Water Removal Institutions in the Lower Mississippi River Valley:

Their Evolution and Role in Economic Development

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Abstract:

Lowland counties of the lower Mississippi River have battled against excess water for two centuries. Today these lands are some of the most fertile and heavily agricultural in the country. Yet widespread agricultural development in these areas required the establishment of protection from (and removal of) excess water. The Great Flood of 1927 is often characterized as the turning point in battle for control of the River. The Army Corps of Engineers, this narrative tells us, took the Flood as an opportunity to provide firm leadership of a disorganized and ineffectual system. We argue using a data from the US Agricultural Census that the reality is more complex. Levee and drainage districts, formed mainly between 1870 and 1900, took considerably longer than in the Midwest to effectuate economic returns. However, by 1920 effective local coordination in lowland counties was conveyed via rising land values; improved farmland acreage and cotton production rose dramatically. It was the economic rise enabled by local levee and drainage districts that created the circumstances around the 1927 flood. Large cotton plantations established in the reclaimed floodplains had induced the migration of the black workers most catastrophically impacted by the flood. The economic productivity of these farms raised owner incomes, increasing their political power in shaping state and federal policy. The destruction of these farms in the 1927 flood also created a sympathetic narrative related to the broad public benefits of flood protection. While other authors have focused on 1927 as a failure of localism, we argue that it was a demonstration of its successes. In the remainder of the paper, we trace agricultural development in the lowlands of Louisiana, Arkansas, Mississippi, and Missouri to show how local districts helped create the economic environment whose destruction spurred federal intervention and eventually the hybrid system of local and federal flood and drainage control that exists today.

I. Introduction

The Mississippi River drainage basin, or watershed, is continentally large, covering parts of 32 states and two Canadian provinces. It collects rain and snowfall from as far west and north as relatively arid north-central Montana and southeastern Alberta and as far east as the much better-watered New York state and Virginia. The main stem of the basin is the more or less north-south oriented Mississippi River itself, but the drainage basin collects waters into the trunk line from a span of major rivers, including the Missouri, Ohio, and Arkansas, from a total of 740 million acres – 37% of the lower 48 states land area. The water so collected funnels to a single outlet at New Orleans.

Of considerable hydrologic significance for the history of American settlement and agriculture is the stretch of the River south of St. Louis, the Mississippi Alluvial Plain, which periodically experiences flooding from the Mississippi and its tributaries as they connect with the Mississippi. Harrison (1961) terms this area "the Alluvial Valley of the Lower Mississippi River" and measures it at 30 million acres, the size of Florida.

The lower Mississippi developed economically much later than did the Midwest, despite the enormous agricultural potential of the Alluvial Plain. In Edwards and Thurman (2025) we chronicle the critical importance of soil drainage to development in the Midwest and how technological innovation, importantly drain tile, spread from New England to the Midwest in the middle of the 19th century and the swampy lands of the upper Mississippi Valley were transformed into the Corn Belt. We discuss in that article how institutional and legal innovation in the form of drainage districts was required to make the transformation possible. But the problems of saturated lands and their periodic flooding along the lower Mississippi were different in degree, if not kind, from those in the Midwest, and the period of institutional innovation to accomplish drainage was longer and came later. The Mississippi Alluvial Plain initially was mainly passed over by settlement, making it the final frontier of agricultural development in the United States.

Like the Midwest, lowland counties of the lower Mississippi initially saw limited collective action to solve drainage and flood control problems until state legislation lowered the transaction costs of forming local levee and drainage districts. These districts formed mainly between 1870 and 1900 and took considerably longer than in the Midwest to effectuate drainage and flood control due to challenges with the magnitude of projects required and the greater scale of coordination this entailed (Edwards and Thurman 2025). Lowland counties are some of the most fertile in the country, but the inability of the government or landowners to unlock this value was reflected in depressed prices until the late 1800s. Today, land in these counties is almost entirely privately owned (97% of the "Mississippi Delta Cotton and Feed Grains Region," as defined in Natural Resource Conservation Service, 2006) and is the most heavily used for agricultural by percentage of total land area in production in the country.

As in the Midwest, agricultural development in the Alluvial Plain required both technological and institutional innovations to enable the coordination across landowners needed to prevent flooding and drain soils. Coordination via districts required states to pass district-enabling laws, which occurred between 1859 and 1912. After much experimentation and failed efforts at coordination and financing, local markets began to reflect the successful removal of water as the feasibility of flood control and drainage was demonstrated. Land prices and development rose together in the early 20th century as coordination mechanisms developed, often in a back-and-forth competition with the river's floods. Today, a web of special districts own levees, coordinate drainage, and collaborate with the US Army Corps of Engineers on design and investment.

In this paper, we examine the emergence of drainage and levee institutions along the Lower Mississippi, using historical data and an array of contemporaneous and contemporary accounts to trace how state capacity and transaction costs shaped the evolution of water removal.

II. Conceptual Framework

We define transaction costs broadly as the costs of establishing and retaining property rights over excess water—protection from and removal of—including the political and bargaining costs related to district formation and governmental coordination. That the enormous scale of the Mississippi and its flooding problem is still managed in part by local interests raises important questions about the nature of coordination to solve natural resource management challenges. We contrast two seemingly contradictory explanations for the organization of economic activity as applied to drainage and levees. The first, due to Hayek (1945), argues that decentralized information, specific to circumstance and place, becomes embodied in price signals through the coordinating actions of local entities, including levee and drainage districts. These price signals motivate collective action at the state and federal levels. The second explanation is a techno-centrist argument, which emerged definitively after the Great Flood of 1927 and is promoted to this day by the Army Corps. It argues that flood control at the scale of the Lower Mississippi Basin is such a large problem that it can only be planned and managed at the scale of the entire basin (Barry 1997) and that prior, more local, coordination has been entirely superseded by federal control.

We trace the present institutional arrangement, which evolved from exclusively private investment circa 1850 to one resembling that of today by 1950, to argue that both explanations are incomplete. Initially, many of the country's wetlands were held by the federal government which, unable to sell them, granted them to the states via Swampland Acts in 1849, 1850, and 1860. A significant portion of the lowland areas along the Lower Mississippi Basin were included in these Acts. The intention was for states to fund drainage projects through land sales; these plans were quickly abandoned. Federal and state governments lacked the institutional capacity to coordinate or fund such large public works projects. The land was largely deemed worthless and sold off to speculators. It was these speculators, or the successive landowners of these private lands, who eventually succeeded in developing the land.

While federal and state actions to stimulate drainage in the mid-19th century failed, locally initiated levee and drainage districts spurred investment over millions of acres. Yet this local success was incomplete in the Lower Mississippi. In areas without large, low gradient river systems, the individual drainage district remains the primary governance structure today, for instance in the Corn Belt (see Edwards and Thurman, 2025). In contrast, the Mississippi Alluvial Plain is periodically flooded—on average twice a decade and sometimes for weeks and months at a time. Drainage cannot profitably be implemented if the drained land isn’t protected from flood. It was large-scale flooding along the Mississippi River in the late 19th and early 20th centuries that encouraged the gradual reentry of the federal government into the management of the swamplands for which it had abdicated responsibility a few decades earlier. This reentry accelerated after the Great Flood of 1927, spurring major investment by the federal government into existing districts. This investment fueled continuing agricultural development in the region, which emerged as one of the predominant agricultural regions in the United States.

The federal government of the 1930s had much enhanced its capacity to undertake natural resource and governance actions. Its ability to invest large amounts of money and its engineering expertise (the Army Corps of Engineers) was coupled with its ability to coordinate management across levee districts and states, even when their interests diverged. However, federal investment did not occur in a vacuum. Increases in land value and development, attributable to the successes of local districts, also raised the

political stakes of federal involvement and encouraged rent seeking by local interests. Districts, which were already organized and coordinating successfully over water removal, naturally evolved into effective lobbying entities. The success of these efforts is reflected in extensive federal investments to fortify farmland from floods and the refusal of the Corps on several occasions to relieve pressure on cities by flooding contractually arranged spillways through agricultural land.

Our findings suggest that the emergence of effective local coordination as conveyed via market signals can encourage centralization, rather than provide an alternative to it, and that local interests may encourage such centralization, because they receive additional coordinating benefits and are well-positioned to extract additional subsidies via the political system.

III. The History of European Settlement in the Alluvial Plain

Figure 1: Map of the Mississippi River Basin

Economic Development before the Louisiana Purchase in 1801

Prior to development, the Lower Mississippi River Basin (LMRB) consisted of floodplain forests and wetlands closely connected to the Mississippi River and its tributaries (Faulkner et al. 2011).[1] Today it is one of the most productive agricultural regions in the United States.[2] But before agricultural production, these lands required extensive clearing and drainage, as well as the construction of levees for protection from flooding from the Mississippi River. Figure 1 provides an overview of the entire basin.

[1] https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/10-0592.1
[2] https://www.ars.usda.gov/ARSUserFiles/np211/LMRBProposal.pdf

The earliest European exploration of the Mississippi River occurred during the 1500s. Prior and through this period the land was occupied by Native American tribes. In 1543, Hernando DeSoto became the first European to describe flooding along the River. During this period of exploration, the French claimed for the king of France the "Louisiana Territory," the entire area drained by the Mississippi. Levees were first built to protect the city of New Orleans from Mississippi floodwaters in 1717 and the city became the capital of the Territory in 1721. One of a number of Great Floods inundated New Orleans in 1735, erasing the previously built levees. Rebuilding after the 1735 flood resulted in there being new levees in place for 20 miles above and 30 miles below New Orleans by 1752 (Harrison 1961, p.55). During the next 50 years there was little new levee building, but plantations along the river were improved (Harrison 1961, p.56).

In 1762, as a result of the Seven Year War (also known as the French and Indian War), France ceded to Spain the western half of the Mississippi Basin and to Britain the eastern half. France regained the west bank of Louisiana territory in 1800 via land trades between Napoleon Bonaparte and Spain. This was just prior to the United States acquiring the territory through the Louisiana Purchase of 1801. The area was largely unexplored and mostly controlled by Native American tribes.

The newly acquired Louisiana Territory was subsequently subdivided and the much smaller state of Louisiana was created in 1812. By this time there were a few settlements on the West Bank of the Mississippi, which was already owned by the United States, between the Red and Arkansas Rivers. Thin settlement characterized the East Bank between Red and Yazoo Rivers but by 1820 there was "rapid expansion of cotton plantations in lowlands of the Mississippi River north of the Red and Yazoo Rivers (Harrison 1961, p.38)."

Early Levees and Drainage Before the Swamp Land Acts: 1801-1850

As development along the banks of the Mississippi proceeded in the early and mid-19th century, states along the lower Mississippi River (Missouri, Arkansas, Mississippi, and Louisiana) began to address the public finance challenges of building and maintaining levees. At initial settlement, riverfront landowners were the most strongly incentivized to build and maintain levees. Subsequently, these landowners were made legally responsible by state law for construction and maintenance. For example, Harrison describes 1838 legislation in Mississippi that was patterned after earlier law in Louisiana:

> "[L]egislation of early Mississippi followed the practices of Louisiana, in that it placed the burden of flood control on the local holders of front lands. Fines were imposed for inspectors and planters who failed in their duty toward flood control. When nonresident holders could not be reached, work on their lands was to be let to the lowest bidder and the cost of the work held against the land by the county boards of police." (Harrison 1961, p. 61)

Responsibility for levees was extended to backland owner beneficiaries of levees when the Mississippi legislature passed in 1846 a levee tax on such owners away from direct contact with the River.

> "The idea of general taxes for levee building soon entered Mississippi Valley flood-control law and regulations, even though they continued to hold front owners responsible. [Inspectors were instructed to] 'lay out the line of said levee, and to estimate the probable cost thereof, and report said amount to the president of the board of police, who shall thereupon convene the board, which, when so convened, shall assess a tax on said land for the requisite amount, to be called a levee tax, together with a sufficient sum for defraying the expenses in collecting the same.' This act provided that the back lands that benefited by the building of the levee should be taxed in proportion to the benefits the proprietors of said back lands would receive." (Harrison 1961, p. 62)

The same Louisiana legislation in 1846 permitted the creation of levee districts to coordinate construction and maintenance of levees. The power of levee districts to tax possibly unwilling participants in the levee building was established in an 1848 law:

> "In Mississippi, reliance on front landholders began to break down. The flood of 1844 made it clear that the riparian holders could not do the job unaided. Threats of fine or sale of property for failure to build proper levees and drains began to be replaced in the law by a system of general levee-tax proposals that would apply to all land protected. An act of March 4, 1848 provided for '... a uniform tax on all land in said county (Tunica), to be called a levee tax, which tax shall not exceed three cents per acre on said land, for any one year, but the same may be kept up from year to year, until the amount raised thereby (together with what the State may appropriate) shall be sufficient for the erection of said levee.' " (Harrison 1961, p. 63)

Other downriver states adopted similar measures as the 1848 Mississippi legislation was mimicked in Arkansas and Louisiana.

While state law evolved to handle the challenges of flood control on private lands, substantial land remained in the federal estate as a result of the Louisiana Purchase. In 1829, the U.S. Congress had appropriated $5,000 for the Army Corps of Engineers to survey and map the Ohio and Mississippi Rivers. Missouri became a state in 1821 and in 1824, Congress appropriated $75,000 for snag removal in the Mississippi below the Missouri (i.e., south of Saint Louis) and in the Ohio River. These small investments were underwhelming relative to the more than 20 million acres of swamplands located along the Mississippi and its tributaries. Congress began to pass these lands back to the states in with a series of Swamp Land Acts, which instructed states sell the transferred swamp land to finance their efforts at flood control. The first such Act was passed in 1849 and transferred 9.4 million acres to the state of Louisiana. The Swamp Land Act of 1850 transferred federal land to other lower Mississippi states: Arkansas (7.7 million acres), Missouri (3.3 million acres), Mississippi (3.3 million acres), and Illinois (1.5 million acres). Later Swamp Land Acts were passed to transfer land from the federal estate to state governments outside of the Lower Mississippi River Basin.

The disbursement of land to the states in 1850 led to an extended period of state efforts to unlock the great wealth that the lowlands represented, which value could only be realized by first protecting them from the periodic flooding of the Mississippi and its tributaries, the Missouri, Ohio, Arkansas, and Red Rivers.

As states absorbed the federal lands in the Lower Mississippi River Basin, state law evolved to enable local communities to organize and invest in flood protection through levee districts patterned after Midwestern drainage districts.

> "After 1855, across states, the system of local and personal responsibility was greatly modified, and whole communities became suffragens in levee voting." (quote from 1874, cited in Harrison, 63) "Louisiana legislation that permitted the creation of levee districts also established the basis for taxation in the interest of flood control." (Harrison 1961, p. 62)

The Evolution of Levee Districts from Drainage Districts: 1850-1927

In the Midwest, drainage investment was generally not effective on a small scale, instead requiring coordination across hundreds or thousands of acres (Wright, 1907; Prince, 2008). While farmers in many states hold the right for water outflow onto neighboring properties, effective drainage in states like Illinois, Iowa, and Minnesota required coordination on the scale of thousands of acres, while optimal farm sizes were hundreds of acres. Drainage districts solved these coordination problems in the Midwest. State

legislation provided for special districts that allowed landowners to retain rights to operate farms at their existing scales while coordinating water removal among 10 to 100 farms. Drainage district laws provided local taxing and eminent domain authority to finance investment in ditches and compel neighbors intent on preventing drainage onto or across their land.

Water removal on the lower Mississippi required an entirely different scale of coordination. While drainage districts in the Midwest ranged in size from hundreds to a few thousands of acres, the levee districts that developed along the Lower Mississippi—initially patterned after Midwest drainage districts—were often 50 to 100 times that size and were much fewer in number. In a 1954 study Burns (1954) reports that 92 districts formed in the early 20th century in Blue Earth County, Minnesota. The average size of a Blue Earth County district in 1930 was 1,161 acres. In Story County, Iowa there were 95 districts by 1920 with an average size of 2,080 acres per district (Hewes and Frandson, 1952). Compare the Blue Earth County average drainage district size of 1,161 acres and the Story County average district size of 2,080 acres with the 285,000 acres comprising the Cypress Creek Drainage District in Arkansas and the 40,000 acres covered by the Ross Drainage District, also in Arkansas (Deaton 2016). Levee districts were many times the size of upper Midwest drainage districts, similarly organized and similar in aims though they may be.

Further, the larger geographic scope of drainage institutions in the Lower Mississippi created the potential for conflict among organizations that was absent in the Midwest. One set of challenges faced by the newly created levee districts was the external effects imposed by, mainly upriver, districts resulting from their own efforts at fortifying and raising the levels of levees. In 1861 a federally-funded and much celebrated report by civil engineers Humphrey and Abbott alluded to the possibility of one region being flooded by the efforts of another and, on the other hand, the possibility of one area being protected by the efforts of another:

> "It is important that it should be understood, that much of the want of success attending the efforts to secure the alluvial lands from overflow has arisen not from inherent difficulties in the construction of works of protection, but from the adoption of systems which have allowed one district to be submerged in consequence of the insufficient character or faulty execution of the laws of another, or left to be protected by taxes levied upon another." (Humphreys, Capt. A.A. and Lt. H.C. Abbott, Report on the Physics and Hydraulics of the Mississippi River Philadelphia, 1861, p. 152; as quoted in Harrison 1961, p. 63)

Flood protection and drainage efforts were brought to a halt by the American Civil War. When the war ended in 1865, local governing institutions were in disarray and the levees along the lower Mississippi and its tributaries had been damaged by strategic sabotage in battles, notably the dynamiting of levees by Union troops during the in the Vicksburg Campaign in 1863, and also suffered from maintenance being put on hold during the war.

The post-war period saw a succession of levee districts created. Early and notable was the Mississippi Levee District in 1877, "the model for other bottomland levee districts." (Otto, p. 26). The Mississippi Levee District contracted to rebuild levees in southern Delta counties after the Civil War, and the rebuilt levees held in the flood of 1884. Otto describes the activities of the District and the beginnings of federal involvement with districts:

> "Selling bonds and imposing taxes to fund levee work, the Mississippi Levee District (MLD) contracted to rebuild the levees in the southern delta counties. Contractors hired Irishmen to wield the shovels and wheelbarrows used in levee construction. Although these handbuilt levees resisted floodwaters in normal years, they failed during the great flood of 1882. Following this

> destructive flood, the Mississippi River Commission, which had been created to improve river navigation, began providing federal funds for levee construction in the Mississippi River Valley. Receiving federal aid, the MLD rebuilt the levees in the southern Delta counties, using animal-drawn scrapes to create stronger embankments. These rebuilt levees held back floodwaters during the 1884 inundation. The successful levee-building of the MLD inspired the state of Mississippi to create the Yazoo-Mississippi Delta levee District (Y-MDLD) in 1884. Responsible for protecting the northern Delta counties, the Y-MDLD began building a coherent levee line in the northern Delta." (Otto, p. 26)

Inspired by success of the Mississippi Levee District, the Yazoo-Mississippi Delta Levee District was created in the northern part of the Delta in 1884. Following that, the Fifth Louisiana and Tensas Basin districts were created in northeast Louisiana in 1886, the Clay and Greene districts in Eastern Arkansas in 1887, and the Laconia, Red Fork, and St. Francis levee districts in Eastern Arkansas in 1891. In 1893, the St. Francis Levee District was created in eastern Arkansas on the sunken lands that were replumbed by the 1811-1812 New Madrid earthquakes. The year 1897 saw the greatest flood on record in the Mississippi to date. Subsequently local levee districts began rebuilding a patchwork levee line (Otto, 27). "By 1897, state levee districts lined the lower Mississippi Valley." (Otto, 35). In 1905, the ambitious Little River Drainage District in the bootheel of Missouri was approved by the Missouri legislature and governor.

The evolution of flood protection and drainage institutions continued in the early 20th century. In 1906 the Alcorn Law was passed in Mississippi. Patterned after the Illinois Drainage Law of 1879, the Alcorn Law called for Drainage District creation through local courts and county boards of supervisors. Brandfon, p. 125)

The Flood Control Acts: 1927-1950

The Great Flood of 1927 was the signal event of the 20th century. Barry (2007) thoroughly recounts the flood, its human and economic toll, and its legacy of extensive federal involvement. The prelude to federal involvement in the basin began in earnest in 1875, when Louisiana Congressman Randall Lee Gibson led a successful effort to create a House standing committee on Mississippi levees. Gibson and U.S. Senator L.Q.C. Lamar of Mississippi used the committee to create the Mississippi River Commission (MRC) in 1881, which served as the main coordinator federal River policy, under the Secretary of War, until 1928. Catastrophic flooding events on the Mississippi were hardly unique prior to 1927, with new federal intervention typically following each flood event.

Initial appropriations in 1891 totaled only $1 million. In keeping with traditional views of levees as protecting private landowners, initial appropriations to the MRC prohibited the use of funds in levee construction or repairs that primarily benefited private interests. Floods in 1890 led to new appropriations ($3.5 million) and allowed MRC to fund levee construction and repairs directly. Floods in 1897 and 1903 led to calls from local interests for more federal funding. Consecutive floods in 1912 and 1913 led landowners to launch a public campaign urging additional federal intervention. These calls were primarily focused on additional funding, not the federal government's expertise or coordination functions, and can be attributed to intra-district issues in raising sufficient funding to protect their private land interests.

More focus on inter-district coordination occurred soon after the MRC aided the Southeast Arkansas Levee District (Chicot Levee District) in closing the Cypress Creek Gap, just south of the confluence with the Arkansas River in 1921. In 1922, a record setting flood below the Gap as attributed by downstream landowners to the closure. Following this flooding, $60 million was appropriated directly for levee

funding and after this work was complete, the MRC declared in its 1926 annual report that the levee system "is now in condition to prevent the destructive effects of floods."

Herbert Hoover declared the 1927 flood "the greatest peace-time calamity in the history of the country." Following the flood, Congress quickly acted. The 1928 Flood Control Act created the Mississippi River Valley project (MRVP) and appropriated $325 million for its work improving the levee system from Cape Girardeau, Missouri to the Gulf of Mexico. This Act largely moved federal coordination from the MRC to MRVP. As important as the dramatic increase in federal appropriations and new structure was Section 2 of the Act, which laid out the public good case for federal involvement in protecting the property values of local interests:

> "That it is hereby declared to be the sense of Congress that the principle of local contribution toward the cost of flood-control work, which has been incorporated in all previous national legislation on the subject, is sound, as recognizing the special interest of the local population in its own protection, and as a means of preventing inordinate requests for unjustified items of work having no material national interest. As a full compliance with this principle in view of the great expenditure estimated at approximately $292,000,000, heretofore made by the local interests in the alluvial valley of the Mississippi River for protection against the floods of that river; in view of the extent of national concern in the control of these floods in the interests of national prosperity, the flow of interstate commerce, and the movement of the United States mails; and, in view of the gigantic scale of the project, involving flood waters of a volume and flowing from a drainage area largely outside the States most affected, and far exceeding those of any other river in the United States, no local contribution to the project herein adopted is required."

With the proverbial levee of federal funding breeched, local interests began securing additional federal funds. The 1938 Flood Control Act appropriated $375 million in new projects on major Mississippi tributaries including the Ohio, Tennessee, Missouri, Upper Missouri, Arkansas, White, Red, St. Francis, and Yazoo Rivers. The Act further removed local contribution requirements for reservoirs. The 1944 Flood Control Act authorized up to 150 additional flood control projects at an expense of $750 million.

While complex economic, political, and hydrologic forces coincided in 1927 to spur a generational shift in federal levee funding, it is worth noting that large changes were not seen after the flooding during the early 20th and late 19th centuries. Our conceptual framework explains that 1927 was a seminal year not only because there was a large flood, but because local levee and drainage districts had been successful enough at developing economically to put considerable value at risk. This development created the circumstances around the 1927 flood. Large cotton plantations established in the reclaimed floodplains employed the black workers most catastrophically impacted by the flood. The economic productivity of these farms raised owner incomes, increasing their political power in shaping state and federal policy. The destruction of these farms in the 1927 flood also created a sympathetic narrative related to the broad public benefits of flood protection. While other authors have focused on 1927 as a failure of localism, we argue that it was a demonstration of its successes. In the remainder of the paper, we trace economic development in the lowlands of Louisiana, Arkansas, Mississippi, and Missouri to show how agricultural development spurred by local districts helped create the economic environment whose destruction spurred federal intervention.

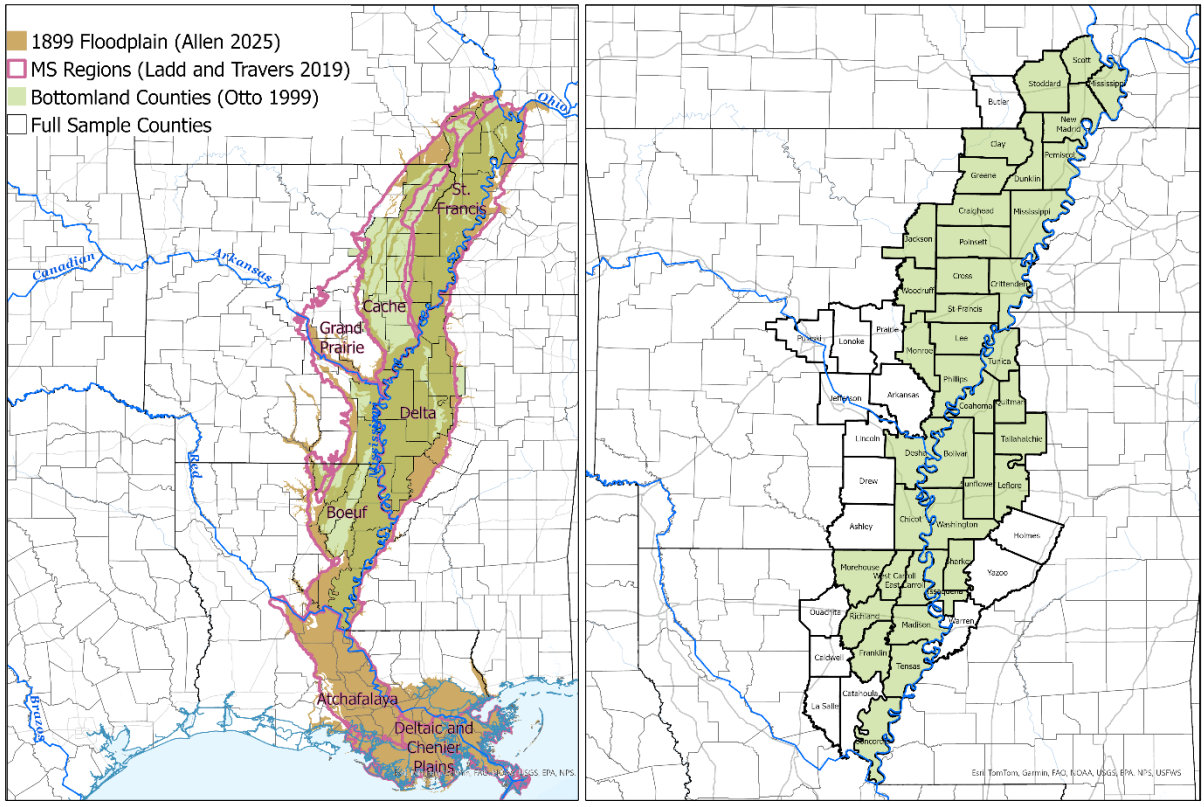
IV. Definition of the Study Region

We define our study region as the lowland counties adjacent to the Mississippi River stretching from its confluence with the Ohio River at Cairo, Illinois to the confluence with the Red River in Louisiana, near Natchez, Mississippi. Alternatively, it is the lowland area stretching from the southern tip of Illinois to the point where the ankle meets the foot of the Louisiana boot. Figure 2 presents three potential, similar, collections of such counties taken from prior work: the Lower Mississippi River floodplain mapped in 1887 by the MRC and digitized by Allen (2025); "Bottomland Counties" from Otto (1999); and the five northern regions of the LMRB defined by Ladd and Travers (2019).

Notice that the region is bounded on the east by the River in Kentucky (between Cairo, Illinois and Memphis, Tennessee) and again, moving downriver, in the middle of Louisiana (South of Vicksburg, Mississippi). These boundaries reflect hills that rise away from the River and serve as natural boundaries to flooding.

Generally, the three measures overlap in the Boeuf, Delta, Cache, and St Francis regions. While the Cache region is generally not part of the floodplain definition, it is included in Otto's definition. The Grand Prairie region is only partially within the floodplain and not included in Otto's bottomland county definition, but retains enough other similarities for our consideration. Despite being mostly excluded from the 1887 floodplain map, both the Grand Prairie and Cache regions partially flooded in the first but not second flood of 1927 (not pictured). The northern portion of the Delta region is notable for not flooding in 1927, potentially due to levee investment. Appendix table A1 shows the counties in each state included in our sample and their primary levee district.

Figure 2: Regional Definition of Lowland Counties



Because the Agricultural Census data that we ultimately want to match to this geography is county level, we construct a study area composed of whole counties, recognizing that some important elements of topography, and some levee and drainage district boundaries, cut through counties. The counties included in the study region are shown in the right panel of figure 2.

We generally exclude from this study the Mississippi River Delta region in Louisiana south of the Red River Confluence.[3] This region—the Atchafalaya and Deltaic and Chenier Plains—is the newest and lowest portion of the alluvial plain. By 1828, levees in this region were continuous from New Orleans to Red River Landing (Harrison 1961, p.57) to enable navigation and protect cities and agricultural land immediately adjacent to the river. It is lower and wetter than the upriver regions, with more saltwater interaction and less extensive agricultural development, in part because farmers were not able to develop the backwater areas away from the river as they did north of the Red River. The southern two regions have a distinct history of development that shares less similarities with the study area. We will refer to the set of counties shown in figure 2 as lowland counties for the remainder of the paper. Otto's Bottomland counties represent a large subset of these lowland counties and we will note in any empirical analysis whether we examine Otto's bottomland counties or lowland counties more generally.

Identification and Mapping of Counties by Levee District

The levee organization associated with each lowland county is shown in figure 3. Each county is assigned to the primary organization within its boundaries. Many counties are marked as belonging to a levee organization that only covers a portion of the county's area. District boundary and dates were compiled by the authors from several sources. The levee organizations represent the main thrust of levee investment in the lowland counties. There are other, smaller organizations, not included in this map, that maintain levees and undertake drainage. We break these sets of non-district counties into two regions, the Bayou Bartholomew region in the southern part of the state (the longest bayou in the world), and the Cache River region starting in Missouri and covering the northern portion of Arkansas east of the main levee districts. Figure 4 plots the mean farmland value in each of the 11 major levee districts in our study region.

[3] A point of onomatological clarification is that the Mississippi River Delta (Atchafalaya and Deltaic and Chenier Plains in figure 2) differs geographically from the farther upriver lens-shaped area traditionally referred to as the Mississippi Delta (Delta in figure 2).

Figure 3: Levee Organizations

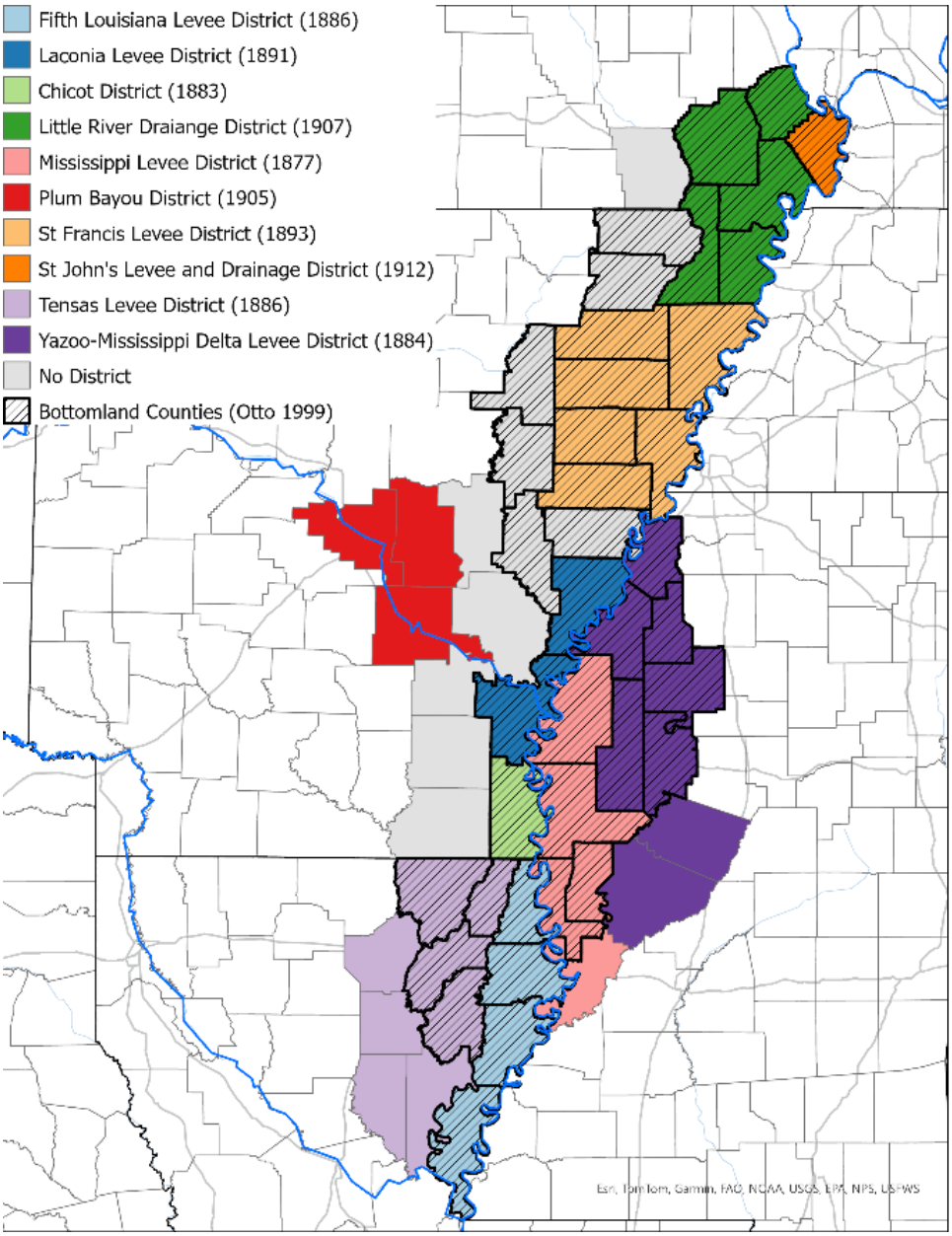
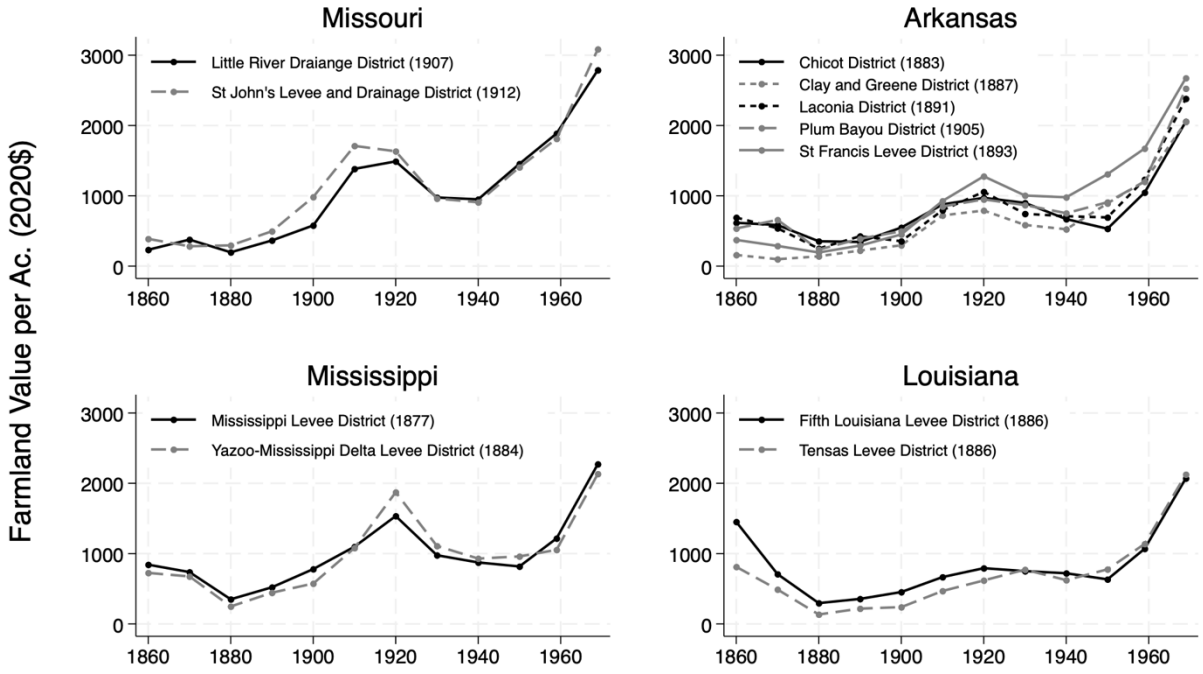


Figure 4: County Mean Farmland Value by Levee District



V. Empirical Analysis of Agricultural Development

We construct a decadal panel spanning 109 years, from 1860 to 1969, on *Improved Acres*, *Total Farm Value*, *Corn (bu.)*, and *Cotton (bls.)* from United States Censuses of Agriculture digitized by Haines et al. (2015). To accommodate changes in county boundaries over time, we scale county data to 1910 county boundaries using area-weight crosswalks constructed by Ferrara et al. (2024). We use Otto's definition of Bottomland counties as our primary geographic analysis for the empirical work. In all analysis, we then exclude other lowland counties not included in Otto's definition.

Table 1 provides summary statistics for Otto bottomland counties and others in the four states outside the Mississippi Basin in 50-year increments: 1860, 1910, and 1959. The Otto counties stay consistent after 1910 while the control counties change significantly, for reasons we have not had the time to understand.

The bottom four variables on table 1 provide a comparison of the means of four geophysical variables. Natural Soil Wetness Index (NSWI) represents the water content in the soil of a given county absent human modification (Schaetzl et al., 2009a). The NSWI is an ordinal measure of long-term soil wetness ranging from 0 to 99. Soils with a NSWI of around 60 are generally termed "somewhat poorly drained," while higher NSWI values represent more poorly drained up to 99, which is open water. The NSWI is derived from soil classification and slope and is not affected by drainage or irrigation. Land quality is measured using the Productivity Index (PI), an ordinal measure of the productivity of a soil (Schaetzl et al., 2009b). The PI uses soil taxonomy information to rank features that tend to be associated with low or high soil productivity from 1 (least productive) to 19 (most productive) To understand the distribution of topography, we construct a county-level measure of roughness: the standard deviation of 40-meter grid elevation observations in a county. As we would expect, the Otto counties are more productive, lower, and with less topographic variability (flatter) than lands elsewhere in the four states. Theses counties also have considerably wetter soils, which means farms in these counties disproportionately benefit from levee and drainage investments.

Table 1: Summary Statistics

	Counties Outside MS Region			Otto Counties		
Variable	1860	1910	1959	1860	1910	1959
Observations	161	205	139	34	39	39
Total farm value (mil 2020$)	52	194	152	108	175	412
	(53)	(222)	(89)	(109)	(91)	(246)
Land value per acre (2020$)	262	816	742	668	998	1,318
	(144)	(2,171)	(308)	(438)	(369)	(429)
Prop. of county improved	0.12	0.35	0.20	0.12	0.30	0.55
	(0.10)	(0.21)	(0.11)	(0.17)	(0.16)	(0.18)
Total number of farms	543	2,765	1,469	274	3,375	1,705
	(279)	(1,251)	(672)	(129)	(1,972)	(690)
Total acres in farms	176,020	264,800	207,251	139,895	174,315	296,868
	(104,255)	(91,533)	(86,926)	(71,551)	(57,956)	(93,349)
Bushels of corn	367,342	804,107	334,516	278,918	704,154	610,146
	(293,579)	(823,916)	(342,534)	(176,276)	(602,733)	(885,010)
Bales of cotton	8,362	5,987	6,989	17,649	19,625	69,643
	(11,975)	(7,701)	(12,405)	(24,197)	(14,606)	(48,048)
Median soil wetness index	47.96	48.26	47.86	73.59	73.67	73.67
	(4.20)	(4.38)	(4.29)	(7.59)	(7.35)	(7.35)
Median productivity index	6.84	7.54	6.38	11.00	10.95	10.95
	(3.23)	(3.50)	(2.99)	(0.35)	(0.39)	(0.39)
Median elevation (m)	162.30	179.24	129.71	53.74	52.72	52.72
	(102.81)	(105.28)	(81.83)	(24.43)	(24.57)	(24.57)
Std. dev. elevation (m)	35.83	34.34	35.13	7.76	7.09	7.09
	(27.68)	(25.17)	(28.82)	(7.10)	(6.85)	(6.85)

Absent extensive drainage and flood control, these counties had similar land values as those elsewhere in the same states in 1910, despite being more productive from a crop yield perspective. This changes by 1959, when land values in Otto counties are nearly double those elsewhere. By 1959 corn and cotton production in Otto counties greatly exceeds production in counties elsewhere in the state. The trends in means can be visualized more clearly by state in figures 4-6, which show, respectively, land value per acre, percent of a county's acres improved, and bales of cotton produced for Otto counties relative to non-Mississippi River Basin counties elsewhere in each state.

Figure 5 shows that at the time of the 1927 flood the bottomland counties of Missouri, Mississippi, and Arkansas had seen two or more decades of increasing land values. Mississippi, whose districts were created first, appears to have seen land value increases starting earlier than Arkansas and Missouri. Because there was little expectation of significant federal involvement in the management of the river, we feel fairly safe assuming that these land values increases were not in anticipation of federal investment and

Figure 6 shows that over the 110-year period the relative acreage in Otto counties increased. By 1920, Otto counties had a higher proportion of land in agriculture across all four states. In Arkansas and Mississippi, the relative development of Otto counties started around 1900. In Missouri, Otto counties were increasing in their relative development throughout the 110-year sample.

Figure 5: County Mean Land Values by Type

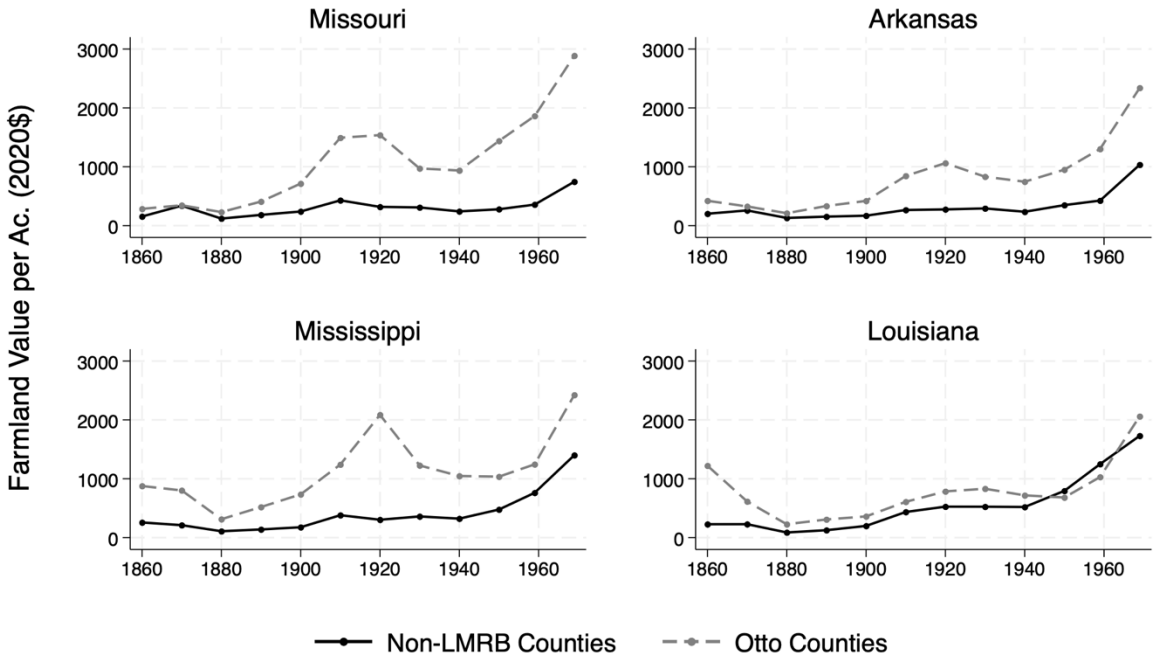
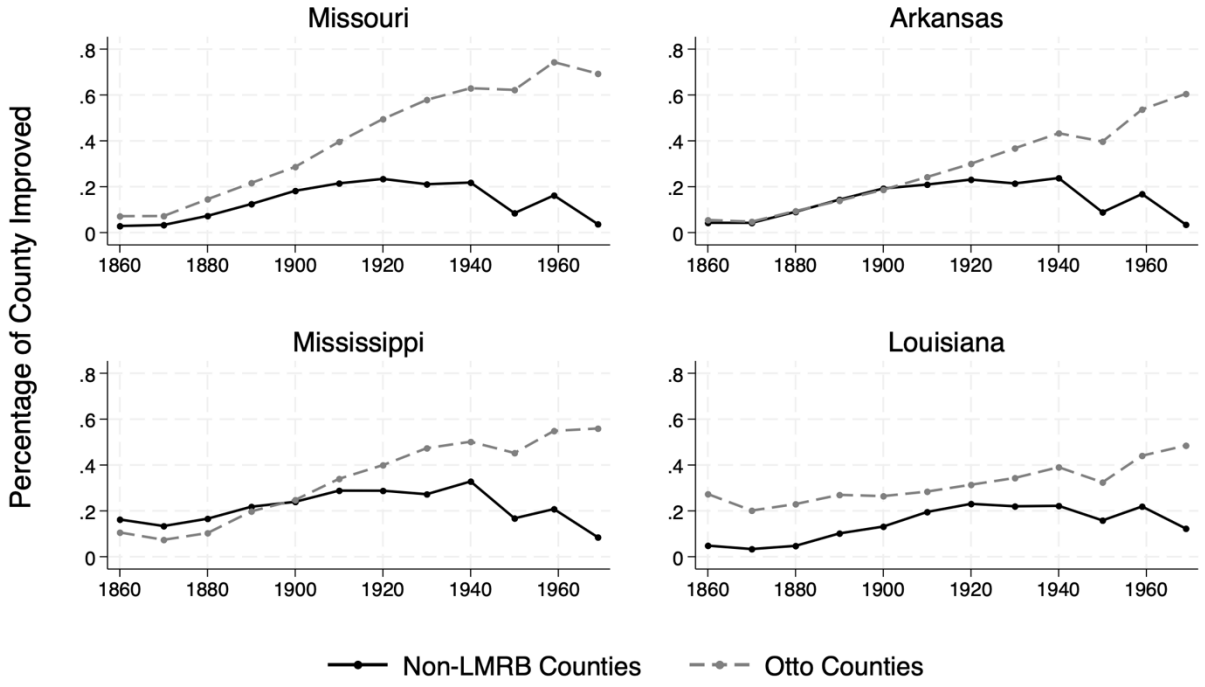


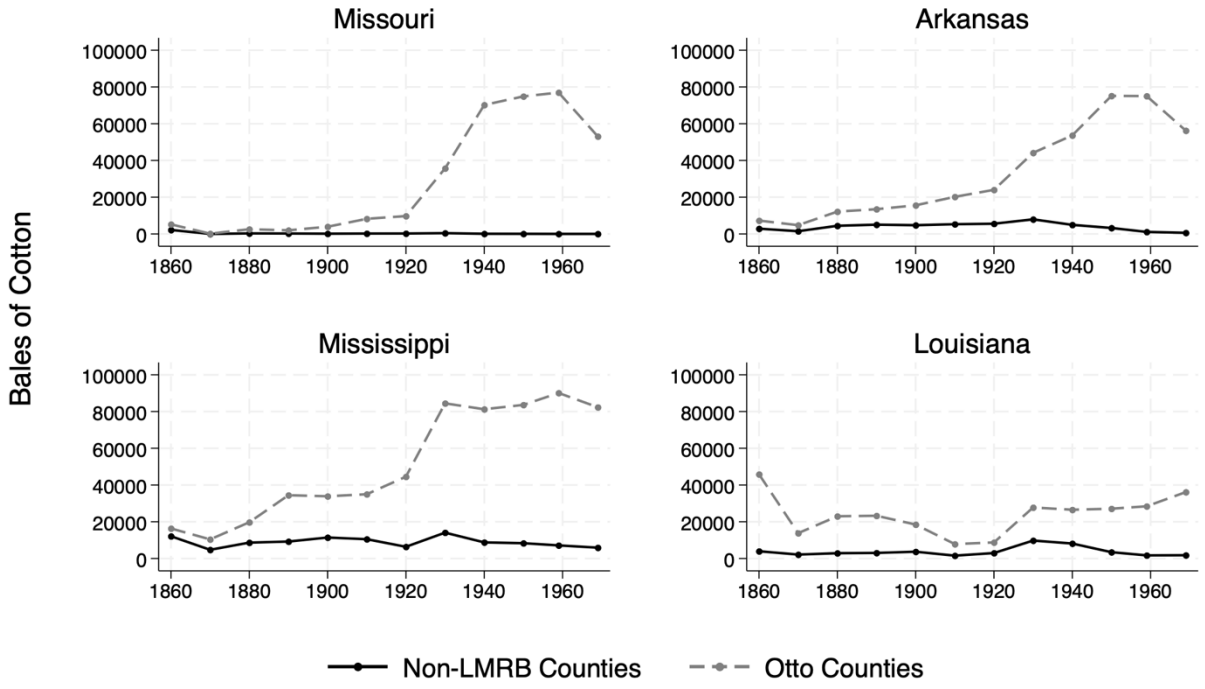
Figure 6: County Means of Percentage of Area Improved by Type



In figure 7, the path of development of cotton in the Otto counties provides key insight into the role this crop played in the devastation of the 1927 flood. In all four states, the period from 1920 to 1930 was characterized by rapid increases in cotton production. This period was characterized by volatile cotton

prices, declining by half from a peak in the early 1920s. Even with declining prices and a large flood, production increased in this decade because more, high productivity land well-suited for cotton production was becoming available due to the success of levee and drainage districts. The 1930 agricultural census was too early to see many results from the federal investment due to the 1928 Flood Control Act, and it is likely that cotton production had increased dramatically from 1920 levels by the time the flood hit in 1927. This increase put worker populations and higher field values at risk, increasing the human and economic toll of the flood relative to earlier floods.

Figure 7: County Means of Cotton Production by Type



We build on the insights from the means using a statistical approach to better control for confounding variation in the mean plots. We regress outcome variables on a set of county and state-by-year fixed effects and then interact an indicator variable for Otto counties with each year.

$$Y_{ist} = \beta^t Otto_i \cdot \tau_t + \lambda_i + \tau_{st} + \epsilon_{ist}$$

where Y_{ist} is the outcome for county *i* in state *s* in year *t* and *in an indicator variable for* a county designated as being in the bottomlands. The model includes a county fixed effect, λ_i, and τ_{st}, a state by year fixed effect. The β coefficients are the relative premium of the outcome variable in Otto counties in each year.

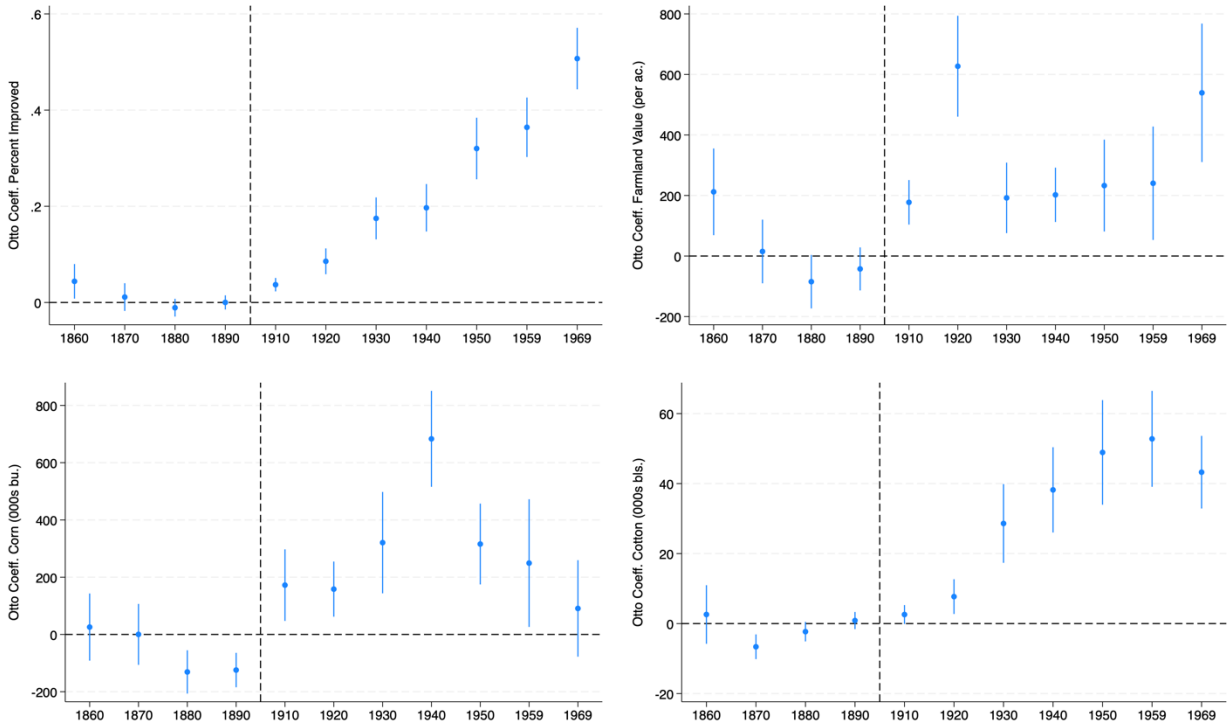
The coefficients on these Otto-year interactions are plotted in figure 8. Although there is no precise pre-district and post-district periods, all but one levee district in the Otto counties had formed prior to 1910 (that one district was St. John Levee District in Missouri formed in 1912). We therefore set the level of the Otto coefficients relative to 1900 to show the performance of Otto counties in the pre-district and post-district periods.

The top left panel of figure 8 shows the relative percentage of Otto counties in improved acres. The rapid rise in improved land after 1900 results in Otto counties having over a 50pp higher share developed relative to non-LMRB counties in the same state. This is consistent with the intensity of agricultural production we see in these counties today, which account for around one-quarter of US cotton production and two-thirds of rice production. Pre-1900 the agricultural development of these counties was similar to those in non-bottomland counties in their respective states, as indicated by coefficients statistically indistinguishable from zero at the 95% level.

By 1920, land values in bottomland counties were over $600 per acre higher (top right panel) than other farmland in the state (2020 dollars). These land value premiums did not exist in the period 1870-1890. Although the 1880 coefficient is nearly significant at the 95% level, it is negative, indicating land values may have been rising slightly prior to 1900.

The bottom panels show relative corn and cotton production across the Otto counties. Relative corn production (left panel) increases from 1890 to 1900 and continues to increase in Otto counties relative to control counties through 1940. Relative cotton production (right panel) increases slightly through 1920 before increasing rapidly between 1920 and 1930.

Figure 7: Relative Development of Otto Counties Before and After 1900



VI. Conclusion

In this paper we trace agricultural development in the lowlands of Louisiana, Arkansas, Mississippi, and Missouri to show how local districts helped create the economic environment whose destruction spurred federal intervention and eventually the hybrid system of local and federal flood and drainage control that exists today. The Great Flood of 1927 is often characterized as the turning point in battle for control of the River. The data suggest that the reality is more complex. Levee and drainage districts, formed mainly

between 1870 and 1900 spurred agricultural development after 1900. By 1920 effective local coordination in lowland counties was conveyed large agricultural land value premiums; improved farmland acreage and cotton production rose dramatically.

It was the economic rise enabled by local levee and drainage districts that created the circumstances around the 1927 flood. Large cotton plantations established in the reclaimed floodplains employed the black workers most catastrophically impacted by the flood. The economic productivity of these farms raised owner incomes, increasing their political power in shaping state and federal policy. The destruction of these farms in the 1927 flood also created a sympathetic narrative related to the broad public benefits of flood protection. While other authors have focused on 1927 as a failure of localism, we argue that it represented a new chapter. Local interests used the flood to remove local contribution requirements to flood control projects primarily benefitting local interests. Appropriations for levee construction increased by orders of magnitude over the next decade. Learning from the levee districts along the lower Mississippi, districts across its tributaries sought and received federal funding for their flood control projects. Like the LMRB districts, these local organizations owed their federal funding to their success in managing floodwaters and reclaiming swamplands via local districts.

Appendix

Table A1: County and District Definitions

Missouri			
St John's Levee and DD (1912)	*Little River DD (1907)*	*(Cache River)*	
Mississippi	Dunklin	*No district*	
	New Madrid	Butler*	
	Pemiscot		
	Scott		
	Stoddard		
Arkansas			
St Francis LD (1893)	*Laconia District (1891)*	*(Cache River)*	*(Bayou Bartholomew)*
		Clay and Greene District (1887)	*Plum Bayou District (1905)*
Craighead	Desha	Clay	Jefferson*
Crittenden	Phillips	Greene	Lonoke*
Cross		*No district*	Pulaski*
Mississippi		Arkansas*	*Chicot District (1883)*
Poinsett		Jackson	Chicot
St Francis		Lee	*No district*
		Monroe	Ashley*
		Prairie*	Drew*
		Woodruff	Lincoln*
Mississippi			
Mississippi LD (1877)	*Yazoo-Mississippi Delta LD (1884)*		
Bolivar	Coahoma		
Issaquena	Holmes*		
Sharkey	Leflore		
Washington	Quitman		
Warren*	Sunflower		
	Tallahatchie		
	Tunica		
	Yazoo*		
Louisiana			
Tensas LD (1886)	*Fifth Louisiana LD (1886)*		
Caldwell*	Concordia		
Catahoula*	East Carroll		
Franklin	Madison		
La Salle*	Tensas		
Morehouse			
Ouachita*			
Richland			
West Carroll			

Notes: *indicates counties not included in Otto (1999) Bottomland County definition.

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