Dissertations

CHICAGO, 1870 AND 1900: WEALTH, OCCUPATION, AND EDUCATION

Edward Bubnys
Illinois State University

This dissertation seeks to shed light on the reasons behind the significant skewness of wealth distribution in 19th century American cities. Several factors commonly included as affecting the distribution of wealth are the level of bequests coming from past distributions of wealth, the current income level, and the formation of human capital in offspring.

The city of Chicago was chosen as the sampling location. Two samples of city residents, one each from the 1870 and 1900 federal censuses, were constructed. The 1870 sample included 1,226 nuclear families with 6,200 individual members, about two percent of the city's near-300,000 population. The 1900 sample consisted of 624 families from several of the city's wards; 75 percent of this sample came from Wards 2 through 10.

The 1870 census included information on family wealth, occupations, and education of the children. The later census included only the latter two. Thus only estimates of the wealth distributions for 1900 could be attempted. It was one of the goals of this research to arrive at some initial conclusions of this wealth distribution from wealth, occupation, and education data from 1870.

I was particularly interested in comparing the performance of the native-born with that of each ethnic group listed. Chicago was a major destination of many 19th century immigrants from overseas. In 1870 four major ethnic groups were identifiable; Germans, Irish, English-speaking, and Scandinavian. The 1900 sample also included "new" immigrants from southern and eastern Europe.

The three explanatory factors of wealth in 1900 were the distribution of wealth in 1870, the level of occupations in 1870 and any changes by 1900, and the extent of human capital formation in 1870.

Wealth distributions were constructed for all ethnic groups, and the city as a whole, in 1870. The patterns of skewness found

were similar to those constructed by Robert Gallman [4], Lee Soltow [6], and others. The German and Irish families showed slightly less skewness, with gini coefficients of .714 and .760, respectively. Most of the others were above .80. The natives clearly dominated overall wealth ownership. They owned two-thirds of the sampled wealth, and the top 12 families owned over 40 percent of all total wealth.

The city compared quite favorably with the rest of the North of 1870 in terms of wealth ownership. Average city wealth, adjusted for direct comparability, was 40 percent higher than for the entire North. Also, a higher proportion of native and foreign-born Chicagoans owned at least minimal wealth than was true nationally. Among nonfarmers, for example, 68 percent of all Chicagoans and 65 percent of all Americans owned at least $100 in wealth of all types. The city's separate native and ethnic groups exhibited similarly favorable comparisons.

On the other side of the coin, almost two out of five city residents (38 percent) owned no wealth. The native part of the population had the lowest proportion of poor, about 23 percent, while the ethnic groups included larger percentages.

In the tradition of Alba Edwards [3] and Stephan Thernstrom [7], occupational classifications were used in the construction of ethnic-specific distributions. A specific number, the Occupational Index (OI), was assigned to each ethnic group.

The natives were most successful at securing the highest occupations. In 1870, their occupational distribution exceeded that of the English-speaking, which in turn surpassed the distributions of the Germans, Scandinavians, and Irish. The latter group of immigrants had a disproportionately large percentage of their members in semiskilled and unskilled day-laborer categories.

The overall city job distribution showed a tendency toward the blue collar (semiskilled and unskilled) part of the occupational spectrum. But the tendency seemed less severe than expected, and the 1900 index showed improvement (albeit insignificant) over that for 1870.

In a manner similar to Michael R. Haines [5], least-squares regressions were constructed on the 1870 sample to test the impact of family factors on the education of the older children. Family size and accumulated wealth were not significant factors in the schooling decision, at least at the elementary level. Occupation was significant, however. White-collar families tended to educate their children more than blue-collar types. The cost of education, both forgone and direct, were estimated for the city, and the higher costs of high school, especially in the "forgone" category, resulted in a sharp drop-off of enrollment of this level.

It was concluded that estimates of wealth distribution in 1900 must take into account the lack of data for the distributions of investment costs of and the rates of returns from education at the

micro, family level. However, A. B. Atkinson [1], J. A. Brittain [2], and others feel that the intervening factors, such as income (or a proxy such as "occupation") and education are not as important as the level of bequests, which comes from previous wealth. Thus the wealth distributions of 1870 serve as a good approximation for estimates on 1900.

REFERENCES

1. A. B. Atkinson, "The Distribution of Wealth and the Individual Life Cycle," *Oxford Economic Papers*, Vol. 23 (July 1971), pp. 239-54.

2. J. A. Brittain, "Research on the Transmission of Material Wealth," *American Economic Review*, Vol. 63 (May 1973), pp. 335-45.

3. Alba M. Edwards, "A Social-Economic Grouping of the Gainful Workers in the United States," *Journal of the American Statistical Association*, Vol. 28 (December 1933), pp. 377-87.

4. Robert Gallman, "Trends in the Size Distribution of Wealth in the Nineteenth Century: Some Speculations," in Lee Soltow, ed., *Six Papers on Size Distribution of Income and Wealth* (New York: Columbia University Press for the National Bureau of Economic Research, 1969).

5. Michael R. Haines, "Industrial Work and the Family Cycle, 1889-1890," in Paul Uselding, ed., *Research in Economic History: An Annual Compilation of Research*, Vol. 4, 1979.

6. Lee Soltow, *Men and Wealth in the United States, 1850-70* (New Haven: Yale University Press, 1975).

7. Stephan Thernstrom, *The Other Bostonians* (Cambridge: Harvard University Press, 1973).

SAVING & INVESTMENT IN MEDIEVAL EGYPT

Gladys M. Frantz
Loyola University of Chicago

Saving and investment are central to the economic growth of any economy. This study fits into the framework of the larger investigation of the emergence of capitalism at a discrete time and place in history. A by-product of the aggressive expansion of Europe was an enlarged sphere of activity for European mercantile capital. The turning point in the emergence of capitalism has

been seen as that enlarged sphere of activity. The European experience has understandably absorbed the attention of economic historians. However, an investigation of other major economic areas of the premodern world may indicate that a nonwestern economy also had the inherent capacity for growth and development.

The thesis of this study is that the economy of Egypt from 868-905 A.D. had such potential. The case of Egypt is relevant, since Egypt constituted a Great Power in the medieval Mediterranean world. An analysis of the medieval Egyptian economy will afford the opportunity to consider those factors which contributed to that potential; and it will also be possible to determine whether structural weaknesses prevented the continued evolution of the medieval Egyptian economy.

Data used in this study were collected from several kinds of sources: (1) from papyrus documents dating from the 7th into the 10th century; (2) from two 12th century administrative manuals, one, a manuscript, entitled *Procedures for the Fiscal Administration of Egypt*, and the other, *Rules for the Ministries*; and (3) narrative sources dating from the late 9th through the 14th century. The thesis presented was investigated by correlating these three bodies of evidence.

The second half of the 9th century was selected for study because that period acquired the reputation of a golden age, and because it was characterized by an unusually strong central government. Agricultural prosperity in Egypt since ancient times was dependent on a strong government which could provide both security for cultivators, and maintenance of an elaborate irrigation system.

The lowest common denominator of developmental economic theory is that the factors basic to economic growth are sufficient resources, human and natural, output, saving, and investment. Since agriculture is basic to the saving and investment potential of a preindustrial economy, it was first necessary to establish the structure of the agricultural sector. The evidence indicates a balance between land and labor. Figures for net tax receipts indicate that returns were at their highest medieval levels.

In order to establish whether saving from the agricultural sector was invested, it was then necessary to establish who gained access to agricultural saving, and how. The key institution in the administration of agriculture was the Central Tax Bureau. The lines of authority in the bureau emanated from the governor. The bureau's organization maximized tax returns, which represented a part of agricultural saving, to the central government.

The Central Tax Bureau had the power to regulate the entire agricultural sector. Total gross agricultural receipts had a reputed value of some 16 million dinars in cash and in kind (a dinar equaled 4.25 grams of gold). The government collected 20 percent of those receipts in taxes. But the government also granted access to the other 12 million dinars of gross agricultural receipts. A

large proportion of land was state land. State land was given on contract by the bureau to those who could assume liability for the agricultural taxes assessed on that land. Those who obtained contracts, granting them access to the land which produced those receipts, represented the economic elite. It was through their hands that agricultural profits flowed.

Thus, agricultural saving was available to the Central Tax Bureau, and to those to whom the bureau granted contracts. Persons with positions in the bureau, and/or those granted land contracts by the bureau, gained access to agricultural saving. Needless to say, the population of tax officials and contractors overlapped. Those who can be counted in both populations were in a position to secure their interests. Tax officials who took contracts were, thus, the functional equivalent of a European landed aristocracy.

Land contractors and tax officials, therefore, represent the most important group of potential investors; and, indeed, the population of those potential investors overlaps with the population of merchants and financiers. It has long been assumed that the economy of the Near East, since ancient times, was dependent on two things, agriculture and trade, and that trade was primarily transit trade. Hence, the structural weakness of the 9th century Egyptian economy should have been the failure to develop industry; and the failure to develop industry has traditionally been explained as the reluctance of Near Eastern elites to invest in anything other than income-producing property.

While scholars have long intimated that textiles were the mainstay of medieval commerce, the importance of the Egyptian textile industry has never been considered. Catalogs of extant Islamic textiles, as well as narrative sources indicate that Egypt was a significant linen producer in the early middle ages.

The tax structure of any economy reflects the goals set by its managers. The analysis of agricultural administration, and of the tax structure, provide inferential evidence that flax, and not grain, was the principal crop in early medieval Egypt; that is, because the tax levied on heavily regulated agricultural production was a nongraduated tax on estimated gross receipts. Grain prices during the period under study were remarkably low and grain in abundant supply. Neither is there evidence of grain export. In addition, the area under cultivation was being extended. The implication is that since tax was levied on gross agricultural receipts, the higher the value of the crop grown, the greater the returns both to the contractor and to the Tax Bureau.

Dozens of Egyptian cities were centers of linen textile manufacture; and extant fragments suggest that the number of linen-producing centers increased in the period under study. Some linen fragments bear the date of manufacture, the city in Egypt in which they were produced, and the specification that the fabric was made in a private or public factory. Nowhere is the distinction between

the two clarified and nowhere is the organization of the textile industry detailed. However, the Governor of Egypt himself considered investing in the textile industry, if he did not actually do so. Other government officials as well as contractors were also involved in the textile industry. Besides investing in the textile industry, government officials and contractors also invested in commerce. Thus, the supposed traditional reluctance of Near Eastern elites to invest in industry is not borne out.

The industrial sector, based on the manufacture of textiles and finished garments, which were Egyptian products from the ground up, represented an industry with significant and far-reaching forward and backward linkages. That industrial sector generated employment in all phases and on all levels of the economy: first, in agriculture, second in processing and production, and third, in marketing and finance. Egypt was a center of international trade, not only as a transit zone, however, but also as an exporter of locally manufactured goods.

The period of elite "capitalism" explored in this study lasted less than a century, and was altered when an alien army conquered Egypt and eliminated or replaced elements of the economic elite. Resistance to the conquest was by Egyptians who had risen to economic predominance. Half a century later, when Egypt was conquered by yet another alien army, resistance was organized by the same class, that is, landholders. The resistance was to the imposition of a new economic elite at the top of a bureaucracy organized to secure agricultural receipts. The degree to which each alien elite altered the economic system needs thorough investigation.

Abuses in the administration of agriculture under this succession of alien elites are outlined; but besides the degeneration of agricultural administration, a significant development was a shift in commercial crops, from flax to sugar. This shift entailed the displacement of the textile industry, as well as a decline in agricultural productivity. This shift in crops, due to a combination of factors, represents another area requiring investigation.

While the brief period focused on in this thesis may suggest a narrow study, the questions raised and the issues addressed had not been previously explored. It was necessary, therefore, to confront those issues for the first five centuries of Islamic Egypt, from the late 7th to the 13th century.

Most of the research presented resulted from the necessity of establishing the economy's potential for saving. Elite investment in the textile industry was documented but remains to be systematically investigated. My research will next focus on increasing the corpus of edited Arabic papyri, since these thousands of unread documents are the only unexplored avenue which may elucidate the textile industry's organization, as well as agricultural administration.

THE COMING OF SOUND TO THE AMERICAN CINEMA: A HISTORY OF THE TRANSFORMATION OF AN INDUSTRY

Douglas Gomery
University of Wisconsin-Milwaukee

The coming of sound was the most important technological change for America's dominant popular culture enterprise, the motion picture industry, during the 1920s. Talkies seemed to sweep across the United States overnight. I argue in my dissertation that the addition of sound was not the radical, chaotic break most historians have led us to believe, but instead a systematic transformation best explained using the theory of technological innovation. Here I follow the methods summarized by Frederick Scherer and Edwin Mansfield [3, pp. 346-78; and 2, pp. 99-133]. I organized the dissertation into five analytical chapters: invention and preconditions (Chapter II), innovation (Chapters III and IV), diffusion (Chapter V), and adaptation -- the workings of a bilateral oligopoly -- (Chapter VI). Moreover, I was able to uncover much heretofore unused data in the records of patent and antitrust suits, congressional investigations, the United Artists Corporation, and in numerous motion picture trade publications such as *Motion Picture News*, *Moving Picture World*, and *Variety*.

The idea of adding sound to the then silent motion pictures was not new to any of the entrepreneurs who headed the major movie firms during the 1920s. A 30-year history of unsuccessful innovation began in 1892 when Thomas A. Edison endeavored to integrate his phonograph and motion picture inventions. He failed. After 1900, on average, one new enterprise based on the movie/phonograph combination came and went each year. In 1913 Edison induced the vaudeville monopolist, Keith Albee, to install his "improved" system in its New York theaters. Despite heavy publicity and concentrated market power, this latest Edison device proved disastrous and signaled the end of this era of attempted innovation. No one had yet developed the technology to synchronize speech satisfactorily and broadcast it clearly to large theatre audiences. Research in the telephone and radio fields provided the knowledge to solve these problems; Western Electric and General Electric controlled the patents. Gradually during the early 1920s Western Electric, General Electric, and their licensees began to utilize this new technology in the phonograph and radio industries.

Prior to the coming of sound all the most profitable first-run movie theaters presented elaborate multimedia shows utilizing films, live acts, special lighting effects, orchestras and organs, all staged in 3 to 5 thousand-seat theaters. In 1925 Warner Brothers was a medium-sized movie production company looking to expand. That year, backed by Wall Street's Goldman, Sachs, Warners acquired greater production capacity, world-wide distribution outlets, and

downtown, first-run theaters. Warners innovated sound to record technologically the most popular vaudeville and musical acts and sell these relatively cheap sound shorts to first-run theaters as a substitute for live acts. Initially Warners only sought a method by which to increase sales to first-run theaters and had no desire to alter the existing formula for movie house entertainment. However, by gradually trying new forms, Warners noticed that audiences would accept more complex forms. Consequently Warners produced narrative sound shorts, then added musical sequences to silent feature films, and finally created all-sound feature films, usually musicals. Moving slowly Warners tested demand at each step, and thus minimized its own risk, and maximized long-run profits. Fox Film, also a medium-sized producer, followed, innovating its sound films via newsreels. Warners utilized the Western Electric sound-on-disc system, Fox the General Electric sound-on-film technique. Other much smaller firms, such as Vocafilm, also tried to cash in on the new market. All lacked the necessary entrepreneurial skills, production capacity and contracts for sound patents, and therefore rarely ventured past one spectacular premiere.

In 1925 three large firms dominated the US motion picture industry: Paramount, Loew's (MGM), and First National. Late in 1926 Paramount, the industry's giant, attempted to produce sound films, but immediately ran into complications. Western Electric had given Warners exclusive rights; RCA was challenging Western Electric's patent hegemony; the novelty of sound seemed to have run its course. Consequently Paramount convinced its fellow oligopolists to collude, wait, gather information, and adopt one common standard system. Market power ensured these industry giants that any delay would provide little risk, or loss of profit. One year later the three decided that talkies could be popular, and on 11 May 1928 signed with Western Electric. All the other US film companies, except RCA-created Radio-Keith-Orpheum (RKO), signed with Western Electric during the summer of 1928.

Contrary to the previous accounts describing "panic and chaos," the diffusion of sound was smooth, rapid, and very profitable for the industry's giant firms.[1] The oligopolists gradually eliminated all silent film production, and substituted sound features, newsreels, and vaudeville and comedy shorts. This changeover took about 18 months; by 1931 the silent film had become an antique. To facilitate the switchover in production the oligopolists pooled information through the Academy of Motion Pictures Arts and Sciences. Distribution changed little. In the third branch of the industry, exhibition, the vertically integrated oligopolists first added sound to their first-run theaters. Smaller, independent, subsequent-run theaters experienced drastic declines in revenue as they waited for the precious sound apparatus. Musicians who had accompanied silent films unsuccessfully tried to protect their jobs. The American Federation of Musicians instituted several

strikes; still by 1931 only a handful of America's largest theaters retained live performance and orchestras. Since the other Hollywood unions were quite weak, there were few other difficulties on the labor front.

Western Electric and the movie oligopolists prospered; merger became the order of the day. In 1929 Fox Film acquired Loew's, and Warners took over First National, and nearly joined Paramount. Successful innovation had enabled Warners and Fox to move into the oligopolistic ranks. In fact on the verge of the Great Depression, four firms (Warners, Fox-Loew's, RCA-RKO and Paramount) dominated movie production, distribution, and exhibition, as well as the radio, phonograph, music publishing, and vaudeville industries.

During the early 1930s the film industry's four giants fought the attempts of American Telephone and Telegraph, Western Electric's parent firm, to raise prices for sound equipment and service. This interaction represented the workings of a bilateral oligopoly. The film oligopolists, through their trade association, the Motion Picture Producers and Distributors Association, battled Western Electric to a standstill, and in 1935 by paying Western Electric off RCA even forced the former to lower its prices. The other significant problem was how best to export the new sound films to a world in which the English language was spoken by a minority of the potential audience. Hollywood had established world hegemony for silent films during the 1920s. Foreign governments used the coming of sound as an opportunity to revitalize the power of their own film industries. Only Germany proved strong enough. Electric giants, Siemens and Halske and AEF, had developed their own sound patents, generated a patent war with Western Electric and forced the creation of a world cartel in 1930. The German companies obtained exclusive marketing rights for Eastern Europe. Other nations such as Denmark and France unsuccessfully tried restrictive quotas and tariffs. During the late 1930s Hollywood reasserted its world-wide dominance, except in Germany.

Thus, despite all the anecdotes and legend, the coming of sound can best be understood using the theory of technological innovation. Movie entrepreneurs acted as rationally as their more famous counterparts in larger industries. With this foundation we can begin to probe more deeply into the workings of the most important popular culture form of the first 50 years of this century, and consequently more clearly understand its impact on America's economy and culture.

NOTE

1. See [1, pp. 299]. In general, historians still follow the arguments set forth by Lewis Jacobs to describe and analyze the coming of sound to the American cinema. See Chapter VII of

my dissertation for a comparison between my arguments and those of Jacobs.

REFERENCES

1. Lewis Jacobs, *The Rise of the American Film* (New York: Teachers College Press, 1939), pp. 297-301.
2. Edwin Mansfield, *The Economics of Technological Change* (New York: Norton, 1968), pp. 99-133.
3. Frederick M. Scherer, *Industrial Market Structure and Economic Performance* (Chicago: Rand McNally, 1970), pp. 346-78.

TAUNTON AND MASON: COTTON MACHINERY AND LOCOMOTIVE MANUFACTURE IN TAUNTON, MASSACHUSETTS, 1811-1861

J. W. Lozier
Bethany College

"Taunton and Mason: Cotton Machinery and Locomotive Manufacture in Taunton, Massachusetts, 1811-1861" (Ph.D. dissertation, Ohio State University, 1978) studies the technological and business practices of the machinery builders in a small industrial city 40 miles south of Boston. Three stages in the development of industrial capitalism occur in antebellum Taunton. Small-time local entrepreneurs introduced cotton manufacture and machine building to Taunton in the 1800s, but eventually limited currency forced them to turn to Boston merchants and lawyers for the capital needed to keep the Taunton factories competitive. Following the failure and departure of the Boston investors, machinist entrepreneurs conducted the machine shops.

In the first stage, factory manufacturing in Taunton was coupled with the putting-out system and conducted by local capitalists operating within a barter economy. At the beginning of the 19th century, rolling and slitting mills put out iron rods to farmers for cutting and shaping into nails. When the embargo and War of 1812 led Taunton entrepreneurs to open cotton spinning mills, yarn was similarly put out for weaving. Barter enabled the Taunton nail and cotton industries to function with a minimum of working capital. In a pattern repeated throughout the northeastern states, local farmers and townsmen bought goods at the company store, the amount being recorded in a ledger. Offsetting these purchases

were entries in the credit column for cloth, cut nails, supplies for the store, labor at the mill, or odd jobs as varied as shoeing horses or painting the store. Even private debts between two store customers were often settled by transfers on the store ledger. Manufactures and supplies from Boston and elsewhere were acquired in much the same manner, being paid for by shipments of cloth, yarn, and nails. Only when accounts had to be settled did money change hands, and then often in the form of promissory notes. Even new factory construction required little cash outlay, since the wages men earned erecting buildings and making machines were offset by purchases at the company store. In the process of building their own machines, the Taunton mills developed some new designs in the 1810s which soon interested other manufacturers. Thus the Taunton machinery building industry began modestly.

In the second and third decades of the 19th century, the second stage emerged when the adoption of power looms and the introduction of nail machines supplanted the putting-out system. The greater cloth output resulting from power weaving increased competition and capital needs for the mills. Many mill owners responded to competitive pressures by enlarging their plants to a more efficient size while others sought success through vertical integration. In 1823 Taunton nail and cloth makers Samuel Crocker and Charles Richmond decided to improve their competitive position by expanding their cotton mills and adding a bleachery and calico-printing plant. Because this large capital investment lay beyond their ability to raise capital in a barter economy, they sought funds from Crocker's political cronies, some of the leading lawyers and merchants of Boston. Hoping to duplicate the success of the Boston Manufacturing Company at Waltham, these Bostonians eagerly invested in Taunton, much as they were doing at the same time in Lowell and Chicopee.

The Boston partners attempted to apply to Taunton the Waltham-Lowell formula of managerial success by creating a large efficient integrated company: however, the small waterpower potential of Mill River forced them into operating a chain of small inefficient cotton and nail factories scattered along two miles of the stream. Repeated efforts to improve both managerial supervision and accounting controls floundered because of the crude state of the art of management at that time. By 1833 most of the Boston capitalists withdrew from Taunton, thereafter investing in northern New England where larger waterpower sites were available.

After the withdrawal of Boston capital, local Taunton mill owners turned to the manufacture of higher-value fine goods in an effort to offset limited waterpower. Because of British competition, Taunton manufacturers helped lead a search for cotton machines which would save skilled labor and power, and in the process became one of the most innovative cotton machinery builders in the nation. However, inadequate working capital caused repeated

failures until 1843 when Taunton machinist William Mason encouraged the Boston cotton goods wholesale house of James K. Mills and Company to join him in taking over the Taunton shops. It was one of the few times after the 1820s Boston capitalists financed a major antebellum manufacturing enterprise in southern New England. By then the barter system had almost disappeared and most mills could afford to buy machines from technologically sophisticated specialists rather than build their own, so William Mason and Company quickly emerged as one of the nation's largest machine builders because of its progressive lines of textile machinery.

While William Mason and Company was typical of partnerships between wealthy capitalists and mechanics rich in talent but poor in cash, it was unusual in that it formed a portion of a commission merchant's empire which evidenced partial vertical integration. James K. Mills and Company was one of five large Boston cotton drygoods commission selling houses which played a central role in creating and operating the large Lowell-type mill town developments. The partners of Mills and Company led the industrialization of Chicopee, Holyoke, and other towns. They furnished part of the capital for the factories of these towns and helped to raise the rest. By the end of the 1840s Mills and Company controlled seven of the largest New England cotton mills through its ownership of part of their stock and by exclusive contracts to sell their goods. Mills and Company partners were treasurers of these mills, and the annual corporate meeting of the mills was held on the same day in the offices of Mills and Company. Along with the cotton mills, Mills and Company controlled the waterpower companies at Chicopee and Holyoke and the cotton machinery building shops at Chicopee, Holyoke, and Taunton. Raw materials such as cotton, coal, and iron were centrally purchased by Mills and Company, and the choice of products manufactured was also dictated from Boston. Mills and Company even divided the cotton machinery market so as to avoid competition between its machine shops. Part of the working capital of these mills and shops was provided by the commission house, largely by acceptance of the factory agent's drafts. It also sold most cotton goods and some machinery, guaranteeing and disposing the commercial paper of the customers. Mills and Company may even have directed William Mason to add locomotive manufacture in 1853 to offset the wild fluctuations in demand for cotton machinery. James K. Mills even attempted to direct some of Mason's locomotive sales. In the final analysis, Mills and Company's activities exhibit characteristics of both of Louis M. Hacker's classifications of merchant capitalism and industrial capitalism (*The Triumph of American Capitalism* (New York: Simon and Schuster, 1940), pp. 248-65), suggesting that Hacker's terminology oversimplifies the nature of early manufacturing finance and management.

William Mason and Company, unlike James K. Mills and Company's cotton mills, sold most of its own goods. Cotton textiles were essentially generic goods sold to a vast number of customers who needed no contact with the manufacturer, hence the services of wholesale merchant specialists were required by the textile companies to tap this highly dispersed market. However, textile machines and locomotives were sold to a small number of customers, each with separate technical requirements. Machinery builders needed not so much to find customers as to satisfy their varied demands. Therefore, direct contact between manufacturer and user characterized the sale of textile machines and locomotives, rendering the role of Mills and Company in the marketing activities of Mason and Company much smaller than its involvement in the operation and selling practices of textile mills.

The beginning of the Taunton Locomotive Manufacturing Company in 1846 and the failure of James K. Mills and Company in 1857 ushered in the third era in Taunton's industrial capitalists. Skilled practical mechanics such as William Mason, who knew well the technical needs of their customers, owned and directed the machine shops of Taunton for the next generation. By this time banks were willing to discount manufacturers' commercial paper, freeing the manufacturers from reliance on merchant capital.

AN EMPIRICAL INVESTIGATION OF FARMERS' BEHAVIOR UNDER UNCERTAINTY: INCOME, PRICE, AND YIELD VARIABILITY FOR LATE 19TH CENTURY AMERICAN AGRICULTURE

Robert A. McGuire
Ball State University

The primary purpose of this study is to provide objective measures of the risks associated with various crops and livestock in the late 19th century and to use these estimates, inter alia, to study two important issues in American economic history -- entrepreneurial decisions in the Southern cotton economy and agrarian discontent of the last third of the 19th century.

Scholars of late-19th century agriculture have long been cognizant of the fact that the uncertainties in agriculture influence farmers' behavior -- for example, the work of L. C. Gray, Fred Shannon, Rupert Vance, and more recently William Parker (besides others) includes many references to agricultural risks. Yet

it is interesting to note that all of these scholarly works lack a substantive ingredient. The necessary empirical work upon which scholars could have founded their assertions about the magnitude of uncertainties in late 19th century agriculture and its causal role in influencing farmers' behavior has not been done. Knowledge of the actual levels of risk is, however, prerequisite to any rigorous analysis of the influence of risk on farmers' behavior. This dissertation is the first attempt at a rigorous estimation of the risks inherent in late-19th century American agriculture.

It is assumed that certain parameters (mean and variance) of the distributions of prices, yields, and incomes can be established empirically. The standard deviation of the *random* portion of each time-series is used as a measure of the absolute variability associated with various crops, cropping systems, and livestock; the standard deviation as a percentage of the mean level of each series (random variability coefficient) is used as a measure of relative variability.

The degree of *random* variability of prices, yields, and income associated with selected crops and livestock in the United States from 1866 through 1909 has been estimated. These estimates are presented on a state-by-state basis using annual observations. The estimates have been computed for all 48 states and consist of approximately 1,800 different time-series results. Random variability estimates of prices, yields per acre, and income per acre[1] associated with all crops -- wheat, corn, oats, barley, rye, buckwheat, potatoes, sweet potatoes, tame hay, tobacco, and cotton -- for which annual state data exist, have been computed. In addition, random variability estimates of numbers on farms and values per head associated with all livestock -- horses, mules, hogs, sheep, milk cows, and all cattle -- for which annual state data exist, also have been computed. The data sources used were numerous USDA statistical bulletins.

An analysis of the risks in agriculture across time must consider the question of trend removal. To do otherwise is to assume complete ignorance on the part of farmers concerning systematic movements in the variables. Only the variability of the random component of each time-series is relevant in a model of farmers' response to risk. Gerard Tintner's [1] variate difference method was the technique used to determine the portion of total variability of each series which may be viewed as random from an individual farmer's standpoint.

The variate difference method separates the systematic component of a time-series from its random component by successive finite differencing and yields a valid variance estimate of the random element. The method avoids unnecessary assumptions about the specific functional form of the systematic portion.

It was found that, in general, the price variability associated with crops was significantly greater than the price variability

associated with livestock. A comparison of the yield variability associated with crops and the variability of livestock numbers on farms leads to similar conclusions, namely, the estimates associated with crops are significantly greater than those of livestock. This is as one would expect and several reasons were given in the dissertation for these results.

Regional patterns in the magnitude of the price, yield, and income variability estimates were shown to exist. The most pronounced regional differences were seen in the price variability estimates, while the income measures had the least pronounced. In general, variability associated with each series was greatest in the less settled and newer agricultural regions of the United States.

The variability estimates associated with five major crops -- corn, cotton, hay, oats, and wheat -- grown in the leading producer states were analyzed in detail. The results have shown that, in terms of price variability, the corn estimates were by far the highest (as high as 50-60 percent in some states), while the cotton estimates ranked at the bottom (as low as 9-10 percent in nearly all cotton states). The magnitude of price variability for the other three crops, while significantly different from the cotton and corn estimates, were quite close to each other. Yield variabilities fell into two distinct groups. The most variable group consisted of wheat, corn, and cotton, while the least variable group included hay and oats. The wheat crop ranked highest in gross income variability, with cotton being the next most variable. Significantly less than both wheat and cotton were the corn and hay estimates which ranked the lowest in terms of gross income variability. Several factors were found to be responsible for these results and they are discussed in the dissertation.

The objective measures of agricultural uncertainty computed in this study were applied to an historical issue, which has been raised by Gavin Wright and Howard Kunreuther [2], concerning the cotton South. Recently, they advanced an acreage management model, which includes the influence of risk on the behavior of farmers, to explain the apparent rise in the cotton/corn output ratio in the South between 1860 and 1880. Among their several conclusions was that cotton was a riskier crop than corn. In addition, they conclude that the cotton/corn *output* ratio of 1880 implies that the cotton/corn *acreage* portfolio of 1880 indicates gambling behavior on the part of postbellum farmers.

While the annual time-series data necessary to determine the relative riskiness of cotton and corn returns for the antebellum period and the relative riskiness of the antebellum *acreage* portfolio do not exist, the estimates in this dissertation allow me to address Wright and Kunreuther's conclusions concerning cotton and corn in 1880. Using what I consider to be more appropriate measures of risk (my random variability coefficients), the results

show that for the region as a *whole*, cotton had a slightly higher level of yield variability, corn had a significantly higher level of price variability, and cotton had a moderately higher level of gross income variability. In this respect, cotton appeared to be a riskier crop; however, on a state-by-state comparison, several states had higher levels of both yield and income variability for corn than for cotton. It also was shown that cotton had one of the lowest levels of risk when compared with other major alternative crops of the South.

Using a utility of crop returns maximizing model adapted from techniques used to select investment portfolios, I also tested the Wright and Kunreuther hypothesis which states that postbellum Southern farmers *were* gambling on cotton. The results of the utility maximizing model employed -- where I was interested in the riskiness of the whole portfolio of crops -- have shown that the actual acreage choice made by postbellum Southern farmers did *not* indicate gambling behavior. I computed 45 estimates which represent farmers' attitudes toward risk indicated by their *actual* acreage decisions. All the estimates were positive, which implies an aversion to risk, and only three failed to pass a test of significance. In fact, it was argued that postbellum farmers would had to have substantially altered their crop-mix for it to imply gambling behavior.

Also investigated in the dissertation was the relationship between the levels of agrarian discontent during the last third of the 19th century. It has been suggested by several scholars that a major source of farmer discontent was agricultural uncertainty. I tested this assertion for both geographical and temporal relationships using a rank ordering process. The results were fairly satisfactory for discontent across time.

In summary, the dissertation presents a substantial amount of quantitative material on the risks inherent in late-19th century American agriculture. The ultimate goal is to have provided historians with appropriate measures of these risks upon which further empirical work can be built. As examples of the usefulness of the risk series provided by this study, the dissertation examined two important topics in American economic history -- acreage management decisions in the Southern cotton economy and agrarian discontent of the last third of the 19th century.

NOTE

1. The impossibility of obtaining accurate cost data for all crops in the 48 states necessitates the use of gross income variability per acre as my measure of fluctuations associated with crop returns. Several reasons are discussed in the dissertation concerning why the use of gross income per acre will not seriously bias the results.

REFERENCES

1. Gerhard Tintner, *The Variate Difference Method* (Bloomington, Ind.: Principia, 1940).

2. Gavin Wright and Howard Kunreuther, "Cotton, Corn, and Risk in the Nineteenth Century," *Journal of Economic History*, Vol. 35 (September 1975), pp. 526-51.