

# Biological Innovation without IPRs: Cotton Breeding in the Antebellum American South

Paul W Rhode  
University of Michigan

April 2015

Preliminary: Please do not cite without permission.

Acknowledgments: I would like to acknowledge the helpful comments of Richard Baker, Lisa Cook, Avner Greif, Petra Moser, Alan Olmstead, Mark Stegeman, and audience members at Clemson, Davis, Michigan, Stanford Institute for Theoretical Economics, and the Western International Economic Association meetings.

In early 2013, the U.S. Supreme Court heard the case of *Bowman v. Monsanto Co.* (657 F.3d 1341) concerning whether a farmer could “reproduce patented seed through planting and harvesting without the patent holder’s permission.” During oral arguments, Chief Justice John Roberts signaled his skepticism of farmer Bowman’s claim that Monsanto’s patent rights for Roundup-Ready soybean seed were exhausted after the initial authorized sale. Roberts inquired: “Why in the world would anybody spend any money to try to improve the seed if as soon as they sold the first one anybody could grow more and have as many of those seeds as they want?” (19 Feb. 2013, Proceeding, p. 3) On 13 May 2013, Justice Elena Kagan delivered the Court’s unanimous opinion in Monsanto’s favor. If protection were exhausted at sale, “Monsanto’s patent would provide scant benefit. After Monsanto sold its first seed, other seed companies could produce seed to compete with Monsanto, and farmers would need to buy seed only once.” This entailed “depriving Monsanto of its monopoly (p. 6).” By passing the Patent Act to provide incentives for innovation, Congress had intended to create an “undiluted patent monopoly” for 20 years, not “for only one transaction. (p. 8)”<sup>1</sup>

The U.S. Supreme Court decision reflects the common argument that intellectual property rights (IPRs) are necessary to promote rapid innovation. To encourage the invention of self-replicating products such as seed or software, strong protection is viewed as essential. In response to Robert’s inquiry about why anyone would invest to improve seed that purchasers could indefinitely reproduce, even Bowman’s lawyer, Mark Walters, concurred: “I agree no one would do that...” (19 Feb. 2013, Proceedings, p. 3) Yet there are notable historical counterexamples. Without any form of IPRs for plants, the upland cotton sector of American South in the antebellum period witnessed

---

<sup>1</sup> U.S. Supreme Court, *Bowman v. Monsanto Co.* (13 May 2013) 657 F.3d 1341; “Supreme Court Supports Monsanto in Seed-Replication Case,” *New York Times*, 13 May 2013.

significant biological innovation.<sup>2</sup> Seed improvers introduced a succession of new cotton varieties—first green-seed, then Mexican white seed and Petit Gulf, and many other new varieties thereafter — that greatly increased the productivity of the region’s land and labor.

As an indication of the progress, the amount of cotton picked per worker per day increased four-fold between 1800 and 1860 (see Panel A of Figure 1 drawn from a plantation-based study with Alan Olmstead).<sup>3</sup> Contemporaries asserted the improved seeds rivaled the importance of the invention of Eli Whitney’s saw gin. These biological innovations helped the American South become dominant global producer of cotton, supplying three-quarters of the key raw material to the industrializing world circa 1860. The British East India Company, the Ottoman Sultan, and planters in the Antipodes all recognized that the U.S. comparative advantage in cotton production was in large part based on its superior seeds. These competing producers actively imported improved cotton seeds from America and hired southern planters who knew how to grow them.

Seeds, by their nature, carry instructions to multiply themselves in large numbers. Assuming no cross pollination, the copies are nearly exact. This meant that farmers could purchase improved seed and imitate the innovation by planting and increasing it on their property. The advent of technologies and laws that limited reproducing commercial seed such as the F1/F2 hybridization process (1910s/20s) and intellectual property protection for sexually-reproduced plants (1970s in United States) [as well as the terminator gene (1998)] increased the market for improved seed. These changes made it easier for commercial breeders to appropriate the returns from their innovations to cover the cost of their investments while at the same time limited the ability of farmers or rival breeders to reproduce seed. However, in an earlier age prior to these developments, seeds were commercial products. In the antebellum American South, the market for cotton seed for

---

<sup>2</sup> These developments are surprising for many reasons. They occurred in the American South, a region with a large disempowered slave labor force, limited pools of skilled/educated workers, few sizeable cities, and a reputation for technological backwardness. They occurred in a place where, as the case of Eli Whitney’s saw gin illustrates, the legal system did not always respect formal patent rights. As another indication of how upside-down the picture was—Whitney’s gin, a labor-saving mechanical innovation, helped propel the region on its highly labor-intensive development path. The new seeds, a form of biological innovation, significantly reduced unit labor requirements, contrary to the standard assumptions of the induced innovation hypothesis.

<sup>3</sup> Alan L. Olmstead and Paul W. Rhode, “Biological Innovation and Productivity Growth in the Antebellum Cotton Economy,” *Journal of Economic History* 68, no. 4 (Dec. 2008), pp. 1123-71.

planting purposes thrived, promoting significant rates of innovation and productivity growth in the complete absence of IPRs.

To frame this analysis, it is important to establish some “stylized facts” about cotton seed and its power to multiply. Unlike grain crops, cotton was not grown for its seed. Lint, the seed’s covering, was a “good.” The seed, at least before the discovery of ways to utilize it for feed, fertilizer, and oil, was a “bad.”<sup>4</sup> Depending on the variety grown, seed made up between two-thirds to three-quarters of the product of a cotton field. It was bulky, weighing between 25 to 33 pounds per bushel. (Using 30 pounds will serve our purposes.) Circa 1849-50, given typical seeding rates of 2.5 bushels per acre, yields of 600 pounds of seed cotton per acre, and a turn-out ratio of one pound of lint and 2 pounds of seed, the seed would multiply 5.33 fold each year. The multiplication ratio could be far higher if greater care was taken. With these crude parameters, the powers of multiplication were sufficiently rapid that, within 17 years, the progeny of a single seed could plant all of the 5 million acres devoted to cotton in the South in 1849.<sup>5</sup> This rate of increase was finite and far slower than Justice Roberts’ hypothetical where as soon as the first seed was sold, “anybody could grow more and have as many of those seeds as they want.” The conditions of the breeders’ market power were determined by the seed’s reproductive rate and cultivation practices rather than by legislative choices and court proceedings. At the time, under the 1836 Patent Act, the term of a U.S. patent, which

---

<sup>4</sup> Untreated cotton seed is poisonous to many mammals and fish. From the 1800s on, virtually every cotton-producing state outlawed dumping cotton seed into lessor waterways or keeping it where might be consumed by stray livestock or pollute the neighborhood with noxious vapors. As examples, see Oliver H. Prince, *Digest of the Laws of the State of Georgia* (Milledgeville: Grantland and Orme, 1822), pp. 115-16 and Harry Toulmin, *Digest of the Laws of the State of Alabama* (Cahawba: Ginn and Curtis, 1823), pp. 103-05.

<sup>5</sup> For standard seeding rates circa 1850, see U.S. Patent Office, *1848 Annual Report*, p. 658. In 1849 there were 2,443,793 bales of 400lb of ginned cotton produced on an estimated 5 million acres in the US. This represents a yield of 195.5lb of lint per acre. U.S. Census Office, *Seventh Census, 1850, Statistical view of the United States, embracing its territory, population—white, free colored, and slave—moral and social condition, industry, property, and revenue*, pp. 174, 176. The calculation assumes there are 120,000 seeds per bushel. See Harry B. Brown, *Cotton: History, Species, Varieties, Morphology, Breeding, Culture, Diseases, Marketing, and Uses* (New York: McGraw-Hill, 1927), p. 78. Taking a multiplication rate of 5.333 per year, the time is  $T = \ln(120,000 * 2.5 * 5,000,000) / \ln(5.333) = 16.75$  years. This multiplication rate is likely on the low side. Cotton growers focused on breeding could secure higher rates by economizing on the use of seed. M.W. Philips, “Cotton Seed,” *Southern Cultivator* 6, no. 7 (July 1848), p. 101 sowed ½ bushel per acre. In addition, the 1850 yields were likely low. A yield of 800 pounds of seed cotton per acre was the median “usual yield” reported by local marshals in the 1860 U.S. Census. We know that 2,155 million pounds of lint was produced in 1859. U.S. Census Office, *Eighth Census, Agriculture, 1860*, p. xciii.

granted “the full and exclusive right and liberty of making, constructing, using, and vending to others to be used,” was 14 years, with the possibility of renewal for an additional 7 years.

The makeup of the cotton plant contributed to the early development of the seed market. The large concentrations of mixed populations of cotton plants with cross-pollination in the field and heterozygosity created a high potential for genetic change. This plasticity made it possible for astute breeders to find and develop productivity-enhancing varieties, but these conditions also caused “deterioration” or scrambling of existing combinations. This created a demand for fresh seed. Planting shocks, such as late-season freezes, also stimulated demand for replacement seed.<sup>6</sup> In addition, seeds are compact, relatively durable, and easily transported, enhancing their efficiency as carriers of technology.

This paper details the development of the antebellum cotton seed market and investigates the sector’s industrial structure and the motives to innovate in the absence of IPRs. It then examines the price path for new releases and asks how the price path fits into a model of the markets for cotton seed inspired by the Boldrin-Levine’s work.<sup>7</sup> The model captures the effects of the expansion of supply on a market with homogeneous purchasers with complete information. Finally, paper explores information problems in the antebellum market and attempts to remedy them.

## **Development of the Antebellum Market for Cotton Seed**

As was true with biological innovations in other parts of the nineteenth world, pirated cotton technologies contributed greatly to the agricultural development of the antebellum American South. While visiting Mexico City as a part of an American mission in 1806, Walter Burling obtained seeds of a high-quality cotton, which he

---

<sup>6</sup> Selecting suitable seed and maintaining quality required extra care and attention—such costs generated the advantages of a division of labor between specialized seed production and more general crop cultivation. Through trial-and-error and careful observation, breeders came to understand the need to separate experimental fields and take special care in ginning. The USDA advocated producers of seed for one-variety community be isolated by one mile from the production of inferior varieties. J. E. Hite, *Community Production and Distribution of Cotton Planting Seed in a One-Variety Cotton Community* USDA Circ. No. 286 (Sept. 1933), p. 7.

<sup>7</sup> Michele Boldrin and David K. Levine, *Against Intellectual Monopoly* (New York: Cambridge Univ. Press, 2008) [levine.sscnet.ucla.edu/general/intellectual/against.htm](http://levine.sscnet.ucla.edu/general/intellectual/against.htm).

smuggled out of Spanish Mexico and then passed on to his Natchez area neighbor, William Dunbar, for experimentation and acclimatization.<sup>8</sup> Over the next two decades, breeders in the Mississippi Valley crossed Mexican highland cottons with local stock to create varieties that possessed higher quality lint, greater resistance to disease (esp. to the “rot”), higher yields per acre, and greater ease of picking. These improved varieties spread throughout the Valley and into the South Atlantic states. The expanded commercialization of improved cotton seed dated to the early 1830s, which witnessed an explosion of advertising for seed across the cotton belt. Panel A of Figure 2 charts the number of advertisements for “cotton seed” by year in the Readex historical newspaper index. (The search excluded “cotton seed oil” and “cotton seed planter.”) The takeoff in advertising for cotton seed is reflected in other sources. This wave of advertising coincided with the great cotton boom of the 1830s. Among the first star product was *Petit Gulf*, a Mexican highland selection produced in the Petit Gulf/Rodney/Gulf Hills region of Mississippi. Commercial seed producers from many parts of the Mississippi Valley affixed the “Petit Gulf” name to their bags of seed. Standard accounts create the development of *Petit Gulf* to Dr. Rush Nutt.<sup>9</sup> He learned the secrets of Llewellyn Price, a pioneering breeder in the 1820s, and made them a commercial success. Rush Nutt and his family produced improved seed under their own brand, acquiring a regional and even international reputation.<sup>10</sup>

Other “improved” varieties— including one alternatively called *Okra*, *Twin*, or *Alvarado*— joined *Petit Gulf* on the market in the late 1830s. The story of *Okra* cotton is illustrative of one source of innovation and the evolving set of marketing practices. Todd

---

<sup>8</sup> Other important examples of smuggled flora and fauna include Merino sheep from Spain, tea plants from China, and rubber tree seeds from Brazil. See, for example, Robert Fortune, *Three Years' Wandering in the Northern Provinces of China, A Visit to the Tea, Silk, and Cotton Countries, with an account of the Agriculture and Horticulture of the Chinese, New Plants, etc.*, (London: John Murray, 1847).

<sup>9</sup> Lewis C. Gray, *History of Agriculture in the Southern United States to 1860*, Vol. 2, (Washington, DC: Carnegie Institute, 1933), pp. 703. Haller Nutt, “Egyptian Cotton Cultivated in Mississippi,” *Farmer's Register* 9, no. 5 (31 May 1841), pp. 312-14 provides an account of the breeding activities of both himself and his father, Rush Nutt. He refers to their main product as “Mexican” rather than *Petit Gulf*. He also notes experimenting with *Twin-Okra* “but abandoned it, as inferior to our Mexican, in almost every respect....”

<sup>10</sup> John Hebron Moore, “Cotton Breeding in the Old South,” *Agricultural History* 30, no. 3 (July 1956), pp. 95-104, esp. p. 98. *New Orleans Times-Picayune* 1842 and 1843; “Gustine” was another well-recognized brand according to the *Southern Cultivator*, Jan. 1841. Other accounts credit Pearce Noland, a Mississippi Judge, with helping to elevate its popularity. M. W. Philips, “Sugar-Loaf Cotton,” *Southern Cultivator* 6, no. 9 (Sept. 1848), p. 131 and “Improved Cotton Seed,” *Southern Cultivator* 7, no. 1 (Jan. 1849), p. 11.

Terry of Autauga, Alabama discovered a distinct plant in a field of *Petit Gulf* cotton—it bore its cotton on the main stem and had no branches. It looked like an okra plant (a close relative to cotton), hence its name. The unusual stalk was picked clean except a single lock containing nine seeds. From these seeds, Terry propagated the strange plant which was very tall and matured early. It was thought to be easier to pick and have a longer tap root, making Okra more drought-resistant. In 1837, Terry marketed seeds for 50 cents each (\$12.7 per seed in 2012 purchasing power) and \$160 per bushel in 1838.<sup>11</sup> The variety gained strong adherents such as Dr. D. Cooper of Harris Co. GA; Cooper “is thoroughly convinced of the superiority of this Cotton, and is taking great pains to disseminate it through the Cotton growing region.”<sup>12</sup> Advertisements touted the advantages of growing the seed not just for oneself but also as a speculative venture to supply others: “The small amount of the seed now in existence will make their production an object of great importance for some time to come; and persons not disposed to go into the culture of cotton, would probably realize great profit by planting with a view to sell the seed.”<sup>13</sup>

The practice of advertising *Okra* seed as an investment vehicle represented a departure. In an editorial that was widely reprinted, Edmund Ruffin of the *Farmer’s Register* criticized the marketing of *Okra* in 1839:

If, according to the heretofore liberal and universal procedure of southern agriculturists, the first holders of this variety of cotton, had offered to *give away* seeds, or to sell them at merely a fully remunerating price, few persons would have cared to plant them. But by pursuing the contrary course, and asking fifty cents a seed, the anxiety to obtain them has probably been increased in the ratio of the advance of price. All this is well, if confided to real improvements; and if such cannot be introduced by operating by means of reason and sound precept, it is certainly desirable that it should be done by operating on the credulity and folly of the recipients. But, unfortunately, it has come to be considered that the high price

---

<sup>11</sup> Letter from F. H. Elmore, in *Farmer’s Register* 7, no. 4 (30 April 1839), p. 252. See also *Niles’s National Register* 7, no. 2, (7 Sept. 1838), p. 24 and *American Farmer* (11 Sept. 1839), p. 127; *Southern Banner*, 27 Sept. 1839, p. 3. According to the article on *Gossypium* in *Farmer’s Encyclopædia, and Dictionary of Rural Affairs*, p. 588, “Okra cotton is also called by some Alvarado cotton.” Ulrich B. Phillips, *American Negro Slavery: A Survey of the Supply, Employment, and Control of Negro Labor, as Determined by the Plantation Regime* (New York: D. Appleton, 1918), p. 222 treats Alvarado as a successor to Okra, reflecting the confusing naming practices of the period. Alvarado was also the name for an early standard variety of Mexican highland cotton in the mid-1820s. “Twin” was also known as “Aldridge” after the planter “who brought it before the public.” *Southern Agriculturalist* 12, no. 6 (June 1839), p. 318.

<sup>12</sup> *Southern Banner* (27 Sept. 1839), p. 3.

<sup>13</sup> *Southern Banner* (4 Oct. 1839), p. 3.

asked for new seeds, &c., is *alone* sufficient evidence of their intrinsic value; and hence dupes are continually made by the vilest and grossest impositions that can be imagined.<sup>14</sup>

When the distinctive biological features of *Okra* proved to have no great productivity or marketing advantages, critics charged these new seeds were “humbugs,” frauds perpetrated on a gullible public.<sup>15</sup>

Ruffin and his fellow farm journalists compared humbuggery in the cotton seed market to other speculative fads affecting farmers in the early nineteenth century. These included so-called *Morus Multicaulis* mania also raging in the late 1830s (as well as the earlier Merino Sheep craze).<sup>16</sup> *Morus Multicaulis* was the fast-growing Chinese mulberry tree favored by silk-raisers. Gideon Smith of Baltimore, MD first introduced its cultivation to America in 1826. Excitement about the tree “grew steadily, slowly...at first, but increasing with a geometrical progression... .The young trees or cuttings, which were sold in 1834 or 1835 for \$3 or \$5 a hundred, came soon to be worth \$25, \$50, \$100, \$200, and even \$500 a hundred.... The times were rife with speculation.” The plants were sold with the prospect of being multiplied and marketed to others the next season. The bubble burst in 1839/40, leaving the mulberry cultivators “in utter ruin.”<sup>17</sup> Panel B of Figure 2 charts the takeoff and crash in advertisements mentioning *Morus Multicaulis* in the *Readex* newspaper index. (The patterns in the Liberty of Congress *Chronicling America* and Gale newspaper indices are almost identical.) This episode colored the

---

<sup>14</sup> *Farmer's Register* 7, no. 4 (30 April 1839), p. 252; also reprinted in *Southern Agriculturist* 12, no. 6, (June 1839), p. 318.

<sup>15</sup> Planter records lend credence to these accounts. In April 1839, Nicholas Massenburg of Franklin county, North Carolina reported planting “2 Twin cotton seeds in his garden, for which I paid 50 cent each.” The seeds sprouted in early May but “all died” by May 20. (UNC Southern Historical Collection No. 908, pp. 201, 256). William Sims Reynolds of the Barnwell District, South Carolina (Univ. of South Carolina Library, 14 April 1840) reported planting the variety in a whole field the next year. But Massenburg’s practice of conducting small-scale experiments seems common. Planters such as Francis Leak of Tippah, Mississippi (RASP: J: 6: 25 14 April 1842, p. 648) and Haller Nutt of Adams county, Mississippi (Duke 4 April 1848, p. 18) tried new seeds in their gardens before moving to field use.

<sup>16</sup> “Morus Muticaulis and Merino Sheep,” *Farmers' Cabinet* 3, no. 3 (15 Oct. 1838), p. 80; “Speculation in Morus Muticaulis,” *Farmers' Cabinet* 3, no. 5 (15 Dec. 1838), pp. 154-56. See also Arthur H. Cole, “Agricultural Crazes: A Neglected Chapter in American Economic History,” *American Economic Review* 16, no. 4 (Dec. 1926), pp. 622-39 Alan L. Olmstead and Paul W. Rhode, *Creating Abundance: Biological Innovation and American Agricultural Development* (New York, Cambridge Univ. Press, 2008), pp. 294-97 for a discussion of the Merino craze.

<sup>17</sup> Linus Pierpott Brockett, *The Silk Industry: a History, prepared for the Centennial Exposition*, (Silk Association of America, 1876), pp. 38-40. See also Herbert H. Manchester, *The Story of Silk and Cheney Silks*, (South Manchester, CT: Cheney Brothers, 1916), pp. 35-36.

views of many farmers, planters, and journalists in the 1840s and 1850s about the value of biological innovations such as new varieties of cotton seed.

A marked contrast to history of *Okra* was *One Hundred Seed*, bred and distributed by Col. Henry W. Vick of Vicksburg, Mississippi.<sup>18</sup> Vick owned a large plantation in Issaquena county. After noting the differences between individual plants in a field of *Petit Gulf* cotton, he became interested in breeding. In 1839, Vick began an annual process of having his most able slaves make special pickings in which they harvested only the finest bolls from the largest and most prolific plants. This cotton was ginned separately and then grown in isolated fields. Vick often ventured into the fields himself in search of valuable mutations and crosses. He personally selected the progenitor of the *One Hundred Seed* variety in 1843 from the particularly appealing bolls of a single plant which he discovered while visiting another plantation in the Delta.<sup>19</sup> He then increased this seed for a few years before marketing it. In the words of Martin W. Philips, “Vicks 100-seed is the result of the most patient, persevering, and scientific selections from the field, and a judicious selection in the house as to staple. It is Mexican or Petit Gulph highest improved.”<sup>20</sup>

Vick worked closely with Philips, a physician and planter from Edward’s Depot, Mississippi. Philips entered into the cotton seed business after his medical practice languished in the late 1830s. He engaged principally in testing, multiplying, and marketing the new varieties that Vick bred and selected. Even without IPRs, a pattern of specialization emerged: Philips commercialized the innovations that Vick generated.<sup>21</sup> Philips was also an energetic publicist and promoter. He founded and edited the short-lived *South-Western Farmer* in the mid-1840s and was an indefatigable correspondent on agricultural topics —mostly notably on improved cotton seed—for the *Southern*

---

<sup>18</sup> Moore, “Cotton Breeding,” pp. 95-104, and John Hebron Moore, *The Emergence of the Cotton Kingdom in the Old Southwest, Mississippi, 1770-1860* (Baton Rouge, LA: Louisiana State Univ. Press, 1988), pp. 12-16. Joseph B. Lyman, *Cotton Culture* (New York, Orange-Judd, 1868), p. 122 called Colonel Vick of Vicksburg “the most persevering and the most successful of all the Mississippi planters in the art of perfecting cotton.”

<sup>19</sup> Moore, “Cotton Breeding,” pp. 99-101; *Vicksburg Sentinel* (7 July 1847), p. 1.

<sup>20</sup> “Letter from M. W. Philips,” U.S. Commissioner of Patents, *1848 Annual Report*, p. 155

<sup>21</sup> Allowing a division of innovative labor between the performance of R&D and its commercialization is one of the advantages of formal IPRs (such as the patent system with assignment). See Joshua Gans, David Hsu, and Scott Stern, “The Impact of Uncertain Intellectual Property Rights on the Market for Ideas: Evidence for Patent Grant Delays,” *Management Science* 54, no.5 (May 2008), pp.982-97.

*Cultivator, American Agriculturist, American Cotton Planter, South Carolina*

*Temperance Advocate*, among others. His activities were tied with other leading southern agricultural reformers including Edmund Ruffin, J. J. Jones, Noah B. Cloud, and Thomas Affleck.

The most celebrated new seed of the mid-1840s was *Mastodon*, a variety named for its large and wooly bolls. Richard Abbey, a Methodist minister from Yazoo City, Mississippi, introduced the new seed for the 1845 crop year. He had purportedly imported the seed from Mexico City in 1841.<sup>22</sup> He claimed it increased production by 50-100 percent.<sup>23</sup> The southern press widely covered the premium cotton, which won prizes at fairs across the South.<sup>24</sup> As part his endeavor to gain influence, Abbey sent a sample to former Vice President John C. Calhoun, adding *Mastodon* “has acquired a reputation beyond any thing (sic) I had anticipated.... I regard it *a great Southern improvement*.”<sup>25</sup> In October 1845, Abbey started advertising the seed for \$1 per bushel.<sup>26</sup> With supplies running out, he raised the price in November to \$2 and by late December to \$4 per bushel (for what he described as largely unginmed seed).<sup>27</sup> Abbey, it was reported, earned \$20 thousand (the equivalent of over \$600 thousand in current purchasing power) during the *Mastodon* boom.<sup>28</sup> At an average prices of \$4 per bushel, the new seed sold for a substantial premium relative to *Petit Gulf*—which regularly went for \$0.50 to \$1.00 per bushel— but never reached the level of *Okra/Twin* at its height.

---

<sup>22</sup> *American Agriculturist* 4, no. 1 (Jan. 1845) p. 37; *Southern Cultivator* 4, no. 9 (Sept. 1846), p. 141. But in *American Agriculturist* 6, no. 2 (Feb. 1847), p. 58, Abbey placed its origin near the Gulf of California, which is unlikely.

<sup>23</sup> *Mississippi Free Trader* (16 Nov. 1844), p. 1.

<sup>24</sup> *Mississippi Free Trader* (8 Nov. 1845), p. 1; *Raymond Gazette* (26 Dec. 1845), p. 1; *DeBow's Review* 1, no. 2 (Feb. 1846), pp. 166-68.

<sup>25</sup> “Letter of 14 Jan. 1846 from Richard Abbey,” John C. Calhoun and Clyde N Wilson, eds., *Papers of John C. Calhoun* Vo. 12, 1946 (Columbia, SC: Univ. of South Carolina Press, 1995), p. 440.

<sup>26</sup> *Yazoo Democrat* (8 Oct. 1845), p. 3; *Yazoo City Whig* (7 Nov. 1845), p. 2.

<sup>27</sup> *Yazoo City Whig* (14 Nov. 1845), p. 2, (26 Dec. 1845), p. 4; *Yazoo Democrat* (26 Nov. 1845), p. 2.

<sup>28</sup> M. W. Philips, “Mastodon Cotton,” *Southern Cultivator* 8, no. 1 (Jan. 1850), p. 5. Again, the plantation records confirm the newspaper evidence concerning the high prices and widespread trials of *Mastodon*. Walter Wade of Jefferson county, Mississippi (RASP: N: 18, 14 April 1846) “brought up a sack of 2 1/2 bushels of Mastodon Cotton seed—Costs \$11.60 at Rodney...” or \$4.64 per bushel. Francis Leak (RASP: J: 5: 25) reported experimenting with *Mastodon* seed in 1846. Lewis Sterling of West Feliciana parish, Louisiana (RASP: I: 2: 25) and John C. Jenkins of Adams county, Mississippi (LSU 24 March 1847) reported the variety in the next year. *Mastodon* spread to the East as well. James Henry Hammond of Silver Bluff, South Carolina grew *Mastodon* (RASP: A, pt. 1: 14) in 1846. Two Sumter, South Carolina planters, McDonald Furman (Duke FF 1287, p. 47) and Samuel P. Gallard (RASP: A, pt. 2, reels 1-26) mention the variety in 1847.

In addition to its distinctive appearance, *Mastodon* had several special features. The fiber clung to the plant, allowing its harvest to be delayed until the other crops were brought in. But planters did not find this flexibility of much value.<sup>29</sup> *Mastodon* had a very long staple length. Its promoters believed it could be produced on upland cotton areas but compete with Sea Island cotton in the market. Its lint purportedly at first sold locally for 16 cent a pound when standard upland cotton sold for 8-10 cent a pound.<sup>30</sup> But after Liverpool merchants rejected the variety following a widely-published trial, *Mastodon* lost favor.<sup>31</sup> Use of conventional saw gins also proved harmful. By mid-1847, the *American Agriculturist* recorded that several communicants pronounced *Mastodon* a “gross humbug on the planting interest,” but the publication choose to “not condemn too hastily” and instead awaited further trials.<sup>32</sup> Some planters continued to favor *Mastodon* although most adopters abandoned it.<sup>33</sup>

A succession of celebrated varieties produced by Mississippi Valley breeders came on the market in the mid- and late 1840s. These included *Sugar Loaf* (1843), *Boyd's Prolific* (circa 1847), *Hogan* (1847),<sup>34</sup> *Banana* (before 1848), *Pomegranate* (1849), and *Jethro* (1848). *Sugar Loaf* was first in the line of cluster types (that is, the plant tended to have multiple bolls at each node on its short fruiting limbs, making the bolls cluster together). *Boyd's Prolific* was the pioneer variety in the semi-cluster line

---

<sup>29</sup> The tenacity of the *Mastodon* fiber to hold on to the boll overcame the only “serious fault” of the Mexican hybrids. These cottons detached readily, meaning the lint could be picked with ease, but it also meant that it would drop to the ground in inclement weather shortly after the boll opened. Moore, “Cotton Breeding,” p. 97.

<sup>30</sup> *Mississippi Free Trader* (1 Jan. 1846), p. 1.

<sup>31</sup> *American Agriculturist* 6, no. 3 (March 1847), p. 90; *Niles' National Register* 22, no. 12 (22 May 1847), p. 180.

<sup>32</sup> *American Agriculturist* 6, no. 7 (July 1847), p. 227. In the *Southern Cultivator* 4, no. 19 (Oct. 1847), p. 301, M. W. Philips asserted that *Mastodon* was a humbug, adding that northern spinners had told R. Abbey as early as 1846 that the lint was unusable.

<sup>33</sup> Eli J. Capell of Adams county, Mississippi (LSU, 1854) grew *Mastodon* long after it lost general favor.

<sup>34</sup> Moore, “Cotton Breeding,” p. 102. On 31 Oct. 1848, William Hogan of Bovina, MS placed an advertisement in the *Mississippi Free Trader* marketing *Hogan Seed*. He noted the early variety offered higher yields per acre, higher turnout of lint-to-seed, and better quality lint than other varieties. The variety was in its second year in the area—in the previous season he sold small lots of seed to P. Noland and N. B. Batchelor for the equivalent of \$1,000 per bushel. On account of current business conditions “and desire to place it in the reach of all who may wish to improve their seed,” he was offering the “celebrated seed, at reduced and moderate price of ten dollars per bushel.”

(which possessed the clustering habit in a less pronounced form).<sup>35</sup> Some represented improvements for specific locales; others were disappointments.<sup>36</sup>

By the mid-1850s, David Dickson and Charles Peabody became important seed breeders in South Atlantic states.<sup>37</sup> Dickson began by selling *Boyd's Extra Prolific* and moved to market his own *Dickson's Select Seed*. Advertisements document his expanding market presence. The 1854 ad lists 12 agents, all but one in Georgia; the 1858 ad includes 13; and the 1860 ad shows a network of 20 plus agents extended across the South, from North Carolina to Texas.<sup>38</sup> (See Figure 3.) As he later put it: "I went into the business of selling cotton seed unwillingly, but it has paid me very well...."<sup>39</sup>

### **The Organization and Operation of the Cotton Breeding Business**

In 1854, *Harper's Magazine* summarized the dynamics of the cotton seed market in the late-antebellum period: "whenever, by good fortune, a higher-yielding cotton plant appears 'instantly . . . the local newspapers teem with advertisements and commission houses are filled with the magic seed.'"<sup>40</sup> In 1868, Joseph Lyman observed: "Beginning with the year 1820, and from that time forward, various planters in different parts of the cotton growing States have devoted themselves to the development and sale of improved varieties of cotton seed, and certain styles of cotton have for two, three, or four years, enjoyed a great, though ephemeral popularity, and, then, as suddenly, been pushed aside

---

<sup>35</sup> While dating to or before 1847, *Boyd's Prolific* was not extensively marketing until the mid-1850s. *New Orleans Commercial Bulletin* (14 Feb. 1855), p. 2 and the *Edgefield (SC) Advertiser* (12 March 1856), p. 2 provide introductory information.

<sup>36</sup> Jacob Osborn Ware, "Origin, Rise, and Development of American Upland Cotton Varieties and Their Status at Present," *University of Arkansas College of Agriculture, Agricultural Experiment Station*, mimeo (1950), pp. 12-14; Phillips, *American Negro Slavery*, pp. 222-23.

<sup>37</sup> David Dickson started as a merchant in central Georgia and then bought poor pine lands in middle part of the state in 1845. He developed a number of novel techniques, including fertilizing with cotton seed mixed with oak ashes (and later with guano), inventing a sweep to cultivate shallowly without harming the plant's roots, and providing greater training and a better diet for his slave labor force. Chester McArthur Destler, "David Dickson's 'System' and the Agricultural Revolution in the Deep South, 1850-1885," *Agricultural History* 31, no. 3 (July 1957), pp. 30-39. He entered the breeding business in the early 1850s and soon "[h]is improved cotton strains became well known wherever that staple was grown extensively." James C. Bonner, "Genesis of Agricultural Reform in the Cotton Belt," *Journal of Southern History* 9, no. 2 (Nov. 1943), pp. 475-500, esp. p. 482.

<sup>38</sup> *Southern Cultivator* 18, no. 12 (Dec. 1860), p. 401.

<sup>39</sup> J. Dickson Smith, ed., *A Practical Treatise on Agriculture to which is Added the Author's Published Letter by David Dickson, Sparta Georgia* (Macon, GA: J. W. Burke and Co., 1870). The statement is from 10 Feb. 1869.

<sup>40</sup> T. B. Thorpe, "Cotton and Its Cultivation," *Harper's Magazine* (March 1854), pp. 447-63, esp. p. 449.

for a new reigning favorite. The improvement of a cotton seed as a business, and sale of the improved varieties, has enabled quite a number of prominent and enterprising planters throughout the South to realize handsome fortunes.”<sup>41</sup>

A rich source of information about the antebellum cotton seed market is the southern press, and especially the numerous advertisements and introductory announcements appearing from the 1830s on. In most of the classified ads, an established local merchant placed a few lines noting the availability of supplies of improved seed. Sometimes, they offered potential purchasers the opportunity to inspect sample bolls or bearing stalks of the new variety. With a prized new variety, a breeder or his local agents went all out, placing large ads announcing its debut. Such ads cataloged the new variety’s characteristics including its fiber quality and picking rates, provided a story of its origins, and offered testimonials (also known as “certificates”) by prominent planters.<sup>42</sup> While the ads rarely offered potential customers a free chance to try the seed, they often claimed to warrantee its authenticity.<sup>43</sup>

The differing characters of the advertisements reflected the differences between southern breeders/seedsman. These were divided into three camps along the dimensions of permanence and innovativeness. The first camp was a stable set of producers of standardized high-quality varieties such as *Petit Gulf*. They sold under brand names through established merchant networks without much fanfare. The second camp was comprised of the one-time discoverers or importers of new varieties. These one-shot wonders were often marketed as revolutionary new introductions.<sup>44</sup> The third camp combined attributes of the other two, working systematically to breed a series of new better cottons. Such producers sought long-run reputations for their innovative efforts. Within this third camp, many of the breeders formed social networks to shared

---

<sup>41</sup> Lyman, *Cotton Culture*, p. 121.

<sup>42</sup> Some origin stories were highly fanciful. See M. W. Philips, “A New Variety of Cotton Seed,” *American Cotton Planter* 3, no. 5 (May 1855), p. 150.

<sup>43</sup> An ad for the Twin variety in *Telegraph and Texas Register* (Houston, TX), 4, no. 26 (5 Jan. 1839), p. 1 did offer to furnish a few trial seeds per individual.

<sup>44</sup> Moore “Cotton Breeding,” pp. 98-99 subdivides the one-shot producers between those who imported seed from Asia, Africa, and the Latin America and those who found “accidental mutations among their ordinary Mexican cotton.” On p. 96, Moore notes “Some of their discoveries... created short-lived sensations” and their seed “occasionally sold for brief periods at very high prices. When put to the test, however, the cottons obtained from abroad or culled from the fields usually were found to have little permanent value.”

knowledge and genetic material.<sup>45</sup> They gave each other credit for advances as well as heaped scorn on others for copying the seeds without proper acknowledgement. Some in this group tied their seed business with other commercial endeavors such as selling fertilizer or publishing farm journals.

Leading upland cotton breeders were typically high-status planters with additional professions such as physician, minister, journalist, or merchant. (Though it was rare for breeders to be politicians or lawyers, a surprisingly high proportion appear to be associated with Whig party. Abbey, Vick, Cloud, and Dickson were all Whigs; Phillips was involved in Democratic party politics in the 1850s.<sup>46</sup>) All were males. Few were white yeoman farmers; none were the enslaved African-Americans who planted and picked the vast majority of the cotton crop.<sup>47</sup> Accounts heralding the democratic nature of American invention have little purchase here.<sup>48</sup> Status, wealth, and notoriety garnered coverage in the agricultural press. Still cotton breeding was uncommon activity for those at the very top of the antebellum southern elite. Among the names appearing in the cotton seed advertisements, only Martin W. Philips was listed in the *Dictionary of American Biography*.<sup>49</sup>

The commercial cotton seed breeding sector thrived in the antebellum period despite an absence of patents, copyrights, substantial monetary prizes, or large investments by the federal or state governments. The U.S. federal government did provide early vital assistance to upland cotton sector by Walter Burling's aft-for-

---

<sup>45</sup> For recent work on innovation networks, see Ross Thomson, *Structures of Change in the Mechanical Age: Technological Innovation in the United States, 1790-1865* (Baltimore, MD: Johns Hopkins Univ. Press, 2009), pp. 100-128; and David R. Meyer, *Networked Machinists: High Technology Industries in Antebellum America* (Baltimore, MD: Johns Hopkins Univ. Press, 2006), esp. pp. 8-15.

<sup>46</sup> For Philip's party affiliation, see Jackson *Mississippian and State Gazette* (12 Dec. 1851), p. 1.

<sup>47</sup> For the inventive activities of African Americans in other sectors, see Lisa D. Cook, "Inventing Social Capital: Evidence from African American Inventors, 1843-1930," *Explorations in Economic History* 48, no. 4 (Dec. 2011), pp. 507-18.

<sup>48</sup> The core contrast appears in Kenneth L. Sokoloff and B. Zorina Khan, "The Democratization of Invention during Early Industrialization: Evidences from the United States, 1790-1846," *Journal of Economic History* 50, no. 2 (June 1990), pp. 363-78; B. Zorina Khan and Kenneth L. Sokoloff, "'Schemes of Practical Utility': Entrepreneurship and Innovation among 'Great Inventors' in the United States, 1790-1865," *Journal of Economic History* 53, no. 2 (June 1993), pp. 289-307; and B. Zorina Khan, *The Democratization of Invention: Patents and Copyrights in American Economic Development, 1790-1920* (New York: Cambridge Univ. Press, 2005)

<sup>49</sup> This limited role for southern elites in cotton breeding contrasts with livestock breeding where many of the leading Americans of the early national period – George Washington, Thomas Jefferson, James Madison, Thomas Pinkering, Robert Livingston, Henry Clay, John Calhoun, Daniel Webster, and Nicolas Biddle – maintained active interests. Olmstead and Rhode, *Creating Abundance*, p. 289.

mentioned efforts to smuggle in Mexican seed in 1806. In 1819, the U.S. Treasury instructed its overseas officials and Navy officers to identify and send to the U.S. foreign plants likely to be of value. The justification for such publically-funded investments was the private farmers and breeders would be unable to capture the benefits of the new seeds they introduced. But such public actions were more substitutes for than complement to private efforts. The U.S. Patent Office, under Commissioner Henry Ellsworth, became the center of federal seed importation and distribution system in the mid-1830s. At first, Congressional representatives used their franking privileges to send seed to constituents. In 1839, Congress appropriated money to Patent Office to perform the task.<sup>50</sup> In 1857, the Patent Office established a germination garden to multiply its supplies. In the late 1850s, the Office spent \$45-85 thousand per year for the “Collection of agricultural statistics and procuring and distributing seeds and cuttings,” with the bulk of the money for the latter purposes.<sup>51</sup> The number of packages of seeds distributed grew from 30 thousand in 1840 to 80 thousand in 1849 to 474 thousand in 1861; the cumulative number distributed by 1861 reached almost 2.5 million packages.<sup>52</sup> But the U.S. Patent Office issued no IPRs for plants and did not do so until the passage of the Plant Patent Act of 1930 (and then only for asexually-reproduced plants). The *Annual Reports* in the late 1840s and early 1850s did include extensive commentary regarding cotton varieties, giving an official outlet for the opinions of M. W. Philips.<sup>53</sup>

The governments of the southern states also played limited roles. Apart from the Savannah Gardens in colonial Georgia, none funded experiment stations conducting research on cotton during this period. In the late-antebellum period, some private

---

<sup>50</sup> A. Hunter Dupree, *Science in the Federal Government: A History of Policies and Activities to 1940* (Cambridge: Harvard Univ. Press, 1957), pp. 110-12. The Patent Office supplied cotton seeds from China to M. W. Philips. Farm journals such as the *Southern Cultivator* also at times sent “free seed” to subscribers who covered postage. See *Southern Cultivator* 18, no. 12 (Dec. 1860), p. 376.

<sup>51</sup> U.S. Treasury, *A Statement of the Receipts and Expenditures of the Government*, various years, 1854-1862. As U.S. Patent Commissioner Charles Mason wrote: “A consideration share of the money appropriated by Congress for Agricultural purposes has been devoted to the procurement and distribution of seeds, roots, and cuttings. It was believed that in this manner the greatest benefit could be realized...” U.S. Patent Office, *Annual Report of the Commissioner of Patents, 1854, Part III: Agriculture* (Washington, DC: GPO, 1855), p. v.

<sup>52</sup> Jack Ralph Kloppenberg, Jr., *First the Seed: The Political Economy of Plant Biotechnology*, 2<sup>nd</sup> Ed. (Madison: Univ. of Wisconsin Press, 2004), pp. 61-62; Alfred C. True, *A History of Agricultural Experimentation and Research in the United States, 1607-1925* USDA Misc. Publication No. 251 (Washington, DC: GPO, 1937), pp. 25-34; U.S. Patent Office, *Annual Report of the Commissioner of Patents, 1849, Pt. II: Agriculture* (Washington, DC: GPO, 1850), p. 12.

<sup>53</sup> Philips also received and tested cotton seed from the U.S. Patent Office. <Letter April 1850>

individuals, such as Philips, conducted ambitious agricultural experiments and disseminated their findings.<sup>54</sup> As a part of the general agricultural reform movement, the southern states did charter agricultural societies and sponsor state and local fairs. By the 1850s, such fairs often held contests with honors, including monetary prizes, for the best cotton. But it would be wrong to treat the antebellum cotton seed industry as an example where prizes successfully replaced patents as the inducement to innovate. The prize stakes were too small.<sup>55</sup> The example of *Jethro* cotton illustrates how awards added value in the market.<sup>56</sup> *Jethro*'s favorable notice at the Crystal Palace exposition in London in 1851 and received the top prize for cotton lint at the New York version of the fair held in 1853. Publicity for the seed promptly featured this triumph.<sup>57</sup>

Most upland cotton producers grew their crops without such publicity, devoting in their private efforts to selecting and maintaining seed quality. If these efforts led to any improvement, the knowledge and seed spread no further than close associates.<sup>58</sup> But this was not due to concern for secrecy. Vick and Philips publicized their innovations broadly and were quite open to share their new seeds with fellow breeders. In 1850, Philips wrote "My crop is always open to inspection; I procure the best seed of each variety, and am willing to send 'for persons and papers,' and submit the case to a jury of

---

<sup>54</sup> Phillips, *American Negro Slavery*, pp. 215-219. An early mention of seeds by Philips appears in *Southern Cultivator* 5, no. 12 (Dec. 1847), p. 184. Philips generally did not intentionally breed new varieties, but instead took Mr. Vick's creations to test and multiply. M. W. Phillips, "The Different Varieties of Cotton Seed," *DeBow's Review* (Aug. 1855), pp. 224-25.

<sup>55</sup> None of the prizes were comparable to the 20 thousand francs (about \$3,830) offered annually by the French Emperor for the best specimen of "longue soie" (Sea Island) cotton. Shreveport (LA), *South-Western* (8 April 1857), p. 1.

<sup>56</sup> Standard accounts assert J. V. Jones of Burke Co, GA discovered *Jethro*. *Albany Patriot* (17 Jan. 1851), p. 2. A different, more collaborative process of invention is reported M. W. Philips, "The *Jethro* Cotton: Testimony," *Southern Cultivator* 9, no. 2 (Feb. 1851), p. 21 and "The Different Varieties of Cotton Seed," *DeBow's Review* (Aug 1855), p. 225. In the winter of 1846-47, Vick sent Philips eight parcels of seed for "examination and experiment." "Inclining to Silk" proved the best and Philips sent sample to J. H. Hammond of South Carolina and J. V. Jones of Georgia. Jones was the editor of *Southern Cultivator* and "brought it [the variety] into notice." Philips named it *Jethro* in honor of the best anonymous contributor to the *Cultivator*. Letter of J. V. Jones, *Transactions of the Southern central agricultural society, from its Organization in 1846 to 1851, Southern Central Agricultural Association of Georgia*, (Macon, GA, 1852), pp.406-408 notes a bale of *Jethro* was awarded a diploma at the "Fair of the American Institute" and was sent to the World's Exhibition in London. As Moore, "Cotton Breeding," p. 101 notes, Vick "the originator of the strain, received no financial benefits whatever" for its sales in the Southeastern states.

<sup>57</sup> *New York Times* (26 July 1853), p. 1, which observed that "although the Crystal Palace contains many articles which make more show, and will attract more attention, it has none which have exercised a greater influence upon the civilization of world," than these cottons.

<sup>58</sup> Phillips, *American Negro Slavery*, p. 222.

all the cotton-planters.”<sup>59</sup> During the 1835-61 period, the agricultural improvers did not complain about the secrecy of the upland cotton producers, but rather about excessive hype and high-priced humbugs. Agricultural journalists and reformers focused on unwarranted publicity for untried new varieties, on proliferation of new names for old varieties. Introductions were like the Mississippi bubble— a very high price justified only by selling to others who sell to others—all before something better came along.

It is germane to compare the rapid progress in upland cotton breeding with the more closed world of Sea Island cotton breeding and production.<sup>60</sup> In this narrow niche-oriented sector, prominent planters limited access to their improved seed and closely guarded secrets about their special preparation and processing techniques. Differences between upland and Sea Island sectors also show up in the records of productivity advance. In contrast to the quadrupling of picking rates in the open-technology upland cotton sector, harvest productivity in the more closed Sea Island sector remained essentially constant over the antebellum period. (Compare Panel B with and Panel A in Figure 1).

### **High IPO prices, followed by a collapse**

Contemporaries often criticized the operations of the antebellum cotton seed market because highly-touted new varieties fetched fantastic prices at first but these prices did not last. One can document the price path of cotton varieties in a dataset assembled from advertisements in antebellum newspapers and agricultural journals. As noted above, such advertisements were common in southern periodicals from the 1830s on. In a small fraction (maybe one-tenth) of ads, the supplier listed a price. Assembling a sample from advertisements creates biases against observing very low prices. The expected profits from the sales had to justify the expense of advertising and there is no evidence merchants treated cotton seed as a loss-leader to generate other trade.

My sample contains 263 price observations from 66 different newspapers and agricultural journals covering a territory from Virginia to Texas over the period from

---

<sup>59</sup> U.S. Patent Office, *Annual Report of the Commissioner of Patents, 1850, Part II: Agriculture*, (Washington, DC: GPO: 1851), p. 262.

<sup>60</sup> Richard D. Porcher and Sarah Fick, *The Story of Sea Island Cotton* (Charleston, SC: Charleston Museum, 2005); Gray, *Agriculture in the Southern United States*, Vo. 2, pp. 675-78.

1835 to 1861.<sup>61</sup> The sample covers 36 different named varieties of upland cotton (introduced after 1820). The unit of observation is a variety listed in an advertisement in a specific publication in a specific crop year (ending in June). The advertisements typically ran over multiple issues of the periodical—but if the text remained unchanged in that source, it counted only once per variety listed. If the supplier published a revision – for example to change the prices over the course of the season—the revision counted as a separate observation. If the supplier placed a similar advertisement in a different periodical, it counted as a separate observation. If the advertisement listed prices for multiple varieties, each was counted as an observation. In some instances, agricultural journalists offered seed in the columns of their publications. Such price quotes were included.

The 36 varieties in the sample were linked to the date of introduction as reported in Ware, Duggar, Tyler, and other sources.<sup>62</sup> Assigning a date of release can be tricky. There is often a difference between when the seed was discovered or imported, when it was made available to a selected few for testing and multiplication, and when it as released for sale to the general public. I adopted a standard close to the date of release. There were advertisements containing prices for 18 additional named varieties which could not be linked. These were not included in the sample. Their prices were roughly

---

<sup>61</sup> The publications include Abbeville (SC) *Banner*, Abbeville (SC) *Independent Press*; Little Rock *Arkansas Gazette*; *Affleck's 1854 Rural Almanac*; Albany (GA) *Patriot American Farmer*; Augusta (GA) *Chronicle and Sentinel*; Augusta (GA) *Constitution*; Baton Rouge (LA) *Gazette*; Camden (SC) *Journal*; Charleston (SC) *Courier*; Charleston (SC) *Mercury*; Charleston (SC) *City Gazette And Daily Advertiser*; Clarksville (TX) *Northern Standard*; Columbia (SC) *Enquirer*; Columbus *Democrat*; *Daily Alabama Journal*; Montgomery (AL) *Daily Confederation*; Columbia (SC) *Daily South Carolinian*; *DeBow's Review*; Edgefield (SC) *Advertiser*; *Farmer's Register*; Fayetteville (NC) *Observer*; Milledgeville (GA) *Federal Union*; Tallahassee *Floridian and Advocate*; Galveston (TX) *Commercial and Weekly Price Current*; Georgetown (SC) *American*; *Georgia Journal*; *Hinds County (Raymond MS) Gazette*; Holly Springs (MS) *Gazette*; Houston (TX) *Telegraph*; *Jeffersonian Republican* (Charlottesville, VA); Keowee (SC) *Courier*; Macon (GA) *Telegraph*; Memphis (TN) *Daily Appeal*; Memphis (TN) *Daily Eagle*; *Mississippi Free Trader and Natchez Gazette*; *Mississippi Palladium*; *Mississippian and State Gazette*; Nacogdoches (TX) *Chronicle*; Natchez (MS) *Courier*; New Orleans *Commercial Bulletin*; New Orleans *Times-Picayune*; *North Carolina Standard*; Pensacola (FL) *Gazette*; Port Gibson (MS) *Correspondent*; Raymond (MS) *Gazette*; *Red-Lander* (San Augustine, TX); Savannah (GA) *Republican*; *Scientific American*; *Southern Agriculturist*; *Southern Banner* (Athens GA); *Southern Cabinet*; *Southern Cultivator*; *Southern Patriot* (Charleston, SC); *Southern Recorder* (Milledgeville, GA); Shreveport (LA) *South Western*; *State Gazette* (Austin TX); Sumner (SC) *Banner*; *Texas Ranger* (Washington, TX); and Vicksburg (MS) *Sentinel*; Vicksburg (MS) *Whig*; Yazoo City (MS) *Democrat*; Yazoo City (MS) *Whig*; and Yorkville (SC) *Enquirer*.

<sup>62</sup> Ware, "Origin"; F. J. Tyler, "Varieties of American Upland Cotton," *U.S. Bureau of Plant Industry Bulletin*, no. 163 (Washington, DC: GPO, 1910); J. F. Duggar, "Descriptions and Classifications of Varieties of American Upland Cotton," *Alabama Experiment Station Bulletin*, no. 149 (1907).

on par with varieties out for 5 years. The regression analysis will be conducted using a less structured form—dummy variables for years since release—and using a more specified functional form—the log of years since release—which smoothes over gaps in the data.

Table 1 summarizes the path of (mean) nominal price per bushel after introduction for selected important varieties. As contemporaries noted, for many high-profile varieties, prices shortly after introduction are very high—between \$100 and \$1000 per bushel in an era where common laborers earned about one dollar per day. Prices subsequently fell, with few varieties commanding more than much \$1 per bushel after five years. (*Boyd's Prolific* represents an exception, but its popularity grew slowly after its discovery in 1845. This variety, which became widely available in the early 1850s, was a selection or refinement of the original “accidental stalk” that Mr. Boyd found in a field of *Petit Gulf*.) The contrast in price paths between *Mastodon* and *100 Seed*, both hitting the market circa 1846-47, is not as great as suggested in the traditional accounts marking the former as a speculative humbug and the latter as the real deal. But the high initial prices for the late 1840 cluster-type cottons—*Hogan*, *Banana*, and *Pomegranate*—do stand out.

Figure 4 presents a scatterplot of log of real prices against time since release. The negative relationship between prices and years since release is evident. Unlike stories about the Dutch tulip mania of the seventeenth century, the seeds of important southern cotton varieties in the mid-nineteenth century rarely experienced a phase of rising prices after the initial public offering.<sup>63</sup> The plotted data include different varieties. The regression analysis below controls for such differences by including variety fixed effects.

The regressions, shown in Table 2, panel B, relate the log of the real price to the indicators for first seven years since release (years 8 plus is the omitted category), for Old South, for small lot size, for second quality, a crop year trend and variety fixed effects. For the full sample (first column), prices in the second year were only 23.6 percent of prices in the first year; prices in the third year were 33.6 percent of prices in the second

---

<sup>63</sup> Peter M. Garber, *Famous First Bubbles: The Fundamentals of Early Manias* (Cambridge, MA: MIT Press, 2000), pp. 49-59, 66. As noted above, the price of *Mastodon* seed did rise over in the winter of 1845-46. There is some indication that Twin-Okra prices rose in the late 1830s as the variety gained popularity, but the information available is too scanty to draw firm conclusion.

year and 8.0 percent of prices in the first year. Overall, this was a 3.54-fold decline each year. Prices for varieties remaining in the sample stabilized after roughly four years. The regressions, shown in Table 2, panel C, use a continuous time measure, log of years since release, in place the year indicators and crop year variable. In this specification, doubling the time since release reduced prices by almost 50 percent.

One might be concerned that the negative price trajectory was the product of humbugs being discovered and discounted in the market. The second column of panel B shows results for the same specification in a sample excluding the two major alleged humbugs (*Twin-Okra* and *Mastodon*). The results for the year indicators are in line with those for the full sample, suggesting the negative price trajectory was not driven by the humbugs alone. The price declines remain sharp, though not as sharp as in the full sample. Prices in the second year were only 34.2 percent of prices in the first year; prices in the third year were 33.7 percent of prices in the second year and 11.5 percent of prices in the first year. This was a 2.94-fold decline each year. The observations on humbugs are too scattered to generate meaningful comparisons running this specification on a humbug-only sample. One can take a step in this direction with the regressions in panel C. Comparing columns (3) and (4) for the non-humbugs and the alleged humbugs, respectively, reveals no sharper price declines for the latter.

One can take a different cut at the sample and distinguish between the “branded” varieties that were subject to extensive introductory advertising in newspapers or major farm journals and “non-branded” offerings. Most of the sample was “branded” by this definition. The “branded” varieties sold for a substantial premium above the “non-branded” offerings.<sup>64</sup> But examining columns (3) and (4) in panel B or columns (4) and (5) in panel C reveals that the “branded” varieties witnessed large price declines since release whereas the “non-branded” varieties did not. For the “branded” varieties, prices in the second year were 22.4 percent of first-year prices; prices in the third year were 6.0 percent of first-year prices. For the “non-branded” varieties, the figures were 65.9 percent and 33.4 percent, respectively. The negative price trajectories of highly advertised seed attracted attention at the time.

---

<sup>64</sup> Regressions (results omitted) without variety fixed effects, the “branded” coefficient is 0.499 (rse=0.198) using the panel B specification and 0.397 (rse=0.188) using the panel C specification.

## Rationalizing the Price Path

Contemporaries often criticized the operation of antebellum cotton seed market because the new variety's high initial public offering (IPO) prices soon collapsed. It was as if the gullible public, caught up in the excitement and speculative environment surrounding the new discovery, paid too much of the seed and then learned it was a complete humbug. But this pattern of initially high, then sharply declining prices is precisely what would be expected if the new productivity-enhancing varieties were released and replicated at a finite rate of multiplication under a regime without IPRs. One might predict that an innovative breeder would seek a new discovery, perhaps build up supplies under one's own control, and then recoup the investment by engaging in a one-time release of the seed at a high initial price. Purchasers would expand supplies of the new seed for their own use and to sell to others. As the seed multiplied, prices would drop sharply. But the breeder would capture at least part of value of the productivity enhancements and of the capability of the seed to reproduce itself. Such a process of innovation and diffusion, under circumstances specified by Boldrin and Levine, might well be more efficient than one proceeding under a strict regime of IPRs.<sup>65</sup> The duration of the monopoly will depend of the rate of multiplication rather than legislative fiat.

To understand this process it will be useful to sketch out a simple model of the cotton seed market. The market for cotton seed is special because lint is the main product and seed is a byproduct. Suppose a breeder starts with monopoly over a supply of  $S$  bushels of a new improved seed that increases the unit value of lint by  $v$  percent over the old seed. That is, given the price of cotton lint is  $P_L$  from the old seed, it will be  $(1+v) P_L$

---

<sup>65</sup> Boldrin-Levine, *Against Intellectual Monopoly*, argue that the standard justification for establishing monopoly rights in intellectual property is that invention involves high fixed costs and imitation is virtually free. In such an environment, innovators could not appropriate sufficient returns to cover the cost of their investments. But Boldrin and Levine assert that in many cases the situation is reversed: invention is cheap and copying is difficult. The invention side of the equation would hold for cotton if the new varieties were discovered as a result of learning by doing—if, while growing their crops, planters remained on the look-out for exceptionally productive individual plants and saved their seed. It would also hold if “invention” involved importing existing varieties from abroad. The copying side would hold if, due to potential for cross pollination, replicating a sufficient supply of pure seed from a small initial purchase was difficult.

from the new seed.<sup>66</sup> Suppose the unit value of old seed is  $P_S$ , which may reflect its value for fertilizer, animal feed, or other uses.<sup>67</sup> Suppose the production technology is otherwise the same—farmers plant “ $b$ ” bushels of seed per acre, expend  $C$  for other costs, and harvest as a joint product of “ $y$ ” pounds of lint and  $m*b$  bushels of seed, where “ $m$ ” is the reproduction rate of seed.<sup>68</sup> Let land be of uniform quality and the total acreage devoted to cotton be fixed at  $A$ . It would obviously be possible for a new variety to alter yields or changes per acre cost, but one can gain insight into the expected path of seed prices by examining the case where the new seed raises quality. The supply of the new seed is initially limited but grows at rate  $m$ . The market price of this seed,  $P_{N_t}$ , will depend on whether the stock is in deficit or surfeit of the quantity required to plant the acreage  $A$ .

Consider the decision to adopt the seed by a planter. The planter could stick with the old technology, spending  $bP_S$  for seed and  $C$  for other expenses and then earning  $yP_L$  for the lint and  $mbP_S$  for the seed. Alternatively, the planter could adopt the new technology, spending  $bP_{N_t}$  for seed and  $C$  for other expenses and then earning  $(1+v)yP_L$  for the lint and  $mbP_{N_{t+1}}$  for the new seed. Letting the one-period discount factor equal  $d \leq 1$ , the planter’s breakeven point will occur where:

$$(1) \quad P_{N_t} = d(vyP_L/b + (P_{N_{t+1}} - P_S)m) + P_S.$$

A planter will adopt the new seed for any price at this level or below.<sup>69</sup>

---

<sup>66</sup> The outcome of the model will not fundamentally change if instead of assuming  $P_{N_{L,t}}^N = (1+v)P_L$ , one assumed  $P_{N_{L,t}}^N = P_L * g(Q_{N_{L,t}}^N / Q_L)$  where  $g' < 0$ . The new seed will be in surfeit when  $g(Q_{N_{L,t}}^N / Q_L) = 1$ . Modeling demand for lint from the new variety with a function such as  $P_{N_{L,t}}^N = \beta(Q_{N_{L,t}}^N)^{-\theta}$  implies the price of seed will fall even faster as  $\theta$  increases.

<sup>67</sup> Reflecting that cotton seed was often a “bad,”  $P_S$  could, in principle, be negative.

<sup>68</sup> For the late antebellum era, it was conventional to think of unginned seed cotton as turning out 2 pounds of seed for every 1 pound of lint. Let us call this ratio,  $t$ , and also let  $w$  represent the number of pounds of seed per bushel. Then the reproduction or multiplication rate of seed, “ $m$ ”, can be expressed as  $m = yt/wb$ , that is (lb of lint output per acre) \* (lb of seed per lb of lint) / (lb of seed per bushel) \* (bushels seed applied per acre.)

<sup>69</sup> A planter would face difficulties if he sought, either for the sake of experimentation or to build up supplies internally, to grow both the old and new seeds near one another. Cross-pollination and seed mixing threatened the “purity” of the new variety unless the planter devoted extra care. We can add this to the model by incorporating a per-period per-unit cost,  $k$ , to keep the new and old seed separate. Such costs can be modeled as increasing proportionally the amount of seed handled but independently of the division between old and new seed if positive amounts of each are handled. Records show that large plantations typically had many fields separated a good distance from one another. At any one time planters

Now consider the year  $t=T$  when  $Sm^T \geq bA > Sm^{T-1}$ . This is first year when the supply of the new seed is sufficient to plant the entire cotton acreage. Given the surfeit of new seed in the hands of planters, new seed will be worth the same as old seed,  $P_{Nt} = P_S$ , in any year  $t > \log(bA/S)/\log(m)$ . Now consider year  $T-1$ . There is  $Sm^{T-1}$  seed which is sufficient to plant  $Sm^{T-1}/b$  acreage. The unit (present) value of seed in  $T-1$  is then  $P_{N,T-1} = P_S + dvyP_L/b$ . The seed's premium is the discount value of the higher-quality lint it yields. Now consider  $T-2$ . There is  $Sm^{T-2}$  seed with unit value of seed,  $P_{N,T-2} = P_S + (1+dm)dvyP_L/b$ . Its premium is the discount value of the higher-quality lint it yields plus the discount value of superior seed for planting in  $T-1$ . By extending this reasoning, one sees the unit value of seed in year  $T-\tau$ , for  $\tau \geq 2$ , is:

$$(2) \quad P_{N,T-\tau} = P_S + (1+dm + \dots + (dm)^{\tau-1}) (dvyP_L/b).$$

In the years prior to  $T$ , the premium will decline by more than  $dm$  per year.<sup>70</sup>

Figure 5 graphically displays the relationship between the supply of seed and the acreage planted. The lower panel plots out the demand function for new seed, tracing out the market prices associated with each quantity. After release, the supply of seed is perfectly inelastic (with respect to its own price) and grows exogenously at rate  $m$  per year.<sup>71</sup> The quantities may be related back to the temporal analysis discussed above. The period of surfeit is associated with quantities supplied above  $bA$ . Quantities in the interval  $(bA/m, bA)$  are associated with a crop season one year before seed surfeit.

---

experimented with several varieties in different test plots. So even though one seed variety dominated a constant process of experimentation was underway. In addition, planters sometimes preferred to grow varieties which fruited at different times to spread out the harvest and decrease peak-load picking problems. The "k" of planters was likely higher than that for breeders, creating advantages of specialization. If a planter with total acreage,  $\tilde{a}$ , bought  $q$  units of seed in year  $t$  at price  $P_{N,t}$ , it would require  $t' \geq \log(b\tilde{a}/q)/\log(m)$  years before the new seed is in surfeit on the farm. Over this period, the planter incurs the cost,  $kb\tilde{a}t'$ , to keep the old and new seeds separate. The planter's decision is to choose the  $q$  that minimizes  $kb\tilde{a}t' + qP_{N,t}$ . Ignoring integer constraints, a necessary condition for optimization is  $q = kb\tilde{a}/P_{N,t}\log(m)$  if seeds are purchased in year  $t$ . Saving on the costs of isolating the new seed should induce planters to purchase non-infinitesimal quantities.

<sup>70</sup> Prices declining at a geometric rate of  $(dm)$  per year serve as benchmark case. Consider a stock that split  $m$ -fold per year with each existing share in year  $T$  guaranteed to be repurchased for price  $P$ . The net present value of a share in year  $k$  is  $(dm)^{T-k}P$ . The seed models differ from this benchmark case because there are other inputs (specifically land) besides seed into production. See Appendix model.

<sup>71</sup> A change in the reproduction rate, "m," has two offsetting effects on the initial value of the stock: it increases the  $(dm)$  term and lowers the  $T$  term.

Quantities in the interval  $(bA/m^2, bA/m)$  are associated with a crop season two years prior. Those, such as the  $S_{.3}$  in the diagram, which are in the interval  $(bA/m^3, bA/m^2)$  are three years prior; and so on.

The initial value of the seed stock to the breeder at release in year 0 is

$$(3) \quad S_0 P_{N,0} = S_0 P_S + (1+dm + \dots + (dm)^{T-1}) S_0 dvy P_L / b.$$

The breeder appropriates all of the returns generated by the new seed during the period that it is in deficit and none generated thereafter. If breeding new seed is costly, this sum set the bar on what is worth pursuing under the regime without IPRs.

The value of making discoveries would be higher if the breeder could, though the operation of IPRs, securely control access to the seed. Compare the outcome above to a regime where the breeder maintains full property rights over the seed and rents its services to the planters. (How the IPRs could be enforced and replication prevented is not addressed; the IPRs are treated here as infinitely lived.<sup>72</sup>) The seed will not have a price; instead the seed services will be rented for  $dvy P_L / b$  per unit of seed up to  $T$  and then for  $dvy P_L$  per acre in the period after the seed stock is sufficient to plant the entire acreage.<sup>73</sup> The net present value of flow of rental payments in a year 0 will be:

$$(4) \quad NPV_0 = ((1+dm + \dots + (dm)^{T-1}) S_0 / b + A(d^T + d^{T+1} + \dots))(dvy P_L) < A(dvy P_L) / (1-d).$$

The first term is the equivalent to  $(P_{N0} - P_S) S_0$ . The flow of payments after  $T$  raises the NPV from the full IPR-rental regime above the NPV of the initial seed to the breeder in the sales regimes. This would support a wider range of costly investments in seed breeding. One further note about the value of the stock as represented in equation (3). This market provides incentives to release as soon as possible—discounting and price

---

<sup>72</sup> Under the assumptions of the model under both regimes, the superior seed does fully diffuse once introduced. Hence there would be no difference in the scope for learning by using. The same acreage would be devoted to the crop and planters could scan the same populations for exceptional individual performers. How an IPR regime would address the development and marketing of offspring seed is not addressed.

<sup>73</sup> Alternatively the breeder might rent land at the opportunity cost of producing with old seed and cultivate under his own control using new seed. Such a strategy might eventually run into either diseconomies of scale or loss of control over the improved seed due to theft.

declines punish holding unplanted seed to the next year and unless the breeder can multiply pure seed faster than the planters, the market provides incentives to release the initial seed immediately.

The above model of a seed market without IPRs makes strong assumptions about the demand structure and the inelasticity and exogenous growth of the supply of seed after release. It fixes both the total acreage and value of the added quality from the new seed. Perhaps more heroically, it assumes the purchasers know quality advantages and price path with certainty. The price dynamics work through relaxing supply constraints as opposed to any form of strategic interaction or learning about quality.<sup>74</sup> The industrial structure of the breeding sector does not come into play until the period of surfeit when competition reduces the price premium to zero. Introducing a second breeder with a supply  $S_2$  of seed of equal (or better quality) would alter the model by hastening the year  $T$  of seed surfeit. If the second seed was better ( $v_2 > v_1$ ), it would continue to displace the first after the year  $T$  was reached.<sup>75</sup>

Using the available evidence, we can gain a sense of the magnitudes involved circa 1850. First, consider the extra annual revenue,  $vyP_L/b$ , generated by a unit of improved seed. Taking the yield as 200lb of lint per acre, the price of lint as \$0.10/lb, and  $b$  as 2.5 bushels (75lb) of seed per acre, then for a new variety that was 5 percent better ( $v=0.05$ ) would generate additional annual lint revenue of about \$0.40 per bushel of seed. Next consider the rate of price declines. If  $d=0.93$  and  $m=5.33$ , then  $dm=4.96$ . Given these figures, the premium on seed ( $P_{T-\tau} - P_S$ ) of a variety that was 5 percent improvement would have the following path:

---

<sup>74</sup> The diffusion path accelerates as the multiplication of seed relaxes the supply constraint on adoption. Instead of a full S-shaped diffusion curve, it is as if only the bottom part occurs.

<sup>75</sup> We can investigate more fully a model of a quality ladder where two improved varieties compete. Suppose variety 0 improves quality by  $v_0$  and is available in stock  $S_0$  at  $t_0$  and variety 1 improves quality by  $v_1$  and is available in stock  $S_1$  at  $t_1$ . We will normalize the name by letting  $t_0 < t_1$  but leave the values of  $v_0$  and  $v_1$ . At  $t_0$ , variety 0 will be sufficient to plant all acreage at  $T_0$ ; variety 1 will be sufficient at  $T_1$ , and they will jointly be sufficient at  $T_{01}$ . To make the competition interesting, let  $t_1 < T_0$ , so that variety 1 is available before variety 0 is in surplus and  $T_{01} < t_1$ .

If  $v_0 > v_1$ , variety 0 will generate a production advantage of  $v_0$  from  $t_0$  to  $T_{01}$  and of  $(v_0 - v_1)$  from  $T_{01}$  to  $T_0$ . Variety 1 will generate a production advantage of  $v_1$  from  $t_1$  to  $T_{01}$  and then be in surplus.

If  $v_1 > v_0$ , variety 0 will generate a production advantage of  $v_0$  from  $t_0$  to  $T_{01}$  and then be in surplus as it is being displaced. Variety 1 will generate a production advantage of  $v_1$  from  $t_1$  to  $T_{01}$  and then a production advantage of  $(v_1 - v_0)$  to  $T_1$ . The price paths can be calculated accordingly.

Yrs Before Surfeit	T	T-1	T-2	T-3	T-4	T-5	T-6
Premium in \$	0	0.37	2.22	11.37	56.8	282	1399

(The premium would vary in proportion to percentage increase in productivity; a seed offering a 10 percent gain would have double the premium listed above.) The high value of seeds in the early period (T-6) suggests that even without IPRs many breeding opportunities would have been profitable—those growing cotton certainly had strong incentives to be on the look-out for outstanding performers in the fields. More generally, the model predicts very high initial prices for seed offering modest productivity enhancements and then very rapid price declines. Actual IPO prices do not typically reach the levels predicted by the model based on the productivity claims. It is likely that uncertainty over quality tempered initial demand.

### **Informational Problems**

Contemporary critics incorrectly interpreted the very high but declining prices as a sign of market failure. They were closer to the mark when they highlighted the serious information problems concerning seed quality. If a supplier made a one-time discovery or introduced a foreign variety, the structure of the antebellum seed market created incentives to make a splash and sell at a high initial price soon after discovery.<sup>76</sup> Playing on the seeders capacity to multiply at high rates, the marketers sold the new seeds in small lots, from a pint (1/64 of a bushel) to even as single seed. But these practices of selling seed of new plants created informational problems.

Without a lengthy period of experimentation and testing, the new variety was likely genetically unstable. And the high prices would induce small purchases and attempts to multiply the supply internally, near existing production. In the absence of care and isolation, cross-pollination with neighboring cotton plants threatened to compromise the variety. We know that even a dedicated and attentive breeder such as

---

<sup>76</sup> This contrasts sharply with the incentives for a breeder, like Vick, who was engaging in a long-term program; he sought to build up his reputation for maintaining quality. “Letter from M. W. Phillips,” U.S. Patent Office, *Annual Report of the Commissioner of Patents, 1848, Part II: Agriculture*, (Washington, DC: GPO, 1849), pp. 154-155.

Martin W. Philips planted the different varieties of seed stock in close proximity.<sup>77</sup> It is likely that more typical planters did the same. In accounting for the failure of *Mastodon*, Richard Abbey blamed the planters and not the plant. In his letter introducing the seed Abbey stressed to planters the necessity to keep the variety pure. He later complained that growers took insufficient care to prevent it from becoming “mixed and crossed.”<sup>78</sup> His brother, M. Ellis Abbey, asserted this showed “the folly of purchasing ‘a few bushels to get a start’ . . . .”<sup>79</sup> Having prominent local planters try the seeds (and quote their certifications) mediated but did not fully resolve these issues.

A further problem was the lack of control over the use of names. Substitution of lower-quality seed was especially troublesome for *Petit Gulf*. Advertisements in the southeast soon addressed the quality issues. In early 1835, G. Y. Davis advertising in the *Southern Patriot* of Charleston, SC, asserted his *Petit Gulf* seed was “of superior quality, with certificates.” Holcombe, Peck, & Co. sold “valuable SEED, warranted fresh and genuine, selected with particular care, direct from plantations on the Mississippi River.”<sup>80</sup> Brand names for *Petit Gulf* came into common use.<sup>81</sup>

Advertisements for *Okra-Twin-Alvarado* also warned about substitutions. “We are aware that many impositions were practiced last season in the sale of cotton seed purporting to be genuine Alvarado or Okra Seed.”<sup>82</sup> Unsatisfactory results from growing Okra were easily attributed to the planters’ use of bargain seed of spurious character, seed which sold for \$2, “while \$5 is the price of a quart of the genuine seed.”<sup>83</sup>

The promoters of *Mastodon* loudly accused counterfeiters of infringing on their product. As early as December 1845, Richard Abbey printed advertisements under the head: “Mastodon Seed-Caution,” carrying the text: “I hold myself responsible for the *purity* or *genuineness* of no Mastodon Cotton Seed unless sold by myself, or my agents. . . .”<sup>84</sup> In early 1846, Abbey’s hometown paper, the *Yazoo City Whig*, trumpeted

---

<sup>77</sup> Franklin L. Riley (ed.), “Diary of a Mississippi Planter, January 1, 1840 to April, 1863,” *Publications of the Mississippi Historical Society*, Vol. 10 (1909), pp. 305-483.

<sup>78</sup> *Southern Cultivator* 4, no. 9 (Sept. 1846), p. 141.

<sup>79</sup> *American Farmer* 2, no. 7 (Jan. 1847), p. 211.

<sup>80</sup> *Southern Patriot* (2 Feb, 1835), p. 3; (3 March 1835), p. 3.

<sup>81</sup> See ads in *New Orleans Commercial Bulletin*.

<sup>82</sup> *Southern Banner* (9 Nov. 1839), p. 3.

<sup>83</sup> *Southern Agriculturist* (Nov. 1839), p. 615.

<sup>84</sup> *Mississippi Free Trader* (9 Dec. 1845), p. 1. See also Holly Springs (MS) Gazette (3 Jan. 1846), p. 3. Abbey added that “My present crop is the first and only *entire crop* of Mastodon Cotton ever raised in the

“Look Out for Counterfeits!!!”<sup>85</sup> Richard Abbey followed up with a “Note to Planters” directly charging New Orleans firm of Ringgold and Ferriday with selling “spurious” Mastodon seed.<sup>86</sup> Not only were they stealing his sales, they were harming Mastodon’s reputation.

In the autumn of 1846, Richard Abbey complained in the widely-read periodical *Southern Cultivator* of the production of “vast quantities of *mixed seed*.” In addition, “*extensive frauds* have been committed by the sale of quite different kinds of seed as ‘Mastodon.’ *A large commission house in New Orleans has been extensively engaged in this business*, and many parts of the country have become flooded with spurious seed.”<sup>87</sup> Responding to planters’ letters, M. Ellis Abbey echoed the charges of fraud: “thousands of bushels were purchased in Mobile and New Orleans for Mastodon Cotton, which had none of the characteristics of the genuine.” He opined that sales of bogus seed exceeded that of the genuine. Dishonest vendors “have not scrupled to post up conspicuously flaming bills assuring the public that they have Abbey’s Mastodon seed, and profess to have obtained certificates of the fact.”<sup>88</sup> The brothers claimed to offer genuine seed with the Abbey name on each sack sold through a network of authorized distributors.

There were also alleged examples of breeders selling existing seeds under new names to differentiate their product. Charges of this practice were widespread in the seed wars of late 1840s and early 1850s. In these wars, a select group of breeders who offered steady supplies of improved seed priced at small premia attacked the one-shot introducers such as seedsman, G. D. Mitchell. Philips, one of the steady innovators, said of the “Cluster” variety, it is “known now by as many names as there are persons who desire to make money by selling seed.”<sup>89</sup> The prevalence of this practice suggests the late-

---

United States and I have taken the utmost pains to destroy all other seed on the plantation to keep this pure.” This indicates an understanding of the need for isolation. Later ads singled out the Mastodon seed offered by t

<sup>85</sup> *Yazoo City Whig* (9 Jan. 1846), p. 2.

<sup>86</sup> *Mississippi Free Trader* (12 Feb. 1846), p. 1; *Yazoo City Whig* (6 March 1846), p. 3. Ringgold and Ferriday advertised Mastodon cottonseed “from the River Guasaculco” in Mexico for \$1/bushel in early 1846. *New Orleans Times-Picayune* (26 Feb. 1846), p. 3.

<sup>87</sup> *Southern Cultivator* 4, no. 9 (Sept. 1846), p. 141; R. Abbey defended his own efforts by declaring Gulf seed a “humbug” in *DeBow’s Review* 2, no. 2 (Sept. 1846), p. 132.

<sup>88</sup> *American Farmer* 2, no. 7 (Jan. 1847), p. 211

<sup>89</sup> M. W. Philips, “The Different Varieties of Cotton Seed,” *DeBow’s Review*, (Aug 1855), p. 225. See also Moore, “Cotton Breeding,” pp. 102-104 and Robert MacFarlane, “The Cotton-Gin, and Cotton,” *American Phrenological Journal* 12, no. 4 (April 1851), pp. 85-87, esp. 86 on Mitchell’s cotton.

antebellum marketplace was receptive to innovations—note that Mitchell was not charged with selling his old seed as under the name of someone’s else improved seed, but with buying someone else’s new improved seed and selling it as his own newer superior creation.

Information problems remained serious. Cotton seed is closer to what economists call an experience good than an inspection good. Merchants might allow the planters to inspect samples of the lint, seeds, or plant, but it was difficult to ensure the seed was from the same stock as the sample. Some features were subject to inspection—in the 1820s, Mexican highland cottons had white seeds, distinct from green seeds of the prevailing varieties. But seed color lost its salience—soon there were bad white-seeded cottons and good brown-seeded Mexican cottons. Testing a seed, gaining experience, involved the opportunity cost of planting land in the new and uncertain variety. As noted above, going smaller involved greater risk of cross pollination as well as increased the risk of accidental death of the experimental plants. In this regime, marketers could not rely on word-of-mouth information flows from experienced purchasers to their neighbors to advance the diffusion process.

Instead, they resorted to heavy advertising including testimonials from prominent local planters regarding their positive experiences with the seed.<sup>90</sup> But these planters might be interested parties with seed promotions. And as noted by Edmund Ruffin in his criticism of Grant Thorburn’s “Chinese Tree-Corn,” finding a handful of successful cases out of thousands of adopters meant very little.<sup>91</sup> The performance of biological innovation was inherently sensitive to the local environment; what succeeded in one field in one season did not necessarily fare well in others.

The newspapers and agricultural journals entered into complicated relationships with seed breeders, relationships fraught with conflicts of interest. Seed ads became a valued source of revenue for newspapers from the late 1830s on. Promotions for new introductions could fill several column inches in the classified section of newspapers or even a full-page in a farm journal. In their own editorial pages, publishers often pointed

---

<sup>90</sup> Cyrus McCormick and other farm implement manufacturers regularly placed advertisements in the regional press containing testimonials from prominent local farmers.

<sup>91</sup> “Grant Thorburn in Defence of Himself and his Chinese Tree-Corn,” *Farmer’s Register* 7, no. 11 (30 Nov. 1839), p. 603.

out the paid advertisements for new seed and reviewed their claims favorably. They accepted letters (along with subscription renewals) from breeders touting their wares or published freely provided content from correspondents with an interest at stake.

One way to raise one's reputation, both relatively and absolutely, was to point out the sins of others. Much of the agricultural reform literature was devoted to criticism as well as praise. Attacks were especially sharp against those boosters whose promises were too good to be true. Their false claims inhibited true improvement. Thus, in addition to lauding the perseverance and modesty of H. W. Vick, Martin Philips chided the activities of others so as far as the southern code of honor among gentlemen (and libel laws) would permit.<sup>92</sup> Philips repeatedly chastised Richard Abbey, the promoter of Mastodon. And beginning in late 1849, Philips sharply criticized G. D. Mitchell in print for introducing his *Pomegranate* variety, which Philips thought was just *Hogan* or *Banana* under a new name.<sup>93</sup> In reply, Mitchell accused Philips of slander and dishonesty.<sup>94</sup> The two attempted to settle their difference through an exchange of visits.<sup>95</sup> But the dispute would not die as Philips, Jones, and fellow reformers continued to deprecate Mitchell and his seed.<sup>96</sup> Mitchell would not back down either. He denied committing any deception, stated he sold the seed by specimen, and claimed all his Georgia customers "were entirely satisfied."<sup>97</sup> He said no one was harmed and charged Philips of being a quibbler and impertinent intermeddler in others' affairs. In accompanying commentary, W. S. Jones, the *Cultivator's* editor, retorted he repeatedly heard Mitchell make deceptive statements.

---

<sup>92</sup> H. W. Vick, "Col. Vick on the Improvement of Cotton," *Southern Cultivator* 9, no. 9 (Sept. 1851), p. 129. In contrast to the disreputable seed mongers, Vick's investigations were purportedly driven by a desire to improve cotton "as far as our climate and soil permit." "No thought of profit, either from increase or quality of crop, or sale of seed" instigated his efforts. He wrote: "I have paid more money for cotton seed, than I received, and have given away more than I have sold."

<sup>93</sup> "Improved Cotton Seed," *Southern Cultivator* 7, no. 11 (Nov. 1849), p. 170 and "Varieties of Cotton" *DeBow's Review* vo. 10, p. 568,

<sup>94</sup> G. D. Mitchell, "Pomegranate Prolific," *Southern Cultivator* 8, no. 1 (Jan. 1850), p. 8

<sup>95</sup> M. W. Philips, "Pomegranate Cotton Seed," *Southern Cultivator* 8, no. 6 (June 1850), p. 92 and "Gen. Mitchell's Prolific Pomegranate Explanation," *Southern Cultivator* 8, no. 11 (Nov. 1850), p. 65

<sup>96</sup> M. W. Philips, "Testing Land Chemically--Pomegranate Cotton," *Southern Cultivator* 9, no. 6 (June 1851), p. 90 and "More about that Pomegranate," *Southern Cultivator* 9, no. 7 (July 1851), p. 108.

<sup>97</sup> "Gen. Mitchell's Vindication—The 'Pomegranate' Cotton Seed," *Southern Cultivator* 10, no. 6 (Aug. 1852), p. 245.

Mitchell, much like Grant Thorburn a decade earlier, learned such controversies generated free publicity and further opportunities to hawk his wares.<sup>98</sup>

The agricultural reformers of the antebellum South puzzled over how best to improve the operation of the cotton seed market. They argued that innovative breeders should share in the productivity advance they created and that high prices for newly discovered or developed seed could well be justified. They did not seek to deny anyone the ability to sell their seed at any price and under any name they choose. Yet they counseled that high prices limited diffusion, and that the proliferation of names and the unwarranted claims slowed the cause of improvement. Such practices harmed the innovative breeders and their risk-taking clientele. The repeated examples of humbugs empowered the conservative “good enough” farmers and their slightly more adventurous “show me” colleagues to resist change.<sup>99</sup> The reformers sought through ridicule and embarrassment to exclude from the ranks of honored improvers those seed sellers who made bogus claims, marketed bad seed, or renamed seed from existing varieties to garner premium prices. The reformers advocated devising unbiased means to test the seed and hold the results up against the proponents’ claims.<sup>100</sup> No one advocated for IPRs.

Many historical accounts concerning the operation of the antebellum cotton seed market are decidedly skeptical. The treatment by Ulrich B. Phillips (with two “l”s) in *American Negro Slavery* (1918) is representative.<sup>101</sup> After noting the surprising success of the early Mexican cottons, Phillips focuses on the excesses of the later years—the proliferation of new introductions accompanied by great fanfares of publicity, the very high prices at the initial public offering and then their collapse shortly thereafter, and subsequent wave of accusations of fraud and humbuggery. Phillips contrasted the typical planters who passed along his improved seed freely to friends with the flamboyant and

---

<sup>98</sup> *Farmer's Register* 7, no. 11 (30 Nov. 1839), p. 603. Ruffin added that publishing Thorburn’s defense amounted to providing new free advertisement for his corn. For later example of ridicule of the practice of selling improved seed, see *Southern Cultivator* 6, no.9 (June 1851), p. 86.

<sup>99</sup> “We are aware that the many deceptions practiced upon the public, by seed mongers, are calculated to make planters very cautious in experiments with new cotton seed. This is very proper; but should not go so far as to prevent small experiments, when there is good evidence that it will result in great advantage.” *Albany Patriot* (17 Jan. 1851), p. 2

<sup>100</sup> John Farrar, “Letter on Agricultural Humbugs,” *Southern Cultivator* 11, no. 4 (Apr. 1853), p. 108 enumerated a long list of humbugs in antebellum agriculture and urged the use of “fair and disinterested trials.”

<sup>101</sup> Phillips, *American Negro Slavery*, pp. 222-23.

less reputable seed promoters. Tellingly, his prime example of the latter was Martin W. Philips. Ulrich B. Phillips' praise of the early rounds of Mexican hybrid cottons is well placed, but his dismissal of later innovations missed the mark. As Figure 1 showed the upward march in picking productivity continued into the early 1860s.

Martin Philips (with one "l") at times adopted a similar scornful tone but he drew the lines far differently. He viewed himself and Vick and Jones as the true friends of progress in the cotton sector, truer than the conservative planters who sold lint but would not market their better seed and far truer than seed mongers such as Richard Abbey and G. C. Mitchell. Despite imperfections in antebellum cotton seed market, Martin W. Philips noted much "good has been done."<sup>102</sup> "Large prices induce attention to be directed to the production of choice seed."<sup>103</sup> They could easily be justified by productivity enhancements. As he wrote in 1850, "admit all this humbuggery, and that the U.S. lost \$100,000 by it, and a few men pocketed the same—yet, there has been and will be improvements that will enhance the value of cotton estates millions of dollars...."<sup>104</sup> And if the market suffered from problems, it was from too many new cottons, not too few.

## Conclusion

This investigation demonstrates the existence of an active market for new varieties of cotton seed in the antebellum American South in the complete absence of IPRs. It collects extensive evidence from newspaper advertisements to chart the price path of the new varieties. At the time of introduction, prices were often very high but in subsequently seasons rapidly declined from the IPO level. These patterns are rationalizable in terms of a market model given the potential of improved seed to increase operating returns and feasible finite rates of seed multiplication. The observed initial prices were also sufficiently high relative to the opportunity cost of labor to provide

---

<sup>102</sup> M. W. Philips, "Cotton Seed," *Southern Cultivator* 6, no. 7 (July 1848), p. 101.

<sup>103</sup> Philips further said while "all can improve," they could not "all improve seed as cheap as they can buy;" "the man who can sell \$500 or \$1,000 ... can bear the extra labor and expense." Letter reprinted in Joseph A. Turner, *The Cotton Planter's Manual, Being a Compilation of Facts from the Best Authorities on the Culture of Cotton; Its Natural History, Chemical Analysis, Trade, and Consumption; and Embracing a History of Cotton and the Cotton Gin* (New York, C. M. Saxton, 1857), p. 99.

<sup>104</sup> M. W. Philips, Letter of 1 Nov. 1849, in U.S. Patent Office, *Annual Report, 1849*, p. 151.

meaningful incentives to search for and refine improved seed varieties. This study also identifies information problems affecting the antebellum cotton seed market, leading observers to claim too many new varieties were released, not too few.

The historical environment under study differs from the current environment in several important ways. The differences in the opportunities, costs, and regulatory environment affecting plant breeding are especially noteworthy. Under current conditions, the costs in scientific resources and time required to produce new biotech cultivars are very large. According to a recent CropLife International study, across the 2008-12 period, each new genetically-engineered trait required, on average, an investment of \$136 million and over 13 years to develop and commercialize.<sup>105</sup> The regulatory hurdles associated with testing and certifying GMO technologies added significantly to these costs.<sup>106</sup>

The costs of innovation in the past were not as large. Many of the new seed developments were the product of learning by doing, or perhaps better put learning-by-growing. Astute growers gathered and selected the new seeds from promising plant variants from their fields of growing crops. Many other new seeds were introduced from outside by travelers and plant explorers. This activity was intentional, costly, and at times illegal. In the late eighteenth and early nineteenth century, nation-states often considered indigenous biological material as part of their patrimony and outlawed its export. Walter Burling's endeavor to smuggle white-seed cotton out of Mexico was one example of a much more wide-spread process of illegal international exchange of genetic material. An additional source of new varieties was systematic breeding. To be successful, new varieties derived from foreign introductions or domestic variations/mutations often requiring breeding work to acclimatize them to the local growing environment. Given that cotton had been grown extensively in the American South only since the 1790s, the technical possibilities for discovering new valuable seed varieties may have been especially fruitful. Such differences must be kept clearly in mind before drawing any current-day policy lessons from the operation of the antebellum

---

<sup>105</sup> CropLife International, "The Cost and Time Involved in the Discovery, Development and Authorization of a New Plant Biotechnology Derived Trait," [www.croplife.org/PhillipsMcDougallStudy](http://www.croplife.org/PhillipsMcDougallStudy), examined 28 Sept. 2013.

<sup>106</sup> Nicholas Kalaitzandonakes, Julian M. Alston, and Kent J. Bradford, "Compliance Costs for Regulatory Approval of New Biotech Crops," *Nature Biotechnology* 25 (2007): 509-11.

cotton seed market. Such differences are also important to understand when applying legal institutions, designed in the late eighteenth century, to modern technologies.

## Appendix: Analogous model for grain crops

The model for cottonseed differs from what would be applicable for a grain crop for which the seed was the final output. The model for such a crop can be sketched as follows. Suppose the old and new varieties differ only in their yields per acre. They do not differ in final use, selling for the same price,  $P$ , which will be treated as fixed. The production cost parameters for inputs other than seed --  $c_0$  (per acre costs) and  $c_1$  (per quantity or per yield costs)-- are also the same. (Treat  $c_0$  as being incurred before planted and  $c_1$  during and after harvest.) The amount of seed planted per acre is also identical and can be used to define the unit, such that one unit of seed is used per acre and the input cost of seed is its price. Let  $y_N$  be the yield per acre of the new seed and  $y_O$  be the yield of the old seed, where  $y_N > y_O$ . Let  $P_{N,t}$  be the price of new seed in year  $t$ .

For simplicity, assume total acreage  $A$  is fixed. One can endogenize the acreage  $A$  and price  $P$  by adding an output demand function  $Q(P)$  and a land supply function  $A(P, y)$ , but this creates complications and little gain to insight. (In a model with fixed acreage, land rents do rise with the increase in yields.)

Let  $S_t$  be the stock of new seed at the start of year  $t$ . Again, define year  $T$  such that  $S_T > A > S_{T-1} = S_T / y_N$ . For all periods before  $T$ , the new seed will be used solely to build up the seed stocks and none will be sold for final use. (One must assume the two varieties can be segregated or distinguished.) From period  $T$  forward, a portion of new seed will be sold for final use at price  $P$  and thus,  $P_{N,t} = P$  for  $t \geq T$ .

Discounted revenues minus costs for production using the old seed are  $d(P - c_i)y_O - c_0 - P$ ; and using the new seed are  $d(P_{N,t+1} - c_i)y_N - c_0 - P_{N,t}$ .

The returns on the two activities will be equal (in the periods  $t < T$ ) if

$$(A1) \quad P_{N,t} = P + d(P - c_i)(y_N - y_O) + dy_N(P_{N,t+1} - P).$$

In year  $T-1$ , equation (A1) becomes  $P_{N,T-1} = P + d(P - c_i)(y_N - y_O)$ .

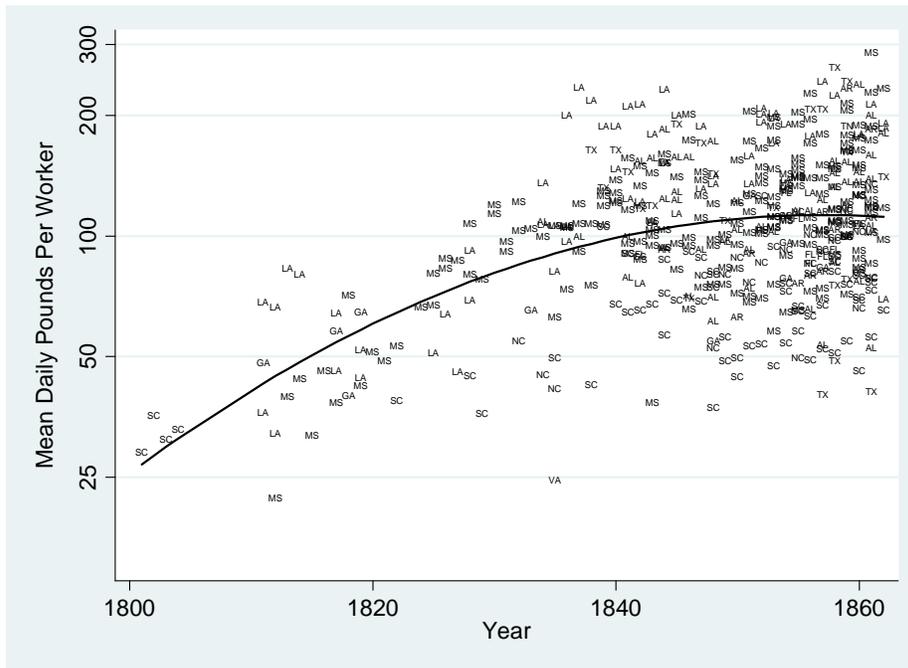
Applying equation (A1), one can work backwards to derive:

$$(A2) \quad P_{N,T-K} = P + (1 + dy_N + \dots + (dy_N)^{K-1})d(P - c_i)(y_N - y_O)$$

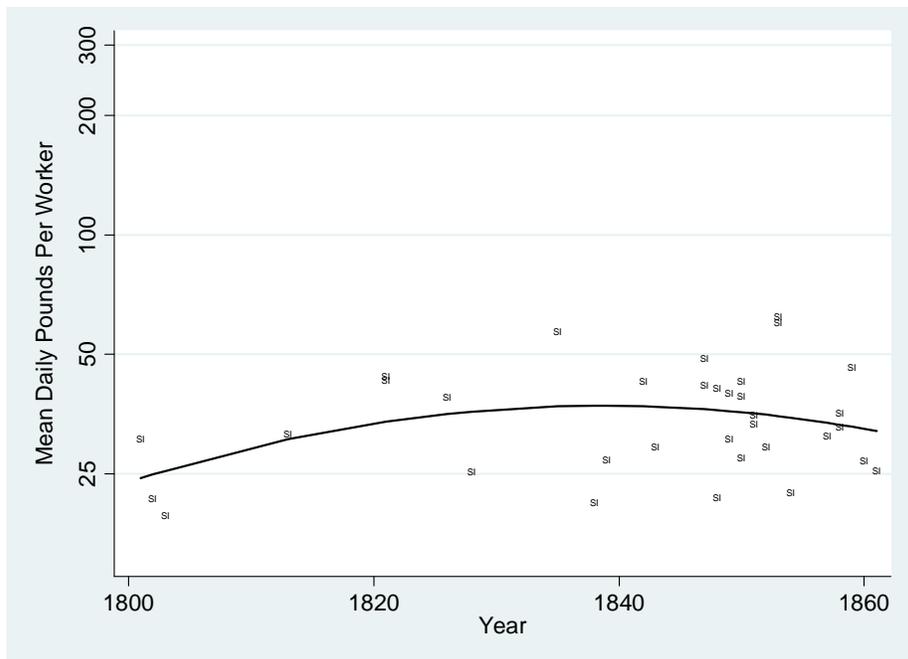
Equation (A2) is analogous in form to equation (2) in the main text with the new seed's yield replacing the multiplication ratio,  $m$ , and with different measure of additional net returns. The qualitative results in the text are not specific to crops such as cotton where seed is a by-product. Prices fall at a rate faster than the benchmark case ( $dy_N$ ) because there are non-seed inputs, specifically land, in production.

Figure 1: Mean Daily Picking Rates by Plantations, 1801-62

Panel A: Upland Cotton (N=468)



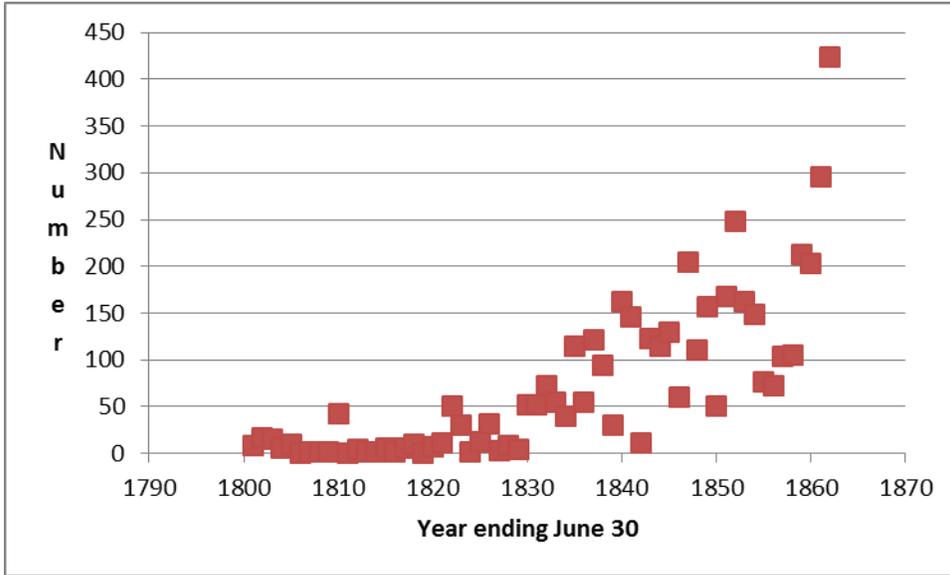
Panel B: Sea Island Cotton (N=34)



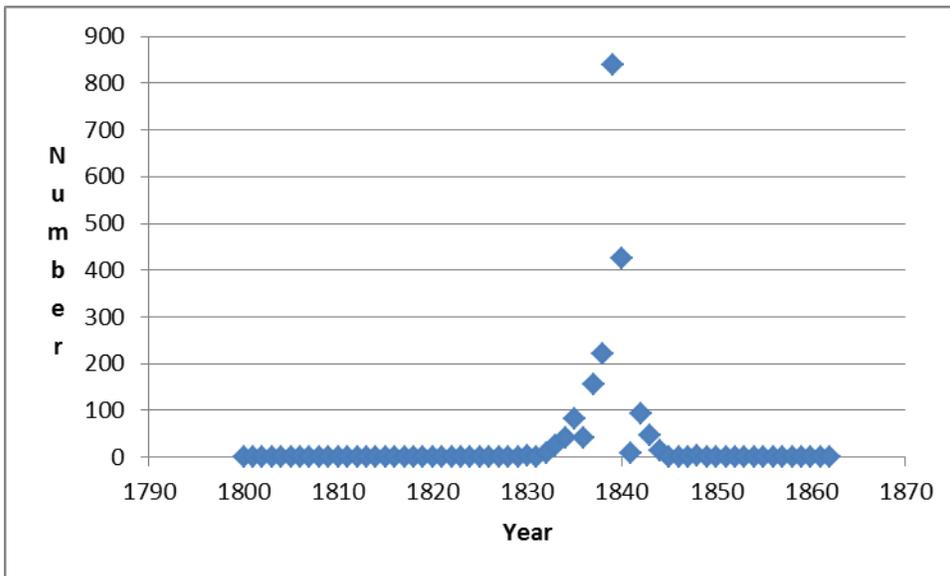
Source: Alan L. Olmstead and Paul W. Rhode, "Biological Innovation and Productivity Growth in the Antebellum Cotton Economy," *Journal of Economic History* 68, no. 4 (Dec. 2008), pp. 1123-71.

Figure 2: “Hits” in Searches of Advertising in the Readex Newspaper Database, 1801-62

Panel A: Cotton Seed



Panel B: *Morus Multicaulis*



Source: Compiled from Readex newspaper index. Search: “Cotton Seed” and not “Cotton Seed Oil” and not “Cotton Seed Planter”.

Figure 3: David Dickson's Seed Advertisements from 1854, 1858, and 1860

## HIGHLY IMPROVED COTTON!

### Boyd's Extra Prolific!

---

This New and Valuable variety of COTTON, FAR EXCELLS ANY COTTON WE EVER HAD IN THIS SECTION FOR YIELD, as is proven by a Written Report of GEN. WILLIAMSON, CAPT. BASS, MATTHEW WHITEFIELD, and other Good Planters who have tested the merit of this Cotton the present year. Every COTTON PLANTER, living in a Short Climate, should plant of this Cotton, as it produces a crop of SQUARES and BOLLS in near HALF THE TIME of the ordinary Cotton, checking the growth of the weed and going on to maturity. It should be topped about the 20th of July, and if planted on strong land the side branches should also be topped. Much is lost by Planters for the want of careful selection of Highly Improved Seeds, not only of Cotton, but Corn, Wheat, &c. Planters wanting seed had best apply early. **PRICE OF THE SEED PER BUSHEL, \$3.**

D. DICKSON.

Covington, Newton Co., Ga., 1854.

### CERTIFICATES!

Covington, Ga., September 26, 1854.

We planted this year Boyd's Extra Prolific Cotton, introduced by D. Dickson, of Covington, which has proved for the most Productive Cotton we ever planted. It is no humbug, but a very Highly Improved variety of Cotton, which we can recommend to our friends with great confidence.

JOSEF FRANKLIN,	M. C. FULTON,	DAWSON H. LANE of Morgan County,
ALFRED LEVINGTON,	JOSEPH B. SLACK,	THOMAS HANMONDS, of Morgan County,
DAVID COOK,	WM. COOK, of Morgan County,	MATTHEW WHITEFIELD, of Jasper County,
HENRY GAITHER,	THOMAS W. SMITH,	JOHN R. CLEM, of Chatham County.
THOMAS WYATT, of Jasper County.		

Covington, Ga., Sept. 27, 1854

We planted this year "Boyd's Extra Prolific Cotton" by the side of our other Cotton, no difference in the land or cultivation; Boyd's will make at least one third more than the other.

JOHN N. WILLIAMSON,  
JOHN W. HINTON.

Covington, Ga., Sept. 28, 1854.

We planted this year "Boyd's Extra Prolific Cotton" by the side of our other Cotton, no difference in the land or cultivation; Boyd's will double the other in production.

JOHN BASS, REUBEN WOODRUFF, JOHN A. WEAVER, JOHN RAY, of Coweta County.

Horton Co., Ga., October 16, 1854.

I planted, on the same half-acre the present year, for an experiment, the Seed of some half-dozen of the Best Improved Varieties of Cotton known in this Country, all having the same chance in every respect. I feel confident in saying that "Boyd's Extra Prolific" excelled in Production either of the other varieties at least One-Third, and some much more than that. It is the most Prolific and Closely Bearing Cotton that I have ever cultivated.

J. A. MILLER.

Covington, Ga., Oct. 7, 1854.

At the request of Mr. Dickson, we examined a patch of "Boyd's Extra Prolific Cotton," planted on the 17th of May, on first and second quality of land, without measure. It is decidedly the heaviest balled Cotton we ever saw to the age of it, notwithstanding the severe growth we had. We counted Sixty-Eight grown Bolls on a stalk only Twenty-One inches High, and 102 grown Bolls on a stalk only 3 Feet High, besides a number of small ones. We know of no other variety of Cotton that would have produced such a crop of Bolls in so short a time.

McKINDREW TUCKER,	JOHN B. HENGRICK,	FERMEGUS RYNSOLE,	COLUMBUS D. PACE,
LEWIS ZACHERY,	FREDERICK COY, of Whitfield County,	JAMES THOMAS, of Sparta.	BENNETT H. CONYERS, of One County.

### AGENTS.

A few Seed may be had from

J. J. PEARCE, Augusta, Ga.	T. STOVALL & CO., Augusta, Ga.	CHARLES H. ALLEN, Almerillo, S. C.
J. R. HUGH, Madison, Ga.	J. M. STAFFORD & CO., Sparta, Ga.	C. J. PEARSON & CO., Kinston, Ga.
C. C. WORTON, Greenboro, Ga.	T. & J. HIGHTOWER, White Plains, Ga.	MATTHEW WHITEFIELD & CO., Sandy Dale, Ga.
MORROW & KENNEDY, Macon, Ga.	W. T. & J. C. TURNER, Athens, Ga.	W. J. ANDERSON, Fort Valley, Ga.

D. DICKSON.

MESSENGER PRINT, COVINGTON, GA.

Source: Hargrett Library Broadside Collection, 1850-1859, Mss. 2622, Hargrett Rare Book & Manuscript Library, University of Georgia Libraries.

# IMPROVED COTTON!

## DICKSON'S SELECT COTTON.

I have selected and improved this cotton until I have succeeded in raising a stalk with 469 bolls only 5 feet high.

### CULTIVATION OF COTTON.

The land should be broken fine and deep before planting, and if planting on high land it should not be planted on beds, the land should be kept as level in the cultivation between the rows as possible to prevent the cotton from shedding in case of drought.

If planted on land inclined to be wet, or on bottom land it should be planted on beds as high as possible, and the middle furrow should be kept open to drain off the surplus water, so that the beds may have warmth and dryness, so essential to the cotton plant. In a short climate for cotton it should be planted on beds as high as Potatoe ridges, and kept so in the cultivation by keeping the middle furrow well open, which will increase the warmth of the land fully one degree, causing it to mature earlier. The land should be plowed as shallow as possible, with sweeps set very skimming to prevent the cotton from making too much weed, and shedding its first fruit, which should be secured if possible.

In all light, loose and sandy soils, cotton should be

cultivated with sweeps set very skimming or light harrows, stirring the ground as shallow as possible, but frequently as the breaking of the young roots or feeders is almost certain to cause the cotton to shed a portion of its first fruit, which ought to be secured to mature a good crop before early frost. Stiff lands should be plowed once only, after planting, and then cultivated as above directed. This variety of cotton must be topped.

On thin and unmanured upland, it should be topped by the 20th July—manured upland the 1st of August, and rich bottom about the 10th August, as too early topping of bottom land will cause it to sucker too much.—If strong land it puts out side branches at the ground which ought to be topped also. This cotton should be left one-fourth thicker in the drill than other cotton, and the rows a little closer.

Price of seed \$5 per bushel. Address me at Oxford Ga.

### AGENTS.

Thos. P. Stovall & Co., Augusta, Ga. Price & Co., Americus, Ga. Allen & Camak, Columbus, Ga. J. H. Wells, Columbia, S. C. G. Walker, Charleston, S. C. Gilmer & Co., Montgomery, Ala. David & Ford, Mobile Ala. Robson & Allen, New Orleans. E. M. Apperson & Co., Memphis, Tenn. Jones, Laws, & Co., Albany Ga. Cheatham & Walker, Dawson, Ga. D. M. Edwards, Milledgeville, Ga. Rabun & Smith, Savannah, Ga.

I also have the Hungarian Grass Seed, at \$5 per bushel. Its growth is so rapid that it may be cut for Hay in 6 weeks after sowing. It will mature its seed in about 2 months, producing 20 bushels per acre on rich land.—Sow from April to June at 1-2 bushel per acre.

Oxford, Ga., Oct., 1858.

D. DICKSON.

# IMPROVED COTTON.

## Dickson's Select Cotton.

I have selected and improved this Cotton until I have succeeded in raising a stalk with 523 bolls, only 4 feet high, and another with 211, only 26 inches high.

### CULTIVATION OF COTTON.

The Land should be broken fine and deep before planting, and if planting on high land, it should not be planted on beds, the land should be kept as level in the cultivation between the rows as possible, to prevent the cotton from shedding in case of drouth.

If planted on land inclined to be wet, or on bottom land, it should be planted on beds as high as possible, and the middle furrow should be kept open to drain off the surplus water, so that the beds may have warmth and dryness—so essential to the cotton plant. In a short climate for cotton, it should be planted on beds as high as Potato ridges, and kept so in the cultivation by keeping the middle furrow well open, which will increase the warmth of the land fully one degree, causing it to mature earlier. The land should be plowed as shallow as possible, with sweeps set very skimming, to prevent the cotton from making too much weed, and shedding its first fruit, which should be secured if possible.

In all light, loose and sandy soil, cotton should be cultivated with sweeps set very skimming or light harrows, stirring the ground as shallow as possible, but frequently, as the breaking of the young roots or feeders is almost certain to cause the cotton to shed a portion of its first fruit, which ought to be secured, to mature a good crop before early frost. Stiff lands should be plowed once only, after planting, and then cultivated as above directed. This variety of cotton must be topped.

On thin and unmaured upland, it should be topped by the 20th of July—maured upland, the 1st of August, and rich bottom about the 10th of August, as too early topping of bottom land will cause it to sucker too much. In strong land, it puts out side branches at the ground, which ought to be topped also. This cotton should be left one-fourth thicker in the drill than other cotton, and the rows a little closer.

Price of Seed, \$5 per bushel. Address me at Oxford, Ga.

### CERTIFICATES.

EVERGREEN, LA., Nov. 23, 1859.

MR. DICKSON—*Sir*: I purchased from you, last Spring, 10 bushels Improved Cotton Seed, a part of them for my neighbors. I only planted 2 bushels myself. Mr. Pearce, my neighbor, who took 2 bushels, planted them on fresh land, and he tells me that it has yielded about 4,000 lbs. to the acre. I planted mine on my oldest land, and in consequence of the drouth, it did not yield so well, but they are the best seed that have ever been in the country.

Respectfully yours,  
AMOS FISHER.

MACON CO., Ga., Sept., 1859.

MR. D. DICKSON—*Dear Sir*: I cultivated and topped your Cotton according to your directions; it is the best cotton I ever saw; it is from 4 to 6 feet high, and full from bottom to top, and all the sides.

Yours, truly,  
G. W. BUSHBEE.

We have raised some of Dickson's Improved Cotton, which has proved to be decidedly the most productive cotton we ever planted. Isham Weaver, Newton co., Ga.; Col. J. J. Griffin, Oxford, Ga.; Casper W. Jones, Barbour co., Ala.; L. L. Lincecum, Washington co., Texas; Capt. Jas. S. Lauderdale, Washington co., Texas; W. Patterson, Liberty Hill, S. C.; W. F. Atkinson, Wayne co., N. C.

WARSAW, N. C., Oct., 1859.

MR. DICKSON—*Dear Sir*: I am happy to inform you that I have this day finished picking over my Cotton, the seed of which I got from you. I am satisfied it is the best Cotton we can plant in this State. I think I shall make between Five and Six Thousand Pounds Seed Cotton on the three acres I planted.

Yours, in haste,

A. FAISON.

SPARTA, Ga., Aug. 24, 1860.

MR. DICKSON—For the last seven years previous to this, I had considered Boyd's Prolific Cotton Seed the very best I had ever seen or planted, for a large yield. But since planting the sack I purchased of you this spring, I must give your "Select Cotton Seed" the preference over all others. What Cotton I planted from your Seed this year, will make nearly double per acre the Cotton planted one to three days before, and some on the same day, the land and the manure being equal. Your Select Seed was planted the 4th of May. All who have seen the Cotton concur with me in this estimate.

Very respectfully,

DAVID DICKSON.

DUNCANVILLE, Ga., Aug. 27, 1860.

DAVID DICKSON—*Dear Sir*: I bought of H. H. Hardaway, last spring, five bushels of your Prolific Cotton Seed, with which I am highly pleased, and willing to certify that your Cotton will do all you say it will; and I believe, if planted on our best Oak or Hickory Lands, and properly cultivated, would surpass your most sanguine expectations. Several gentlemen have looked at my little patch, and say they had not the most distant idea that Cotton could be brought to such perfection by cultivation. I would be glad if you would do me the favor to select five bushels of seed for me; I am willing to give you almost any price for five bushels of your own selection.

Yours, very respectfully,

JAMES G. HALL.

### AGENTS.

Messrs. Stovall, McLaughlin & Co., Augusta, Ga.; Allen & Camak, Columbus, Ga.; Gilmer & Co., Montgomery, Ala.; F. M. Apperson & Co., Memphis, Tenn.; D. M. Edwards, Milledgeville, Ga.; T. H. & J. M. Allen, New Orleans; Clutcher & McRiven, Vicksburg, Miss.; Pomeroy & Marshall, Mobile, Ala.; W. Simpson, Eufaula, Ala.; W. Y. Lonic, Selma, Ala.; W. Hendley & Co., Galveston, Texas; Pratt & McKinzie, Apalachicola, Fla.; J. M. & W. P. Marvin, Monticello, Fla.; Wardlow, Walker & Co., Charleston, S. C.; J. N. McKinnon & Co., Thomasville, Ga.; Patton & Miller, Savannah, Ga.; M. McInnis, Wilmington, N. C.; J. M. Cooper & Co., Albany, Ga.; Ford & Hawthorn, Mobile, Ala.; Lanier & Price, West Point, Ga.; T. G. Burmette, Greenville, Ala.; Cody, Fleming & Swift, Columbus, Ga.; P. H. Wilson & Co., Athens, Ga.; L. L. Lincecum, Long Point, Texas; W. Shivers, Columbia, S. C.; John Lee, Columbus, Ga.; Hopkins & McGinnis, Tallahassee, Fla.; Dr. W. H. Mariner, Starkville; Evans & Dunlap, West Point; Fleming & Baldwin, Natchez, Miss.

Address,

## D. DICKSON.

Oxford, Ga., Oct., 1860.

Dec60-1\*

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Figure 4: Scatterplot of Log Real Prices versus Number of Years Since Release

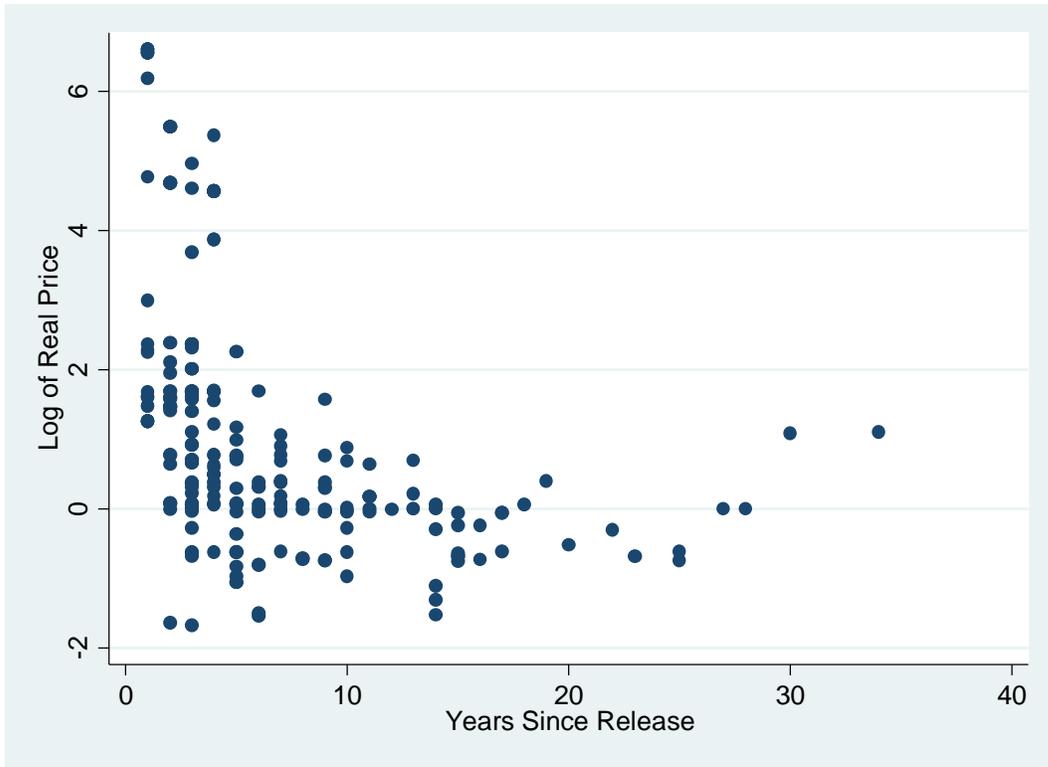


Figure 5: The Market for New Seed

Panel A. Relationship between Seed Supplies and Increase Value on Lint Production

Panel B. Demand Function for New Seed

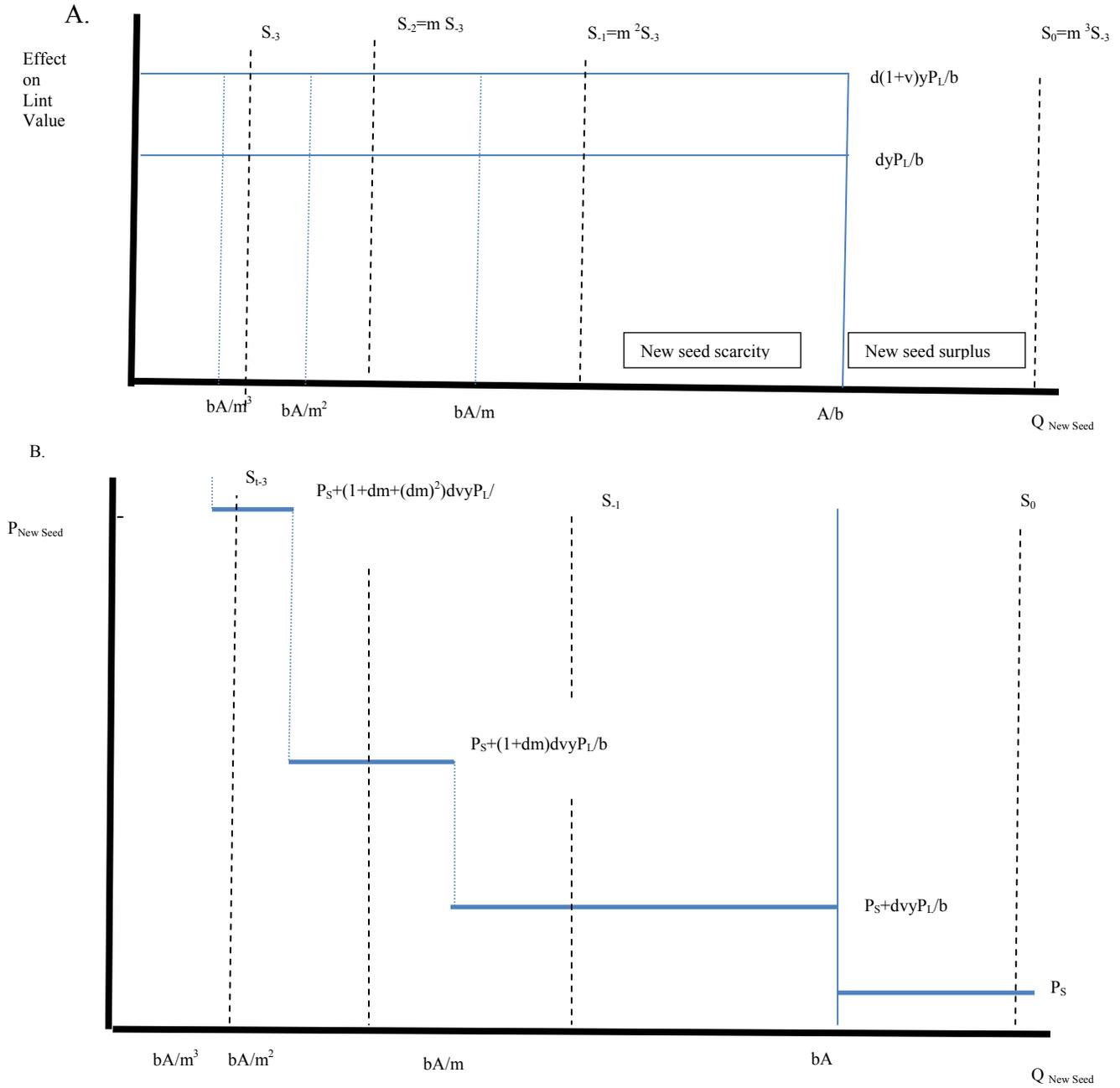


Table 1: Price path since release for selected important varieties

	Year of Release	Mean Price per Bushel by Year since Release (Release= Yr1)										No. of Obs.
		Yr 1	2	3	4	5	6	7	8	9	10	
Petit Gulf	1833		5			0.7	0.4			0.8	1	15
Okra/Twin	1837			78	102	10					1	17
Sugar Loaf	1843				1.5			0.9	1	1.3	0.5	8
Mastodon	1845		3	2.5						2	2	26
100 Seed	1846		7		1.5	1.5	1.3	1.2		1.2		16
Boyd Prolific	1847									5	1	3
Jethro	1848				5	1.3		1.6	0.5			10
Hogan	1848	691	32.5	1	1.3							13
Banana	1848	672	178	7.3	1.6	2.5						29
Pomegranate	1849	448		4.2	4.3	1.5		3	0.5		0.8	20
Dean	1853	5	3	2.1		0.4						12
Dickson	1858	5	5	5	4	1						8

Notes:

For Petit Gulf, the quotes for "genuine" seed imported from Mississippi Valley; prices in Southeast for locally grown "second crop" are much lower.

A bulk purchase discount of 0.7 was applied to quotes for small lot to convert into full prices ; this was the median ratio in advertisements quoting both small lots and whole bushels.

For Okra-Twin, a price for year 14 is listed under in column for year 10.

Table 2: Empirical Results  
 A. Summary Statistics

	Obs	Mean	St. Dev.	Min	Max
Log (Real Price)	263	1.179	1.913	-1.667	6.603
Year 1	263	0.102	0.304	0	1
Year 2	263	0.110	0.314	0	1
Year 3	263	0.194	0.396	0	1
Year 4	263	0.156	0.363	0	1
Year 5	263	0.080	0.272	0	1
Year 6	263	0.038	0.192	0	1
Year 7	263	0.069	0.253	0	1
Log (Years Out)	263	1.478	0.821	0	3.526
Year	263	1849.7	5.941	1834	1861
Small_Lot	263	0.076	0.266	0	1
Second_Quality	263	0.042	0.201	0	1
Old_South	263	0.580	0.494	0	1
Branded	263	0.764	0.425	0	1
Humbug	263	0.171	0.377	0	1

B. OLS Regressions	Dep Var: Log(Real Price)			
	1	2	3	4
Year Indicator				
Specifications	Full	Not		Not
	Sample	Humbug	Branded	Branded
Year 1	3.575	3.498	3.917	1.190
	[0.543]	[0.577]	[0.726]	[0.524]
	<0.880>	<0.979>	<1.068>	<0.944>
Year 2	2.133	2.426	2.425	0.773
	[0.398]	[0.516]	[0.549]	[0.823]
	<0.776>	<0.930>	<1.019>	<0.441>
Year 3	1.043	1.338	1.130	0.094
	[0.311]	[0.322]	[0.447]	[0.461]
	<0.437>	<0.490>	<0.589>	<0.737>
Year 4	0.990	0.849	1.068	-0.128
	[0.291]	[0.256]	[0.352]	[0.414]
	<0.572>	<0.526>	<0.603>	<0.624>
Year 5	0.154	0.406	0.064	0.312
	[0.278]	[0.271]	[0.382]	[0.316]
	<0.270>	<0.219>	<0.431>	<0.503>
Year 6	0.055	0.259	0.291	-0.384
	[0.270]	[0.266]	[0.366]	[0.308]
	<0.282>	<0.406>	<0.453>	<0.428>
Year 7	0.367	0.401	0.364	0.062
	[0.212]	[0.207]	[0.257]	[0.371]
	<0.282>	<0.296>	<0.324>	<0.366>
Year	0.027	0.041	0.013	0.024
	[0.016]	[0.016]	[0.040]	[0.022]
	<0.019>	<0.021>	<0.040>	<0.033>
Small_Lot	2.112	2.567	1.889	--
	[0.430]	[0.550]	[0.454]	--
	<0.531>	<0.678>	<0.580>	--
Second_Quality	-1.227	-1.195	-1.228	-1.091
	[0.271]	[0.313]	[0.272]	[0.272]
	<0.094>	<0.074>	<0.284>	<0.066>
Old_South	0.365	0.176	0.431	0.422
	[0.135]	[0.149]	[0.185]	[0.153]
	<0.130>	<0.126>	<0.181>	<0.153>

Constant	-49.422 [30.129] <36.177>	-75.906 [29.418] <39.145>	-24.343 [73.753] <74.385>	-43.789 [40.331] <61.461>
Categories	36	34	25	13
Obs	263	218	201	62
R-squared	0.873	0.892	0.868	0.914

C. OLS Regressions		Dep Var: Log(Real Price)				
Log Year	1	2	2A	3	4	
Specifications	Full	Not			Not	
	Sample	Humbug	Humbug	Branded	Branded	
Log (Years Out)	-0.958 [0.150] <0.395>	-0.923 [0.179] <0.458>	-0.853 [0.337] <0.627>	-1.439 [0.227] <0.508>	-0.042 [0.227] <0.084>	
Small_Lot	2.909 [0.392] <0.696>	3.467 [0.378] <0.499>	0.695 [0.712] <0.135>	2.501 [0.399] <0.696>	-- -- --	
Second_Quality	-1.640 [0.278] <0.243>	-1.636 [0.289] <0.243>	-0.912 [0.214] <0.234>	-1.269 [0.191] <0.279>	-1.175 [0.304] <0.060>	
Old_South	0.207 [0.161] <0.181>	0.034 [0.192] <0.208>	0.423 [0.374] <0.116>	0.291 [0.187] <0.203>	0.434 [0.136] <0.102>	
Constant	2.332 [0.286] <0.637>	2.206 [0.376] <0.807>	2.778 [0.307] <0.734>	3.043 [0.374] <0.791>	0.220 [0.494] <0.191>	
Categories	36	34	2	25	13	
Obs	263	218	45	201	62	
R-squared	0.842	0.864	0.811	0.845	0.887	

All regressions include variety fixed effects.  
[robust standard errors]  
<standard errors clustered at variety level>