, 105-108; Coventry Ledgers 1725-1759; Durham Ledger 1744-1749; Mount Pleasant Ledger 1737-1744; Tulpehocken/Charming Ledgers 1754-1783; Pottsgrove Ledgers 1755-1766; Warwick Ledgers 1747-1762; Mary Ann Ledgers 1762-1774; Mount Joy Ledgers 1757-1768; Elizabeth Ledgers 1766-1774; Roxborough/Berkshire Ledgers 1755-1783; Colebrookdale Ledgers 1735-1774; Cornwall Ledgers 1764-1783, all *HSP*; Durham Ironworks Collection 1727-1794, *Bucks*.

29. Pine Ledger 1733-1736 and Mary Ann Ledger 1771-1774, both *HSP*. Chapman made approximately £89 for producing pig iron at 5s per ton, and £38 for casting potware. After paying his keeper's wages, he had increased his total income by over seven percent. Ridgely made approximately £135 for producing pig iron, and £109 for casting. His total income after paying his keepers increased nearly nine percent.

30. Pool Forge Ledger 1725-1726, *Berks*.

31. Mary Ann Waste Book 1762-1763, *HSP*.

32. New Pine Ledger 1758-1761, *HSP*.

33. Durham Ironworks Collection 1778-1789, *Bucks*. Eighty-two workers (subcontractors and helpers), or thirty-nine percent of the annual workforce at Durham were indirect hires. The total of 209 annual workers at Durham does not include an unknown number of sons, daughters, wives, etc. who helped cut wood, make charcoal, or engaged in other work attributed to listed employees.

34. A number of historians have produced a wealth of material on the large numbers of tenant farmers throughout the colonies, including: Lucy Simler, "Tenancy in Colonial Pennsylvania: The Case of Chester County," *William & Mary Quarterly* 43 (1986), 542-



569; Lois Green Carr and Russell R. Menard, "Immigration and Opportunity: The Freedman in Early Colonial Maryland," in Thad W. Tate and David L. Ammerman, eds., *The Chesapeake in the Seventeenth Century* (W.W. Norton & Co., New York, 1979), 206-242; and Sung Bok Kim, *Landlord and Tenant in Colonial New York: Manorial Society 1664-1775* (University of North Carolina Press, Chapel Hill, N.C., 1978). Also, see Michael V. Kennedy, "An Alternate Independence: Craft Workers in the Pennsylvania Iron Industry, 1725-1775," *Essays in Economic & Business History* 16 (1998), 113-125; Kennedy, "Over the Hills and Far Away with Ludwig Nuspickel: Commercial Markets in the Lehigh and Musconetcong Valleys, 1735-1800," in Jean R. Soderlund, ed., *The Forks of the Delaware: Pennsylvania's Lehigh Valley in the Eighteenth Century* (forthcoming, Bethlehem, Pa., 1999); and Peter O. Wacker and Paul G.E. Clemens, *Land Use in Early New Jersey: A Historical Geography* (Newark, N.J., 1995), 92-93. The mirage of self-sufficiency has been

addressed from many angles by James T. Lemon, "Household Consumption in Eighteenth-Century America and its Relationship to Production and Trade: The Situation Among Farmers in Southeastern Pennsylvania," *Agricultural History* 41 (1967), 59-70; Bettye Hobbs Pruitt, "Self-Sufficiency and the Agricultural Economy of Eighteenth-Century Massachusetts," *William & Mary Quarterly* 41 (1984), 333-364; Carole Shammas, "Consumer Behaviour in Colonial America," *Social Science History* 6 (1982), 67-86; Daniel Vickers, "Competency and Competition" and *Farmers and Fisherman*; Clemens and Simler, "Rural Labor and the Farm Household"; Duane E. Ball and Gary M. Walton, "Agricultural Productivity Changes in Eighteenth-Century Pennsylvania," *Journal of Economic History* 36 (1976), 102-117; and Joyce Appleby, "Commercial Farming and the 'Agrarian Myth' in the Early Republic," *Journal of American History* 68 (1982), 833-849.