Summaries of Doctoral Dissertations

Infrastructure and Economic Growth in Spain, 1845–1935

Between the mid-nineteenth century and the outbreak of the Spanish Civil War in 1936, Spain undertook a sustained process of economic growth and structural change, but was unable to converge with the core European economies.[1] The reasons behind Spain's failure to converge have been a subject of debate among historians for decades.[2] This dissertation aims to analyze the role played by infrastructure in Spanish economic growth during that period, and tries to find out to what extent the potential shortage or inadequacy of the Spanish infrastructure endowment was one of the factors to blame for the country's nonconvergence.

The dissertation draws on recent research on the economic impact of infrastructure, and on the numerous attempts to measure that impact which have been undertaken in the wake of David Aschauer's work on the United States.[3] One of the conclusions of this literature is the idea that infrastructure has a substantial growth impact under certain circumstances, especially in the case of construction of large-scale networks based on new technologies.[4] This situation could indeed be found in Spain during the late nineteenth century, when the railroad network was established, as railroads constituted a completely new, large-scale network with far-reaching consequences. Moreover, on the basis of social saving estimates, transport historians have insisted that the role of railroads was especially important in countries such as Spain and Mexico, which lacked alternative waterway systems.[5]

As a consequence, the elasticity of productivity growth to infrastructure increases might be expected to have been relatively high in Spain during the period under analysis, and the hypothesis might be suggested that Spanish economic growth would have been higher if there had been a higher infrastructure investment effort. There is, however, an objection to this interpretation, because the high level of the social saving estimates available for Spanish railroads, on which this hypothesis is partially based, has been fiercely criticized by some historians. Critics insist that the failure of the Spanish railroad companies as private businesses constitutes powerful evidence that Spanish railroads were constructed ahead of demand, without paying attention to real transport requirements. On the basis of this hypothesis, they conclude that the economic effects of Spanish railroads were actually lower than those suggested by the social saving figures available.[6]

[1] This dissertation was completed in 2002 in the Department of Economic History at the London School of Economics and Political Science. The author would like to thank his supervisors Nicholas F. R. Crafts and Dudley Baines, examiners Leandro Prados de la Escosura and Max-Stephan Schulze, and Carles Sudrià, for invaluable support and criticism. Financial assistance from the British Council, the Economic and Social Research Council, the Bank of Spain and "La Caixa" is gratefully acknowledged.

[2] The different interpretations on this subject have been summarized, for instance, in Prados de la Escosura, "Política económica liberal," pp. 85–86.

[3] See Aschauer, "Is Public Expenditure Productive?" and a survey of this literature in Gramlich, "Infrastructure Investment."

[4] Fernald, "Roads."

[5] See, for instance, Fogel, *Railroads*, p. 31, and O'Brien, "Transport," pp. 12–13. The social savings of freight transported by Spanish railroads was estimated in the early 1980s by Gómez Mendoza, "Railways."

[6] See, for example, Tortella, "Introducción," pp. 250–53.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

These conflicting interpretations constitute a historiographical puzzle, which this dissertation tries to clarify using a two-part approach to the problem. The first part of the thesis analyzes the available information on Spanish infrastructure, and measures the response of the economy to its growth. The second part of the thesis has a narrower focus: It examines and interprets the evidence available on the Spanish railroad sector in order to provide some answers to the ongoing debate on the matter.

THE RESPONSE OF THE SPANISH ECONOMY TO THE GROWTH OF INFRASTRUCTURE

The first part of the dissertation provides yearly estimates of Spanish infrastructure investment and stock during the first long wave of the country's industrialization, which took place between the 1840s and 1935. This is the first time that such series have been produced for the Spanish economy. The assets covered by the estimates are: transport infrastructure (railroads, roads, ports, and urban transport), communication networks (telegraph and telephone), electricity distribution and hydraulic works, which accounted for 95 to 100 percent of the Spanish "economic" infrastructure during the period. The estimation is based on the analysis of public and private statistics, companies' accounts, fiscal data, and technical literature. According to the new estimates, infrastructure investment was, on average, 1.1 percent of Spanish GDP, and 14 percent of Spanish capital formation in 1850–1935. Unsurprisingly, these percentages were lower than in more developed economies. For instance, investment in infrastructure was about 2 percent of French, German, or British GDP during the same period.[7] As a consequence, the endowment of infrastructure per unit of output was lower in Spain than in more advanced countries.

Most of the investment was addressed to the railroad system, although the railroad share of total infrastructure investment decreased as time went by, due to the gradual diversification of investment, and the increasing importance of roads, ports, electricity distribution networks, and hydraulic works. The evolution of investment in infrastructure was closely linked to that of the entire economy. For instance, from a long-term perspective, the series contains no structural breaks, as is the case with most Spanish economic variables during the period.[8] On the other hand, from a short-term point of view, fluctuations in infrastructure investment followed fluctuations in production with a brief time lag, in a Wagner's Law–type process. By contrast, apart from the interwar years, infrastructure investment cycles never preceded production. This may be interpreted as evidence of the absence of backward effects of infrastructure construction in the short term, a result that is consistent with previous research on railroads and other infrastructure.[9]

The geographical distribution of Spanish infrastructure was quite stable between the mid-nineteenth century and the 1930s, and the best-endowed regions were Madrid and the Northern and Mediterranean coastal areas. The thesis includes a panel data analy-

[7] See Groote, *Infrastructure*, pp. 76 and 85.

[8] Cubel and Palafox, "La continuidad," search for the presence of structural breaks before 1936 in the series of Spanish GDP, industrial production and investment, with no positive results. Pons and Tirado, "Discontinuidades," analyze Spanish GDP and GDP per capita in 1870–1994, and the earliest structural break they find is in 1935, which is obviously associated with the impact of the Civil War.

[9] On the railroads, see Tortella, *Los orígenes*, pp. 12 and 339, and Nadal, *El fracaso*, pp. 158–65. On telecommunications, see Calvo, "El teléfono" and "Los inicios."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

sis of the geographical distribution of railroads and roads that identifies population density and economic development as the main determinants of regional infrastructure endowments. Infrastructure seems, therefore, to have been a reinforcing factor of the economic differences among the Spanish regions. However, other determinants, such as topography and, in the case of state-financed infrastructure, equity criteria were also present in the investment decisions.

On the basis of the new series, the dissertation analyzes the response of the Spanish economy to growth in infrastructure, through the estimation of a vector autoregressive system for the 1850–1935 period, made up of three variables: industrial output, investment in infrastructure, and investment in machinery and equipment. The outcomes of the estimation provide two main findings. On the one hand, as has been said, investment in infrastructure responded closely to short-term fluctuations in production, in a Wagner's Law–type process. But, on the other hand, the model is unable to capture any positive response of the Spanish economy to investment in infrastructure, either in the short or in the medium-to-long term. In the short term, this result would be consistent with the aforementioned hypothesis that Spanish infrastructure construction had very small backward linkages. In the medium and long term, the estimation results indicate that the Spanish economy did not react to the new opportunities created by infrastructure increases, or that its reaction was too slow for the model to capture it.

Therefore, according to the results of the estimation, infrastructure would not have constituted a binding constraint for Spanish economic growth during the period under study. In other words, the estimation would imply that, if infrastructure investment efforts had been more intense, Spanish economic growth would not have been any higher than it actually was, at least in the medium-to-long term. The apparent lack of response of the Spanish economy to growth in infrastructure contrasts strongly both with Spain's relative shortage of infrastructure, and with the indispensable economic role that is usually assumed for Spanish railroads. Two possible reasons might explain this surprising result. Firstly, investors' adaptation to the new opportunities created by growth in infrastructure may have been very slow, due to Spain's low level of development. Disadvantages such as the scarcity of some crucial resources (such as skilled labor), the high cost of capital, or the inadequacy of institutions may have exceeded the advantages provided by new infrastructure and discouraged private investors from creating new firms or enlarging or relocating existing ones. Secondly, the results of the estimation might also reflect the country's geography and the extremely low population density of some regions. Obviously, Spanish investment in infrastructure was not limited to the most developed and populated areas of the country, but was spread all over the territory. This was because new infrastructure consisted, to a great extent, of national systems aimed at integrating the whole economy. In addition, investment in infrastructure was not only an instrument of economic growth, but performed other essential social and political functions. As a consequence, a substantial share of investment in infrastructure was situated in sparsely populated areas, where it had quite low economic returns.

THE ECONOMIC IMPACT OF SPANISH RAILROADS

In the second part of the dissertation, I try to reconcile the outcomes of the first chapters with the traditional idea that Spanish railroads were "indispensable" for economic growth, a hypothesis that was originally based on the high level of the social savings they provided. To this end, I re-calculate the social savings of railroad freight

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

transport on the basis of the most recently available evidence, and obtain much lower figures than Antonio Gómez Mendoza's previous estimates. Concretely, under the most likely assumptions, social savings are reduced from 7.5 to 2.5 percent of GDP in 1878, and from around 20 to approximately 12 percent of GDP in 1912. For 1912 these social savings are still very high, but in the case of 1878 they are comparable to figures for advanced countries with well-developed water transport systems. This striking result may only be explained by the low share of the Spanish GDP that railroad transport accounted for until the end of the nineteenth century. Due to their initial low economic weight, Spanish railroads took an extremely long time to produce their maximum potential impact. This would be consistent with the conclusions of the econometric analysis that is carried out in the first part of the thesis.

A lower level of social savings, however, does not necessarily confirm some historians' hypothesis of overinvestment in the Spanish railroad system. In fact, an estimation of the social rate of return of the Spanish railroads provides a relatively high figure even for 1878, despite the exclusion of the externalities of the railroad system from the calculation. Moreover, although those externalities are impossible to quantify, they seem to have been very relevant in Spain. Spanish railroads allowed a profound geographical re-organization of economic activity, which must have provoked substantial productivity improvements through the exploitation of scale, specialization, and agglomeration economies.[10]

Despite the evidence on the relatively high social returns of the Spanish railroads, there is still ground for pessimism due to the serious financial problems that the railroad companies suffered throughout their lifetime. This dissertation shows, however, that the private returns of the Spanish railroad companies were not particularly low by European standards. They were, of course, lower than the opportunity cost of the capital invested. But this situation must be understood in the context of the state's involvement in the system. The importance of the railroads for the country, not only on economic but also on social and political grounds, led the Spanish State to encourage their construction up to a level at which they could not be profitable.[11] This was especially true of a number of peripheral lines that were opened after the first railroad mania of 1855–1866, which carried much less traffic than the core lines that were constructed before 1866. Nevertheless, such a situation was not exclusive to Spain, as many European states tried to stimulate the extension of railroads throughout their entire territory. This was accompanied by the regulation of the system in order to guarantee service standards and returns on private capital.[12] The Spanish state, however, appears to have lacked the necessary resources to perform these functions, and would have had to resort to the "indirect taxation" of railroads users and shareholders in order to undertake them.

CONCLUSIONS

The dissertation concludes that the Spanish economy responded very slowly to the new opportunities created by growth in infrastructure, due to both geography and the level of economic development. Construction costs were high in Spain, and private

[10] This process has been described in Tirado, Paluzié and Pons, "Economic Integration."

[11] On the State's willingness to expand the network to the whole Spanish territory, which was patent from the 1860s onwards, see especially Mateo del Peral, "Los orígenes," pp. 90–131.

[12] See, for instance, Leclerq, "L'Etat," pp. 53–54; Girard, "Transport," p. 238; and Andersson-Skog, "National Patterns," p. 37.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

and social returns were slow to rise. Therefore, as far as the initial question of the dissertation is concerned, it cannot be stated that higher investment in infrastructure would have produced more growth and convergence in Spain, at least in the medium-to-long term. On the contrary, some of the investment that was actually undertaken might have been redundant from a purely efficiency point of view, although not when viewed from the perspective of equity and welfare in peripheral regions.

ALFONSO HERRANZ-LONCÁN, *University of Barcelona*

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Public Finance and Economic Development in a Historical Institutional Perspective: China 1840–1911

One of the central themes of modern Chinese economic history is the puzzle of "China's premodern success and its downfall after the Opium War."[1,2] In 1644 Manchu tribes from northeast China founded the Qing Dynasty upon the ruins of the civil war that ended the Ming Dynasty (1368–1644). Despite the initial popular resistance to its rule as an alien minority, the dynasty quickly recovered. For the next two centuries, the economy steadily expanded, China solidified her regional dominance by assuming suzerainty over neighboring states and regions, and the dynasty strengthened its imperial power. Equally well known, however, is the swift economic stagnation (and decline relative to the world economy) and political disintegration of China in the decades following the First Opium War (1840–1842).[3] The Opium War, as the first open military conflict with the industrializing West, was the watershed of modern Chinese history. A new geopolitical reality, symbolized by the ensuing military defeats and the resulting treaties, brought about significant macroeconomic shocks and posed unprecedented challenges for the Qing government. In particular, fiscal stability and adequacy in the earlier periods gave way to modest revenue growth that fell short of the government expenditure levels that a modernizing economy required. Not only did overall economic growth stagnate, but sustainable, large-scale modern economic growth was also absent—mechanized industrial production, modern infrastructures (such as the railway and telegraph) and economic institutions (such as modern commercial banking) developed at a very slow pace.[4] External crises and economic stagna-

[1] This dissertation was completed in 2003 at the Department of Economics, Stanford University, under the supervision of Avner Greif, Gavin Wright, and Yingyi Qian.

[2] Deng, "Critical Survey."

[3] Parts of China, for instance the Lower Yangzi Delta, continued to grow during this period at a rate probably comparable to the average rate of growth in Europe (see Pomeranz, *Great Divergence*). However, the Chinese economy as a whole lagged behind countries that did industrialize.

[4] According to Jones et al., *Coming Full Circle*, in 1912 China, there existed only 353 mechanized factories, alongside thousands of small handicraft workshops. Less than 1 percent of enterprises employed more than 500 people.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

tion bred further internal political strife—domestic rebellions reached an unprecedented scale and corruption became widespread. In 1911 the dynasty collapsed under mounting fiscal and political pressures.

The relevant historical literature offers two divergent views on China's failure to *keep up* much less *catch up* in the global race of industrial development: the "foreign-intervention" approach that blames the West's gunboat diplomacy and colonial economic exploitations, and the "domestic-limitation" approach, which focuses on China's internal growth-inhibiting institutions.[5] The criticism of the "foreign-intervention" approach lies in the mixed impact that the West's military and economic superiority had on China's society and economy.[6] The domestic-limitation approach is inconsistent with the fact that the supposedly growth-inhibiting institutions did not prevent China from enjoying tremendous economic and political successes before the mid-nineteenth century. What, then, had impeded rapid, sustainable, and large-scale industrial development in China during the late nineteenth century, despite of its "premodern success"?

In this dissertation, I develop the hypothesis that the contrasting political and economic outcomes in pre- and post-1840 China reflect underlying institutions that both formed the foundation of the Qing's early success, and paradoxically, contributed to its eventual demise. To examine these institutions, I adopt a game-theoretical approach. My methodology differs from standard political economy analysis in that, instead of taking the political order of the pre-1840 China as given, I derive early-nineteenth-century China's political stability, economic prosperity, and fiscal adequacy as equilibrium outcomes that rested on the inflexibility of coordinating beliefs. When compounded with drastic exogenous shocks, the resulting institutional inflexibilities limited the regime's ability to adapt to the post-1840 world. I further articulate the impact of such institutional inflexibilities as manifested in the fiscal changes, guild development patterns, and the speed and scope of China's economic development during this period.

In chapter 1, I focus on the fiscal aspect of the aforementioned "puzzle" and pose the question: Why did China's system of public finance, which had previously enjoyed a long period of stability and sustainability, fail rather "unexpectedly" in the late nineteenth century? To address this question, I start by developing a context-specific model. One part of the model is a game of political pre-emption in which, at the equilibrium, the sovereign offers an attractive career option with a sufficiently high payoff and thus diverts local elites from leading political opposition. The other part of the model is a game of taxation in which a perfect equilibrium prevails where the threat of third-party enforcement triggered by taxpayers' collective rioting deters tax agents from overtaxing. By linking the two games together, I formulate the hypothesis that taxation during the Qing, especially land tax, functioned as a double-edged sword—it mobilized resources for the state as well as encouraged rent seeking by the local elite that pre-empted political opposition. By entering the bureaucracy, local elite became tax officials whose fiscal discretion allowed them to profit from retained extralegal tax proceeds. Through a highly meritocratic selection process that emphasized classical learning, the expected economic gains from becoming a bureaucrat acted as an important incentive that diverted the ex ante human capital investment by the local elite away from subversive activities. At the same time, despite the absence of formal institutions constraining the state, shared beliefs coordinated rural taxpayers, whose threat of collective action protected their property rights against potential fiscal predation by

[5] Thomas, *Foreign Intervention*

[6] For instance, see Rawski, "Chinese Dominance"; and Eastman, *Family, Fields, and Ancestors*.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

tax agents. Secure property rights in turn, provided the basis for long-term fiscal viability for the state and sustained economic growth.

The centrality of entrenched cultural beliefs that sustained such an equilibrium also implies institutionalized inflexibilities that limited the Qing's fiscal discretion. To evaluate this thesis, I use insights from the model to suggest how these beliefs would affect the formulation of government fiscal policies in response to exogenous shocks, and what their economic repercussions would be. The set of hypothesized fiscal policy reactions and their impact correspond to some of the major fiscal changes occurring in the late Qing period, namely, the Qing's reluctance to increase land tax despite the apparent administrative ease of doing so, its puzzling preference for taxing commerce for additional revenue, and the egregious violations of property rights that resulted. By empirically substantiating these hypotheses, I am able to explicitly capture the source of the institutional inflexibilities that restricted China's fiscal adaptability, and in particular, the ability to raise substantially more tax revenues.

In chapter 2, I further study the pattern of guild growth in the late Qing, which include the acceleration of guild formation, the strengthening of internal guild power, and the expansion of guilds' external influence, in light of the above theses. The analysis developed in chapter 1 adds a crucial fiscal dimension that much of the prior work on Chinese guilds has failed to capture. Building on earlier sociological and historical studies on Chinese guilds, I embed this pattern of guild development in the fiscal context of the late Qing, where the initial lack of coordinating beliefs made commerce a preferred source of government revenue, and consequently, merchants an easier target of property-rights abuse by tax officials.[7] From this basis, I demonstrate how guilds came to farm the collection of the particularly egregious *likin* tax (a domestic transit tax instituted in mid-nineteenth century) by resorting to their ability to coordinate and enforce the tax-farming agreement and restrain *likin* officials' fiscal predation. Effective internal monitoring, professional guild management, and the ability to enforce intraguild compliance via multilateral reputation mechanisms allowed member merchants to overcome their organizational deficiencies. Consequently, tax farming by guilds effectively protected merchants' property rights on the one hand and enabled a viable commercial taxation for the state and local officials on the other. In turn, the success and wide adoption of tax farming by guilds enhanced the value of guild membership, strengthened guilds' internal cohesion, and fueled their growth in size, number, and stature. Interpreting the prominence of late Qing guilds as a result of the self-enforcing nature of this tax-farming arrangement helps us appreciate some peculiar aspects of guild growth in the late Qing that have not been successfully addressed in the literature—open, universal membership; tendency for guilds to merge and form supraguild organizations; and provision of public goods to communities beyond their membership. The consistency between these empirical observations and the guilds' ability to leverage their organizational capabilities to sustain tax farming brings additional support to my hypothesis.

Finally, in chapter 3, I investigate the implications of late Qing's fiscal stagnation on China's economic development during this period. I begin by proposing that the lack of fiscal means was a major impediment to China's industrialization. I then explore its national security implications and, hence, the public-good nature of industrial development in this historical context and establish the causal relationship between the fiscal means and the success of industrial development in the late Qing. In addition, I study how such exogenous geopolitical events as the Opium War created systemic macroeconomic risks,

[7] See Burgess, *Guilds of Peking*; Golas, "Early Ch'ing Guilds"; and Liu, "Chinese Merchant Guilds."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

which, compounded with capital market imperfections, severely constrained the amount of financial intermediation towards China's nascent industrial sector. Furthermore, I examine how the anemic government support in infrastructure and technology transfer limited China's ability to capitalize on the dynamic possibilities unleashed by new technologies and cross-sector linkages. By juxtaposing nineteenth-century China with contemporary Japan, I further suggest that if the Qing had been given sufficient fiscal resources, the paths of the two economies might have been much more similar.

MU Y. LI, *Stanford Graduate School of Business*

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Determinants of Innovation Evidence from 19th Century World Fairs

Patent laws are designed to create the optimal incentives for innovation, but we know little about how exactly this works.[1] The need to better understand the effects of patent laws is particularly urgent today, as industrialized countries lobby to introduce and strengthen patent laws in developing countries around the world. Although it is difficult to predict the results of such changes, historical data from the mid-nineteenth century may hold important lessons for patent policies today. The nineteenth century is an ideal period to study the effects of patent laws: Mid-nineteenth-century patent laws were adopted in a relatively ad-hoc manner, depending on legal traditions rather

[1] This dissertation was completed in the Department of Economics at University of California, Berkeley in 2002 under the supervision of Christina Romer.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

than economic considerations. Large differences in patent systems existed across countries, and patentees depended on domestic patent laws because patenting abroad was prohibitively expensive and almost all countries discriminated heavily against foreign patentees. As a result, domestic patent laws played a more important role in creating incentives for domestic invention than at any later stage in history.

This dissertation introduces a new data set that reveals the effects of patent laws on innovation across a wide range of countries in 1851 and 1876. I have constructed internationally comparable data from the exhibition catalogues for two nineteenth-century world fairs on technology: the Crystal Palace Exhibition in London in 1851 and the Centennial Exhibition in Philadelphia in 1876. The Crystal Palace was the most popular event of its age, and it became the first in a long series of world fairs, which allowed inventors and firms to exchange innovations across countries. More than six million visitors attended the Crystal Palace, and almost ten million visitors came to the Centennial Exhibition. For the Crystal Palace fair I have counted and classified 13,876 exhibits in 30 industries of use. For the Centennial I have counted and classified more than 19,076 exhibits in 344 industries.

A typical entry in the exhibition catalogue begins with the exhibitor's name, address, and country of origin, followed by a brief description of the innovation, as well as some information about the exhibitor's occupation and state of patent protection. From these records, I have constructed data for 32,952 innovations, their industry of use, and country of origin. I also determine whether exhibitors held a patent or not, distinguishing foreign from domestic patents. Information on domestic patents allows me to calculate proxies for patenting rates across industries. In addition, I construct measures for the quality of innovations based on awards for inventiveness. These awards ranked all exhibits according to their novelty and usefulness, and granted prizes to the most innovative exhibits.

Exhibition data are particularly useful for studying the effects of patent laws on innovation because they measure economically useful innovation in a way that is independent of changes in patent laws. As employed here, economically useful *innovation*—the commercial introduction of new or improved products and processes—is distinct from *invention*—the conception of such products and processes. Exhibition data measure economically useful innovations, whereas patent data count those inventions which inventors chose to patent. This distinction matters because only a fraction of innovations are patented and not all patents develop into economically useful innovations. Historical records bear witness that national committees selected their most innovative products to be exhibited at the fairs. Participation was competitive and a uniform system of selection admitted less than one-third of all applicants to exhibit at the fairs.[2] Most importantly, exhibition data measure innovation independently from differences in domestic patent laws. Exhibitors displayed innovations regardless of whether they could be patented at home, including many innovations that they had chosen not to patent.

Exhibition data allow me to compare innovative activity across countries with and without patents. This represents an empirical advance over the theoretical literature on patent laws, which simply assumes that the existence of patent laws raises levels of innovation. Without exhibition data, empirical studies of nineteenth-century patent laws relied on patent data, but these studies cannot identify whether the existence of patents raised levels of innovation. Equally important, they cannot identify whether the nature of innovation differs in countries without patent laws. Nineteenth-century exhibition data allow me to analyze these questions empirically.

[2] Berichterstattungs-Kimmission, *Amtlicher Bericht*, vols. 1–3; Cole, "International Results"; and Curti, "America."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

Previous studies of innovation have focused on the number of innovations that are created in an economy. Among the key predictions in this literature, such as those of William Nordhaus, Paul Klemperer, and Richard Gilbert and Carl Shapiro, is that strong patent laws raise the number of innovations that are made within a country.[3] According to this argument, countries without patent laws should display few novel technologies. In contrast, the exhibition data show that countries without patent laws brought many important innovations to the fairs. Mid-nineteenth-century Switzerland, for example, had the second highest number of exhibits per capita among all countries that visited the Crystal Palace. Moreover, exhibits from countries without patent laws received disproportionate shares of medals for outstanding innovations. Countries without patent laws were exceptionally inventive in a small number of industries: food processing and the manufacture of scientific instruments.

Previous studies have ignored the effects of patent laws on the direction of innovation, although this may be a key determinant of economic growth. Simon Kuznets observes that technological innovation concentrates in a few fields at any given time; he argues that such concentrations determine countries' potential for economic growth.[4] Economic history supports these claims: Germany's focus on chemical innovations is widely understood to have enabled Germany to replace Britain as the industrial leader in the late nineteenth century. Nathan Rosenberg argues that the United States overtook Europe at the beginning of the twentieth century because of its concentration on labor-saving innovations.[5]

This dissertation sets out to analyze the causes of such concentrations of innovative activity. More specifically, it asks the questions whether and how patent laws create or intensify a country's tendency to focus innovation in certain industries. A simple model predicts that weak patent laws encourage innovation in industries where alternative methods to protect intellectual property are particularly effective relative to patent protection. By this argument, weak patent laws may help to create differences in technological comparative advantage among industrialized countries and their followers.

Previous empirical analyses of the effects of patent laws had to rely almost exclusively on patent counts, despite some obvious limitations of these data.[6] Economic research benefits from data on mid-nineteenth-century innovations, because this period is uniquely suited to study the effects of patent laws. At the time of the Crystal Palace Exhibition in 1851, most governments had adopted patent laws but they had not yet begun to modify these laws in response to pressures from domestic interest groups. Differences in domestic patent laws were large and mattered greatly to domestic inventors, because international treaties had not yet begun to harmonize patent laws or to protect the rights of foreign patentees. However, nineteenth-century patent data are available for less than a handful of countries. Even within these countries, they omit entire industries because patent laws did not extend to all sectors of the economy. In addition, many important nineteenth-century patents, such as various improvements in the steam engine, had to be dropped from patent counts because they could not be assigned to a specific industry. Patented inventions vary greatly in their commercial viability and quality; the quality of innovations is difficult to proxy based on patent data.

[3] Nordhaus, "Economic Theory"; Klemperer, "How Broad Should the Scope"; and Gilbert and Shapiro, "Optimal Patent Length."

[4] Kuznets, "Meaning."

[5] Rosenberg, *Technology*.

[6] See Gilfillan, "Inventiveness," for an early use of patent data in international comparisons. Schmookler, *Invention* and "Economic Sources"; and Sokoloff, "Inventive Activity," employ U.S. patents to show that invention responds to profit incentives.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

Most importantly, the way in which patents measure innovation varies with changes in patent laws. The definition of what constitutes a patentable invention varies across countries. In the United States only first and true inventors are allowed to patent; in France first importers have equal access to exclusive patent rights.[7] Differences in the length of patent grants, in patent costs, and in the security of patent rights create further differences in what inventors choose to patent.

Exhibition data offer a complement to nineteenth-century patent data that addresses many of the concerns about patent data. Uniform rules of selecting exhibits ensure that exhibits are comparable across countries, regardless of domestic patent laws. Exhibition data include information on three patentless countries: Switzerland and Denmark in 1851 and Switzerland and the Netherlands in 1876. No other data are available to study early innovation in these countries. Exhibition data cover innovations in all industries, including those that were excluded from the patent system. Awards to the most innovative and useful exhibits provide a measure for the quality of innovation. References to patents in the exhibition data allow me to distinguish patented innovations from those that are protected by alternative mechanisms.

The analysis of exhibition data suggests that patent laws may be an important factor in determining the direction of innovative activity. Exhibition data show that countries without patents share an exceptionally strong focus on innovations in two industries: scientific instruments and food processing. At the Crystal Palace, every fourth exhibit from a country without patent laws is a scientific instrument, whereas no more than one-seventh of other countries' innovations belong to this category. At the same time, the patentless countries have significantly smaller shares of innovation in machinery, especially in machinery for manufacturing and agriculture. After the Netherlands abolished her patent system in 1869 for political reasons, the share of Dutch innovations that were devoted to food processing increased from 11 to 37 percent.

Proxies for differences in the propensity to patent across industries, which I have constructed from the Crystal Palace data, document that innovators' propensity to patent varies strongly across industries. Exhibition data show that innovations in scientific instruments and food processing are less likely to be patented, especially compared to innovations in machinery. These proxies indicate that only 10 percent of exhibits in scientific instruments, but close to 40 percent of exhibits in manufacturing machinery are patented. Nineteenth-century sources report that secrecy was particularly effective at protecting innovations in scientific instruments and in food processing. On the other hand, patenting was essential to protect and motivate innovations in machinery, especially for large-scale manufacturing.

I use these differences in patenting rates across industries in combination with detailed information on the geographic location of exhibitors to examine whether patent laws fulfilled their second major goal, the diffusion of technical knowledge within countries. An analysis of geographic clustering and the patenting behavior of 4,465 British exhibitors at the Crystal Palace suggests that patents facilitated the spread of new ideas. Innovations in industries with high patenting rates were geographically dispersed, whereas innovations in industries with low patenting rates exhibited strong patterns of geographic concentration, not only across counties, but even within cities. These results suggest that patent laws may not only influence the direction of innovation, but also its geography.

PETRA MOSER, *MIT Sloan*

[7] See Coryton, *Treatise*, pp. 235–64.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

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The Economic Progress of American Black Workers in a Period of Crisis and Change, 1916–1950

The first half of the twentieth century was a period of major crisis and change.[1] The Unites States' economy experienced unprecedented business cycle activity as the na-

[1] This dissertation was completed at the University of Arizona under the supervision of Price V. Fishback.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

tion faced two world wars and the Great Depression. Strikes were relatively frequent, turnover rates were high, and turbulence and institutional change marked the growth of organized labor. The racial landscape of northern labor markets was altered as thousands of black workers migrated north out of the South. In this thesis the interplay between industrial racial hiring practices, unionization, institutional change and competition among unions, and business cycle activity in the North is explored. The racial industrial hiring practices of northern employers were partly a function of the crises and institutional changes that characterize the interwar period. Further, the unique experience of black workers with respect to these crises and changes was in part driven by differences in how workers were employed across industry.

Since emancipation, black workers have been able to secure substantial income gains relative to the fast growing incomes of white workers.[2] Between 1870 and 1940, the ratio of black-to-white earnings grew from 0.25 to about 0.50 and has grown to about 0.70 today.[3] Economists debating the source of this progress have either contended that the relative gains were almost exclusively the result of relative gains in human capital accumulation or have emphasized the episodic relative progress in black earnings that coincided with the passage of civil rights laws in the 1960s.[4] Gunnar Myrdal, writing in the early 1940s, was pessimistic about the future of black economic progress.[5] However, the 1940s turned out to be a period of extraordinary relative gains for black workers.[6] The period between the Civil War and the 1930s was also a period of significant gains. In 1870, soon after the end of slavery, black workers had next to no physical assets and an illiteracy rate of about 80 percent. By 1940 their earnings had advanced significantly relative to that of whites and their illiteracy rate had dropped to 12 percent.[7] Myrdal's pessimistic outlook was probably in part a function of the fact that the decade previous to the time in which he was writing "was the only decade between 1890–1980 in which the ratio of black-to-white average earnings actually declined."[8]

The episodic advance of black workers between 1910 and 1950 was driven substantially by the crises and institutional changes characterizing this turbulent period and may have had little to do with government antidiscrimination policy. As thousands of southern black workers made their way north in search of economic progress, the U.S. economy experienced two world wars that appear to have aided the progress of black workers and the Great Depression that retarded it. Union movements, often anathema to the progress of black workers, experienced their own ups and downs. Among nonagricultural workers, union density rose from about 10 percent in 1915 to its highest private-sector level ever of about 35 percent in 1945.[9] Not all unionization slowed black progress. Unions affiliated with the industrial unions of the Congress of Indus-

[2] Higgs, "Black Progress."

[3] Fishback, "Operations"; and Heckman, Lyons, and Todd, "Understanding Black-White Wage Differentials."

[4] The human capital argument is primarily associated with the work of Smith, "Race"; and Smith and Welch, "Black Economic Progress." The argument that black economic progress has been not only a function of human capital accumulation but also has advanced episodically due to changes in civil rights legislation was advanced by Heckman and Payner, "Determining the Impact"; and Donohue and Heckman, "Continuous versus Episodic Change."

[5] Myrdal, *American Dilemma*, pp. 205–09, 423–26.

[6] Maloney, "Wage Compression"; and Margo, "Explaining Black-White Wage Convergence," p. 471.

[7] Higgs, "Black Progress."

[8] Sundstrom, "Last Hired."

[9] Freeman, "Spurts," p. 266.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

trial Organizations (CIO), which openly competed with the American Federation of Labor (AFL) affiliates in the late 1930s and 1940s, often actively supported the recruitment of black workers.[10]

Though much has been learned of black economic progress during the interwar period, due to data limitations, the experience of black workers with respect to the crises and changes of the period remains largely an untold story. Much has been learned about the Great Migration of black workers from the South into the urban North, the extraordinary gains of black workers during the 1940s, and the disproportionately high unemployment suffered by black workers during the Great Depression.[11] Much has also been learned of black workers' experience with occupational and industrial segregation in the North.[12] The research presented in this dissertation fills an important gap in the economic history of black Americans by exploring the interplay between industrial racial hiring practices, unionization, institutional change and competition among unions, and business cycle activity.

The attention given to black economic progress during the interwar period by cliometricians, though significant, has been limited by the availability of data. The Integrated Public Use Microdata Series (IPUMS) furnishes the researcher with race-specific information on workers' earnings, occupation, industry, and human capital characteristics for the years 1910, 1920, 1940, and 1950.[13] The fact that the data are only decennial, (except for the 20-year jump between 1920 and 1940), limits the cliometrician's ability to assess the effects of business cycle activity or political changes. Further, the IPUMS furnish no information on unionization. In this study, these obstacles have been bridged by the use of state-level reports containing race- and sex-specific industry annual employment data for every year from1916 to 1950 in the state of Pennsylvania. The data were reported at a very fine level of industry classification, containing about 300 classifications among the manufacturing and mining sector. Data on union densities, Fair Employment Practice Committee (FEPC) cases, and workers' compensation have been collected and matched with the industry race-specific employment data.

Pennsylvania serves as an ideal setting in which to explore the impacts of the crises and changes of the interwar period on the economic welfare of black workers. During the Great Migration of the First World War, when many northern employers first hired black workers, Pennsylvania experienced a relatively large influx of black workers from the South. Between 1910 and 1920 Pennsylvania's southern-born black population increased by 72 percent, and in the next decade the state experienced an additional 59 percent increase. During this period Pennsylvania had the highest black population of any of the northern states.[14] Further, Pennsylvania had relatively high rates of unionization and was a substantial contributor to war production during the two world wars.

[10] Dickerson, *Out of the Crucible*, chaps. 6–7; Murray, *Negro Handbook*, pp. 132–33; and Weaver, "Recent Events."

[11] On the Great Migration, see Collins, "African-American Economic Mobility" and "When the Tide"; and Margo, "Effect." On the gains of black workers during the 1940s, see Collins, "Race"; Maloney, "Wage Compression"; and Margo, "Explaining Black-White Wage Convergence." On unemployment suffered by black workers during the Great Depression see, Sundstrom, "Down or Out" and "Last Hired."

[12] Maloney and Whatley, "Making the Effort"; Maloney, "Degrees"; Sundstrom, "Color Line"; and Whatley, "Getting a Foot."

[13] Ruggles, Sobek, et al., *Integrated Public Use Microdata Series.*

[14] U.S. Department of Commerce, *Negroes*, p. 25.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

Robert Higgs and others have shown that unskilled black and white workers performing the same job in a given industry were generally paid the same wage.[15] This is strong evidence that competitive market forces mitigate black-white wage differentials among comparable unskilled workers. Other scholars have argued that it is often the case that black and white workers do not compete for the same jobs due to occupational or industrial segregation.[16] This segregation attenuates the beneficial effects of competitive market forces. Gavin Wright found that industrial segregation existed in the South, that it persisted over time relatively unchanged, and that it had a significantly negative impact on black workers over time.[17]

Among manufacturing and mining industries in Pennsylvania, there was a significant difference in how black and white workers were distributed across industry immediately after World War I (chapter 2). However, this pattern of segregation was not rigid, changing substantially over time. After World War II, the black-white industrial distribution differential was significantly less than it had been after the First World War. Further, among manufacturing and mining industries black workers were not disproportionately employed by industries with a relatively low-wage structure. Multivariate analysis on individual data suggest that if black workers had been distributed across industry as white workers were, they would not have earned more, but, if anything, would have earned less. Black workers were not disproportionately employed by industries that were disproportionately dangerous or that were relatively labor intensive.

The degree to which the distribution of black workers across industry differed from that of whites was partly a function of the business cycle activity of the interwar period (chapters 2 and 3). During periods of economic expansion, there were significant reductions in the extent of industrial segregation. The period of most significant integration took place in the late 1930s and 1940s. During World War II, black workers obtained their highest level of representation within the overall manufacturing and mining sector between 1916 and 1950. However, some measures of segregation increased during World War II, suggesting that black workers were disproportionately hired by some industries during the wartime expansion. After the small recession following the Second World War, all measures of black integration suggest that industrial segregation after the war was less than it was before.

One way that industrial segregation harmed black workers was by exposing them to a greater risk of unemployment (chapter 2). During periods of expansion, the fast-growing industries disproportionately hired black workers. Regardless of race, workers in the industries that disproportionately expanded during times of boom found their jobs relatively insecure during periods of bust. During the Great Depression, black workers suffered a disproportionate share of the declines in employment. One of the causes of this unemployment differential was the black-white industry distribution differential.

The integration of black workers into the manufacturing and mining sector during the interwar period was significantly influenced by the level and nature of unionization (chapter 3). The craft unions affiliated with the American Federation of Labor (AFL) were not open to the integration of black workers into their ranks.[18] This exclusive attitude carried

[15] Higgs, "Firm-Specific Evidence" and "Black Progress." See also Fishback, "Operations," pp. 176–77; Margo, "Explaining Black-White Wage Convergence," p. 472; and Wright, *Old South*, pp. 182–85.

[16] Dickens and Lang, "Test" and "Where Have all the Good Jobs"; Reich, Gordon, and Edwards, "Theory"; and Wright, *Old South*, pp. 177–97.

[17] Wright, *Old South*, pp. 177–97.

[18] Dickerson, *Out of the Crucible*, chaps. 6–7; Murray, *Negro Handbook*, pp. 132–33; and Weaver, "Recent Events."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

over to the employment policies of the industries that they organized. Higher levels of craft unionization were associated with lower levels of black integration.

Due to the AFL's policies of racial exclusion and its attempts to enforce craft union jurisdictions in industries not conducive to craft organization, a substantial segment of workers were left unorganized. In the late 1930s John L. Lewis recognized and acted on an opportunity to successfully organize this sector by expanding industrial, rather than craft, unionization. Because many of these industries conducive to industrial organization also had work forces employing a substantial number of black workers, a key to union success was the organization of black workers. The Congress of Industrial Organizations (CIO) was formed after Lewis and other industrial union promoters were forced out of the AFL.[19] Many of the union organizers maximized the likelihood of success in their organizational drives by seeking and obtaining support from black leaders and black workers.[20] Subsequently, the level of black integration was negatively associated with craft unionization and positively associated with industrial unionization.

The 1940s, including the wartime expansion of the Second World War, was a period of significant black integration. There are a number of factors that could have influenced this integration, including tight labor markets, the changing level and nature of unionization, and the Fair Employment Practices Committee (FEPC). The FEPC was a government agency created to enforce an executive order that made it illegal for defense contractors to discriminate on the basis of race, religion, or national origin. Arguably, the FEPC was a weak agency created to appease the demands of protesting black activists who might interfere with war production.[21] The empirical analysis of this study suggests that the FEPC did not have a significant impact on black employment (chapter 3).[22] Rather, wartime tight labor markets and unionization were the forces shaping the contours of black industrial employment. At the end of World War II, the proportion of private sector workers that were organized reached its highest level in the United States. The industries in which AFL unionization expanded became more exclusive to the integration of black workers. However, the industries in which the CIO expanded did not change their generally positive attitude towards black integration.

The New Deal policies that strove to obtain a "living wage for the forgotten man" may have caused more harm than good among the most forgotten—black Americans. There is evidence that these policies were successful in increasing labor's share of revenue during the Great Depression. Increases in labor's share of revenue increased blacks workers' share of economic downturns and decreased their share of the steady-state employment that did not fluctuate with the business cycle (chapter 4). Increases in unionization had a similar effect. Thus, New Deal high-wage policies that successfully increased labor's share of revenue and expanded unionization increased the degree to which black workers suffered disproportionately high rates of unemployment during the Great Depression.

RYAN S. JOHNSON, *Brigham Young University*

[19] Bernstein, *History*, pp. 427–31.

[20] Dickerson, *Out of the Crucible*, chaps. 6–7; Murray, *Negro Handbook*, pp. 132–33; and Weaver, "Recent Events."

[21] Dalfiume, *Desegregation*, pp. 118–21; Bernstein, "America," p. 298; and Polenberg, *War*, pp. 122–23.

[22] Collins ("Race"), using city-level data, finds that FEPC activity had a significant positive impact on black employment.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

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Specialization, Information, and Regulation in American Economic History

This dissertation concerns the role of specialization and asymmetric information in contributing to the rise of the American regulatory state in the late nineteenth and early twentieth centuries.[1] It consists of three essays that attempt to demonstrate how the forces of specialization created asymmetric information problems in markets for many goods and services, and how this in turn generated a potentially productive role for government regulation.

[1] This dissertation was completed in 2003 in the Department of Economics at Washington University, St. Louis under the supervision of Sukkoo Kim (chair), Gary Miller, Douglass North, and John Nye.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

Since Adam Smith, economists have recognized that specialization increases the gains from trade. Specialization is productive because it enables each of us to do what he or she does best. However, specialization also comes at a cost, because transaction costs must be overcome for us to capture the gains from trade.[2] In the context of modern economies, perhaps the most important of these transaction costs are those related to information. Specialization increases information costs because the more specialized each individual is, the less he is likely to know about the goods and services he purchases from others. When buyers know less about product quality than sellers, "lemons" problems may emerge in which low quality items dominate the market.[3]

The forces of specialization clearly played an important role in shaping the United States economy during the late nineteenth and early twentieth centuries. Falling transportation costs brought about the integration of the national economy, leading to regional specialization and urbanization.[4] Advances in knowledge gave rise to technological changes that resulted in the introduction of new goods and services. But these developments also fundamentally altered the nature of the market, for specialization, the introduction of new and unfamiliar goods and services, the growth of knowledge, and the rise of impersonal exchange also made it harder for consumers to know about the products they were buying. Could it be that government regulation emerged during this period partly as a response to these problems?

Among economists, there is recognition (at least in theory) of the productive role that regulation can play in markets characterized by asymmetric information. However, economic historians and political economists have generally ignored or minimized its importance in their accounts of the emergence of the regulatory state. Much scholarship on the rise of regulation in American economic history emphasizes special interest motivations for regulation and their redistributive consequences.[5] Different scholars highlight the importance of different interest groups—for instance, William Niskanen emphasizes the bureaucracy, whereas Gabriel Kolko focuses on the role of "big business"—but the general flavor of these accounts is quite similar.[6] Special interests undoubtedly have and most likely will continue to shape regulation in America but whether their influence has been the dominant one remains an open question.

The essays in this dissertation suggest that a better understanding of the emergence of the American regulatory state in the late nineteenth and early twentieth centuries may be obtained by taking explicit account of how specialization and asymmetric information altered the markets for many goods and services. Using examples from food, drug, and occupational licensing regulation, I attempt to show that, at least in some contexts, regulation emerged in response to problems of asymmetric information, and that regulation played an important role in making a market for certain goods and services. Although these examples may not characterize all regulations that were enacted at the turn of the century, I think they are sufficient to illustrate that specialization and problems of information were also important forces driving the rise of regulation during the Progressive Era.

The first essay in this dissertation is about the origins of state pure food regulation in the late 1800s. In this essay I argue that specialization and technological change in food production made it difficult for consumers to judge product quality and created opportunities for cost-reducing deception by firms. Reputation mechanisms may not have been

[2] Wallis and North, "Measuring the Transaction Sector."
[3] Akerlof, "Market for Lemons."
[4] Kim, "Economic Integration" and "Urban Development."
[5] Hughes, *Governmental Habit*; Higgs, *Crisis*.
[6] Niskanen, *Bureaucracy*; Kolko, *Triumph of Conservatism*.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

effective in dealing with this asymmetric information problem because advances in science made it possible for firms to adulterate their goods in ways that were not easily perceived by consumers. State regulation of product labels therefore arose as a solution to this "lemons" problem regarding product ingredients because regulators had a comparative advantage over consumers in detecting food and dairy adulteration.

The available evidence is more consistent with this hypothesis than the main alternative hypothesis, which argues that pure food and dairy laws were enacted to increase the market power of the producers of "traditional" food items. Three pieces of evidence appear to support my claim. First, using city-level panel data on the prices of six "traditional" food and dairy items, I find no evidence that pure food and dairy regulations favorably affected the prices of these items. Hence, although producers of these traditional foods may have wanted regulation to increase their market power, the price evidence does not suggest that this occurred. Second, cross-sectional data on food consumption in different states reveals that the consumption of food items that were commonly adulterated was higher in states where pure food laws were stricter. I interpret this evidence as implying that pure food regulation played a role in reducing consumer uncertainty about product quality. Finally, qualitative and quantitative data on the political economy of the pure food movement suggests that certain consumer interests were at least as important as producer interests in determining the timing, enforceability, and comprehensiveness of pure food and dairy regulations. The fact that both consumers and producers were part of the political constituency in favor of pure food and dairy laws is more consistent with my hypothesis than with the alternative, because regulations that solve a lemons problem should benefit both producers and consumers whereas regulations that increase market power should only benefit producers.

The second essay examines the enforcement of the 1906 *Pure Food and Drug Act*, the first major federal law regulating interstate commerce in food and drugs. Some scholars of food and drug regulation in America maintain that the fledgling Food and Drug Administration (FDA) was unsuccessful in enforcing the *Pure Food and Drug Act* because the way this law was written made it difficult for the FDA to prosecute offenders in court.[7] Others argue that in order to build a political constituency in favor of a federal food and drug law, the leaders of the FDA allowed themselves to be captured by special interests from industry and that this also contributed to weak enforcement.[8] In this essay I analyze information about the FDA's enforcement work from 1906 to 1938 (the year that the *Pure Food and Drug Act* was repealed and replaced by the *Food, Drug and Cosmetics Act*) to shed light on whether the FDA was captured by special interests and whether it was effective in obtaining compliance with the law.

The evidence indicates that although the FDA was unsuccessful in enforcing the law through the courts, the FDA was still able to obtain compliance from firms in many segments of the food industry because it was able to offer benefits to producers in the way of product quality certification and direct assistance in improving product quality. By engaging in this kind of *ex ante* enforcement strategy, the FDA was able to circumvent problems associated with coercive *ex post* enforcement through the courts. Although it is difficult to determine whether special interests from industry "captured" the FDA, the evidence suggests that the FDA's enforcement work did not tend to con-

[7] Hutt and Hutt, "History." Until the late 1920s, the organization that we know today as the FDA was the Bureau of Chemistry, an agency within the US Department of Agriculture. In 1927 the name of this organization was changed to the Food, Drug and Insecticide Administration, and in 1930 it was shortened to the Food and Drug Administration. Henceforth, I shall refer to the Bureau of Chemistry as the FDA.

[8] Coppin and High, *Politics of Purity*.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

fer exclusive advantages on incumbent firms. In particular, an analysis of the FDA's enforcement program generally shows that its *ex ante* enforcement efforts did not create barriers to entry. I interpret these facts as implying that industry did not "capture" the FDA (at least in the narrow sense of using the FDA to impose entry barriers) and that the FDA was reasonably effective in enforcing the law.

This analysis of the FDA's enforcement work is also suggestive of the broader role that regulators can play in shaping the markets for goods and services. The economic literature on regulatory enforcement has traditionally focused on the "cops and robbers" side of enforcement and generally does not analyze of alternative methods of enforcement and their long-run impact on the nature of the markets for goods and services.[9] The information presented in this essay shows that by engaging in an *ex ante* enforcement policy, the FDA played an important role in improving quality standards in the food industry over time. It is not clear whether this role was specific to the FDA or whether it has been played by other regulatory agencies at different times, but it does suggest that a closer investigation of how government officials enforce other laws and regulations and how these regulatory efforts in turn affect the markets for other goods and services may be in order.

The third essay deals with the rise of "professionals"—whom I define as individuals who acquired a university-based education as an integral part of their vocational training—and the emergence of occupational licensing regulation in the late 1800s and early 1900s. I argue that the expansion of specialized knowledge made it advantageous for individuals engaged in certain occupations to acquire a systematic university-based education. Hence, the university gradually displaced the apprenticeship as the primary vehicle for vocational training and professionals came to dominate many occupations. I also argue that the expansion of specialized knowledge contributed to the adoption of modern occupational licensing laws. Professional licensing regulations emerged in response to an asymmetric information problem that arose as specialization and the growing complexity of many professional services made it increasingly difficult for consumers to accurately discern service quality. Although market mechanisms may also help solve asymmetric information problems, the effectiveness of market solutions will depend on the nature of the service being transacted, the ability of buyers of the service to determine quality, and the ability of sellers of the service to signal quality. Licensing laws that specified the qualifications needed to practice certain occupations were a partial solution to this asymmetric information problem, particularly for those services where market mechanisms were less likely to be effective in guaranteeing quality.

If licensing laws were adopted to solve the asymmetric information problem, then "stricter" licensing laws should be adopted for those occupations where the asymmetric information problem was such that market forces were less likely to work effectively to assure consumers of service quality. Hence, to test this hypothesis, I examined cross-occupational variation in the strictness of occupational licensing laws to see if stricter licensing laws were indeed adopted for those occupations where market forces were less likely to be effective. I measured strictness in a variety of ways: by comparing the provisions of state licensing laws for different occupations, by a detailed analysis of the licensing laws for two major professions (law and medicine), and by exploiting cross-state variation in the timing of these laws to econometrically estimate the effect of these laws on entry into 11 different occupations. In general, I found that stricter laws were adopted for professions such as medicine where market forces

[9] See Polinski and Shavell, "Economic Theory."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

were least able to guarantee quality and that less strict laws were adopted for architecture, engineering, teaching, law, and other professions where market forces were likely to work reasonably well. I interpret this evidence as being consistent with the hypothesis that licensing laws were a partial solution to the asymmetric information problem that arose in the markets for increasingly specialized services.

My econometric analysis of the effect of regulation on entry also allowed me to test the main alternative hypothesis that has been advanced to explain the origins of occupational licensing laws—that these laws were enacted to serve as an entry-barrier.[10] Overall, the regression results are not strongly supportive of this hypothesis: for most occupations, the introduction of licensing did not have a significant effect on the number of workers or the growth rate of workers. Although the desire to establish entry-barriers was clearly an important motivation for occupational licensing regulation, I believe that my hypothesis offers a superior explanation for cross-occupational variation in the nature and timing of occupational licensing laws.

MARC T. LAW, *University of Vermont*

[10] See, for instance, Moore, "Purpose of Licensing."

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https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

Currency Policies and the Nature of Litigation in Colonial New England

Judicial enforcement of debt agreements was one of the central and most important aspects of government promotion of the nascent colonial economy.[1,2] Nevertheless, legal historians have characterized the colonial court system in contrasting terms as a bulwark of pre-industrial cultural norms impeding development, or as a crucial catalyst of commercial transformation. In either case, legal historians' focus on law developed in the courts, as opposed to the policies of the legislative or executive branchs of government, has led to an assumption that the law adjusts in some natural way to changing economic and cultural climates. According to this view, lawsuits are an indirect reflection of prevailing cultural norms and market conditions. Judges adapt the law as those norms and conditions change. The court system therefore fulfills an institutional role of ensuring that the law keeps pace with economic and societal transformation, and comes close to optimally satisfying the legal needs of local communities.

The most prominent description of the insular and community-oriented base of colonial law is Morton Horwitz's *The Transformation of American Law, 1780-1860*. Horwitz emphasizes the centrality to eighteenth-century law of limitations on market activity such as the just price and usury doctrines, contracts involving transfers of property rather than monetary payments, and damages based on equity and fairness rather than on satisfying expectations.[3] Emphasizing the prevalence of litigation based on direct property exchanges, Horwitz concludes that the law reflected undeveloped markets and a community-oriented society in which goods "were usually not thought of as being fungible. . . . [and] [e]xchange was not conceived of in terms of future monetary return."[4] To Horwitz, colonial law reflected a pre-industrial communitarian mindset, "essentially antagonistic to the interests of commercial classes,"[5] in which justification for contractual obligation was "the inherent justice or fairness of an exchange."[6] Colonial law applied by judges, therefore, reflected the values associated with pre-industrial, agrarian societies. In this respect, Horwitz contrasts the judicial doctrine of the eighteenth century with that of the nineteenth century, when judges began using common law instrumentally to promote capitalist values and a market economy. With regard to both the colonial period and the nineteenth century, however, Horwitz portrays the law as harmoniously synchronized to advance prevailing cultural norms and preferences regarding economic activity.

More recently, Bruce Mann's *Neighbors and Strangers: Law and Community in Early Connecticut* presents a contrasting interpretation of colonial law and its relation to market development. Mann examined changes observable in litigation data, rather than changes in legal doctrine. He found that litigation related to book accounts domi-

[1] This dissertation was completed under the direction of Robert W. Gordon at Yale Law School.

[2] Debt litigation dominated the caseload of the colonial courts. Debt cases, for example, constituted 74 percent of all cases heard during the period 1725 to 1774 in the Plymouth, Massachusetts County Court of Common Pleas, the court of original jurisdiction for civil (non-criminal) lawsuits. See Nelson, *Dispute*, pp. 23–24.

[3] See Horwitz, *Transformation*, pp. 160–73.

[4] Ibid., pp. 162–63.

[5] Ibid., p. 167.

[6] Ibid., p. 160.

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nated the court dockets in the seventeenth century.[7] Book account disputes were frequently contested in court, and judges in these cases tailored their decisions to the individual litigants and their unique circumstances. By the 1720s and 1730s, however, Mann found that litigation had changed in two ways. First, the debt cases that were litigated increasingly involved formal credit instruments, the terms of which left little to dispute in court. Greater use of formal credit instruments therefore corresponded closely with an increasing percentage of debt cases ending in a default judgment (where the debtor did not appear to contest the dispute) or confession of judgment (where the debtor conceded responsibility for the debt). Second, the volume of litigation increased exponentially—beyond population growth—over the first half of the eighteenth century.

Mann interprets the default judgments as creditors and debtors using the court system to record debts in the courts' registers. Default judgments allowed creditors to establish their "place in line" to debtors' assets. Default judgments also secured creditors' interests in debtors' property by allowing quick execution (seizure and possibly sale of the debtors' property by sheriffs) at their discretion. Debtors acquiesced to the entry of judgments against them by default because they too benefited from the bureaucratization of credit, possibly from lower interest rates. According to Mann, "credit had become something extended in single transactions in return for formal admissions of liability."[8] Thus, to Mann, the high percentage of cases ending in default indicates the creation of a modernized mechanism for debt recording, similar in kind to today's perfection of security interests through Article 9 of the Uniform Commercial Code.

In Mann's account, the bureaucratization of the courts' role reflected an institutional transformation resulting from economic advance and the commercialization of the society. In sum, economic advance led to more transactions that crossed community lines. Formal credit instruments, which were difficult to contest in court, were better suited for impersonal contractual relations. Presumably to lower interest rates, creditors and debtors recorded default judgments at the time debt agreements were entered into. In the process, the courts' primary function changed from dispute-resolution to debt recordation. An institutional base of the colonial economy transformed to accommodate economic growth and commercialization.[9]

My Dissertation presents a starkly different view of the colonial court system's role in the economy. The Dissertation presents the results of an empirical study (described below) demonstrating that default judgments were not a rationalized means of security recordation, but represented real defaults, that is, creditors using litigation to collect debts when debtors failed to pay after the terms of their loans had passed. Moreover, I

[7] Book accounts were records (like a tab) of goods or services others took on credit. In the colonial period, in addition to being used in more formal creditor-debtor relations, people in a community established accounts with each other, taking goods and services on credit, and gradually reciprocating by exchanging different goods and services over time.

[8] Mann, *Neighbors*, p. 40.

[9] In one passage, for example, Mann states that: "An expanding economy requires that individual transactions be governed by generally applicable rules. Because of the sheer number of such transactions and the distances they may involve, they have to be conducted in a routine fashion. Their form and the legal rules that direct them must be uniform and calculable. Rational economic exchange requires the assurance that like cases will be treated alike. To provide that assurance, general rules override the individuality of particular cases and force them into a common mold. Formal requirements that limit litigation to the instruments themselves and restrict appeals homogenize the underlying transactions and give them a uniform, predictable legal character." *Neighbors*, p. 36.

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empirically examined the level of court fees imposed on the litigants in relation to the debts that ended in default judgment and found them to be so high as to create a disincentive to record debts during stable economic conditions.[10] How, then, should we characterize the nature of debt litigation, and how should we explain the exponentially increasing volume of litigation in the first half of the eighteenth century and, more generally, the colonial court system's role in the economy?

Relying on extensive research of primary materials, my Dissertation emphasizes the ways in which currency policies enacted by colonial assemblies, mercantilist policies adopted by Parliament and the Board of Trade in England, as well as domestic and international economic conditions, influenced the forms in which people transacted and the volume of litigation. Colonial governments began issuing paper fiat currencies in the late seventeenth and early eighteenth centuries as a method of financing increasing military expenditures. Each colony's annual determination of the paper currency in circulation reflected a struggle within colonial assemblies, which faced pressure from part of the public—often debtors—to issue paper money in greater volume, and conflicting pressure from English and New England merchants who desired a stable currency of high value to satisfy English import debts. In New England, the tensions between the elected, representative assemblies and the English—representatives of a foreign sovereign promoting a mercantilist agenda—led to policies that created disastrous uncertainty. New England experienced periods of steady inflation as well as of currency scarcity, when colonial citizens were forced to use promissory notes as a substitute for cash, and to revert to commodity money exchange and barter-like transactions, such as paying laborers in shop notes.

I present data revealing that periods of exponentially increasing litigation coincide with economic conditions and the periods of greatest uncertainty relating to government currency policies. In a context of high court fees that would ordinarily deter litigation, exponentially increasing litigation can be attributed to two economic conditions. First, litigation increased during times of economic recession and monetary scarcity, often driven by depressed credit conditions in Britain, when debtors on a widespread basis were simply unable to pay their debts. Second, litigation increased in response to inflation and uncertainty about colonial governments' currency policies. During periods of inflation, or when the public predicted inflation based on the governments' inability to commit to its currency policies, debtors failed to repay their debts as a delaying tactic to benefit from declining currency values, forcing their creditors to sue. Inflation lowered the real value of court fees as well as the underlying debts. I trace the effects on litigation of British mercantilist and domestic currency policies in a detailed account of the first half of the eighteenth century in Massachusetts.

In contrast to the optimistic rendering of the courts in the standard account, contemporary pamphlets concerning Massachusetts's currency policies show that colonial citizens were frustrated by the swamping of the courts with debt-related litigation during periods of currency instability, that some complained bitterly about excessive court fees, and that serious questions were raised about judges' dogged enforcement of the common law principle of nominalism—allowing debtors to satisfy their debts with payment in nominal, not real, values of the debts. In a 1743 pamphlet, one writer claimed about nominalism that:

[10] In the Plymouth County Court of Common Pleas in 1740, for example, fees comprised an astounding 79 percent of the underlying debt for the quartile of cases reflecting the smallest debts. The average and median court fee / debt ratios for all cases were a substantial 32.6 percent and 21.7 percent, respectively.

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> This [legal tender] Law . . . habituat[ed] Debtors to suffer themselves to be sued for indisputable Debts, and to appeal from Judgments obtain'd against 'em upon their own Defaults to the Superior Court merely for Delay . . . [T]his Sort of Actions multiply'd in Proportion, to the great Hurt and Scandal of the Country; insomuch that the Number of such Suits within the Province was increas'd . . . Between the Years 1730 and 1742, to near double what it was before.[11]

Thomas Hutchinson (the future Governor) wrote in 1736 that: "[T]he Government is the Guarantee that all just & legal Contracts shall be perform'd; but with us they are daily broken, & necessarily will be so, whilst our Money continues in its present fluctuating Circumstances."[12]

Mann's interpretation of litigation, that "debtors conceded liability before payment for their creditors' convenience,"[13] assumes a key empirical fact: that litigation will occur close in time to the execution of the debt agreement. The ambition of debt recordation is to establish a legal priority to a debtor's assets. Delay of any period reduces the value of the debt by affording an opportunity for other creditors to establish claims prior or equivalent to the previously extended debt. Using the records of the Plymouth County courts, I examined over 3500 cases ending in a default judgment in the period 1724 to 1750 to determine the length of time between the date the parties entered debt agreements and the date creditors filed suit to collect.[14] My interpretation—that confessed judgments and defaults in the first half of the eighteenth century primarily represented real defaults—implies an interval between debt execution and litigation beyond the term of the debt.

The customary terms of credit extended to local retailers in the period ranged from six to twelve months, though sometimes less.[15] I found that the median interval between debt agreement and litigation for all debt litigation ending in default between 1724 and 1750 was 531.5 days (17.5 months). Only 14.5% of all debt cases resulting in default were litigated within six months of the execution of the debt agreement. I therefore concluded that the vast majority of default judgments—that is, at least 85.5%—represented litigation after real defaults. Periods of a high litigation volume would therefore reflect widespread economic distress or a delaying tactic in anticipation of inflation, rather than, as Mann suggested, the extension of credit and an agreement between debtors and creditors to secure debts with default judgments.

Anecdotal evidence in historians' accounts confirms that litigation was "a last resort" for creditors and, indeed, that colonial creditors incurred great costs to obtain information about debtors' financial status and to keep any negative information secret

[11] An Enquiry into the State of the Bills of Credit of the Province of Massachusetts-Bay in New-England in a Letter From a Gentleman in Boston to a Merchant in London (n.p. 1743), reprinted in Davis, *Colonial Currency Reprints*, vol. 4, pp. 162–63.

[12] A Letter to a Member of the Honourable House of Representatives, on the Present State of the Bills of Credit (Boston, n.p. 1736), reprinted in Davis, *Colonial Currency Reprints*, vol. 3, pp. 160–61. I found strong ties between currency policies, debt litigation, and the seeds of Revolution in Massachusetts. During a period of severe currency scarcity (and high levels of debt litigation), there emerged a widespread popular movement to establish a private bank, backed by land. Parliament suppressed the Land Bank by applying the Bubble Act to the colonies in 1740. John Adams later claimed that the "act to destroy the Land Bank scheme *raised a greater ferment in this province than the Stamp Act did*." Adams, *Works*, vol. 4, "Novanglus," p. 49 (emphasis added).

[13] Mann, *Neighbors*, p. 45.

[14] Konig, *Plymouth Court Records.*

[15] See Harrington, *New York Merchant*, p. 101, suggesting between 3 and 12 months as the customary terms for domestic credit; and Soltow, *Economic Role*, p. 133, describing customary domestic credit terms as between 6 and 12 months.

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from other creditors in order to avoid having to sue.[16] As described by A.G. Roeber, court sessions were widely attended and, indeed, "Court days" were regional, popular events, in part, because they were the best time for creditors to see "who was recovering against whom and what their own roles might be at any given moment."[17] Outside of court days, creditors worked to keep negative information about debtors' financial status secret, according to Virginia Harrington, because "every creditor hoped to be able to collect his debts before the insolvency of the debtor became generally known."[18]

My account of the nature of colonial debt litigation is further confirmed by the events of Shays' Rebellion, which in 1786 and 1787 constituted a widespread attack on the structure of the colonial court system, culminating in the violent takeover and closing of many county courts in western Massachusetts and throughout New England. The Shaysites (who referred to themselves as Regulators) condemned its injurious costliness, its fee structure which, they claimed, enabled judges, witnesses, and sheriffs to profit at the expense of litigants, and its cooptation by lawyers. Defenders of the regime dismissed the Regulators as "men in distress involved in debt and discontented"[19] and desiring "equal distribution of property," and "the annihilation of debts." [20] Several of the Regulators' principal court reform proposals, however, were designed chiefly to reduce costs and administer justice more effectively. One Regulator proposed adopting a system according to which creditors and debtors could inexpensively record and secure debts, for example, by substituting the common pleas courts with "courts of record" that would specifically provide a debt-securing and recording service.[21] The General Court responded by enacting the Confession Act of 1786,[22] which allowed debtors to avoid costly litigation in any debt case by "confessing" judgments against themselves to a justice of the peace for a small fee.

Far from the picture legal historians have presented of a court system performing a role almost perfectly responsive to the economic and social needs of the community, we can conclude that the courts in New England did not provide the economic benefits that a debt-recording system, such as the modern UCC, achieves by reducing or eliminating uncertainty over collection. In the colonial period, creditors and debtors, as a general matter, incurred the costs of creditors' uncertainty about their priority with respect to other creditors, creditors' uncertainty about the nature of debtors' other debts, and the costs of litigating in an expensive system when creditors feared that they would not otherwise be repaid.

A separate contribution of the Dissertation is to reveal the importance of monetary history to our understanding of the court system and legal doctrine in the seventeenth and eighteenth centuries. During much of the colonial period, the New England economy largely functioned without the widespread circulation of currency (paper or spe-

[16] See Soltow, *Economic Role*, pp. 140–42. W. T. Baxter's review of the debt collection practices of the Hancock family in Massachusetts led him to conclude similarly that "[a]most every account tells the same long- drawn-out story of dawdle and delay." Baxter, *House*, p. 192.

[17] See Roeber, *Faithful Magistrates*, pp. 85, and 73–95.

[18] Harrington, *New York Merchant*, p. 119.

[19] Letter from William Plumer to John Hale (13 August 1786), in *Publications of the Colonial Society of Massachusetts*, vol. 11, p. 386.

[20] Letter from William Plumer to John Hale (20 September 1786), in *Publications of the Colonial Society of Massachusetts*, vol. 11, p. 392.

[21] See Taylor, *Western Massachusetts*, p. 198 n. 21, citing Newton, *Independent Chronicle* (Boston), 8 June 1786.

[22] 1786–1787 The Acts and Resolves Public and Private of the Province of Massachusetts-Bay, pp. 105–11, chap. 43.

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cie).[23] The scarcity of cash was profoundly important in determining the types of contractual obligations entered into by individuals. Being constrained to "quasi-barter" exchanges greatly suppressed economic activity and reinforced an economic system based upon intracommunity exchanges and localism. Horwitz's emphasis on the prevalence of contracts involving direct exchanges of goods and transfers of property focused on a set of phenomena that might be better regarded as the *effects* on the legal system of a scarcity of currency than a "premarket" ideology. Understanding the difficulties of exchange without a circulating currency and the ways in which colonial merchants ameliorated those difficulties suggests a more materialist explanation of the communitarian aspects of early colonial society. Intracommunity contractual relationships were reinforced by economic conditions and were not necessarily driven by (although in some areas they plausibly coincided with) a pre-industrial, communitarian mindset. New England citizens involved in the market, however, aggressively advocated the adoption of private and governmental currencies as early as 1682, expecting that widespread availability of currency would lead to economic advance. As a consequence, the evidence Horwitz explained would change once currency became more widely available and markets developed whether judges actively promoted economic advance or not.

The importance of currency policies and macroeconomic conditions in propelling litigation during particular periods reveals that legal historians' narrow focus on highly localized sources of law has been misguided. To the extent currency policies affected litigation trends, "law" should not be characterized as created exclusively by endogenous processes. The influence of currency issuance and currency policies on civil litigation reveals that even litigation on book accounts—the most community-oriented form of economic relations—reflected colonial responses to conditions of monetary scarcity generated by the English Board of Trade and Parliament, thousands of miles away. Local communities and the norms prevailing within them were irrelevant to the process of establishing and implementing currency policies. Court fees similarly were determined by colonial legislatures and were not entirely sensitive to the moral climate of local communities. Although the fact that colonial courts reliably and mechanically enforced debt agreements was essential to colonial economic growth, the policies of the colonial courts deserve far more scrutiny by economic historians than they have received thus far.

CLAIRE PRIEST, *Northwestern University School of Law*

[23] Currency scarcity also had tremendous implications for the nature of government. New England colonial governments in the seventeenth century, for example, were often required to tax in commodity currencies, such as corn and wheat, because the citizenry lacked other currencies with which to satisfy their tax obligations. This limited the extent to which government institutions could finance and realistically expand the scope of their operations.

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Comments on Moser, Herranz-Loncán, and Li

On the last day of July 1851, Lorenza Berbineau, a Boston servant girl who accompanied the family of Francis Cabot Lowell II on their tour of Europe, "went to Hyde Park to the great Exhibition." In breathless prose, she exalted:

> It was magnificent I saw things from the United States handsome lamps machinery farming emplements . . . from France saw a splendid door of Malachite green also tables Chairs vases some say it is stone some say it is a Metal it was taken from a mine I saw the Horse in Bronze the wild horse there was two men tying a man on to him I saw a wrought silks & caps wrought with gold thread a great many Swiss things cut from wood . . . some Turkey carpets also French Tapestry Carpets there were two large Diamon I was told the man who cut it was put in Prison for 21 years for cutting it so badly . . . I saw some Vases made from Cannel Coal they looked like black Ebony . . . there was a good deal of machinery from Different parts of the world some of it was in motion I saw them make bricks they put the clay in it came out formed into brick . . . I was there about 3 hours to day I got very tired.[1]

The sense of being overwhelmed by the richness, variety and sheer volume of the Great Exhibition at Crystal Palace (there were over 100,000 objects on display) was a common reaction among visitors. Both Charles Dickens and Lewis Carroll acknowledged their "bewilderment" while James Ward described his "state of mental helplessness" in the face of such a phantasmagoria.

Petra Moser finds herself in no such state of mental helplessness. She has walked (metaphorically, of course) along the more than 20 miles of aisles and paths that traversed the exhibition grounds of Hyde Park, cataloguing and classifying the exhibits. Moreover, she has done this not just for the Crystal Palace, but also for the Centennial Exhibition in Philadelphia a generation later. She has meticulously catalogued almost 33,000 exhibits by industry of application, country of origin, geographical location

[1] Berbineau, *From Beacon Hill*.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

(for more than 4,000 British and over 500 American exhibits in 1851), whether the exhibit was patented or not, and whether it received a medal from the exhibition juries. Moser's remarkable data set is rich enough to test an array of hypotheses regarding nineteenth-century technology—including the relationship between innovation and patenting, industrial and locational biases in innovation, and the political economy of patent laws. The results are suggestive and significant, the approach sophisticated and sensible, and Moser's reasoning powerful and persuasive.

The central premise of the dissertation is that the exhibits provide a more secure base for understanding the process of technical change than patent data, with their well-known biases. We should begin then by asking, what exactly do the exhibits represent? Thomas Hughes, who cut his teeth as a technological historian with the very same catalogues from the Crystal Palace, referred to it as a "census of the facts of industry . . . a museum for industry most representative in 1851."[2] I think that is roughly right, at least of the British exhibits. Petra Moser argues further that the exhibition counts measure "economically useful innovation." I think that is also right, but we should be cautious not to interpret that phrase too literally, nor too liberally. It is tempting to view the exhibits as examples of novel innovation—that they are the functional equivalent of patents, but that they measure the flow of new applications rather than of new ideas. An alternative interpretation would be to view the exhibits as representing the stock of invention, innovation and improvements up to the time of the exhibitions—the cumulative effect of a half-century or more of technological change.

The interpretation of the exhibits as a stock rather than a flow measure of "economically useful innovation" is consistent with what we know about the origins of the Crystal Palace Exhibition. Prince Albert, in his famed Mansion House speech, set the agenda: "the Exhibition of 1851 is to give us a true test and a living picture of the point of development at which the whole of mankind has arrived."[3] In Jeffrey Auerbach's words, "the exhibition was open to a broad spectrum of exhibitors; . . . it was inclusive rather than exclusive . . . encompass[ing] the full range of commercial possibilities."[4] This sort of industrial stock-taking had an avowedly educational aspect—as reflected in the number of models of blast iron furnaces, coal mines, bridges, and lighthouses, as well as a 40-foot model of the Liverpool docks. One of the mostly widely viewed textile exhibits was that of Hibbert and Platt, which showed samples of cotton, flax, wool, and hemp in their raw form and illustrated by way of models and on-site demonstrations how the materials were transformed into the finished products of everyday life. The displays also included every conceivable article of apparel, new and traditional—from cotton aprons and loincloths to ermine robes, "mathematical" undergarments, and a corset that opened instantaneously in case of emergency.

Most frequently, of course, the exhibitions provided a means for manufactures to provide examples of their product, to impress potential customers, to gain exposure, or simply for the warm feeling of gaining recognition from being identified a winner in an open competition. Unlike today, however, in neither 1851 nor 1867 was ingenuity a requirement for exhibiting. Quality of workmanship was certainly as, if not more, important. A quick glance at the judges' reports at the Centennial Exhibition confirms this. Commendations employed expressions such as "a good exhibit of its class," or most frequently "good workmanship" (sometimes in the form of "good standard workmanship")—only rarely was innovation or ingenuity mentioned. It is also implicit in the system of awards. In 1851 only the Council Medal (awarded to less than 1 per-

[2] Hughes, "Industry," p. 3.
[3] Quoted in Davis, *Great Exhibition*, p. 68.
[4] Auerbach, *Great Exhibition*, p. 92.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

cent of exhibits) referred to innovation, whereas the Prize Medal (awarded to 18 percent, with a further 12 percent receiving Honorable Mention) focused on "excellence in production of workmanship."

Not all exhibits were innovative. Those that did reveal innovative technology or techniques were not always novel. The British exhibits in 1851, for example, included Naysmith's steam hammer, invented in 1839, a variety of Jacquard looms dating back to the 1790s, and models of Murdoch's locomotive (1785) and Watt's steam engine (1784), while "Sir Samuel Brown sent the iron cables he had invented as long ago as 1810, and a model of the Brighton chain pier, which he had built in 1823"[5]; the American exhibits included a replica of Whitney's cotton gin, as well as "plans and models illustrating a variety of principles of locomotion invented by" Henry Pinkus in the previous quarter-century; displayed in the Swiss section was an ingot of meteor steel, invented by J. C. Fischer in 1825.[6]

When exhibits were both new and innovative, they were not necessarily economically useful. The production of champagne out of rhubarb, for example, or the remarkably named Anhydrohepseterion—a device that enabled a potato to be stewed in its juice, or, my 11 year-old son's personal favorite, the penknife with 1,851 separate blades (not, oddly enough, made by the Swiss), which was declared to have no useful function whatsoever other than to amuse. Novel innovations were often no more than novelty products. Those innovations that did merit positive comment were not always perceived as of commercial use—the exhibit of the British and Foreign Bible Society included copies of the Good Book in 148 languages, in 121 of which it had never published before, many in "languages which had never previously existed in written form." Because of an error in the allocation of space, the Bibles were exhibited in the middle of the machinery exhibit, squeezed in between a distilling apparatus and a malt machine. This did not please Lord Ashley, the President of the Society and a well-known temperance reformer.

Obviously, we should not exaggerate the frequency of novelty items. Contemporary commentators, especially those skeptical of the merits of the exhibitions, tended to poke fun at the outlandish; it is likely that these represent little more than "white noise" in the overall meaning of the exhibits. Something of the flavor of this can be gauged from the descriptions of the American exhibits at the Crystal Palace. When Walter Bagehot, the editor of the *Economist*, visited the Great Exhibition on its first day, he commented that Americans must be "extremely well off for soap": their immense compartment was filled with pyramids of soap, "soap in colors, soap transparently contrived to imitate a stained glass window; soaps molded into busts, pyramids, statuettes . . . soaps in words, letters, in flowers and other devices."[7] Other commentators, quick to dismiss American primitivism, focused on the large number of milk churns and such oddities as papier-mâché chairs (reflexive anti-Americanism among British intellectuals is apparently nothing new). But the American exhibit also included examples of the American system, including Colt's revolvers, rifles from Robbins and Lawrence, and locks from Day and Newell, the McCormick reaper, as well as various India Rubber wares from Charles Goodyear, examples of telegraphic instruments, and new signaling technology for locomotives.

The stock interpretation can be carried over to the evidence on patenting contained in the exhibition catalogues, which identified those exhibits already under patent. It is

[5] Quoted in Hobhouse, *1851*, p. 80.

[6] Great Exhibition of the Works of Industry of All Nations, *Official Descriptive and Illustrated Catalogue*, vol. 1, pp. 210, 277, vol. 3, pp. 1269, 1437, 1454, 1460, 1465–66.

[7] ffrench, *Great Exhibition*, p. 239.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

also a relevant consideration when considering the different rates of patenting in certain sectors, and the issue of urban bias in exhibiting, both central themes of Moser's dissertation. Moser finds no difference in patenting rates between rural and urban exhibits, but her analysis of the location of British exhibits makes it clear that they were biased towards urban places, especially London and Birmingham. Whitney Walton finds a similar urban bias in French exhibits, with almost 60 percent drawn from the *departement de Seine*[8] There is more than one way to interpret this finding. Moser focuses on agglomeration effects, Marshallian external economies, and knowledge spillovers, consistent with the assumptions of the New Growth Theory. A crucial question is whether the exhibits capture the cumulative effect of past innovations or the direction of current ideas—i.e., whether the urban bias is in production or in innovation. Walton interprets the Parisian bias differently, noting that many French provincial manufactures refused to send their wares to the regional juries for selection to the Crystal Palace for fear that their goods, especially textiles, metals, and machinery, would compare unfavorably with the British (transport costs were another constraint).

Commentators in 1851, official and unofficial, were certainly concerned about selection bias in the composition of exhibits. The Commissioners of the Great Exhibition believed "the omission of Austrian machinery was due in part to protectionist suspicion"; and noted in their First Report that "the primitive state of patent law gave little protection from foreign or domestic plagiarism and many articles were withdrawn."[9] The Official Catalogue reported of the British exhibits that "it is probable . . . that there are fewer novelties in mechanical inventions than there would otherwise have been, had the Legislature provided against piracy of them at any earlier period than April, 1851."[10] The *Illustrated London News* commented sadly on the poor showing of "the industry of Lancashire, indifferent as it is, compared to what might have been had Manchester done its duty."[11] Moser has some good evidence on the question of biases due to patent uncertainty, which suggests that the problem was small; but I would also encourage her to test the hypothesis regarding regional biases using census data on the distribution of industrial employment.

Perhaps the most important aspect of Moser's research concerns the issue of why inventors do and do not patent—how they choose to protect intellectual property rights. Patents require disclosure and are bounded in time. For many products, Moser suggests that secrecy may be a more attractive and effective means of protecting knowledge from prying eyes. The fundamental issue is the opacity of the production process—the limited potential for reverse-engineering. This suggests a likely difference in patenting rates between production processes (which may be opaque) and production tools (which are certainly not). There may, of course, be other factors involved in the decision to patent or not to patent—the cost (including the opportunity cost of time involved in filing and processing); the degree of sophistication of the invention or improvement; the rate of technological obsolescence and the scale of technological change; the possibility of first mover advantages; and how skill based an industry is. It is likely that the very low rates of patenting found by Moser in sectors as diverse as textiles, scientific instruments, jewelry, and foodstuffs reflect a combination of factors—limited need for intellectual property rights protection in some; different mechanisms for effective protection in others.

[8] Walton, *France*.
[9] Davis, *Great Exhibition*, p. 155.
[10] Great Exhibition, *Official Catalogue*, vol. 1, p. 20.
[11] Quoted in ffrench, *Great Exhibition*, p. 251.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

An important counterpart to the question of what do patents protect, is the question of what do inventors and innovators do in the absence of patent protection. Moser examines the exhibits from both Crystal Palace and Philadelphia to test the impact of patent laws on the industrial location of innovations (current and cumulative). There are two outliers in 1851—Switzerland and Denmark—small countries with no patent laws. They do not demonstrate any lower proclivity to innovate, an important finding in itself. Both economies tended to concentrate their innovative energies into foodstuffs and scientific instruments, two products that are less susceptible to reverse-engineering than, say, the production of machinery. Patent laws appear then to influence the direction of innovation (Moser considers the possibility that patent laws are themselves endogenous to the production structure, but provides good reasons to refute this). Moser emphasizes the role of secrecy as the determining factor that protects intellectual property rights in these industries. This seems more than plausible for foodstuffs (just think of the secret recipes associated with Coca-Cola and KFC), but I am less sure about scientific instruments (clocks, watches, optical instruments, barometers, etc.), a classic craft-based industry, for which the intensive employment of product-specific human capital would have reduced the need for patent protection. Moreover, the Swiss exhibited a comparative advantage in textiles in 1851 and 1867; this once again seems to be less a matter of protection via secrecy, but rather a combination of craft-skill and product differentiation in the production process. The most telling argument in favor of Moser's general proposition about the influence of patenting laws on innovation is to be found in the case of the Netherlands, which repealed its law in 1869. Between 1851 and 1875, as Moser observes, there were significant changes in the direction of Dutch industry and the emergence of such innovative food products as oleo-margarine, pioneered by van de Bergh and Jurgens.

In 300 densely packed pages, Alfonso Herranz-Loncán both deepens and widens our understanding of Spanish economic growth in the century before Franco by focusing on investment in market infrastructure. One of the significant contributions of Herranz-Loncán's thesis is that it goes beyond the limitations of the standard historical focus on railways to incorporate other sorts of infrastructure investment—roads, tramways, ports, and telegraphs, as well as such public utilities as gas, water, and electricity. He provides new estimates of investment flows and accumulated capital stock by infrastructure category; examines the geographical distribution of infrastructure investment by province; places the record of Spanish infrastructure investment in a broader European context; and analyzes the contribution of infrastructure investment, and railways in particular, to economic growth in Spain between 1850 and the Civil War. This last part leads to a re-evaluation of one of the most vital debates in recent Spanish historiography—the alleged failure of railways. The thesis is written with a sure command over sources, maturity of insight and sophistication of explanation. It demonstrates a significant investment of human capital (measured in terms of both quantity and quality) and a high social rate of return. It is a considerable accomplishment.

The thesis takes us back to the pioneering days of the New Economic History, when debates were raging over the meaning and relevance of "social savings" and over the precise nature of its relationship to the more familiar concepts of the social and private rate of return. Herranz-Loncán returns to these debates, but adds a further dimension by constructing annual series on new capital investment, retirements, renewals, and the other components necessary to produce consistent series on the gross and net capital stock of infrastructure broadly defined. As he observes, his measurements are incomplete, because there are no figures available to permit inclusion of urban (or suburban) development, but nevertheless key results emerge—most strikingly the contrast

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between railways and the rest of infrastructure investment. Railway capital was dominant up to 1865 or so; still accounted for the lion's share of infrastructure stocks until 1895; and then became increasingly less important as the building of new lines largely ceased while investment in other forms of infrastructure investment continued to expand. Railways did still matter to overall capital flows, of course, because of the massive scale of renewals necessary to maintain the existing capital stock (the cyclical volatility of gross investment is, for example, dominated by railways as much in the 1920s as in the 1870s). I applaud Herranz-Loncán for the effort that went into the construction of these data; they represent a significant addition to knowledge and will be extremely useful for future scholars.

Yet, despite the added richness provided by these new series, it is still railways that dominate the story—both quantitatively (especially in the nineteenth century) and analytically. So it is perhaps inevitable that the remainder of my remarks is directed at Herranz-Loncán's revisionist views concerning the role of railways in Spanish economic development.

I well remember that the very first economic history workshop I attended as a graduate student in Oxford in the late 1970s was a discussion of the social savings of Spanish railways by Antonio Gomez-Mendoza. Gomez-Mendoza produced spectacularly large numbers—between 18.5 and 23 percent of GDP in 1912 on freight alone.[12] These are the highest figures calculated for social savings in any European economy of the period, and are eclipsed only by the estimates for Mexico and Brazil on the eve of World War I. The high rate of social savings, it has been argued, indicates that railways could not have been a failure. Not all historians have agreed.

Herranz-Loncán's revised estimate of the social savings from freight traffic, integrating new evidence on the opportunity costs of railway transportation and his own calculations of the marginal cost of freight carriage, is a little lower than Gomez-Mendoza's. The overall contribution of the railways is raised by extending the social savings calculation to passenger transportation—which Gomez-Mendoza treated as an entirely new commodity that would not have developed without the railways, in contrast to Herranz-Loncán, who identifies a vibrant, if limited, stagecoach sector before the railways. The additional social savings is small, but adds to the distinctiveness of the Spanish case.

The very high level of Spanish social savings from railways was achieved despite having one of the lowest ratios of ton-miles (and the lowest level of passenger-miles) relative to GDP in Europe. The answer to this apparent paradox is to found in the nature of the alternative means of transportation—the reliance on roads in a geography absent of major river systems. The social savings figure grew significantly between 1878 and 1912, due partly to the enlargement of the Spanish railway network, and partly to changes in the economics of road transport.[13]

Is a high (and rising) social savings figure sufficient evidence to reject accusations of failure? An argument could surely be made that a high estimate rather indicates the fundamental failure of railways to modernize the economy—in the sense that the denominator in the calculation (GDP) is not large enough. This interpretation would be consistent with Herranz-Loncán's VAR analysis of Spanish economic growth, in which he finds that infrastructure did not promote economic growth. It would be helpful to use the same panel data to create a four-sector model that would explicitly

[12] See, for example, Gomez-Mendoza, "Spain," pp. 148–69.

[13] The much lower social savings for freight traffic in 1878 is due to the assumption of significant seasonal underemployment of pack animals, which results in a much lower value placed on the resource cost of shipping goods by road.

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model the impact of railway infrastructure on economic growth; but it seems likely that the results would be the same. The dynamics of social savings matter most, and it was here that railways played such a weak role. It appears that the high social savings figure captures a once-and-for-all effect associated with the original construction of the system—raising Spain to a higher steady-state growth path, as it were, but not effecting a higher growth rate itself. This is, presumably, in part what critics of the social savings conclusion mean by the failure of the Spanish railways—the failure to transform.

The issue begs for a social rate of return calculation to complement the social savings figure. Herranz-Loncán provides it, calculating a very high number for both 1878 and 1912. I think it would also be instructive, if it were possible to do so, to construct the average social rate of return for different lines in different regions at different benchmarks between 1850 and 1935, from which could be inferred the marginal social rate of return on railway investment as the system expanded. My suspicion is that there would be significant divergences between the inter-urban routes that dominated early building and the inter-regional lines that came later. It seems clear from data provided by Herranz-Loncán that the density of use for railways built after 1873 was much lower than for established routes and that the private rate of return was also substantially lower. The second wave of railway building extended the network into rural and outlying areas, apparently with limited economic benefits. The calculation of social rates of return in this manner might resolve the crucial puzzle—if the social rate of return on railway investment was so high, why was the marginal impact of infrastructure investment on Spanish growth essentially zero?

It appears to me that this is a classic case of overbuilding of the railroad system—of Schumpeterian excess, with building ahead of demand unhappily unaccompanied by subsequent growth. I suspect that Herranz-Loncán would disagree with this interpretation, but I am still not quite convinced by the counter-argument. I recognize that railways were a public good in the nineteenth century and that opening up rural areas was a "good thing." But you can, of course, have too much of a good thing, and it appears that the Spanish railway system achieved that unhappy state.

This does not necessarily make the railways a failure, however. It may well be that the fault in the Spanish economy lay elsewhere—in the failure to take up the opportunity created by the new system of transportation. Was the problem fundamentally one of agricultural stagnation and entrepreneurial intransigence? Or simply the result of a deficiency of resource endowments? Was it due to over-confidence on the part of the railway promoters when predicting future traffic? Or was it corruption and a political system manipulated by speculators? Was the railway system poorly designed? Or were railways compromised by other weaknesses in the infrastructure, such as the poor investment in secondary roads necessary to provide a full transportation network? It should be noted that the density of roads in Spain was very low relative to economic density compared to other European countries; and that communications infrastructure was also relatively weak, with poor access to a limited telegraph system and expensive rates.

The social savings method looks at roads as substitutes, whereas an infrastructure approach emphasizes that they were complements. Certainly, the locational advantages of new infrastructure investment appear not to have been fully realized for Spain. The railways may have integrated the Spanish economy, but they did not break down established regional hierarchies. There was considerable spatial auto-correlation in the rail network as it expanded over time; similarly in road infrastructure as well. Moreover, over time the distribution of roads and railways became more similar across

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provinces, suggesting that infrastructure investment was producing commercial momentum and geographical inertia simultaneously.

Failure in the mind of such critics of the railway system as Gabrielle Tortella covers not only the transformative power of investment, but includes also the apparent failure of the railways as private enterprises. Herranz-Loncán rightly observes, however, that Spanish railways do not look so bad when placed in a broader European context. The (average) ratio of net receipts to capital was relatively high compared to other systems, and the ratio of working expenses to traffic revenues was relatively low. But I am not yet convinced that these statistics do not simply prove that fares were relatively high on Spanish railways, due to the relatively low volume of traffic carried per mile of track, and that Spanish railways allocated fewer resources to maintenance and service. Indeed, the problems of the Spanish railways at the end of the nineteenth century would not be unfamiliar to the bosses of Amtrak or Virgin Rail at the beginning of the twenty-first, with complaints about high fares, poor quality of service, and insufficient funds to maintain the infrastructure, let alone effect capital improvements. As today, the most densely settled lines seem to be the only ones capable of achieving a reasonable rate of return on capital, whereas the less well-used lines suffer from increasing neglect.

In short, Spanish railways seem to have begun to suffer from the problems of the railway in a mature economy, long before Spain became a mature economy. The problems of the modern railroad emanate in no small part from competition provided by other more efficient, more flexible sources of transportation. But nineteenth-century Spain had no alternative source of transport—indeed inland waterway systems were so poor, that they faced no competition to speak of at all. This, of course, is why the social savings are so high. It also seems likely that this is why private returns were also relatively high, but why the overall contribution to economic growth was so low.

Herranz-Loncán places the burden of responsibility for such failures as did exist squarely on the state. It was the state's mismanagement of the auction process by which public subsidies were allocated that created a poor deal for shareholders; it was the state's corrupt system of inspections that allowed the poor quality of service; it was the state's inability or reluctance to regulate prices in an imperfectly competitive market that allowed fares to be among the highest in Europe. But if the state was responsible for the problems, was government regulation the answer? It is perhaps ironic that the state should be identified as the lost savior of railways, when the British and American cases, for example, emphasize that nationalization and public regulation exacerbated the problem. To be fair, if you go back far enough, the British case also suggests that it was private ownership and the absence of public regulation that exacerbated the problem. The lessons from the history of railways in the pioneer economies suggest that the problems of railway management have less to do with ownership or control and far more to do with the nature of the market and the peculiar nature of the railway companies—the classic decreasing cost industry with huge network effects.

The fallibility of the state also lies at the heart of Mu Li's dissertation on fiscal administration in late Qing dynasty China, which applies a game-theoretic approach to a fundamental question of Chinese economic historiography—why was there "No Great Leap Forward" in the 1850s and beyond? Essentially, Li's argument is that, as a result of repeated games over the previous two centuries, during which the primary actors in civil society—the sovereign, the local elites, and the taxpayers—rehearsed their lines, a stable equilibrium emerged. Over time, however, this equilibrium took on the characteristics of stasis, such that it could not adapt to changing circumstances. The period after 1850 saw a significant number of developments and opportunities—in particular

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the opening up of China to western possibilities and western challenges—that exposed the weakness of the Chinese economic and political system.

I found this a fascinating dissertation to read. It asks a fundamentally important question about Chinese economic development and it approaches it with verve. The model is well designed, the predictions and implications clearly articulated and imaginatively tested against the available, and necessarily fragmentary, evidence. Because of the inherent weakness of the historical and economic record of nineteenth-century China, the interpretation is necessarily suggestive rather than definitive. Indeed, given the fragmentary and incomplete historical record, one of the characteristics of Chinese historiography is that no-one can expect to have the last word. But Mu Li provides a fresh voice that will have to be listened to.

There are, to my mind, three areas where Li might need to pay attention as she makes the transition from dissertation to publication.

Firstly, the model. There are three primary players—the sovereign, the elites, and the taxpayers. My question concerns the depiction of the elites who are modeled, for obvious reasons of parsimony, as homogenous. But it might be asked if this represents unnecessary simplification—how far can we treat the elites of nineteenth-century China as functionally homogenous? In particular, it strikes me that there needs to be a greater distinction drawn between the impoverished rural elites and the less disadvantaged urban elites. Implicitly, such a distinction is already advanced in the thesis by the discussion of *likin*—tax-farming among merchants—and the emergence of guilds in chapter 2. The guilds are in effect loose combinations drawn from the ranks of the urban elites; rural elites are largely absent from these new institutional forms. Bifurcation of elites will, to be sure, make little or no difference to the outcome of the primary game, which establishes the equilibrium conditions of the mid-nineteenth century, but it would enrich the analysis of the breakdown of that equilibrium and the resulting, endogenous, institutional changes that it generated.

In particular, differentiating among the elites would help enrich the analysis of the breakdown in the implicit fiscal contract—because the rural elites were bound by the cap on land taxes established early in the eighteenth century and had developed extralegal devices to raise money for local (not central) purposes gradually over time, as population expanded and local needs grew. The particular problem for the Chinese state in both the eighteenth and nineteenth centuries was a consequence of the decentralization necessary to run a vast and sprawling empire. The local elites were effectively co-opted by being given control over revenue-raising; by so doing, the state sacrificed any ability to extract additional resources from local sources, especially after the land tax was frozen in 1713.

It is therefore no accident that such innovations in fiscal administration that did emerge in the nineteenth century were centered on the urban elites, for whom no such constraints applied. The added element to this is that expectations regarding fiscal limits were largely absent for commercial taxation. Li recognizes this. But the other side of the contractual relationship also needs to be explored more closely—in the form of reciprocal expectations of the merchants to the limits of state action. One of the reasons for the failure of the self-strengthening movement in the second half of the nineteenth century was (actual or feared) government predation of any profits that the new joint stock enterprises might generate. There had been, in the language of Li's approach, an insufficient number of repeated outcomes to educate the major players in this sub-game in the rules of conduct necessary to sustain a mutually beneficial equilibrium.

If we follow the logic of this distinction, the crucial period is the second quarter of the nineteenth century rather than post-1850 as Li suggests. For it was in this period

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that the emperor attempted to renegotiate the terms of the rural equilibrium by imposing a more rational tax code. The strategy failed. The combination of rebellions, economic depression, and the impact of price deflation on the real value of land taxes (and extra-legal assessments) destabilized the position of the sovereign. What was the response of the government to the wave of unrest? To make concessions—to lower taxes in the areas most affected by economic distress. This renegotiation of the social contract worked in completely the opposite direction sought by the Emperor a generation earlier. The whole movement can be ascribed to the pursuit of fairness in the form of increasingly harsh economic realities. But the renegotiation involved sacrifice by the sovereign (whose revenue stream was also suffering during this period) and one wonders whether these were the actions of a benevolent state wedded to concepts of fairness, a strong state using rent-seeking devices to pre-empt political opposition, or a weak state unable to marshal political or military resources to effect its goals.

Finally, the matter of Japan. The explicit comparison that is drawn by Li when discussing a possible counterfactual late Qing China is Japan under Meiji rule. Here was a state that was able to expand its fiscal reach considerably after 1868, and was therefore able to develop military security and bureaucratic strength at the same time as tax revenues were devoted to infrastructure investment, capital market subsidies, and industrial development. The Meiji dynasty overcame the fiscal constraints in an era of largely stagnant agriculture by introducing land reform, something the Qing dynasty, shackled by cultural expectations and institutional rigidities, was unable to do.

There is no doubt that Meiji Japan was not subject to fiscal restraints (or indeed the same pressures on the expenditure side) as Qing China. But I wonder if this is in itself enough. Historians have increasingly rejected the comparison of China and the West, or at least complicated the nature of that comparison. But if it is no longer appropriate to ask "Why was China not Britain (or Germany)?" is it any more reasonable to ask "Why was China not Japan?' And if we do make the comparison, we need to avoid the perils of reductionism.

There is surely more to say in a Sino-Japanese comparison than just the matter of relative fiscal success. Japan was, to begin with, a much smaller nation—about the size of a single Chinese province in 1870. The relatively small scale of population, plus the relatively compact geography of Japan, made central administration more feasible, in contrast to China where decentralization was essential to maintaining the state without an over-bloated bureaucracy. The authoritarian nature of the new regime in Japan, supported by a dominant military authority, meshed with the fundamentally hierarchical structure of society to force through changes that were all but inconceivable in China. The contrast in fiscal outcomes is a result of fundamental social, civic, and cultural contrasts rather than a reason in itself. This provides a real opportunity for Mu Li to pursue a similar institutional analysis of the political economy of fiscal administration in Japan to discern how far the underlying social and cultural forces established a shift from a pre-Meiji equilibrium to a Meiji dynamic.

One of the issues that a new institutional analysis of Japan and China would need to internalize is the difference in political agendas at the time of dynastic formation. The Qing dynasty as early as 1720 practiced concessions to placate potential political opposition in the provinces; the Meiji rulers 150 years later used power to effect the same result. And while the emperor in Japan exercised *force majeur*, the emperor in China in the 1860s appealed once again to the culture of Confucian purity to maintain fidelity with a social contracted renewed continuously since the early eighteenth century. In Veblen's thought-provoking "The Economic Opportunity of Japan," the emphasis is placed on the cultural dissonance between entrepreneurial expectations and

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an authoritarian social system to produce a disequilibrium dynamic of rapid growth. In Qing China, by contrast, accommodationism, designed to protect the stability of the equilibrium, was the enemy of development.

I end by returning to the Great Exhibition of 1851. The Council Medal at the Crystal Palace exhibit was reserved for exhibits that demonstrated "important novelty of invention or application, either in material or process of manufacture, or originality combined with a great beauty of design." Each of these dissertations deserves such a commendation. I applaud them all.

MARK THOMAS, *University of Virginia*

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The Dissertations of Doctors Law, Johnson, and Priest: 2003 Allan Nevins Prize Competition of The Economic History Association

The dissertations in the Allan Nevins prize competition have often been read as tea leaves to discern the future direction of the profession. Collectively, those submitted covered diverse subjects, as represented in this panel by topics ranging from colonial currency to food safety regulation to World War II antidiscrimination legislation. The time-periods covered in the works were also spread broadly, although none centered in the nineteenth century, which has traditionally dominated the attention of economic historians of North America. The pivotal period for Claire Priest is the 1730s and 1740s, for Marc Law the 1900s and 1910s, and for Ryan Johnson the 1930s and early 1940s. The new works should serve to widen our time-horizons. Another feature unifying these dissertations is that all three study (to one degree or another) the effects of policies and their enforcement on the economy. We learn of the balance between the courts and the regulators and of the gaps between the stated goals of legislation and the results actually achieved.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

But the exercise of tealeaf reading is probably just seeking patterns where none exists. It neglects the true virtues that make each of these dissertations worthy of inclusion in this panel—namely, that each starts with an interesting question and takes impressive steps towards providing answers. I focus my remarks on what I found most exciting about these dissertations.

I should admit I face some risk in discussing these dissertations because each addresses a topic far outside my area. I have learned much from each dissertation— perhaps too much given that the bulk of what I now "know" about these topics is derived from the authors' work. There is then a risk that I will expose my ignorance— or still worse lead you to adopt it as your own—by venturing some unsupported claim or issuing some criticism long dismissed by those with greater learning. Given this, I will begin with the topic nearest to my own and then proceed into areas I admit to knowing less about, indeed little before reading these dissertations.

MARC LAW

Marc Law's dissertation is actually about this very issue—what happens as the scope of specialized knowledge grows and the information gap between producers and consumers widens. His study is set in the turn-of-the-twentieth century U.S. economy as it is experiencing a growing national market, increasing urbanization, a greater division of labor, and the rising importance of science.

This innovative work is sweeping in scope. It starts with the specific and local—examining food regulation at the state level—then moves to the national level to investigate the operation of the Food and Drug Administration, and then explores the more general issues of the rise of professions and the impact of occupational regulation. The questions about regulation are broadly framed in the market power versus efficiency debate. Do the regulations and regulatory agencies operate to restrict competition to benefit the economic groups that have captured the legal process as Clayton Coppin and Jack High suggest or do they operate in the public interest to relieve market failures, such as those due to problems of asymmetric information.[1]

Although Law employs statistical analysis, the papers are not set up in the classic cliometrics showdown where the hypotheses from the existing literature face-off in a grand econometric confrontation (a duel by regressions employing the newest data and the latest techniques) and after a careful tallying of significant *t*-statistics, a victor is declared. Rather, Dr. Law uses the statistical tests as pieces of evidence, in combination with narrative evidence and qualitative arguments to advance his case incrementally.

In general, he does not find much support for the anticompetitive effects of the food safety or occupational regulations. Instead in the chapters on food safety, Law argues quite plausibly that well-equipped labs and superior training gave government scientists a comparative advantage over the typical consumer in detecting food adulteration. He further asserts that state enforcement of labeling regulations—and for Law, the key was the presence of an enforcement agency rather that mere laws on the books—helped solve the lemons problems for the benefit of both sides of the market. Such problems were growing more severe as urbanization and commercialization increased the gap between food consumers and producers just as the advance of science was creating new chemical additives that provided low-cost means of "extending" products—adding glucose to liquid honey—as well as new preservatives to prevent decay.

In his exploration of city-level prices over the 1890–1903 period (for butter, cheese, milk, sugar, molasses, and vinegar), Law found that the presence of a state enforce-

[1] Coppin and High, *Politics*.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

ment agencies did not have a statistically significant effect in raising prices, slowing their decline, or reducing variance, as the market-power hypothesis would suggest. The only possible exception is butter, where the effects of restrictions on oleomargarine are well known. Law also used the 1903 U.S. Bureau of Labor Statistics survey to examine the relationship with food regulations and household consumption patterns. If enforcement of pure food laws reduced information costs (as he suggests), per capita consumption of potentially adulterated products should be higher in states with stricter legislation. This prediction is confirmed for butter, tea, and coffee.

Several aspects of this analysis caught my attention. First, Law sought to explain his exceptional cases rather than treating them as statistical freaks. Second, these price data have been available forever but Law displayed an admirable ability to make "old" data do new tricks. If I must be critical, I would note that none of these results is overwhelmingly powerful and that although the study is focused on state-level regulation, it relies predominately on federal sources to summarize these efforts. He does not exploit the wealth of state- and municipal-level sources that might hold keys to generating stronger findings.

Adopting the national perspective is far more appropriate for his study of the 1906 Pure Food and Drug Act and its effectiveness in stemming the interstate trade in adulterated and misbranded products. Law goes beyond theorizing to examine the cross-product variation in enforcement activities of the FDA as revealed in its annual reports. Again Law finds the market-power explanation lacking. The Pure Food and Drug Act worked primarily through labeling requirements with only limited restrictions on food products "not fit for human consumption." Thus it appears to create a level playing field rather than restrict competition among the players. The act's authors (chiefly Harvey Wiley) sought to avoid direct confrontations with the producers of patent medicines, although the FDA did not shy away from pursuing misbranding cases when they arose. Law finds that FDA enforcement efforts were focused on those food products most subject to deception about quality—canned tomatoes, seafood, and condensed or evaporated milk—just as his information-based hypothesis suggests.

He further argues that the FDA chiefly gained compliance chiefly through using noncoercive means—ex ante advice and certification—instead of relying on forceful ex post enforcement. Many producers cooperated with the FDA to attain low-cost signals of quality—as in the voluntarily program at its Color Investigation Laboratory that certified the safety of coal-tar based food dyes and its agency's inspection efforts for the canned seafood industry. The threat of bad publicity also kept some of the food producers and drug makers in line.

This discussion called to mind the memorable exchange at the 1994 Clio meetings between Joel Mokyr and Richard Sutch over the economic gains versus culinary losses resulting from the invention of the tin can.[2] In light of modern food fashions, particularly the rediscovery of the virtues of fresh, locally grown ingredients, the FDA appears like an enabler for junk food addicts. As Law notes, American consumers were initially very reluctant to purchase canned or processed food. In 1900, the can opener was "deemed an evil symbol"; by the 1920s it was "Boss of the kitchen." I fear that the many economic historians who style themselves gourmets may want to indict the FDA for raising the can opener's status.

Finally let me briefly draw a link that I think deserves elaboration between the last chapter on the rise of professional training and the earlier two chapters on food safety. For an economist operating in an intellectual environment influenced by the public choice school, the obvious and difficult question is why the regulator would enforce

[2] Mokyr and Stein, "Science," as presented at the 1994 Cliometrics Meeting, Phoenix, AZ.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

the rules honestly or nonopportunistically. Why is he or she not just one more grasping hand seeking a bribe or perhaps just a complete do-nothing? The answer would seem to come from the regulator's membership in a profession, one requiring a lengthy investment in training and certification and one holding frequent meetings (not unlike the EHA) and providing honors and demerits.

Such a training process serves to inculcate the values of the profession and weed out some who fail to adopt them. Once completed, this training allows the professional to receive a stream of rents above what one can earn (ex post) in other activities. However, if one violates the professional codes of conduct, one is decertified—e.g., disbarred as a lawyer—and loses this earnings stream. The dichotomy between efficiency versus market power addressed in the final chapter on the rise of professions then appears to be slightly misleading. It is threatened loss of the ex post rents (resulting from barriers to entry) that helps hold the professional hostage and limits opportunist performance. These are just poorly informed speculations, but I wonder what forces Dr. Law believes work to keep the food safety regulators on-task.

RYAN JOHNSON

In his praise-worthy dissertation, Ryan Johnson taps into the wealth of information available at the state level that can help address questions that national data cannot address. He creates a valuable public good by assembling a new data set on manufacturing and mining in Pennsylvania in the period bracketed by the World Wars. The annual nature of this data provides extra leverage for analyzing key issues regarding business-cycle conditions and policy shifts that cannot be easily answered with the existing IPUMS cross-sections.

Pennsylvania is just one state, but it is nearly ideal for investigating the issues at the intersection of race, unionization, and employment. The Keystone State had the largest black population in the North, was the second leading industrial state circa 1929, and a leader in industrial unionization in the 1930s and 1940s.

As in Dr. Law's work, Dr. Johnson's chapters are organized in the form of articles, including some repetition, but allowing for easier separation for publication, which is smart. Another aspect of the work that I liked was that the results allowed Johnson to enter directly into outgoing debates, specifically with William Collins on the impact of Fair Employment Practices Commission during the Second World War and with William Sundstrom on the origins of the black-white unemployment gaps.[3] Now at times I feel I am working in my "own private Idaho" and interacting with others chiefly by smiling politely and waving from a distance. If you miss the close-quarters, give-and-take debates that were once common in economic history, you will appreciate Ryan Johnson's work.

The study's data is a panel of annual observations on over 300 manufacturing and mining industries over a crucial 35-year period from the Pennsylvania "Report on Productive Industries." (I am not sure why but the academe was not considered a "productive" industry.) The Pennsylvania data do not have everything one might desire—the units of observation are industries rather than plants or individual workers. And although the data set includes the composition of the labor force (black, native white, and foreign-born white; male and female) by industry and average wages, it does not have race-specific wages.

Despite these limitations, Ryan Johnson uses his data set to generate a number of valuable, novel, and robust findings. These include, first, that the degree of industrial

[3] Collins, "Race"; and Sundstrom, "Last Hired."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

segregation, while initially high in Pennsylvania, did not display the rigidity that characterized Southern manufacturing. A major increase in integration appears to occur after 1935. Second, blacks were disproportionately hired in high-wage (not low-wage) industries until the mid-1940s. This surprising finding raises serious questions with the industrial-crowding hypothesis that dominates the literature. Occupational and education differences, not industry segregation, must explain black-white income differentials in the region in 1940. One of the aspects that I liked most about this analysis is that Johnson cross-checked his findings with the IPUMS sample and then rechecked to see whether the results were due to the operation of compensating differentials (for example, whether blacks were in disproportionately dangerous industries, they were not.) The annual nature of the Pennsylvania data allows Dr. Johnson to show blacks were clustered in the more cyclically volatile industries—those that experienced disproportionately rapid growth during the booms of the 1920s and disproportionately rapid declines during the 1930s.

If he were to link his data set to the U.S. Census of Manufactures, which is available biennially over the period under exploration, I think Johnson could push his analysis a little further by exploring the relation between segregation and plant size—were black workers less common in industries with small plant sizes? In such industries, interactions with white workers might be different than in industries with large plants.

When examining the emergence of racial employment gaps (which Sundstrom found in 1931 but not 1910), Johnson focuses on the role of policy. He extends the work of Harold Cole and Lee Ohanion, others who showed that New Deal policies slowed the desirable deflation of wages to argue that the high-wage policies worsened economic conditions for blacks.[4] I must admit having some difficulties with Johnson's analysis. First, regarding his theoretical model, we already know that we need sticky (non-market-clearing) wages to generate unemployment. Two, we know there was unemployment before the New Deal, unemployment that was unlikely to be caused by the November 1929 White House Conference where Hoover and leading employers swore fidelity to the high-wage ideals.[5] Hoover and other presidents have hosted innumerable White House conferences but it seems hard to attribute anything as great as the Great Depression to such confabs and photo-ops. This timing issue is especially glaring because the rise in the labor share of revenue, which is taken as a proxy for high-wage policies, occurred between 1929 and 1932. Perhaps, this measure is too imperfect a proxy because it also captures nonpolicy effects such as capacity utilization—the shadow returns to fixed capital should be close to zero at the low levels of utilization prevailing in the 1930s. Nonetheless, one intriguing finding is that blacks empirically had a more transitory employment experience—fitting the last-hired, first-fired characterization. Another is that both increases in labor's share of revenue and unionization increased the transitory (vs. permanent) component of black employment. Thus, if New Deal policies increased unionization and labor's share of revenue, they perversely worsened the position of the "forgotten men" of color.

The study on the integration of blacks into Pennsylvania manufacturing during the Second World War takes Johnson into another vital area of recent research. In a series of important papers, Collins has argued that African-American who entered the defense industry during the war and then remained employed there in 1950 earned 14 percent more than their observationally equivalent counterparts, that the legal action of Roosevelt's wartime Fair Employment Practice Commission appears to have opened doors to these jobs for blacks, and that the more racially tolerant CIO unions helped

[4] Cole and Ohanion, "Great Depression."
[5] See O'Brien, "Behavioral Explanation."

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

push the antidiscrimination agenda before, during, and after the war. By linking his panel data set with industry-specific information on the extent of unionization and on FEPC case files, Johnson can explore whether Collin's story is the Pennsylvania story. The ability to use annual data on favorably resolved antidiscrimination complaints allows Johnson to claim greater leverage in identifying the effects of the agency. He finds minimal effects. The CIO is also cast in a more neutral light, without as strong negative effects on integration as the AFL or nonaffiliated unions, but not a powerful force for change either.

As I said above, I think the great aspect of this work is that Ryan Johnson is ready to step in directly to several important policy debates that we will all find stimulating and insightful. There is also substantial potential to push the analysis back to examine the labor market during the First World War and to investigate the competition between blacks and foreign-born whites in the 1910s and 1920s. I also see many fruitful avenues for extending this work by linking to other state and national datasets.

CLAIRE PRIEST

From these two works on twentieth-century economic history, Claire Priest takes us back far into the colonial period to examine the colonists' early money troubles and their impact on New England's legal and economic evolution. Although this dissertation is grounded firmly in its time period, a period remote from us, I was struck as I read this work that many of the underlying issues are timeless. Consider a recent example (June 2003) in Iraq. After the forces from the "Coalition-of-the-Willing" overthrew the regime of Saddam Hussein, U.S. authorities confronted complaints from the civilian population about shortages of money, especially of the small-denomination 250-dinar notes. The money of the old regime continued to circulate (perhaps locals believe the Saddam was only temporarily deposed). The 250-dinar notes used in day-to-day trades were so scarce that they exchanged at a substantial premium (one-third) above their face value with 10,000-dinar notes. The eventual disruption to trade and accompanying banks riots became so severe that U.S. authorities opted in June to "solve" the problem by printing 250-dinar notes of the old style, that is, bearing the picture of Saddam Hussein.[6]

There is something a little strange about money both in theory and in practice. In monetary theory, money is a magic lubricant for trade, one drop of which is all you need, given flexible prices, to avoid the inconveniences of barter. In practice, the concept runs into trouble given that you need small denomination notes to carry out day-to-day transactions.

Now good money is better than no money, but bad money (based on broken or soon-to-be-broken promises) apparently has value too. And bad money is far easier to produce. Bad money tends to depreciate, leading to trade disruptions and complaints of shortages of small-denomination notes (recall the stories of the German hyperinflation), which weak authorities "solve" by issuing still more bad money.

The participants in the story Claire Priest tells can at least claim that, because paper money was relatively new, they were not simply repeating past mistakes. Before 1690, Massachusetts existed as cash-scarce, semibarter economy where high transaction costs limited specialization. Citing numerous colonial pamphlets and texts, Priest demonstrates widespread private and public support for paper issuance. In 1690 Massachusetts began to issue paper bills of credit to provide back-pay for soldiers, promising the notes could be used to pay future taxes at a 5 percent premium. This experi-

[6] *New York Times*, 21 June 2003.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

ment proved so successful that many other colonies soon followed suit (South Carolina in 1693; Connecticut, New Hampshire, New Jersey, and New York in 1709; Rhode Island 1710; and North Carolina 1712). In 1712 Massachusetts granted its bills legal tender status and in 1714, began to print bills to loan out at interest. But the purported scarcity of bills in this period led the colonial government in 1715 to ignore provisions to retire the bills and instead issue more. The real fun began as *the good money went bad*.

One recalls the quote from Benjamin Franklin that appeared in Paul Samuelson's *Economics* textbook: "About this time there was a cry . . . for more paper-money . . . I was on the side of an addition, being persuaded that the first small sum struck in 1723 had done much good, by increasing trade, employment, and number of inhabitants . . . Tho' . . . there are limits beyond which the quantity may be hurtful."[7]

Priest's fascinating account of the currency crises of the 1720s and 1730s leaves me with numerous questions: by what objective measure are the currency crises (1720/21, 1726/27, 1733/34, 1738–1741) dated? How did each specific episodes end? When the legislature eventually (in 1742) replaced the common law doctrine of *nominalism*—the idea that the payment of nominal value of a debt satisfies one's legal obligation—on what precedent or prior example did they act? And how precisely did they form the schedule underlying their price indexation scheme? It would appear that not only did the American colonists introduce paper money to the modern world, but COLAs (cost-of-living-adjustments) as well.

Her account calls into question two of the major approaches to colonial legal history. On the one hand, it bowls over the traditional view advanced by Morton Horowitz that sees in colonial legal structure a pre-industrial mentality aimed at maintaining community harmony.[8] Priest argues that New England's early insular, communal economy was not voluntary but rather the result of its severe currency shortage. She shows that from 1690 to 1720, much of the population clambered for more paper money, Land Banks, and similar expedients. When the currency supply became unstable in the 1720s and 1730s, depreciation became rampant, and debt relationships strained, the citizens of Massachusetts (here reflected in the county of Plymouth, a mixed economy south of Boston) did not seek harmony but rather took their feuding to court.

On the other hand, her account challenges the competing modernization view advanced by Bruce Mann and Cornelia Dayton.[9] These scholars document a rising level of debt litigation in New England, but interpret this trend as a positive development reflecting the innovation of a new legal means of recording debt and, more generally, of increasing commercial activity. Dr. Priest counters that few economic historians find signs of rapid expansion of per capita trade or income in region over the eighteenth century. And more pertinently, she shows a close correlation between annual litigation volume in the Plymouth County Court of Common Pleas and the periods of economic distress associated with currency crises of the 1720s and 1730s. Finally, her investigation of the court records demonstrates how costly reaching settlements under the Massachusetts legal system were in the eighteenth century. In her samples, the bite of the court fees was very high—the median fees were 17–22 percent of the debt. At going wages, this fraction represented over a week of a farmer's labor—compare to today's 2002 fees, which are on average are equivalent to four hours of labor at minimum wage. Of the lowest quartile of cases, the eighteenth-century court fees consumed 80 percent of the sums at stake. Now putting serious knocks on two leading approaches

[7] Samuelson, *Economics*, p. 316.
[8] Horowitz, *Transformation*.
[9] Bruce Mann, *Neighbors*: and Dayton, *Women*.

https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press

with a single study of 223 pages is a neat trick. The results of further scholarship and debate in this area should be of great interest.[10]

But for me, the payoff of the dissertation was its path-breaking analysis of the origins of Shay's rebellion, one of the major catalysts for replacing the Articles of Confederation with the Constitution. The rebellion is seen not solely as a revolt against taxes or debt but more specifically as a revolt against the court system that was costly, inefficient, and lacking a mechanism by which debts could be secured. To quote directly: "Shay's Rebellion was a reaction to the high cost of credit and court fees in an environment of deflation and recession." The underlying problems were not resolved until General Court passed the Confession Act of 1786 allowing debtors to register debts with the justice of peace for a small fee. Priest argues Shay's Rebellion gives lie to the debt-recording interpretation of the modernization theory. Why was the Confession Act passed if a suitable recording instrument was in place for 50 years?

More generally, Priest's study highlights the Massachusetts legislature's power (for good or ill) over the region's economic conditions through its use of currency policy and shows convincingly that struggles over court reform have as long a history in this country as the better-known phenomena of tax and debt revolts.

PAUL W. RHODE, *University of North Carolina-Chapel Hill and NBER*

[10] See Mann, "Law," for his response to Priest's work.

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https://doi.org/10.1017/S0022050704272801 Published online by Cambridge University Press