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Financial Failure?

The Real Returns to the Blackstone Canal

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ABSTRACT

The Blackstone Canal was a financial failure but yet it is attributed with stimulating the economic development of the Blackstone River Valley, a common story for antebellum canal investment. Previous research on the contribution of canals to economic development has focussed on the social savings from lower transportation costs. I argue that canals also altered control of water rights to improve water power in ways that would not otherwise have been possible under the extant riparian system. Water power appears to be the primary objective of promoters of the Blackstone Canal and a transportation canal a means to that end.

INTRODUCTION

The Blackstone Canal ran from Worcester, Massachusetts, 45 miles southeast to the tidal waters of Providence, RI, beginning operation in 1827 and collecting its last toll in 1848. Its existence has been credited with stimulating the industrialization of the Blackstone River Valley by opening transportation connections to the world, from the growing markets of central Massachusetts through Providence's port.¹ By all accounts, the canal was a financial failure, paying only a total of \$4.10/share in dividends on a \$100

¹ See for example, Blackstone River Valley, pamphlet of Blackstone River Valley Heritage Corridor, Massachusetts/Rhode Island, National Park Service, US Department of the Interior.

share between 1825 and 1850. Finally, the canal was sold off piecemeal to meet the demands of creditors, primarily a group of mill owners along the Blackstone River who had won a lawsuit against the company for diminishing the flow of water in the river and damaging their mill operations.² Contemporaries and more recent analysts regarded it as a technical failure as well. There was inadequate water to operate some sections efficiently, limiting freight traffic on the canal. It froze over in the winter and ran dry occasionally in the summer so transportation was inadequate. In fact, full freight service to Worcester was not established until 1832 and was irregular at best after that time.³

However, in studying the source of indirect returns to investment in the canal, an additional factor must be considered: access to improved water power. Some investors wanted the canal in order to improve the water power provided to their existing mills and planned mill expansions. Building the Blackstone Canal was a cost-effective method of achieving this goal and costs for an individual mill owner were reduced as a result of the participation of those investors who were primarily interested in the benefits of economic growth provided by improved transportation. The transportation function of the canal was important to all investors but was essential to those seeking improved water power. Granting the right of eminent domain, the element of the state charters of incorporation that made the project cost-effective, required that the project benefit the public, not transfer private property from one individual to another. The larger goal of the canal promoters was to develop viable waterpower where it did not currently exist.

A review of the literature on the financial success and contribution to US economic development of canal investments indicates that most were marginally

² Coombs, "The Blackstone Canal." 7.

³ Houston, *Failure of the Blackstone Canal*, 30.

successful at best. These studies however only consider the direct returns and the social savings of lower transportation costs, not the value of improved water flow for power. An analysis of the Blackstone river and canal demonstrates where waterpower existed and where it was improved or created by the canal. A calculation of the internal rate of return to canal investment including the value of improved waterpower indicates that building the canal was a very cost-effective method to develop power. The priorities evolving with the riparian water rights systems that were emerging at the time explain the choice to build a canal rather than just make changes necessary to provide or improve waterpower. I argue that canals were not just about transportation but also control of water rights and the value of those rights must be considered in calculating the profitability of canal investment and the contribution of canals to economic development.

LITERATURE ON THE FINANCIAL SUCCESS OF CANALS

In fact, financial failure was common for many early transportation improvements. Harvey H. Segal finds that for more than one fifth of total canal investment, the costs exceeded the benefits even when reduced transportation costs are considered as part of the benefits.⁴ If only financial statement profits are considered, more than 2/3's of canal investment in the antebellum US lost money.⁵ When measuring the contribution of canals to US economic development, he adds for consideration the benefits of the widening of markets and increases in land values.⁶ Roger Ransom is even less optimistic about the profitability of canal investment.⁷ Majewski concurs, finding

⁴ Segal, "Canals and Economic Development," 247.

⁵ Ibid. 241.

⁶ Ibid. 223.

⁷ Ransom, "Canals," 373 and 375.

that investors in many early transportation projects lost money in terms of direct returns to investment but relied on the indirect benefits of their investment, such as increased property values, to provide the returns. He poses an important question relative to this plan for returns on investment: "One puzzle remains with regards to the early transportation companies: how did they solve the freerider problem associated with indirect benefits?" and indicates that the answer lies in a combination of social pressure, kinship ties, and supplemental state funding.⁸ The Blackstone Canal relied on all of these methods in some form to overcome the freerider problem.

Canals however provide water in addition to transportation and this benefit also needs to be considered in its own right. The value of improved water flow was recognized and exploited by some canals. For example, the Schuylkill Navigation Company began selling waterpower in 1819.⁹ The large waterpower complex at Lowell began operation in 1823 after purchasing the rights to a short transportation canal that that was built about 1800.¹⁰ Mill-owning promoters of the Blackstone Canal recognized the potential to develop waterpower for their own use.

THE GEOGRAPHY OF THE RIVER

The Blackstone River is relatively small at its headwaters in Worcester and grows in size as it continues southeast towards the tide waters at Providence. The Blackstone River officially begins along the southern border of Worcester near the town of Millbury. At this point, several tributaries, including Mill Brook converge to form the river. The canal however began about 2 miles north in downtown Worcester, following the course

⁸ Majewski, "Who Financed," 773-74.

⁹ Shelton, "Mechanization" 54.

of Mill Brook to the Blackstone River. The primary water source for Mill Brook and the canal was North Pond. The dam that created North Pond was originally built by the town of Worcester to provide a more consistent water supply by saving water from the flood seasons for the dry seasons. The rights to this dam were passed to the canal company, which improved the dam to provide more water for the canal. The dam was raised again in the 1830's to satisfy the requests of mill owners.

In 1820, industrialization along the Blackstone River was primarily at the southern end between Valley Falls, RI and Providence. The reason for this concentration is twofold. First, this is where the water flow is actually strong enough to support the textile mill machinery of the time and there is adequate access to a major port for transporting inputs, mostly cotton, to the mills and shipping finished products out to larger markets in the US and Europe. Here, Samuel Slater and a number of others built the first large-scale textile mills in the US. About 4 miles up the river, near the town of Albion, the canal broke away from the river for the last time and followed the Moshassuck River to the tidewater area in Providence. The canal diverted water away from the river, never to return it again, just before the river reached the most heavily industrialized section. For transportation reasons, this made sense. The terrain along this section of the Blackstone River was difficult if not impossible to navigate because of the falls and the speed of the river. A canal requires slack water for mules or horses to be able to pull boats up stream. The canal company chose a route along the Moshassuck because it was smoother. The Moshassuck did not however provide adequate water for navigation so water had to be diverted from the Blackstone for the canal to operate. This river suffered from the same problems that the Blackstone did in Worcester; it was a

¹⁰ Hunter, *Waterpower*, 251 and 255.

relatively small river with very irregular water flow. The building of the canal helped to increase and regulate the flow of water in this river, which proved helpful to mill developers along its course. For the existing mills further down the Blackstone River however, this created a problem because the canal's diversion diminished their waterpower. This situation created the largest lawsuit against the company and contributed to its poor financial position.

VALUE OF WATER POWER

To assume that canal investors wanted waterpower presumes that they had decided against alternative power sources, in this case steam power. To determine if investment in the canal was a cost-effective way of obtaining waterpower, I calculate the internal rate of return on investment in the canal, incorporating estimates of the value of improved water power provided by the canal for a variety of investors using a discounted value formula as follows:

$$DPV_{1825} = 0 = \sum_{n=1}^{25} \frac{C_{1824+n} + B_{1824+n}}{(1+r)^n}$$

C = cost of canal investment
B = benefits from canal investment
r = internal rate of return

For each investor, I used information about the stock's history, waterpower costs at Lawrence, MA, and additional estimates of waterpower facilities to estimate their rate of return. The cost of canal investment was the purchase price of shares in the company. Initial shares were sold at \$100 per share, paid in equal installments over 4 years or \$25 per year from 1825 to 1828. A subsequent 1829 issue was for shares at \$15 per share. Enough of this additional issue was subscribed by stockholders that all holders were

required to purchase new shares on a one for one basis. Dividends totaling \$4.10 per share were paid sporadically from 1831 to 1850 when the canal company officially closed its books, giving an internal rate of return of -18% if an investor did not participate in the new issue or -16% if the investor did participate and the only benefits considered are the dividends.

The benefits from canal investment include dividends and the estimated value of waterpower received from the canal. The dividend stream is presented in Table 1.

Table 1
Dividends Paid by the
Blackstone Canal Company

| Year | Dividend per share |
|------|--------------------|
| 1831 | \$1.00 |
| 1833 | \$0.50 |
| 1834 | \$0.40 |
| 1835 | \$0.50 |
| 1836 | \$0.25 |
| 1846 | \$1.00 |
| 1848 | \$0.20 |
| 1850 | \$0.25 |

Source: Board Meetings, Minutes and Reports, 1825-1850. Blackstone Canal Company records, MSS 296, Box 1, Folder 1, Rhode Island Historical Society (RIHS).

To estimate the value of waterpower received from the canal, I use Atack, Bateman, and Weiss' estimates for the cost of waterpower at Lawrence, MA, of \$3.52 per horsepower for owners of original water rights and \$14.08 per horsepower for later renters.¹¹ These estimates put a lower bound on the return to investment, with \$14.08 per

¹¹ Atack, Bateman, and Weiss, "Regional Diffusion," 294, footnote 43.

horsepower approximately equating steam power costs with waterpower. In fact they indicate that for owners of original water rights in Lawrence, “no plausible levels of steam power cost elements would have induced a switch to steam.”¹² This does presume that investors in the Blackstone Canal did not have access to significantly cheaper sources of fuel, primarily coal, for steam power than mill-owners in Lawrence and there is no reason to believe that they did. Therefore, using these estimates for waterpower values, I assume that waterpower was the lowest-cost choice.

To value the benefit of waterpower, I also need estimates of the horsepower requirements of each investor. Atack, Bateman, and Weiss indicate that the average waterwheel in 1850 produced 15 horsepower per year.¹³ Louis C. Hunter provides some more industry-specific estimates of waterpower use, indicating that typical mid-sized cotton mills in the 1830’s used between 50 and 75 horsepower and iron forges in the early 1800’s ranged from several horsepower to as much as 240 horsepower.¹⁴ These estimates give reasonable ranges for the power required by the mills of each of the investors but where possible, I have used more precise estimates of the size of specific facilities.

Since several of the mills existed before the canal, I also need estimates of how much the canal improved the waterpower situation rather than just the total power utilized. Depositions in a case brought against the canal for damaging the waterpower to one mill about mid-way down the canal indicates that the canal approximately doubled the water flow or doubled the length of time that mills could operate during the year. Sylvanus Holbrook testified that, “He can do double the business in consequence of the

¹² Ibid.

¹³ Ibid, page 295.

canal reservoirs above his works.”¹⁵ Ichabod Washburn, an operator of one of Stephen Salisbury’s mills, indicated that there was double the water in Mill Brook, though less than twice as much during dry seasons.¹⁶

The return to investment for three investors or investor groups is presented in Table 2. Estimated returns range from -3% to 100% depending on the size of initial investment and the estimated contribution to waterpower provided by the canal. All of the investors could possibly have attained a 6% rate of return on their investment, a reasonable benchmark return for other possible investments.

Table 2
Estimated Return to Investment in the Blackstone Canal
including Value of Waterpower Received

| Investors | Low Water Cost Estimate | High Water Cost Estimate |
|---|-------------------------|--------------------------|
| Sylvanus Holbrook | 37%-48% | 79%-100% |
| Edward Carrington, Thomas P. Ives, and Nicholas Brown | -3% | 7% |
| Stephen Salisbury | -1% | 8% |

Source: See text

Sylvanus Holbrook was a mill owner in Northbridge, MA, along the Blackstone River and Canal. His investment consisted of one share in the canal but he was still elected as a commissioner, a position which he held from 1827 to 1850 even though he sold his share in 1830 for \$35, without ever receiving a dividend or purchasing his share due from the additional issue.¹⁷ He owned two mill complexes comprising three mill buildings that were in operation for most years between 1828 and 1850. The range of

¹⁴ Hunter, *Waterpower*, 435 and 438.

¹⁵ Jenckes Family Papers, subgroup 1, series 2, box 5, folder 7, sheet D, p. 1, RIHS.

¹⁶ *Ibid.*, same folder, other set of bound depositions, not labeled.

returns for each waterpower price is based on estimates of between 12 horsepower and 18.75 horsepower required per mill and that the canal doubled the amount of time he could operate his mills during the year.¹⁸ The high estimated return on his investment is primarily due to his small investment in the canal. The stockholder record books for the company do not exist, but scattered receipts for stock purchases indicate that there were many who only bought one share, so his situation was not unusual. Also, a fire at his larger mill complex in 1850 forced him into bankruptcy, losing all of the mill properties. From accounts of the incident, it appears that he was not a man of great financial means, so his small investment is not surprising.¹⁹ He certainly made the most of it.

Edward Carrington, Thomas P. Ives, and Nicholas Brown, all from Providence, were the initial promoters of the canal and the largest investors in the canal, subscribing 175 of the initial shares (about 1/12 of the total initial capital). These three men were also jointly invested in at least three mills along the canal, one of which was operating before the canal opened and two larger mills began operation in 1830. All of the mills had multiple water wheels. I assume that the earliest mill, located in Blackstone, MA, on the state border with Rhode Island, had two average sized water wheels of 15 horsepower each and that the canal doubled their use or added 7.5 horsepower each. The new mills were much larger, one located in Woonsocket, RI and the other at Lonsdale, RI. I assume that the Woonsocket mill was on the lower end of Hunter's typical mid-sized cotton mill so each wheel generated 50 horsepower and that the canal had doubled the volume of water to make this possible or contributed 25 horsepower per wheel. Lonsdale became one of the largest mills in the region and is located where the Blackstone canal left the

¹⁷ Richard W. Greene Collection (Greene), MSS 144, subgroup 5, box 35, folder 8, p. 108, RIHS.

¹⁸ For more details of Holbrook's situation, see Dupree, "Sylvanus Holbrook."

Blackstone River and entered the Moshassuck, using what became the Lonsdale mill ponds as their course for the transition. Without the canal, this mill would not have been possible, so I assume that the two wheels were 50 horsepower each and that the canal contributed all of the waterpower or 100 horsepower. It is interesting to note that these men began acquiring the land for the Lonsdale mill in 1822 through agents, one year before they first proposed the canal project. The apparent low returns, ranging from -3% to 7% are primarily due to the conservative size estimates of the two new mills that these investors built as a result of the canal.

Stephen Salisbury was the wealthiest person in Worcester by 1834 property valuation.²⁰ As of 1834, he owned 40 shares of stock in the canal company. In 1835, Salisbury built and leased two machining mills in Worcester along Mill Brook, above the canal basin. These were built concurrent with the canal company raising the dam at the canal headwaters. I assume that both of these mills were of average size, generating about 15 horsepower and that they would not have been built without the canal because of the timing. Salisbury clearly had the financial ability to build sooner but chose not to.

These are the only investments for which I have some reasonable estimate of the size of investment but there are many other investors who are known to have mills along the course of the canal and to have benefited from improved waterpower. It is clear that investors in the canal company earned their returns not from the operation of the canal, but from other benefits conveyed by the canal. However, the best interest of a transportation canal and a water power canal may run counter to each other. Since the canal's commissioners, charged with making the operating decisions of the canal, were

¹⁹ Miller, *Among Hills and Vales*, 61.

²⁰ Holly V. Izard, Research Historian, in-progress research notes, Worcester Historical Museum.

also those with strong interests in non-transportation functions of the canal, it is likely that some poor operating decisions were driven by these competing forces. The question is then, why go through the trouble of building a canal if waterpower is what the investors wanted?

WHY A CANAL?

There are two reasons why promoters chose to build a transportation canal, even though they were primarily interested in improved waterpower: the legal understanding of water rights under a riparian system and the necessity of gaining the right of eminent domain. Riparian water rights are allocated to the landowners adjacent to the waterway. This was the system in place in Massachusetts and Rhode Island at the time. The system was evolving to give priority to users who invested capital to use the water but limited their effect on the flow of water to a reasonable level as determined by the courts. These laws were just emerging in the 1820's and 1830's when the Blackstone Canal was being built and used.²¹ Massachusetts and Rhode Island recognized these principles and in common law applied a standard of occupancy that held that the first user to invest in capital improvement to use water had the priority right to the continued flow of water. This meant that if an improvement would damage the property of someone who had not made water-using capital improvements, the investor in the improvement would have to pay reasonable damages, but could not be prevented from making changes to the water's flow pattern. If however an investment would cause damage to others that had already made improvements, they had prior rights to the water's flow. It was not until the

²¹ See Horwitz, *Transformation*, 34-62, and Rose, "Energy and Efficiency," 261-296 for a history of the development of riparian water rights laws.

1850's, after the canal had already closed, that the states began to use a looser rule, allowing reasonable damages to prior investors. Under the strict-occupancy rule then, the ability to further develop waterpower along the Blackstone River was hindered for two reasons. First, there was significant development of waterpower along the southern end of the river, establishing prior right to the water flow. Second, the effort to increase and better regulate the flow of water along the river required a system of reservoirs that did not closely correspond with the location of the mills, involving many parties. Seven of the nine reservoirs supplying the water system were located in Massachusetts and the two reservoirs in Rhode Island were located at the point where the canal left the Blackstone River. Rhode Island mill owners would not have been able to improve their waterpower without the Massachusetts reservoirs. It was relatively easy to make contracts with one or two neighboring users under the strict occupancy rule, but once the situation expanded beyond that, transactions costs became prohibitive.

Obtaining the right of eminent domain would overcome these difficulties. Eminent domain is the right of the government to take property for public uses.²² The priority given to the earlier developers at the lower end of the river under common law would be overridden by eminent domain. Also, it created a means to reduce the transactions costs of negotiating agreements with riparian owners all along the course of the system to make building the system cost effective.²³ The right of eminent domain could be obtained through the granting of a state charter of incorporation, but the critical

²² Horwitz, *Transformation*, 65.

²³ See Rosenthal, "Development," 633. Rosenthal's work on irrigation systems in Provence highlights the importance of a cohesive system for granting rights of eminent domain in reducing transactions costs for canal projects, indicating that "transaction costs associated with irrigation development increased dramatically when projects crossed authority boundaries." Indeed, he finds that the French Revolution created an effective national government system that was able to grant rights of eminent domain for the

issue was that the corporation be formed for a public purpose. In fact, the courts were quite hostile to the idea of eminent domain being used to transfer private property for private use and the right was generally limited to the building of transportation improvements.²⁴ The transportation canal solved the legal problems that a pure waterpower improvement project could not.

CONCLUSION

I believe that the primary goal of the promoters of the Blackstone Canal was to develop a viable water power system. Given the riparian water-rights system in place at the time and the necessity of gaining the right of eminent domain, a transportation canal made it possible to make the desired improvements. The return to investors came not from the canal's operation, by which standard it was a dismal failure and very poor investment, but from the other benefits they accrued from its existence, including water rights. This paper begins to make some estimates of the value of these benefits.

Previous research on the value of canals in US economic development has focussed on the benefits of improved transportation leading to expanded market access. It is important to remember that canals also control water flow. Water has a direct value of its own and this value must be considered when evaluating the financial success of canals and their contribution to economic development.

construction of irrigation canals and that this change was the turning point in the development of irrigation in Provence.

²⁴ Horwitz, *Transformation*, 63-65.

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