KING HAY

Energy History and Economic Nationalism in the American Civil War Era

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In 1857, a southern dissident named Hinton Rowan Helper published an explosive manifesto entitled *The Impending Crisis of the South*. Helper was a virulent racist who opposed slavery because he thought that slaveholders were ruining the prospects of non-slaveholding whites (such as himself) and holding the entire South back. Conversely, the North's rapid development seemed to prove free labor's superiority. To prove his point, Helper made the startling assertion that northern hay was more valuable than southern cotton.[1] This claim, meant to upend pro-slavery ideologists' declarations that cotton was "king," has been noted by several historians, none of whom have taken it very seriously.[2] Yet unlikely as it may seem, the idea of a "King Hay" cannot be dismissed so easily. To put it simply, Helper's data and arithmetic were sound enough. While it is

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[1] On Helper and the controversy surrounding him, see David Brown, *Southern Outcast: Hinton Rowan Helper and the Impending Crisis of the South* (Baton Rouge: Louisiana State University Press, 2006); George M. Fredrickson, "Antislavery Racist: Hinton Rowan Helper," in *The Arrogance of Race: Historical Perspectives on Slavery, Racism, and Social Inequity* (Middletown, CT: Wesleyan University Press, 1988), 28–53. According to Fredrickson, "it would not be difficult to make a case for *The Impending Crisis* as the most important single book, in terms of its political impact, that has ever been published in the United States" (28).

[2] See, for instance, Paul Wallace Gates, *The Farmer's Age: Agriculture, 1815-1860* (New York: Holt, Rinehart and Winston, 1960), 249–51; Robert William Fogel and Stanley L. Engerman, *Time on the Cross: The Economics of American Negro Slavery* (New York: W. W. Norton & Company, 2013), 160–69; Margo J. Anderson, *The American Census: A Social History* (New Haven: Yale University Press, 1988), 53–57; Fredrickson, "Antislavery Racist," 40. Gates, a renowned agricultural and land-policy historian, saw an "element of truth" in Helper's claim but otherwise deprecated the notion. Fogel and Engerman dissected Helper's methods, concluding that "his estimate of the value of the northern hay crop was 48 percent too high and his estimate of the value of the cotton crop was 34 percent too low" (164). However, they provide no explanation of how they arrived at these figures, nor do they do so in the companion volume, *Time on the Cross: Evidence and Methods* (Boston: Little, Brown and Company, 1974). It should be noted, as will be discussed in more detail below, that accepting their correction to Helper's figures makes the two crops roughly comparable in value. Anderson notes Helper's hay claim in passing only (53-54).

necessary to revise his figures, doing so does not fundamentally alter the nature of his challenge. Given the unquestioned centrality of slave-grown cotton to the global transformation we call the Industrial Revolution, what should we make of Helper's calculation that, in 1850, northern hay was worth nearly *twice* as much as southern cotton?

This question can be usefully approached in three parts, each of which requires us to confront the significance of national economies as opposed to global ones. First, what was hay for? From the perspective of energy history, hay mattered because of its caloric content. The age of railroads and steamboats made horses more important than ever in a wide range of farm operations and urban transport. Simultaneously, urban growth created new consumer demands that helped transform much of the northern countryside into a specialized landscape of beef and dairy production. Feeding a rapidly rising number of horses and cattle required hay in tremendous quantities. King Hay therefore sheds light on the nineteenth century's energy transition.[3] It casts the epochal shift from an organic to a mineral energy regime as gradual and sometimes halting due to specific supply bottlenecks.[4] Before the internal combustion engine and widespread electrical power generation, coal made animal power more rather than less important and thereby encouraged the expansion rather than the contraction of plant energy. Importantly, this phase entailed a particular spatial configuration of the economy. Hay was too bulky to transport very far and was rarely exported. Hence urban growth in the United States significantly depended on trade with internal hinterlands that traced domestic rather than global commercial circuits.

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[3] J. R. McNeill, *Something New Under the Sun: An Environmental History of the Twentieth-Century World* (New York: W.W. Norton & Company, 2000); E. A. Wrigley, *Energy and the English Industrial Revolution* (Cambridge: Cambridge University Press, 2010); Helmut Haberl et al., "A Socio-Metabolic Transition Towards Sustainability? Challenges for Another Great Transformation," *Sustainable Development* 19 (2011): 1–14.

[4] My approach here is influenced by Alan Mikhail, "Unleashing the Beast: Animals, Energy, and the Economy of Labor in Ottoman Egypt," *American Historical Review* 118 (April 2013): 317–48.

A second way to approach King Hay is to ask how contemporaries made sense of Helper's claim. Present-day scientific concepts of energy were little known in the 1850s, so debate centered on the comparison between northern and southern economic systems within which Helper situated his argument. This conversation concerned familiar questions about the relative efficiency and justice of free and enslaved labor, but also questions of governance and territoriality.[5] Because cotton was the country's leading export while hay was barely exported at all, King Hay argued not only for free labor over slavery, but also for national markets over international ones, domestic economic development over global commerce, and protectionism over free trade. Many nineteenth-century Americans made sense of King Hay from the perspective not of energy but of economic nationalism.

The Philadelphia businessman and political economist, Stephen Colwell, ably represented this view. Although less known than his friend and fellow protectionist, Henry Charles Carey, Colwell was significant in his own right as an economic theorist, political observer, and government official in the Republican Party's sweeping reconstruction of the American scene after the Civil War. For Colwell, hay's value signified that none of the South's vaunted staple exports, not even cotton, could compete with the North's complex internal economy, in which no single staple predominated, but rather a great "quantity and variety" of goods reciprocally spurred economic development. Contextualizing King Hay within Colwell's oeuvre suggests the power of nationalism for making sense of contemporary economic transformations and for guiding U.S. policy in

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[5] For a classic account of northern critiques of the southern economy, see Eric Foner, *Free Soil, Free Labor, Free Men: The Ideology of the Republican Party Before the Civil War* (Oxford: Oxford University Press, 1995), 40–72. See also James L. Huston, *Securing the Fruits of Labor: The American Concept of Wealth Distribution, 1765-1900* (Baton Rouge: Louisiana State University Press, 1998); James L. Huston, *Calculating the Value of the Union: Slavery, Property Rights, and the Economic Origins of the Civil War*, Civil War America (Chapel Hill: University of North Carolina Press, 2003).

the second half of the nineteenth century. Indeed, a great deal of nineteenth-century history turns on the politics of constructing nation-states as agents of industrialization, yet neither historians of nationalism nor historians of economic thought have devoted much attention in recent years to the material and intellectual bases of economic nationalism during the mid-1800s.[6]

Finally, the straightforward empirical question must be addressed: was Helper right? Any answer requires making judgments about how to measure hay's value. Unlike cotton, which was produced almost entirely for commercial sale at the prevailing global price, most hay never made it past the farm gate. When it did, it sold for different prices in regional markets. As one of Helper's critics insisted, "three-fourths of the Hay of the North . . . has only a local value."[7] My efforts to account for these factors indicate that Helper's figures should be adjusted significantly downward. But his challenge to King Cotton remains. In some years, hay exceeded cotton in value; in others,

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[6] For recent accounts of the politics of nationalism, industrialization and imperial trade zones, see Sven Beckert, "American Danger: United States Empire, Eurafrica, and the Territorialization of Industrial Capitalism, 1870–1950," *American Historical Review* 122 (October 2017): 1137–70; Marc-William Palen, *The "Conspiracy" of Free Trade: The Anglo-American Struggle over Empire and Economic Globalisation, 1846-1896* (Cambridge: Cambridge University Press, 2016). For a classic account of the nineteenth century's most important theorist of economic nationalism, see Roman Szporluk, *Communism and Nationalism: Karl Marx versus Friedrich List* (New York: Oxford University Press, 1988). As far as I can tell, the main journals dealing with the history of economics, *History of Political Economy*, *The Journal of the History of Economic Thought* and *The European Journal of Economic Thought*, have not published any articles explicitly focused on economic nationalism. For early modernist approaches to the general topic, typically employing the idiom of empire rather than nation, see Sophus A. Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge, MA: Harvard University Press, 2011); Isaac Nakhimovsky, *The Closed Commercial State: Perpetual Peace and Commercial Society from Rousseau to Fichte* (Princeton University Press, 2011); Istvan Hont, *Jealousy of Trade: International Competition and the Nation State in Historical Perspective* (Cambridge, MA: Belknap Press of Harvard University Press, 2010). The study of economic nationalism has waned in the fields of international relations and diplomatic history, where it once thrived. See, for instance, David Levi-Faur, "Economic Nationalism: From Friedrich List to Robert Reich," *Review of International Studies* 23 (July 1997): 359–70; Edward P. Crapol, *America for Americans: Economic Nationalism and Anglophobia in the Late Nineteenth Century* (Westport, CT: Greenwood, 1973). A few sociologists have revisited the matter of economic nationalism in recent years, though from a perspective quite different from mine here. See Anni Kangas, "Market Civilisation Meets Economic Nationalism: The Discourse of Nation in Russia's Modernisation," *Nations and Nationalism* 19 (July 2013): 572–91; Takeshi Nakano, "Theorising Economic Nationalism," *Nations and Nationalism* 10 (July 2004): 211–29; Andreas Pickel, "Explaining, and Explaining with, Economic Nationalism," *Nations and Nationalism* 9 (January 2003): 105–27.

[7] Gilbert J. Beebe, *A Review and Refutation of Helper's "Impending Crisis"* (Middletown, NY, 1860), 17.

not. That the two were comparable is reason enough to rethink aspects of how the history of capitalism is commonly presented.

A consideration of the dilemmas intrinsic to estimating hay's value helps show how statistical cognizance shapes a commodity's visibility and, in the process, the metonyms and "stylized facts"—the modes of representation—by which we tend to understand the broader economy. Commodities entering global trade pass through customs houses that record trade volumes with relative accuracy. Because the data are good, a lot is known about this kind of commerce. But internal trade is difficult to measure. Before modern states began building institutions to collect detailed commercial statistics, domestic markets were opaque. Parsing the numbers therefore offers more than methodological transparency. First, it exposes the evidentiary imbalance that can lead us to over-emphasize global trade, a matter concerning the material as well as the ideological construction of what might be called the statistical archive. Second, it casts light on the key policies that economic nationalists undertook in order first to perceive, and then to develop, their domestic economies. It thus reveals something about how states learned to conceptualize and observe commercial objects at a particular historical moment and, in doing so, to establish distinctive national economies.

Whether considering the spatial dimensions of hay energy's production and exchange, the rhetoric and ideas by which northerners made sense of Helper's claim for hay, or the state development through which hay became known statistically, one is forced to contend with the fundamental importance of the nation-state for organizing capitalist development as a domestic phenomenon in which international trade, while important, was often auxiliary. King Hay thus leads to some critical reflections about the transnational turn and its affinities with commodity history and the new history of capitalism.

The rise of globalization as a master-narrative for our own times has impelled historians to break out of national historiographical traditions to investigate past global connections. Commodity history has proven an effective vehicle for this because it is well-suited to tracing linkages across national boundaries.[8] But the global scale is not always the relevant one and one ought not assume that long-distance trade is inherently more significant than local, regional, or national trade. Financialization, a key paradigm in the new history of capitalism, does not offer much purchase here either.[9] The present-day dominance of the financial sector has naturally sent historians looking for origins and earlier iterations. This search is often connected with the transnational turn because financial innovation has historically been key to long-distance trade. Historians have therefore shown how nineteenth-century developments in communication and transportation, and concomitant expansions of state power and law, enhanced financiers' control of commodity flows. But hay, in part because it rarely entered global trade, was not subject to the elaborate grading, storage, and transportation systems that increasingly shaped the economies of commodities exchanged at long distance, including wheat, cotton, and even enslaved human beings.[10]

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[8] For examples of commodity histories that highlight global connections, see Sidney W. Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (New York: Penguin Books, 1986); Jennifer L. Anderson, *Mahogany: The Costs of Luxury in Early America* (Cambridge, Mass: Harvard University Press, 2012); Richard Follett et al., *Plantation Kingdom: The American South and Its Global Commodities* (Baltimore: Johns Hopkins University Press, 2016).

[9] For the turn toward financial topics, see Jonathan Levy, "Appreciating Assets: New Directions in the History of Political Economy," *American Historical Review* 122 (December 2017): 1490–99; Jeffrey Sklansky, "Labor, Money, and the Financial Turn in the History of Capitalism," *Labor: Studies in Working-Class History of the Americas* 11 (Winter 2014): 23–46.

[10] For wheat, see William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton, 1991), 97–147; Scott Reynolds Nelson, *A Nation of Deadbeats: An Uncommon History of America's Financial Disasters* (New York: Vintage Books, 2013), 149–79. For cotton, see Sven Beckert, *Empire of Cotton: A Global History* (New York: Alfred A. Knopf, 2014). For the commodification of slaves, see Caitlin Rosenthal, "Slavery's Scientific Management: Masters and Managers," in *Slavery's Capitalism: A New History of American Economic Development*, ed. Sven Beckert and Seth Rockman (Philadelphia: University of Pennsylvania Press, 2016), 62–86; Calvin Schermerhorn, *The Business of Slavery and the Rise of American Capitalism, 1815-1860* (New Haven: Yale University Press, 2015); Edward E. Baptist, *The Half Has Never Been Told: Slavery and the Making of American Capitalism* (New York, NY: Basic Books, 2014); Walter Johnson, *River of Dark Dreams: Slavery and Empire in the Cotton Kingdom* (Cambridge, MA: Belknap Press of Harvard University Press, 2013); Richard Holcombe Kilbourne, *Slave*

A lack of globalization and financialization ought not be mistaken for insignificance or stasis. Despite the hay trade's rudimentary arrangements, hay was central to the entire nineteenth-century economy as a basic input for virtually every other good. Moreover, hay production changed dramatically over the period, absorbing new biological and mechanical technologies and reshaping the built and natural environments. Technical adaptations represented a kind of transnational nationalism, as homegrown "agrarian patriots" deliberately emulated the agricultural systems of countries they perceived to be more advanced. The state was often directly involved in such efforts because obtaining the texts, seeds and bodies that encode agricultural improvement was central to all national developmental strategies. Meanwhile, as slaveholders learned during the Civil War, the power of commanding world markets could prove illusory.[11]

To pay attention to economic nationalism, then, is not to abandon transnational perspectives.[12] In the United States and elsewhere, nationalists sought *strategic* engagement with global markets, emphasizing emulative technology transfers alongside restrictions on commodity flows

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Agriculture and Financial Markets in Antebellum America: The Bank of the United States in Mississippi, 1831-1852 (London: Routledge, 2006).

[11] I borrow "agrarian patriots" from C. A. Bayly, *Imperial Meridian: The British Empire and the World, 1780-1830* (London: Longman, 1989), 121–26. My thanks to Richard Drayton for pointing me to this term. For the state in American agricultural reform and improvement, see Philip J. Pauly, *Fruits and Plains: The Horticultural Transformation of America* (Cambridge, MA: Harvard University Press, 2008), esp. 119-123; Ariel Ron, "Summoning the State: Northern Farmers and the Transformation of American Politics in the Mid-Nineteenth Century," *Journal of American History* 103 (September 2016): 347–74. On the transfer of seeds and other biological technologies, see Alan L. Olmstead and Paul Webb Rhode, *Creating Abundance: Biological Innovation and American Agricultural Development* (Cambridge: Cambridge University Press, 2008), 262–84; Courtney Fullilove, *The Profit of the Earth: The Global Seeds of American Agriculture* (Chicago: University of Chicago Press, 2017); Emily Pawley, "The Point of Perfection: Cattle Portraiture, Bloodlines, and the Meaning of Breeding, 1760-1860," *Journal of the Early Republic* 36 (Spring 2016): 37–72. On emulation as a strategic mode of engaging the global economy, see Reinert, *Translating Empire*; Erik S. Reinert, "Emulation versus Comparative Advantage: Competing and Complementary Principles in the History of Economic Policy," in *Industrial Policy and Development: The Political Economy of Capabilities Accumulation*, ed. Mario Cimoli, Giovanni Dosi, and Joseph E. Stiglitz (Oxford: Oxford University Press, 2009), 79–106; Ha-Joon Chang, *Bad Samaritans: The Myth of Free Trade and the Secret History of Capitalism* (New York: Bloomsbury Press, 2008).

[12] On this point, see, especially, Noam Maggor, "To Coddle and Caress These Great Capitalists: Eastern Money, Frontier Populism, and the Politics of Market-Making in the American West," *American Historical Review* 122 (February 2017): 57n6.

in order to foster national economic development and geopolitical power. King Hay exemplified this formula because it was premised on imported grass species, livestock genes, and agricultural methods adapted to American conditions. To be clear, then, my claim here is *not* that hay should replace cotton or any other commodity as a metonym of American economic development. Nor am I suggesting that we turn away from transnationalism. But neither should we focus exclusively on global trade and high finance, because this means missing much of the action occurring within rather than between national markets that were deliberately constructed as distinct economic spaces.

HAY = ENERGY

Hay occupied a strategic juncture, a bottleneck, in the transitional energy regime that carried the world into the carbon age. In the northern United States and elsewhere, it was the primary fuel for horses, making it indispensable to commerce. Everything in the contemporary economy depended on horses. They pulled canal boats and stagecoaches that transported goods, passengers, and mail. They dragged plows that prepared fields for planting, harrows that cultivated growing crops, and reapers that harvested mature grains. They powered capstans, paddle wheels, and treadmills that pumped water out of mines, propelled ferries across river crossings, and drove all manner of farm and factory machinery. They were the era's irreplaceable "living machines."[13]

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[13] Clay McShane and Joel A. Tarr, *The Horse in the City: Living Machines in the Nineteenth Century* (Baltimore: Johns Hopkins University Press, 2007); Ann Norton Greene, *Horses at Work: Harnessing Power in Industrial America* (Cambridge, MA: Harvard University Press, 2008); Vaclav Smil, "Horse Power," *Nature* 405, no. 6783 (May 2000): 125. My conception of a "strategic juncture" in the energy regime is influenced by Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London: Verso Books, 2011).

By the 1850s new mineral resources, especially Pennsylvania's anthracite coal, were transforming American energy use. Since energy, in its classic scientific definition, is the capacity to do work, it is easy to see how an energy regime largely limited by the rate of photosynthesis must limit economic development. But coal and later petroleum made eons worth of solar energy suddenly available in concentrated form. With technologies and transportation networks to exploit deposits of underground carbon, energy output skyrocketed and economic growth along with it. Cities were freed from dependence on wooded hinterlands for heating, factories from dependence on power from falling waters. Vast urban-industrial agglomerations began to emerge. Philadelphia, Baltimore and New York, in particular, grew into large manufacturing centers thanks in part to their access to Pennsylvania's anthracite beds and, later, its oil fields.[14]

These changes eventually rendered horses economically obsolete, but not for some time. As late as the 1930s, the triumph of the internal combustion engine remained less than complete. Throughout the nineteenth century, power generated by horses and other animals remained essential. As mineral energy increased the size of the economy, so, too, did it increase the demand for horses. "Our dependence on the horse has grown almost *pari passu* with our dependence on steam," observed *The Nation* in 1872 after an equine epizootic briefly paralyzed the Northeast (Figure 1). Indeed, from 1840 to 1910, the era of mass immigration into the United States, horses increased faster than people, their population rising more than six-fold from 4.3 million to 27.5 million.[15]

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[14] Christopher F. Jones, *Routes of Power: Energy and Modern America* (Cambridge, MA: Harvard University Press, 2014); Sean Patrick Adams, "Warming the Poor and Growing Consumers: Fuel Philanthropy in the Early Republic's Urban North," *Journal of American History* 95 (June 2008): 69–94; Thomas G. Andrews, *Killing for Coal: America's Deadliest Labor War* (Cambridge, MA: Harvard University Press, 2010).
[15] Greene, *Horses at Work*, 1 ("our dependence"), 41 (statistics). See also McShane and Tarr, *The Horse in the City*, 14, 60; Alan L. Olmstead and Paul W. Rhode, "The Agricultural Mechanization Controversy of the Interwar Years," *Agricultural History* 68 (July 1994): 35–53.

The interdependence of old and new energy was most obvious in transportation but went well beyond it. After 1815 or so, new implements and machinery began a gradual transformation of American agricultural technology through the "application of horsepower to every critical task in growing crops." By the 1840s, anthracite-fueled mills turned out cheap iron and steel to manufacture these tools, reducing their price and expanding their usage. Mineral and animal energy thus combined to revolutionize much of American farming. Indeed, everywhere in nineteenth-century America, industrialization and animal power went together. Equine labor became increasingly productive thanks to improvements ranging from steel plows to railed streetcars, each of which cut friction and thereby increased the effective work that horses did. In many instances, horses yielded cost savings over steam engines thanks to the remarkable efficiency with which their bodies convert carbohydrates into mechanical energy. Imported breeds, such as the French Percheron, increased horsepower at both the extensive and intensive margins—that is, both total number of animals and the work done per animal rose.[16]

All those horses had to be fed. The hay harvest cut vast swaths through the northern countryside. In 1850, hay occupied about 8 million acres in the Northeast alone, accounting for nearly a quarter of the region's improved farmland (Table 1). The corresponding figures were lower for the Midwest because its smaller cities generated less demand for horsepower and dairy products. Even so, by 1860, the Midwest was a major hay producer and the North as a whole devoted over 16 million acres to the crop, some 40 to 60 percent of which went to horses (Table 2). This hay

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[16] Clarence H. Danhof, *Change in Agriculture: The Northern United States, 1820-1870* (Cambridge, MA: Harvard University Press, 1969), 181; Peter D. McClelland, *Sowing Modernity: America's First Agricultural Revolution* (Ithaca, NY: Cornell University Press, 1997), 53–62; Peter Temin, *Iron and Steel in Nineteenth-Century America: An Economic Inquiry* (Cambridge, MA: M.I.T. Press, 1964), 35–44, 72–75; McShane and Tarr, *The Horse in the City*, 4–5, 34, 64–65, 126–27, 132–33; Greene, *Horses at Work*, 20–21, 43–46, 68, 166–67, 190–91; Olmstead and Rhode, *Creating Abundance*, 361–85; Smil, "Horse Power."

production far surpassed the South's, which accounted for only about 1 million acres and two percent of the region's improved farmland during these years. Although southern farms had other fodder sources, southern agricultural reformers repeatedly complained about the inadequacy of these sources and sought a grass variety suitable to their region.[17] As Helper noted pointedly, southern towns imported northern hay at high prices.[18]

The divergence between northern and southern hay production was bound up with broader differences in the organization of agriculture attributable partly to environmental conditions but more so to differential investment in slavery. Northern farmers adapted northern European methods that centered on the use of grasses to maintain livestock and soil fertility, whereas southern farmers practiced shifting cultivation that left the better part of every farm in fallows while maximizing production of a few exportable staples. During the antebellum period, northern cities' demand for horsepower, meat, and dairy products led farmers to intensify production by expanding cultivated meadows and planting them with nonnative grasses, which doubled the nutritional value of native grasses and facilitated animals' capacities to put on weight and provide power. In the South, by contrast, shifting cultivation remained the norm, livestock were typically set out to forage the woods and fallows, and a relative dearth of towns meant tiny markets for fodder and dairy products. In Louisiana, for instance, Solomon Northup, a New Yorker abducted into slavery, observed that there were "no meadows appropriated to the cultivation of the grasses."[19] Hence the

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[17] "Report of the Commissioner of Patents for the Year 1849. Part II. Agriculture," H. R. Ex. Doc. No. 31-20 (Washington: Office of the Printer of the House of Representatives, 1850), 152-167; Albert G. Way, "'A Cosmopolitan Weed of the World': Following Bermudagrass," *Agricultural History* 88 (Summer 2014): 359; Olmstead and Rhode, *Creating Abundance*, 280–82; Pauly, *Fruits and Plains*, 116–17.

[18] Hinton Rowan Helper, *The Impending Crisis of the South: How to Meet It* (New York: Burdick Brothers, 1857), 49–50; Stephen Colwell, *The Five Cotton States and New York; or Remarks upon the Social and Economical Aspects of the Southern Political Crisis* (Philadelphia?, 1861), 36–37; Paul Wallace Gates, *Agriculture and the Civil War* (Knopf, 1965), 132–34.

[19] Solomon Northup, *Twelve Years a Slave*, ed. Kevin M. Burke and Henry Louis Gates, Jr. (New York: W. W. Norton & Company, 2016), 101.

South produced little hay. Moreover, the northern countryside's labor scarcity, widespread land ownership, and high levels of education encouraged adoption of labor-saving machines and implements. These required upping drafting power by increasing the number of horses or substituting horses for oxen, which in turn required more hay. In the South, enslaved labor supplied much of the energy.[20]

Horses ate more than hay, but the North also dominated the cultivation of oats, the other major source of horse calories. New York, Pennsylvania, Ohio, and Illinois alone grew more oats in 1860 than the rest of the country combined.[21] On the other hand, not all hay fed horses. Much of it nourished northern cattle, supporting a developing landscape of specialized beef and dairy production that converted grass into "living men and women—yea, into the very workers themselves."[22] Hay for cattle, as for horses, evidences the decidedly sub-global relationship between growing cities and agricultural development in the North. Before the advent of refrigerated transport, most dairy and meat tended to trace regional or national commodity circuits rather than

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[20] John Majewski and Viken Tchakerian, "The Environmental Origins of Shifting Cultivation: Climate, Soils, and Disease in the Nineteenth-Century US South," *Agricultural History* 81 (October 2007): 530; Brian Donahue, *The Great Meadow: Farmers and the Land in Colonial Concord* (New Haven: Yale University Press, 2007), 54–73, 221–34; Olmstead and Rhode, *Creating Abundance*, 262–83; Pauly, *Fruits and Plains*, 115–19; Steven Stoll, *Larding the Lean Earth: Soil and Society in Nineteenth-Century America* (New York: Hill and Wang, 2002), 56–58, 126–27; William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983), 141–46; Percy Wells Bidwell and John I. Falconer, *History of Agriculture in the Northern United States, 1620-1860* (Washington, DC: The Carnegie Institution of Washington, 1925), 102–5; Homer L. Kerr, "Introduction of Forage Plants into Ante-Bellum United States," *Agricultural History* 38 (April 1964): 87–95; Ronald D. Karr, "The Transformation of Agriculture in Brookline, 1770-1885," *Historical Journal of Massachusetts* 15 (January 1987): 33–49; Robert A. Gross, "Culture and Cultivation: Agriculture and Society in Thoreau's Concord," *Journal of American History* 69 (June 1982): 42–61. For education, see Sun Go and Peter Lindert, "The Uneven Rise of American Public Schools to 1850," *The Journal of Economic History* 70 (March 2010): 2; Jeremy Atack and Fred Bateman, *To Their Own Soil: Agriculture in the Antebellum North* (Ames: Iowa State University Press, 1987), 47; John Majewski, "Why Did Northerners Oppose the Expansion of Slavery? Economic Development and Education in the Limestone South," in *Slavery's Capitalism: A New History of American Economic Development*, ed. Sven Beckert and Seth Rockman (Philadelphia: University of Pennsylvania Press, 2016), 277–98.

[21] Gates, *The Farmer's Age*, 172–73.

[22] "King Hay," *New York Times*, March 2, 1861.

global ones.[23] Hence, whether it went to market by the bale, the bucket or the hoof, hay tended to remain within national bounds.

Partly for this reason, hay markets remained relatively informal (Figure 2). Although municipal regulation of hay markets stretched back to the colonial era, not until 1877 did the Chicago Board of Trade establish hay grading standards, more than a generation after doing so for wheat. The New York Produce Exchange waited until 1883. There were few "bonanza" hay farms, no such thing as a Hay Trust, and no hay futures traders elbow to elbow in "the Pit."[24] For most of the nineteenth-century, hay remained less than fully commoditized. Despite its absolute centrality to the economy, it stayed an item of mostly local, informal trade, its production scattered among many small producers outside the arcane financial networks of global capital markets. On the margins of financial innovation, the hay business illustrates David Edgerton's point that unheralded technologies and production methods have been as essential to the modern world as cotton and sugar, the Model T and the iPhone.[25]

The neglect of bankers did not mean stagnation. Because haymaking was a labor-intensive enterprise requiring field preparation, timely harvesting, and a series of careful steps to ensure proper curing, even a lighter pitchfork could be among the period's "wonderful changes." By the 1850s, more elaborate, horse-powered tools were becoming common in the North's principle haying regions. Mechanical mowers let one farmer cut a field of grass faster than a whole gang of neighbors using scythes. "Revolving" rakes, which had two sets of tines that could be easily

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[23] Rebecca J. H. Woods, *The Herds Shot Round the World: Native Breeds and the British Empire, 1800–1900* (Chapel Hill: University of North Carolina Press, 2017).
[24] McShane and Tarr, *The Horse in the City*, 138–40; Louis P. Tremante III, "Agriculture and Farm Life in the New York City Region, 1820-1870" (Ph.D. diss., Iowa State University, 2000), 89–91. For classic accounts of how wheat was standardized and traded in futures contracts, see Cronon, *Nature's Metropolis*, 97–147; Frank Norris, *The Pit: A Story of Chicago* (New York: Penguin Classics, 1994).
[25] David Edgerton, *The Shock of the Old: Technology and Global History Since 1900* (Oxford: Oxford University Press, 2007).

switched to make the rake face opposite directions, did away with wide-circling U-turns at the end of each row. Tedding machines fluffed gathered grass so that it would dry without spoiling. Screw presses compacted hay into bales that could be transported further more cheaply. Horse and human energy thus begat still more horse and human energy.[26]

These mechanical innovations were only the most visible developments in hay production over the nineteenth century. As nonnative grasses increasingly displaced native grasses, deeper changes to the built and natural environments followed. Farmers seeking to emulate the intensive methods of European agriculture hauled enormous quantities of lime, marl, gypsum and other substances to reduce soil acidity and make their lands suitable to the new grasses.[27] They ditched, drained, and irrigated to convert marshes and woods into cultivated meadows.[28] They built lime kilns and redesigned their barns to make hay storage, baling, and loading more efficient.[29] They gradually learned to sow more clover and alfalfa because these legumes not only provide nutrition to animals, they improve soil fertility with their unique ability to fix atmospheric nitrogen in a form available to plants.[30] Altogether, then, despite the fact that merchants and financiers paid it

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[26] Allen R. Yale, *While the Sun Shines: Making Hay in Vermont, 1789-1990* (Montpelier, VT: Vermont Historical Society, 1991), 1–31; Gates, *The Farmer's Age*, 250-255 ("wonderful" quoted on p. 251); Gates, *Agriculture and the Civil War*, 235–37; Clarence H. Danhof, "Gathering the Grass," *Agricultural History* 30 (October 1956): 169–73; William R. Baron and Anne E. Bridges, "Making Hay in Northern New England: Maine as a Case Study, 1800-1850," *Agricultural History* 57 (April 1983): 165–80; Christopher Baas and Darrin Rubino, "The Most Successful Press in This or Any Other Country: The Material Culture of 19th-Century Beater Hay Presses in the Mid-Ohio Valley," *Material Culture* 45 (Spring 2013): 1–20; McClelland, *Sowing Modernity: America's First Agricultural Revolution*, 155–64.

[27] Richard A. Wines, *Fertilizer in America: From Waste Recycling to Resource Exploitation* (Philadelphia: Temple University Press, 1985); Sally McMurry, *Transforming Rural Life: Dairying Families and Agricultural Change, 1820-1885* (Baltimore: Johns Hopkins University Press, 1995); Stevenson Whitcomb Fletcher, *Pennsylvania Agriculture and Country Life, 1840-1940* (Harrisburg: Pennsylvania Historical and Museum Commission, 1955).

[28] Donahue, *The Great Meadow*; Henry Flagg French, *Farm Drainage* (New York: Orange Judd & Company, 1859).

[29] Sally McMurry, "The Pennsylvania Barn as a Collective Resource, 1830–1900," *Buildings & Landscapes: Journal of the Vernacular Architecture Forum* 16 (June 2009): 9–28; Cynthia G. Falk, *Barns of New York: Rural Architecture of the Empire State* (Ithaca: Cornell University Press, 2012); Warren E. Roberts, "An Early Hay Press and Barn on the Ohio River," *Material Culture* 25, no. 1 (1993): 29–36.

[30] Olmstead and Rhode, *Creating Abundance*; Robert C. Allen, "The Nitrogen Hypothesis and the English Agricultural Revolution: A Biological Analysis," *Journal of Economic History* 68 (March 2008): 182–210; Enrico Tello et

little attention, haymaking was innovative. Without this, northern economic development as a whole would have been stunted because of hay's strategic position in the energy system.

"Quantity and variety" in Stephen Colwell's economic nationalism

In the 1850s, scientists were just beginning to articulate the laws of thermodynamics that underpin the present ecological conception of energy. Hence Helper's interlocutors could not have understood hay as energy. Instead, they situated Helper's claim within an ongoing national debate over the sources of economic development and the nature of wealth, a debate that ultimately revolved around slavery.

Few contemporaries were better positioned to join this debate than the Philadelphia businessman and political economist, Stephen Colwell. Born in 1800 in the thin sliver of Virginia jutting northward between Pennsylvania and Ohio, Colwell was nominally a southerner, a fact he sometimes used to rhetorical advantage. But the Virginia he knew had very few slaves and, indeed, formed part of the breakaway state of West Virginia during the Civil War. Colwell had anyway left the area as a young man, attending college in Pennsylvania and studying law in Ohio before establishing himself as an attorney in Pittsburgh. In 1836, he married up and began managing his father-in-law's iron mills near Philadelphia. By the 1850s, he was one of Philadelphia's leading citizens: a director of several railroads and a trustee of both the University of Pennsylvania and the Princeton Theological Seminary. Meanwhile, he collected perhaps the largest library of political-economic tracts in North America. At a time when most American colleges were content to transmit the classical teachings of Adam Smith and J.B. Say, Colwell sought out a much wider range

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al., "Building on Allen's Nitrogen Hypothesis: The English Agricultural Revolution during the Maunder Minimum in the Little Ice Age (1645-1715)" (Agricliometrics II, Zaragoza, Spain, 2015).

of work, particularly from economic nationalists on the European continent who, like him, rejected free trade and *laissez faire*. Among the fruits of Colwell's researches was a massive survey of monetary theory and, significantly, a long essay introducing the first English translation, which he commissioned, of Friedrich List's *National System of Political Economy*, the *locus classicus* of modern economic nationalism. Thanks to his library and experience in law and business, Colwell was among North America's best-informed commentators on economic issues.[31]

Colwell had begun to worry about southern economic thinking several years before Helper entered the picture. "Heaven help the South if such minds are to shape their policy," he noted on an envelope, apparently to himself, in 1852.[32] It was not only southerners' celebration of slavery that disturbed him, but their inflated regard for the power of cotton exports. They seemed to believe that cotton diplomacy gave them infinite leverage, reasoning that because the fiber supplied European mills and paid for northern imports, the South commanded the balance of global commercial power. "You dare not make war on cotton," South Carolina's Senator James Henry Hammond famously declared. "Cotton is King."[33]

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[31] Stephen Colwell, *The Ways and Means of Payment: A Full Analysis of the Credit System, with Its Various Modes of Adjustment* (Philadelphia: J.B. Lippincott & co, 1859); Stephen Colwell, "Preliminary Essay and Notes," in *The National System of Political Economy*, by Frederick [Friedrich] List, trans. G. A. Matile (Philadelphia: J.B. Lippincott & Co., 1856). For Colwell's library, which remains uncatalogued and virtually unknown at the University of Pennsylvania's rare books and manuscripts library, see Colwell to J. Dobson, Jan 1839, Stephen Colwell Papers; note in *Library Chronicle of the Friends of the University of Pennsylvania Library* 18 (1951-1952): 74; typescript blurb about the "The Colwell Collection," in the files of the Kislak Center for Special Collections, Rare Books and Manuscripts, University of Pennsylvania. For biographical information, see Stewart Davenport, *Friends of the Unrighteous Mammon: Northern Christians and Market Capitalism, 1815-1860* (Chicago: University of Chicago Press, 2008), chap. 8; Bruce Morgan, "Stephen Colwell: Social Prophet before the Social Gospel," in *Sons of the Prophets: Leaders in Protestantism from Princeton Seminary*, ed. Hugh T. Kerr (Princeton: Princeton University Press, 1968), 123–47; Henry C. Carey, *A Memoir of Stephen Colwell: Read Before the American Philosophical Society, Friday, November 17, 1871* (Philadelphia: Collins, 1871). For a comprehensive if somewhat tendentious overview of Colwell's economic writing, see Joseph Dorfman, *The Economic Mind in American Civilization, 1606-1865* (New York: A. M. Kelley, 1966), 2:809-826. On List, see Szporluk, *Communism and Nationalism*; Keith Tribe, *Strategies of Economic Order: German Economic Discourse, 1750-1950* (Cambridge University Press, 2007), 32–65.

[32] Isaac R. Davis to Colwell, 11 Jun 1852, Stephen Colwell Papers, University of Pennsylvania (penciled on envelope).

[33] *Congressional Globe*, 35th Cong., 1st Sess., 4 Mar 1858, 961. For southern confidence in cotton diplomacy, see Matthew Karp, *This Vast Southern Empire: Slaveholders at the Helm of American Foreign Policy* (Cambridge, MA:

Colwell thought this was absurd. It presumed that only exports generated real wealth, whereas the opposite was closer to the truth. "We are not unfriendly to foreign trade," he explained. "We merely avoid beginning at the wrong end of the subject." The right end was the domestic economy:

> Every nation must have a system, mainly, its own. It is literally impossible, that a population occupying an extensive territory, can be dependent upon other countries for any considerable portion of its consumption, without great sacrifice. . . . In point of fact, it is found that every nation mainly supplies its own wants. . . . And it cannot be doubted, that the industry on which a people are dependent for ninety to ninety-nine per cent. of their consumption, must be a more important interest than that which furnishes only from one to ten per cent.[34]

Colwell's proportions were about right. According to a cliometrician, commodity exports accounted for no more than 6.3 percent of U.S. gross national product (GNP) in 1860; adding services probably does not raise the figure above nine percent. To put this in perspective, consider that South Korea's export share of gross domestic product (GDP) has often surpassed fifty percent in recent years. That is a truly export-led economy. The anachronistic comparison underscores the important differences between past and present trade patterns, warning us against reading our own globalization backward too easily. Today, shipping's containerization, a range of production technologies and international trade agreements allow the United States to export hay to Asia (including to South Korea). This would have been unthinkable through most of the 1800s, when cotton

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Harvard University Press, 2016), 125–49; Brian Schoen, *The Fragile Fabric of Union: Cotton, Federal Politics, and the Global Origins of the Civil War* (Johns Hopkins University Press, 2009), 213–59.

[34] Colwell, "Preliminary Essay and Notes," lxix, lxxviii, lxxx. For a similar argument and figures, see Jonathan B. Wise, *The Relative Position in Our System of Industry of Foreign Commerce, Domestic Production, and Internal Trade* (Philadelphia: Linday and Blakiston, 1850), 10. Wise is identified as a pseudonym for Colwell in Dorfman, *The Economic Mind in American Civilization, 1606-1865*, 2:813; William Cushing, *Initials and Pseudonyms: A Dictionary of Literary Disguises* (New York: Thomas Y. Crowell & Co., 1885), 308. However, the Library of Congress Name Authority File identifies Wise as John L. Hayes (1812-1887), another protectionist; see http://id.loc.gov/authorities/names/n85363492.html. Hayes and Colwell worked together on wool tariff rates in the late 1860s (see note __ below) and expressed similar views in their published work.

was indeed at the heart of transatlantic commerce, but the American economy as a whole remained largely a domestic affair. Even now, after decades of global trade liberalization, the export share of U.S. GDP rarely exceeds thirteen percent because the American domestic market is so large.[35]

This is why Colwell commissioned the translation of List's *National System*. In a lengthy introduction, he sought to substantiate his emphasis on internal trade by comparing the domestically-oriented North to the export-oriented South. In column A were the "Eastern and Middle States," including Maryland and Delaware; in column B were the remaining slave states. Though column A showed barely a quarter the total territory of B, its land under cultivation was just a fraction less, the value of that land was almost four times more, and the annual product of its manufactures was greater by an order of magnitude—all without bothering to include the Midwest. "Let this comparison be extended to the whole range of agricultural products, including cotton, sugar and tobacco," Colwell continued, and "it will be found that . . . the product of the two regions is widely different in value, a great advantage in point of *quantity and variety* being on the side of the North." Colwell therefore concluded that the southern problem was ultimately not slave labor's deficit of productivity, as free labor ideologists frequently claimed, though that was also important.

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[35] Colwell, "Preliminary Essay and Notes," lxix, lxxviii, lxxx; Robert E. Lipsey, "US Foreign Trade and the Balance of Payments, 1800-1913," in *The Cambridge Economic History of the United States: Volume 2, The Long Nineteenth Century*, ed. Stanley L. Engerman and Robert E. Gallman (Cambridge: Cambridge University Press, 2000), 691; John T. Bowen Jr. and Nancy B. Hultquist, "Compressing Nature: The Development of the Export Hay Industry in the Western United States," *Yearbook of the Association of Pacific Coast Geographers* 75 (January 2013): 83–103. Lipsey's data does not appear to account for freight services. However, he states that around 1800 these services accounted for about 30 percent of export earnings (687). The *Historical Statistics of the United States, Millennial Online Edition*, provides data on exported goods and services starting in 1929. In that year, services accounted for only 10 percent of exports, but by 2002 that figure was back up to 30%, as it had been two centuries earlier. If we suppose 30% of export earnings to have come from freight charges in 1860, then total exports would amount to 8.6 percent of GDP, still well within Colwell's reckoning. Data on present-day GDP and exports comes, respectively, from the World Bank (http://data.worldbank.org) and the Organization for Economic Cooperation and Development (https://data.oecd.org), accessed 17 Nov 2015. Goods (as opposed to services) account for about 85 percent of total Korean exports over this period. Although Lipsey uses GNP and the Korean data give GDP, the difference in calculating the two measures of national output is insignificant in this case.

The problem was rather "the infatuation which possesses the people of the South for foreign commerce." In fixating on commodity exports, they had fundamentally misconstrued what made nations rich.[36]

A year later, Helper used a similar comparative technique in *The Impending Crisis*. The book's first and longest chapter presented a series of sectional and state-by-state statistical comparisons to make the case for total northern economic superiority. Southerners ought to be especially mortified, Helper maintained, that northerners surpassed them even in agriculture. To drive that point home, he staged a kind of tabular inversion:

Hay crop of the free States	$142,138,998
Cotton, tobacco, rice, hay, hemp, and sugar of the slave States	$138,605,723
Balance in favor of the free States	$3,533,275

"Cotton . . . is no longer King," Helper crowed. "Dried grass, commonly called hay, is, it seems, the rightful heir to the throne."[37]

Cotton apologists remained unmoved. Hay mattered little, they said, because it was an item of merely domestic trade. "'King Hay' . . . never once ventured on board a merchant vessel, to seek a foreign land," wrote David Christy in an influential essay vindicating cotton's "imperial character."[38] Pro-slavery southerners typically understood wealth as a function of exports. William Harper argued in his renowned "Memoir on Slavery" that southern agriculture alone was profitable

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[36] Colwell, "Preliminary Essay and Notes," lxxxi, lxxxiii (emphasis added).
[37] Helper, *Impending Crisis of the South*, 53, 122. The table also appeared in the more widely distributed abridgment, which was where most people likely saw it; Hinton Rowan Helper, *Compendium of the Impending Crisis of the South* (New York: A. B. Burdick, 1860), 29, 61. The original table refers to "sundry products" of the South; I have replaced this language with the actual commodities Helper refers to in the text. For the prevalence of such North-South statistical comparisons, see Eli Cook, *The Pricing of Progress: Economic Indicators and the Capitalization of American Life* (Cambridge, MA: Harvard University Press, 2017), 161; Foner, *Free Soil, Free Labor, Free Men*, 43–44.
[38] E.N. Elliott, ed., *Cotton Is King, and Pro-Slavery Arguments: Comprising the Writings of Hammond, Harper, Christy, Stringfellow, Hodge, Bledsoe, and Cartwright, on This Important Subject* (Augusta: Pritchard, Abbott & Loomis, 1860), 220.

because "the products of Slave labor furnish more than two-thirds of the materials of our foreign commerce."[39] The Georgian agricultural reformer, William Terrell, was more direct: "in proportion as you increase your surplus exportable products will your wealth and power increase."[40] This way of thinking led Hammond to dismiss the "trashy census-books" on which Helper based his calculations and to substitute the following train of logic in their stead:

1. National wealth amounts to "surplus production."
2. There can be no surplus "if it is all consumed."
3. Because the North consumes most of its own productions, it creates little surplus.
4. The South, on the other hand, has staples to spare, which it ships abroad.
5. Hence the South produces a much greater surplus and contributes more to national wealth.[41]

This "strange" and "marvelous" notion, Colwell replied, practically beside himself from incredulity, "is so absurd as scarce to deserve a denial, much less a formal refutation." The reason is obvious: by Hammond's reckoning, the mythical country of Wakonda is poor because it does not trade, even though its technologies and living standards far surpass those of its peer nations. By contrast, Colwell understood national wealth to be first and foremost a matter of productive capacity. Trade merely facilitated this. Hence what mattered was that "northern farmers continue to produce and enlarge their crop of hay, to sell it, and to put the money in their pockets."[42]

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[39] Drew Gilpin Faust, ed., *The Ideology of Slavery: Proslavery Thought in the Antebellum South, 1830-1860* (Baton Rouge: Louisiana State University Press, 1981), 91–92.
[40] William Terrell, *Letter from Dr. Terrell, to the Executive Committee of the Southern Central Agricultural Society* [Macon, GA: Published by the Southern Central Agricultural Society, 1854], accessed via Readex American Broadsides and Ephemera, January 4, 2018.
[41] *Congressional Globe*, 35th Cong., 1st Sess., 4 Mar 1858, 961. For similar reasoning, see the attempt to debunk Helper's calculation in Samuel M. Wolfe, *Helper's Impending Crisis Dissected* (J.T. Lloyd, 1860), 49–50.
[42] Colwell, *Five Cotton States and New York*, 34–37. After the Civil War, Colwell expressed precisely the reverse logic of Hammond, writing that "The strength and wealth of a country should be measured by the quantity and value of its productions which it consumes, and not by what it sends to other countries"; see David Ames Wells, Stephen Colwell, and Samuel S. Hayes, *Reports of a Commission Appointed for a Revision of the Revenue System of the United States, 1865-'66* (Washington: GPO, 1866), 278. Hay's purchasing power seems to have been rising in these years, making it a profitable line for farmers; see S.E. Ronk, *Prices of Farm Products in New York State, 1841 to 1935*, Bulletin No. 643 (Ithaca: Cornell University Agricultural Experiment Station, 1936), 21.

Yet for Colwell, hay was not really king, just one commodity among the cornucopian abundance of the northern home market. That was his real point. Helper had been "astonished" by "the *variety and quantity* of Northern agricultural productions," echoing Colwell's very words ("quantity and variety") in his own brief for northern economic superiority. But why stop at hay or even agriculture? "Many other important items of Northern wealth . . . might be added," Colwell observed. Or, as the New York *Times* put it pointedly on the eve of Civil War hostilities, "if King Hay won't do, how with King Iron?"[43] Economic "variety" and "quantity" were intimately connected. Early economic nationalists extolled the benefits of what they called a "diversity of pursuits." Alexander Hamilton, for instance, argued that the greater the range of employments, the fuller the utilization of the range of human talents. But the more straightforward explication, the one that in Colwell's mind accounted for the North's obvious economic advantage, was that diversification delivered "not only . . . comfort, but a great stimulus to exchange and increased productions." It created its own reciprocal internal markets and thereby an upward trajectory of national growth and development. "There need be no limit . . . but the productive power of labor," he maintained.[44]

Colwell's confidence in northern development left him in no doubt about the fate of slavery should the South secede. While the Constitution offered slaveholders their "mightiest bulwark," secession would inevitably spark civil war and culminate in emancipation. The South's only chance was an alliance with Britain, but Colwell considered this fanciful. The British were more

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[43] Helper, *Impending Crisis of the South*, 48; Colwell, *Five Cotton States and New York*, 42; "King Hay," 4. See also William L. Hodge, *Disunion and Its Results to the South: A Letter from a Resident of Washington to a Friend in South Carolina* (Washington: H. Polkinhorn, 1861), 8.

[44] Colwell, *Five Cotton States and New York*, 42; Colwell, "Preliminary Essay and Notes," lxxxi; Alexander Hamilton, "Report on Manufactures," in *Papers on Public Credit, Commerce, and Finance*, ed. Samuel McKee, Jr. (The Liberal Arts Press, 1957), 190. See also Colwell's remarks in Wells, Colwell, and Hayes, *Reports of a Commission Appointed for a Revision of the Revenue System of the United States, 1865-'66*, 274, 278.

than capable of absorbing a temporary economic shock in the interest of preserving their international hegemony. In any case, "abhorrence of American slavery" pervaded the British ruling class, which meant that abolitionists could bring down any government that dared openly support an independent slaveholding South. Without a powerful ally, the South would face a total blockade. "Not a bale of cotton, not a cask of rice, nor a hogshead of tobacco could be exported." So much for Hammond's surplus theory. Meanwhile, given "border warfare of the most bitter kind," slaves within a hundred miles of the fighting "would soon become . . . almost impossible to retain in service." The South might never be entirely conquered, but it "could and would be ruined." Colwell even correctly predicted a lengthy, hard-fought war instead of the easy Union victory many northerners expected. Easy or hard, however, northern triumph was certain because "the wealth, power, and productive force of the North surpasses that of the South immensely." It was as simple as that.[45]

Here and elsewhere Colwell's writing displays the pitiless candor of a powerful man speaking plainly to other powerful men. It evinces little intention to sway the "masses," whom he once compared to "horses saddled and bridled or harnessed for work." No one who sought popular influence in the raucous white male democracy of the antebellum North could have published a line like that. Committed to leadership by the better sorts, Colwell was nevertheless cantankerous

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[45] Stephen Colwell, *The South: A Letter from a Friend in the North* (Philadelphia: C. Sherman & Son, 1856), 22–23, 29–31, 38. For historians' view of the Constitution as a protector of slavery, see, for example, Don E. Fehrenbacher, *The Slaveholding Republic: An Account of the United States Government's Relations to Slavery* (Oxford University Press, 2002); Paul Finkelman, *Slavery and the Founders: Race and Liberty in the Age of Jefferson* (Armonk, NY: M.E. Sharpe, 1996). For the ruin of the southern economy, see Eric Foner, *Reconstruction: America's Unfinished Revolution, 1863-1877* (New York: Harper & Row, 1988). That the South was never really "conquered" comes through especially clearly in Gregory P. Downs, *After Appomattox: Military Occupation and the Ends of War* (Cambridge, MA: Harvard University Press, 2015).

and independent enough to hold unorthodox views. In the words of a recent historian, he was an "insider's outsider."[46]

Just this quality, perhaps, led Republican party leaders to appoint him one of three Special Commissioners of the Revenue after the Civil War. Although not a glamorous sounding job, it was an important one, because in shaping the post-bellum fiscal regime, Colwell helped shape the very structure of Gilded Age political economy. Industry journals considered him one of a select group who "constituted the real 'power behind the throne' occupied by public men."[47] He was, for instance, responsible for drafting the critical iron and steel tariff schedule. Equally important, he brokered a historic deal between wool growers and woolens manufacturers which, by adjusting tariff rates on raw and finished wool to the satisfaction of key farming and industrial interests, secured a core piece of the Republican coalition. Much like Colwell himself, that coalition was "not unfriendly" to international trade, but it focused resolutely on domestic industrialization and agricultural development. By the early twentieth century, the United States was gradually shifting toward a globalist conception of its economic interests that sought Open Door policies abroad and, eventually, free(ish) trade even at home—but only after having nourished itself for decades on a vast internal market.[48]

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[46] Stephen Colwell, *The Claims of Labor, and Their Precedence to the Claims of Free Trade* (Philadelphia: C. Sherman & Sons, 1861), 24; Davenport, *Friends of the Unrighteous Mammon*, 107. After the Civil War, when authoring an official report on the country's revenue system, Colwell sang a different tune: "The producing classes here have risen already so far in the scale of intellect and knowledge that they cannot be forced back"; Wells, Colwell, and Hayes, *Reports of a Commission Appointed for a Revision of the Revenue System of the United States, 1865-'66*, 285.

[47] "Stephen Colwell: Champion of Protection," *Bulletin of the American Iron and Steel Association* 32 (Aug 1898): 114.

[48] John L. Hayes to Colwell, 22 Dec 1864; E.B. Bigelow to Colwell, 14 Mar 1866; John L. Hayes to Colwell, 9 Mar 1866, Stephen Colwell Papers; Carey, *Memoir of Stephen Colwell*, 27–28; Harry Brown, "The Fleece and the Loom: Wool Growers and Wool Manufacturers during the Civil War Decade," *Business History Review* 29 (March 1955): 1–27; Richard Franklin Bensel, *The Political Economy of American Industrialization, 1877-1900* (Cambridge: Cambridge University Press, 2000); Walter LaFeber, *The New Empire: An Interpretation of American Expansion, 1860-1898* (Ithaca: Cornell University Press, 1998).

Colwell's understanding of the domestic economy was clearly ideological, yet this does not require us to dismiss the idea that national economic linkages could matter more than global ones, nor that the northern economy in particular achieved important things that the southern economy did not. Southern cotton cultivation itself was anything but laggard. As historians of slavery and capitalism have shown, southern planters' methods were innovative and brutal—and even innovatively brutal.[49] During the Civil War, moreover, Confederate officials oversaw hothouse industrialization that achieved remarkable results.[50] But facing an insurgent enslaved population and a powerful, determined foe, none of this was enough. When the war came, Hammond's notion that anything needful could be purchased abroad proved chimerical as the Union Navy tightened its blockade of southern ports. While the Confederacy struggled to feed and supply its troops on its own soil, the northern economy boomed and Union armies fought deep into enemy territory as perhaps the best equipped military force the world had ever seen, plentifully supplied by well-nourished horses (Figure 3).[51] And so, when Union troops captured New Orleans in the spring of 1862, one headline read almost predictably: "King Hay Dethrones King Cotton."[52]

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[49] Rosenthal, "Slavery's Scientific Management: Masters and Managers"; Beckert, *Empire of Cotton*, 98–135; Johnson, *River of Dark Dreams*, 73–96, 176–208; Alan L. Olmstead and Paul W. Rhode, "Biological Innovation and Productivity Growth in the Antebellum Cotton Economy," *Journal of Economic History* 68 (December 2008): 1123–71; Baptist, *The Half Has Never Been Told*, 86. For the general view that the slave South was modern in its way, see L. Diane Barnes, Brian Schoen, and Frank Towers, eds., *The Old South's Modern Worlds: Slavery, Region, and Nation in the Age of Progress* (New York: Oxford University Press, 2011).
[50] Chad Morgan, *Planter's Progress: Modernizing Confederate Georgia* (Gainesville: University Press of Florida, 2005).
[51] Drew Gilpin Faust, *The Creation of Confederate Nationalism: Ideology and Identity in the Civil War South* (Baton Rouge: Louisiana State University Press, 1988), 17; R. Douglas Hurt, *Agriculture and the Confederacy: Policy, Productivity, and Power in the Civil War South* (Chapel Hill: The University of North Carolina Press, 2015), 140; Mark Wilson, *The Business of Civil War: Military Mobilization and the State, 1861-1865* (Baltimore: Johns Hopkins University Press, 2006).
[52] *Daily Evening Bulletin* (San Francisco), 5 May 1862.

WHAT WAS HAY REALLY WORTH?

Many years after the war, when Helper was a washed-up has-been peddling racist diatribes, an acquaintance called him a man who had once written "a book which stated a very patent fact in a striking way."[53] The hay argument was exactly this, because it combined the emerging appeal of statistical knowledge with the American tradition of ironic anti-monarchism. That the combination could then be mapped onto a division between hardworking northern farmers and aristocratic southern pretenders made it all the more powerful. What better image than humble hay toppling haughty cotton, presented in that most modern of styles, "incontrovertible facts and statistics"?[54] Helper drew together the forward-looking authority of quantification with very old tropes, inherited from the English rivalry with the Spanish, of vigorous northern peoples besting lazy southern grandees. Little surprise that at least one contemporary regarded the hay argument as "the most prominent feature of the work."[55]

But what about those "incontrovertible facts and statistics"? Whatever King Hay's rhetorical power, its empirical validity remains to be shown. Let us begin with Helper's method. To calculate hay's value, Helper simply multiplied total northern production, as reported in the 1850 Census, by an average national price, which he claimed to derive from information published by "the Bureau of Agriculture in Washington."[56] This procedure was naïve in several respects, but it was precisely the same one followed by the U.S. Department of Agriculture (USDA) when it first

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[53] Quoted in Brown, *Southern Outcast*, 268.
[54] Helper, *Impending Crisis of the South*, 28. Helper's book marked a "dramatic change in the 1850s" toward the use of economic rather than "moral" statistics in the antislavery cause; see Cook, *The Pricing of Progress*, 160–61. Also see Fredrickson, "Antislavery Racist," 28, 43; Michael Zakim, "Inventing Industrial Statistics," *Theoretical Inquires in Law* 11 (2010): 283–318.
[55] Beebe, *A Review and Refutation of Helper's "Impending Crisis,"* 16.
[56] Helper, *Impending Crisis of the South*, 50–53. Helper apparently referenced the annual reports of the semi-official "Agricultural Division" of the Patent Office. These reports indeed included various observations of high prices, some of which are included in Table 3, but I have not been able to find the precise figure Helper cites. It is possible that Helper averaged some of the prices quoted in the various reports.

began trying to collect reliable annual crop statistics in the 1860s, and again a century later when it compiled historical time series of those statistics.[57] Moreover, no less an authority than the era's leading financial journal, *Hunt's Merchant Magazine*, published derivations essentially similar to Helper's—even noting that hay exceeded wheat and cotton by value—a year before publication of *The Impending Crisis*.[58] Helper was therefore no more statistically innocent than some federal officials and business observers charged with precisely these matters. The only really obvious flaw in his calculations concerned cotton rather than hay. He quoted a cotton price of $32 per bale when $50 was closer to the average in 1850. He thus underestimated cotton's value by roughly a third, though the corrected figure still puts hay comfortably ahead.[59]

The more serious difficulties start when trying to construct better hay value estimates. Most hay never changed hands, serving instead as input for other agricultural commodities. The question therefore arises of how to price an intermediate good that never entered the market. When farmers did sell hay, they did so in regional markets at prices ranging from three to thirty dollars per ton or more, though typically ranging from five to fifteen dollars per ton.[60] Obtaining a national average requires observing numerous local hay price quotations and assigning each a weight on the basis of local production or actual sales. Finally, "hay" really encompasses several goods differing by species, quality of preparation, and method of packing. Table 3 indicates some of this variability, which adds to the uncertainty.

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[57] "Report of the Commissioner of Agriculture for the Year 1865," H. R. Ex. Doc. No. 39-136 (Washington: GPO 1866), 60-61; United States Department of Agriculture, *Agricultural Statistics, 1967* (Washington: Government Printing Office, 1967), 319. Some fifteen years before Helper, the U.S. Commissioner of Patents gave substantially similar figures; see Kerr, "Introduction of Forage Plants into Ante-Bellum United States," 93.
[58] "Commercial Value of the Hay Crop of the United States," *Merchant's Magazine and Commercial Review* 34 (Mar 1856): 380. For Freeman Hunt and his publication, see Cook, *The Pricing of Progress*, 128–58.
[59] Fogel and Engerman point this out; see note 2 above. For cotton prices, see L. C. Gray, *History of Agriculture in the Southern United States to 1860* (Washington, DC: Carnegie Institution of Washington, 1933), 2:1026-1029.
[60] Gates, *The Farmer's Age*, 252.

With these issues in mind, I have constructed lower- and upper-bound estimates for the value of the national hay crop in census years from 1840 to 1900. The results are presented in Table 4, in current dollars, along with comparisons to well-known agricultural staples; Figure 4 charts output trajectories for hay, cotton and wheat over the same period in constant dollars.[61] The table and figure notes detail my procedures, but here I stress that absent heroic research into the prices, quantities, types, and uses of hay across many local markets for successive years, it is necessary to make educated guesses. I have deliberately made the range of estimates broad to account for and underline the inherent uncertainty. While the range remains somewhat speculative, the order of magnitude is a good deal more certain. The table demonstrates that hay was roughly comparable in value to cotton and wheat—far beyond tobacco—even if it did not live up to Helper's extravagant claim.

These hay estimates take no account of some important considerations. First, because hay was harvested before seed development, seed production occurred separately. Including this branch of haymaking would add several million dollars each year. Second, hay production restored soil fertility, either directly in the case of nitrogen-fixing legumes, or indirectly via the intestinal tracts of livestock whose manure was returned to fields. This means that a significant portion of hay's value accrued to the grain crops that followed it in rotation. Similarly, because hay was the primary fuel for draft animals, it was an energy input for all other agricultural commodities. It is highly questionable whether market transactions accurately priced these complex relationships in the sense of accounting precisely for nutrient and energy exchanges on the farm. While it may be possible to construct such estimates today, doing so would introduce new assumptions and uncer-

[61] The northern share of the national hay product ranged between 90 to 95% from 1840 to 1870.

tainties so that the ultimate conclusion would remain at the level of comparative orders of magnitude. In short, while hay may or may not have exceeded cotton or wheat in value in any given year, it was undoubtedly on a rough par with these better-known agricultural staples.

Historians and economists know relatively little about hay in part because they know so much more about major commodity exports, especially cotton and wheat. No direct measure of hay production exists before 1840, the first year the federal census collected agricultural data, nor are there annual (as opposed to decennial) figures before 1866. By contrast, annual statistics on cotton production and prices are readily available going back to 1790, thanks to the Treasury Department's access to customs receipts and market information in major ports. As far as I can tell, *all* extant data on cotton production and prices up to 1836 trace back to Treasury Secretary Levi Woodbury's report of that year.[62] Of course, the numbers did not compile themselves. Cotton's

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[62] "Letter from the Secretary of the Treasury, Transmitting Tables and Notes on the Cultivation, Manufacture, and Foreign Trade of Cotton," H. R. Doc. No. 24-146 (Washington: Blair and Rives, 1836). This document, sometimes known as the Woodbury Report, appears to be the ultimate source for all early US cotton production data. Some price indices go back further, drawing on other sources, but do not document production. For the most accessible present figures, begin with Olmstead, Alan L. and Paul W. Rhode , "Cotton, cottonseed, shorn wool, and tobacco – acreage, production, price, and cotton stocks: 1790–1999 [Annual]," Table Da755-765 in *Historical Statistics of the United States, Earliest Times to the Present: Millennial Edition,* edited by Susan B. Carter, Scott Sigmund Gartner, Michael R. Haines, Alan L. Olmstead, Richard Sutch, and Gavin Wright (New York: Cambridge University Press, 2006). For data before 1865, Olmstead and Rhode cite U.S. Department of Agriculture, Bureau of Statistics, *Cotton Crop of the United States, 1790-1911*, Circular 32 (Washington: Government Printing Office, 1912). This USDA circular, in turn, does not specify sources but provides identical numbers to those in the Woodbury Report. The same final destination is reached if we begin with Marvin Towne and Wayne Rasmussen, "Farm Gross Product and Gross Investment in the Nineteenth Century," in *Trends in the American Economy in the Nineteenth Century*, by Conference on Research in Income and Wealth, National Bureau of Economic Research Studies in Income and Wealth (Princeton University Press, 1960), 255–315. This leads back to the Woodbury Report via United States Department of Agriculture, Bureau of Agricultural Statistics, *Statistics on Cotton and Related Data*, Statistical Bulletin No. 99 (Washington, DC, 1951). Still another well-known source for cotton statistics is Gray, *History of Agriculture in the Southern United States to 1860*. This too leads back to the Woodbury Report via yet another USDA report: James L. Watkins, *Production and Price of Cotton for One Hundred Years*, United States Department of Agriculture, Division of Statistics, Miscellaneous Series, Bulletin No. 9 (Washington, DC: Government Printing Office, 1895). For an explanation of how customs officials valued and recorded exports, see "Statistical Accounts of Commerce and Navigation," 16th Cong., 1st Sess., no. 225, in *American State Papers: Commerce and Navigation*, vol. 2 (Washington: Gales & Seaton, 1834), 391–93.

extraordinary commercial importance drove data assembly, much as it drove enslaved and industrialized labor on both sides of the Atlantic. As one late-nineteenth-century statistician observed, "There is no agricultural product of the United States that commands such universal attention at home and abroad as cotton. . . . Nor is there any one of our staple products as to whose production and consumption we have more accurate information."[63]

Measuring internal trade poses tremendous challenges and was not really possible until modern states with robust administrative capacities emerged.[64] In the United States, the Civil War proved a watershed as Republicans, who were ideologically committed to domestic development, swept into power. Stephen Colwell was among those leading the call for greater government cognizance of the national economy. He and his fellow special revenue commissioners, appointed at the close of the war to advise Congress on how to pay off the war debt without slowing growth and development, repeatedly complained about "the very great difficulty which they have experienced in their investigations in obtaining exact statistical information." Colwell particularly stressed the importance of understanding domestic supply chains in order to ensure that the plethora of compounding excise taxes levied during the war did not undo tariff protections. With Republicans asserting a more vigorous role for national government in domestic economic space, federal agencies began collecting and publishing more data more frequently, casting their statistical gazes over a wider range of objects and moving from decennial to annual and even to quarterly reporting.[65]

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[63] Watkins, *Production and Price of Cotton for One Hundred Years*, 3.
[64] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), 23–24; Cook, *The Pricing of Progress*, 43–48; Anderson, *The American Census*, 20.
[65] Wells, Colwell, and Hayes, *Reports of a Commission Appointed for a Revision of the Revenue System of the United States, 1865-'66*, 51. For Colwell's concern, see his "Special Report No. 9—Influence of the Duplication of Taxes on American Industry," 270-275. For an overview of federal statistical reporting in the postbellum era, see

The challenges to collecting internal statistics are well illustrated by the pioneering efforts of the USDA. Many of the *annual* agricultural time series now available date to 1866, the year the USDA began publishing reasonably reliable national figures. Although created only in 1862, the department was by then already drawing on a quarter century's experience. In 1839, federal officials had initiated two distinct agricultural statistics-gathering projects, the first connected to the decennial census, the second to the Patent Office. The census promised a truly comprehensive national accounting of all important crops; starting in 1850, it did so by sending enumerators to interact directly with every farm household in the country. The Patent Office, meanwhile, sought timelier data, but without anything like the census's scale of operation. It adopted a method of voluntary correspondent surveys, compiling responses from around the country from which it made annual adjustments to the baseline of the decennial census. Through the 1850s, the agency's agricultural division remained too tiny and underfunded to produce dependable results. The Republicans' creation of the USDA during the Civil War changed this. The new department systematized the correspondent method and, after the war's end, produced the first usable national agricultural statistics.

The correspondent network was as essential as it was problematic. The USDA sought one correspondent per county to return monthly data obtained by querying "observing farmers in different localities."[66] Tabulated together, the questionnaires yielded "the united, deliberate *judgment* of a corps of careful resident observers." The department's statistician readily admitted that the results were "not absolutely correct," but he maintained that they were "the nearest approximate

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U.S. Department of the Treasury, *Report of the Commission on the Bureau of Statistics of the Treasury Department* (Washington, DC: Government Printing Office, 1877).

[66] "Report of the Commissioner of Agriculture for the Year 1864," H. R. Ex. Doc. No. 38-68 (Washington: Government Printing Office, 1865), 565.

estimate ever yet attained for the guidance of interested producers and consumers who always do and ever will seek greedily current judgments concerning crop productions, however incomplete, partial, and unreliable."[67] The system has been much refined and partly professionalized over the years. Yet it remains essentially similar even today in its ultimate reliance on thousands of diverse, voluntary judgments about crop conditions. The contrast with export data, collected as a matter of law at a few major chokepoints, is clear. Internal market statistics, especially in a country as large and varied as the United States, require an established infrastructure of cooperation between federal officials and numerous observers on the ground, in addition to considerable centralized data processing and publishing capacities. It is not the sort of thing an early modern state could undertake with any regularity.[68]

Over the course of the nineteenth century, the federal government and other state agencies played an increasingly active role in national economic development. Internal statistics were as much an effect as a cause of this drive for domestic development, which proved especially profound in agriculture.[69] At the moments when the Census and the USDA first took cognizance of the domestic scene, northern economic development and the hay production that helped fuel it were already substantial. Northern farmers had always known that hay was important to them; as

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[67] "Report of the Commissioner of Agriculture for the Year 1865," H. R. Ex. Doc. No. 39-136 (Washington: Government Printing Office, 1866), 61 (emphasis added).

[68] For the way that federal officials developed relationships with agricultural informants in the late nineteenth and early twentieth centuries, see Emmanuel Didier, "Cunning Observation: US Agricultural Statistics in the Time of Laissez-Faire," *History of Political Economy* 44 (January 2012): 27–45. For the difficulties that government officials in general often encounter in trying to gather and standardize data, see, for instance, Oz Frankel, *States of Inquiry Social Investigations and Print Culture in Nineteenth-Century Britain and the United States* (Baltimore: Johns Hopkins University Press, 2006), 159–62; Scott, *Seeing Like a State*, 25–52, esp. 47–49.

[69] Ariel Ron, "Scientific Agriculture and the Agricultural State: Farmers, Capitalism, and Government in the Late Nineteenth Century," *Journal of the Gilded Age and Progressive Era* 15 (July 2016): 294–309; Ariel Ron, "Developing the Country: 'Scientific Agriculture' and the Roots of the Republican Party" (Ph.D., University of California, Berkeley, 2012); Alan L. Olmstead and Paul W. Rhode, *Arresting Contagion: Science, Policy, and Conflicts over Animal Disease Control* (Cambridge, MA: Harvard University Press, 2015); Gabriel N. Rosenberg, *The 4-H Harvest: Sexuality and the State in Rural America* (University of Pennsylvania Press, 2015); Kathleen Mapes, *Sweet Tyranny: Migrant Labor, Industrial Agriculture, and Imperial Politics* (University of Illinois Press, 2009).

one stated simply, "hay is our staple crop."[70] Yet the new synoptic view provided by national statistics seemed to surprise even close economic observers, who suddenly realized that "the product of our grass land [adding pasture to hay] is not only far beyond that of any other crop in the United States, but is probably greater than all other crops combined."[71] A century and a half later, the surprise is perhaps even greater.

CONCLUSIONS

Hay was an important crop in the nineteenth century because it filled a bottleneck in the energy system created when coal transformed manufacturing and long-distance transport but left many other tasks unaddressed. Historians should recognize this. However, this is not to contend that hay was really king, that the real story of nineteenth-century economic development has somehow been missed until now. Much of what has been said here about hay could be said about maize twice over. Nor do I mean my findings to detract from the importance rightly assigned to cotton and other well-studied staples like wheat and tobacco. Although none of these commodities can serve as metonyms for the economy writ large, each illuminate essential aspects of the complex, multifaceted, and multi-scalar set of activities we designate as "the economy."

King Hay does caution for a more critical reading of trade statistics and more awareness of the relative significance of exports when compared to hard-to-measure domestic exchanges. Just as feminist scholars have long asked which economic activities receive what kind of statistical

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[70] "Report of the Commissioner of Patents for the Year 1849," 291.
[71] "Value of the Grasses," *American Agriculturist* 5 (Apr 1846): 105. See also "The Hay Crop of the United States," *Frank Leslie's Illustrated Newspaper* 2:37 (23 Aug 1856): 163, cited as "Important Statistical Work" in Alan L. Olmstead and Paul W. Rhode, "Cotton, Slavery, and the New History of Capitalism," *Explorations in Economic History* 67 (January 2018): 13n48.

representations, it bears asking whether the questions that most mattered to contemporary financiers, merchants, and high government officials—people who required numerical summaries to make quick judgments from afar—should most matter to historians. In the nineteenth-century agricultural press, hay was a much-discussed crop and this contributed significantly to the emulative practices, biological transfers, and mechanical innovations that dramatically altered its production. Yet because these changes were little captured by aggregate statistics until midcentury—and, even then, were of little interest to leading businessmen who expended their speculative energies elsewhere—hay has never engaged the attention of economic and commodity historians. My exercise in valuation is meant to establish that hay is worth paying attention to, but the real payoff requires going beyond the numbers to investigate the qualitative contours of northern agriculture's place in the energy transition and economic development of the 1800s.

Finally, the magnitude of hay production within an almost entirely domestic economic setting should lead us to ask when globalization is the best framework for understanding the rise of capitalist political economy, and when it is not. A great deal of world politics from the mid-nineteenth century to World War II turned on the construction of national economies and new imperial trade zones in which the state played a larger developmental role than ever before. Understanding how and why the state sought to develop these spaces is critically important. We live in an age when the prevailing economic wisdom favors global trade despite growing political pushback. Debates in this area rarely seem to take seriously the idea that the alternative to the global free market is not simply a set of cloistered national markets, but a potentially transformative role for the state engaged strategically in both development and trade. In the past, states have conquered and enslaved their way to development, even as they have also invested in education, infrastructure, social welfare, environmental sustainability, and more. There may yet be cause today to think

about how national economies might be structured by something other than the negative state or a narrow ethno-nationalism.

Table 1: Acreage in hay by region

	1850		1860	
Region	Area in hay (mil. acres)	Share of all improved farm area (%)	Area in hay (mil. acres)	Share of all improved farm area (%)
North	11.0	18	14.9	16
Northeast	8.2	24	8.8	23
Midwest	2.8	11	6.1	12
South	0.9	2	1.3	2
West	0.0	0	0.3	9
Total	11.9	11	16.6	10

Sources and notes: Regions correspond to the four major U.S. Census Divisions. Production was divided by yield and compared to total improved acreage. Figures for production and improved acreage come from the 1850 and 1860 Federal Census, as recorded in Michael Haines, Price Fishback, and Paul Rhode, "United States Agricultural Data, 1840-2012" (Ann Arbor, MI: Inter-University Consortium for Political and Social Research, June 29, 2016), https://doi.org/10.3886/ICPSR35206.v3. Yield was set at 1.16 tons/acre, which is the average of hay yields over 1866-1875 as given in United States Department of Agriculture, *Agricultural Statistics, 1967* (Washington: Government Printing Office, 1967), 319, Table 395. This comports with McShane and Tarr's statement that, around midcentury, one ton of hay required about one acre of land; see Clay McShane and Joel A. Tarr, *The Horse in the City: Living Machines in the Nineteenth Century* (Baltimore: The Johns Hopkins University Press, 2007), 135.

Table 2: The northern horse population and its hay requirements

Year	Horses on farms (thous.)	Horses in cities (thous.)	Mules (thous.)	Total (thous.)	Hay required, lower (thou. acres)	Hay required, upper (thou. acres)	Share of northern hay crop, upper bound	Share of northern hay crop, lower bound
1840	2,293	547	--	2,840	3,413	5,249		
1850	2,472	643	70	3,185	3,847	5,861	35%	53%
1860	3,822	961	172	4,955	5,960	9,052	40%	61%

Sources and notes: The number of northern farm horses and mules was derived from Michael Haines, Price Fishback, and Paul Rhode, "United States Agricultural Data, 1840-2012" (Ann Arbor, MI: Inter-University Consortium for Political and Social Research, June 29, 2016), https://doi.org/10.3886/ICPSR35206.v3. For 1840, mules are included with horses on farms; these figures should be regarded with caution. The earliest data on the number of urban (rather than farm) horses is for the entire United States in 1860. See "Horses, Mules, and Motor Vehicles," USDA Statistical Bulletin No. 5 (Washington: Government Printing Office, 1925), 2. To get the number of urban horses in the North, I proportioned the figures to the northern share of the national human urban population. For 1840 and 1850, it was also necessary to interpolate the total urban horse populations on the basis of the ratio of urban to farm horses in 1860. To estimate hay requirements, I assigned lower and upper bound consumption estimates to each category of draft animal and divided the sum by an average yield of 1.16 tons/acre (see Table 1 for yield determination). The following sources provide the basis for the consumption requirements: Frederick Strauss and Louis H. Bean, "Gross Farm Income and Indices of Farm Production and Prices in the United States, 1869-1937," Technical Bulletin No. 703 (Washington: U.S. Department of Agriculture, December 1940), 59; Winifred B. Rothenberg, "A Price Index for Rural Massachusetts, 1750-1855," *The Journal of Economic History* 39 (Dec 1979): 991; Paul Wallace Gates, *Agriculture and the Civil War* (Knopf, 1965), 133; Clay McShane and Joel A. Tarr, *The Horse in the City: Living Machines in the Nineteenth Century* (Baltimore: The Johns Hopkins University Press, 2007), 128–29; "Lyford's Price Current," *Monthly Journal of Agriculture* (New York) 7 (Jan 1848): 348-349. Lower bound: 1.25 tons/year for farm horses, 2 tons/year for city horses, and 1.25 tons/year for mules. Upper bound: 2 tons/year for farm horses, 2.75 tons/year for city horses, and 1.25 tons/year for mules. The lower-bound guesstimate for farm horses is based on the presumption that these horses worked more intermittently than city horses and that much of their consumption was pasture rather than cut hay.

Table 3: Hay price quotations around 1850

Date range	Location	Type	Typical price range (per ton)
Many observations			
1849-1850	Boston	"Screwed hay per cargo"	$11-12
1849-1850	Augusta, ME (pop. 8,225)	"Hay, loose"	$7.50-9
1849	Brattleboro, VT (pop. 3,805)	Hay (type unspecified)	$8-10
1851-1852	New York	Average monthly hay prices statewide	$8.50-10.47
1848	Philadelphia	Hay (type unspecified)	$12-20
1849	Pittsburgh	Timothy	$8-9
1849	Cleveland	"Wagon" hay	$6.50-8
1848	Ohio	Average of mixed hay prices in 38 counties	$4.50-5
1850-1851	St. Louis	Hay (type unspecified)	$13-14.50
Single observation			
May 1850	Boston	"New country"	$16-17
May 1850	Boston	"Eastern pressed"	$9-11
Aug 1849	New York City	"Hay, in bales"	$8-9
Sep 1850	New York City	"Hay, new and old"	$10-12
Feb 1851	New York City	"Hay, for shipping"	$14-15
Feb 1851	New York City	"Hay, for city use"	$16
Feb 1851	New York City	"North River, in bales"	$13-17.50
Jan 1853	Cincinnati	"Mixed to prime Timothy from river"	$10-11
Jan 1853	Cincinnati	"From wagon, in market, loose"	$12.50-21
Jan 1849	Louisville	Hay (type unspecified)	$8
Apr 1848	Detroit	Hay (type unspecified)	$10-12
Dec 1851	Milford, CT (pop. 2,465)	"First quality hay"	$9-11
Dec 1849	North Kingston, RI (pop. 2,971)	Hay (type unspecified)	$12-15
1850	Croydon, NH (pop. 861)	Hay (type unspecified)	$6-10
Dec 1851	South Freedom, ME (pop. 948)	Mixed hay (timothy and clover)	$8
Dec 1850	Norridgewock, ME (pop. 1,848)	Mixed hay ("all consumed here")	$7
1849	New Castle Co., DE	Mixed hay	$11-14
Jan 1850	Penn Yan, NY (Finger Lakes)	"Market price in cities and villages"	$8-10
Jan 1850	Penn Yan, NY (Finger Lakes)	"In the country"	$5-7
Dec 1851	Seneca Co., NY	Hay (type unspecified)	$6
Jan 1852	Richmond, IN (pop. 1,443)	Hay (type unspecified)	$6
Oct 1852	Lafayette, IN (pop. 6,129)	Hay (type unspecified)	$8
Dec 1849	Plymouth (pop. 2,431)	"Tame hay"	$5-8

Sources and notes: Boston: *Maine Farmer*, *Zion's Herald and Wesleyan Journal*, *New England Farmer*. Augusta: *Maine Farmer*. Brattleboro: *Semi-Weekly Eagle*. New York: S.E. Ronk, *Prices of Farm Products in New York State, 1841 to 1935*, Bulletin No. 643 (Ithaca: Cornell University Agricultural Experiment Station, 1936), 58. Philadelphia: Gates, *The Farmer's Age: Agriculture, 1815-1860* (New York: Holt, Rinehart and Winston, 1960), 252. Pittsburgh: *Pittsburgh Daily Gazette and Advertiser*. Cleveland: *Plain Dealer*. Ohio: *Third Annual Report of the Ohio Board of Agriculture* (Columbus: S. Medary, 1849), 29-111 (county reports). St. Louis: *Western Journal of Agriculture, Manufactures, Mechanic Arts, Internal Improvement, Commerce, and General Literature* 7 (Feb 1852): 327. Single observations come from various sources, including: *Plough, the Loom and the Anvil*; *Ohio Cultivator*; *Indiana Farmer*; *Michigan Farmer*; *American Agriculturist*; *United States Economist and Dry Good Reporter*; "Replies to Circular," *Report of the Commissioner of Patents for 1851. Part II: Agriculture* (Washington: 1852), 131-493; "Hay," *Report of the Commissioner of Patents for 1849. Part II: Agriculture* (Washington: 1850), 291-294; "Letters and Reports Relating to Crops," *Report of the Commissioner of Patents for 1849. Part II: Agriculture* (Washington: 1850), 83-206.

Table 4: The hay crop's dollar value in current prices

	Hay				Cotton	Wheat	Tobacco
	Production (mil. tons)	Avg. prices in major markets ($)	Lower value (mil. $)	Upper value (mil. $)	Value (mil. $)	Value (mil. $)	Value (mil. $)
1839	10	11.00 - 13.00	63.5	100.9	62.1	45.0	0.4
1849	14	11.00 - 13.00	88.9	141.3	118.3	68.7	0.4
1859	19	14.00 - 16.00	153.6	236.1	217.3	151.0	1.0
1869	27	11.20 - 13.20	174.6	276.7	343.0	216.5	1.5
1879	35	8.26 - 10.26	167.0	278.8	354.3	397.1	3.5
1889	67	6.71 - 8.71	259.6	453.1	396.1	306.8	3.9
1899	79	6.91 - 8.91	315.3	546.6	437.2	328.6	4.0

Sources and notes: Hay production totals come from *Historical Statistics of the United States, Millennial Online Edition*, Table Da746-754. The table breaks at the year 1859 to emphasize the different sources of *price* data for hay in the period up to and after this year. The range of prices in major markets for the years 1839-1859 represents my own guesstimates based on various primary and secondary sources, including those cited in Table 3. The range for 1869-1899 was obtained by averaging the prices given in the following two sources and then subtracting and adding $1 to obtain the lower and upper bounds; Marvin Towne and Wayne Rasmussen, "Farm Gross Product and Gross Investment in the Nineteenth Century," in Conference on Research in Income and Wealth, National Bureau of Economic Research Studies in Income and Wealth, *Trends in the American Economy in the Nineteenth Century* (Princeton University Press, 1960), 298-299; Frederick Strauss and Louis H. Bean, "Gross Farm Income and Indices of Farm Production and Prices in the United States, 1869-1937," Technical Bulletin No. 703 (Washington: U.S. Department of Agriculture, December 1940), 61-62. Values for cotton, wheat, and tobacco come from Towne and Rasmussen, 294, 306-307.

To construct ha)y value estimates, I introduced two modifications to the simple multiplication of price by production that Helper used. First, I established a local market price as a ratio of the major market price: 50% for the lower bound and 70% for the upper bound. Second, I allocated shares of production to each market category on the basis of a study by the Bureau of Agricultural Economics finding that 20.5% of hay production went to urban (i.e., major) markets in 1900 (Strauss and Bean, 60); I used 15.5% for the lower bound and 25.5% for the upper bound. (In 1900, the urban share of both the human and horse populations would have been larger than in earlier decades, but by then, too, new energy sources and technologies were replacing animal power or making it more efficient in cities while farms relied on horses more than ever, so that it is unclear whether the urban share of total hay consumption would have been lower or higher, compared to 1900, in earlier decades.)

For 1850, a more elaborate specification that attempts to account for price variations among local, mid-sized, and large markets in the Northeast and Midwest, respectively, produced an estimate of $110.4 million. Although the prices and weights here remain essentially guesstimates, the fact that the more complex formula gives a figure about midway between the lower- and upper-bound estimates adds confidence that the simpler formula offer a reasonable range.

Figure 1: "Ruined, and Winter at the Door": Consequences of the 1872 Horse Epizootic

RUINED, AND WINTER AT THE DOOR—AN EPISODE OF THE HORSE PLAGUE.—[DRAWN BY PAUL FRENZENY.]

Sources and notes: This print depicting an instance of the horse epizootic highlights the crucial importance of horses to the livelihoods of ordinary people. Note the hay loft at the top. *Harper's Weekly*, 23 Nov 1872, p. 908.

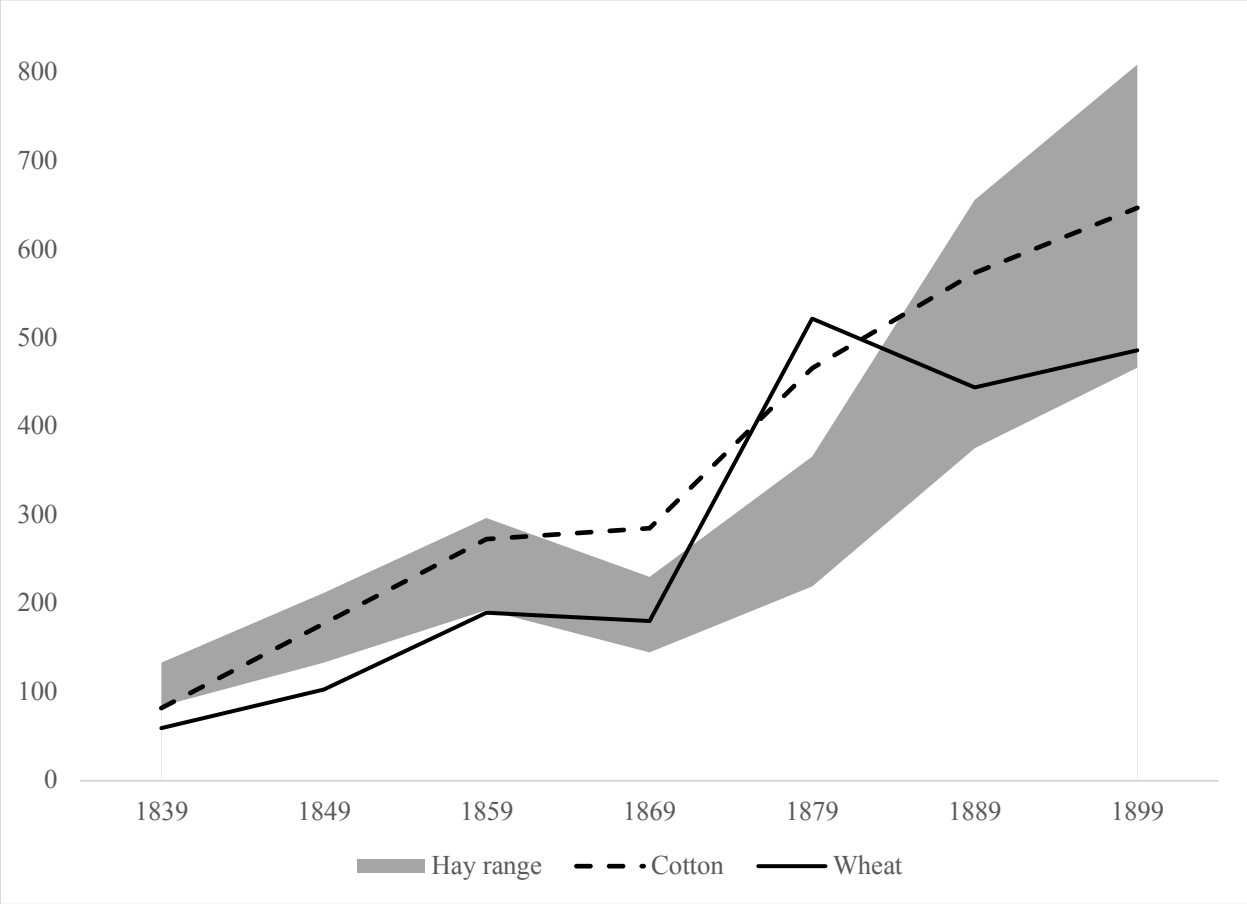
Figure 2: Newark's Informal Hay Market on the Lower Green, c. 1844

Sources and notes: This engraving depicts sales of hay and cordwood at the farmer's market on the Lower Green of Newark, New Jersey, circa 1844. A large, ox-pulled haycart can be seen to the right of the flagpole, just above the word "Newark" in the caption. John W. Barber and Henry Howe, *Historical Collections of the State of New Jersey* (New York: Tuttle, 1844), 176.

Figure 3: Union wagon train entering Petersburg, Virginia

Sources and notes: This photograph of horse-drawn supply wagons stretching into the horizon illustrates horses' essential role in the Civil War. It also suggests something of the strategic advantage that economic development conferred on the Union. Civil war photographs, 1861-1865, Prints and Photographs Division, Library of Congress.

Figure 4: Hay, cotton and wheat output in constant 1910-1914 prices (mil. $)



Sources and notes: Output values from table 4 four were adjusted ("deflated") with the Warren-Pearson wholesale farm products price index. For each crop, these constant-dollar figures chart an output trajectory for the entire period, with the area between the lower and upper bound hay estimates shaded to represent an estimated output range. Since each crop is being divided by the same deflator in any given year, comparisons *between* crops remain the same as in the unadjusted figures in table 4. The apparent decline in hay output between 1859 and 1869 is probably an artefact, in part, of the disjunction in data sources (see table 4 notes); it can be taken as an indication of the basic difficulty in obtaining a synoptic statistical picture of hay output in terms of dollar value. See G. F. Warren, F. A. Pearson, and Herman M. Stoker, *Wholesale Prices for 213 Years, 1720 to 1932*, Cornell University Agricultural Experiment Station Memoir 142 (Ithaca, NY: Published by The University, 1932), 84-86 (Table 35).