Teaching to the tests: An economic analysis of traditional and modern education in late imperial and republican China

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ABSTRACT

A traditional education system, based on the Confucian classics, was a pillar of imperial China's social structure, government, and economy for centuries. Study in traditional schools prepared students to take a series of highly competitive exams that conferred gentry status and civil service positions. Reformers in late imperial China called for the modernization of educational institutions, seeing in Western education the skills necessary to develop China's economy. In the late 19th century, the traditional education system was joined by a "modern," Western track, which offered teaching in science, math, social science, law, and engineering. In this paper, early 20th century employee records from the Tianjin-Pukou Railroad are analyzed to identify differences in labor market outcomes associated with study in the traditional and modern educational systems. The employee records reveal that modern and traditional education were both associated with wage premiums, but that these were significantly larger for individuals trained at high levels in the modern system, especially those trained in engineering. Individuals trained in the traditional system worked disproportionately in the clerical department of the railroad, while those with modern education were more often in managerial and technical roles. Qualitative and quantitative evidence suggests that these results are not driven by sorting into educational institutions according to ability. These findings indicate that beyond years of schooling, the content of schooling can play an important role in the process of economic development.

1. Introduction

A traditional education system, based on the Confucian classics, was a pillar of imperial China's social structure, government, and economy for centuries. Study in traditional schools prepared students to take a series of highly competitive exams that conferred gentry status and civil service positions upon those who passed. Elman (2000, p. xvii) writes, "In China since medieval times, imperial dynasties, gentry-literati elites, and classical studies were tightly intertwined in the operation of the civil service examinations. All three were perpetuated during the late empire (1368–1911), and they stabilized for five hundred years because of their interdependence."

Military defeats at the hands of Western countries (in Opium Wars ending in 1842 and 1860) as well as Japan (in the Sino-Japanese War of 1894–1895) indicated to many Chinese the need for institutional change. Among the changes proposed were reforms to the structure and content of the imperial exams, and thus to the content of the education system. There were passionate statements made on both sides of the debate over educational reform. Those in favor saw clear links among international competitiveness, economic modernization, and educational reform. Elman (2006, p. 201) writes of a Qing official who felt that "the military successes of Meiji Japan were a model for China and that emulating the Japanese would require expanded education in the sciences and industry." In 1898, the Guangxu Emperor wrote, “Our scholars are now without solid and practical education; our
artisans are without scientific instructors; when compared with other countries we soon see how weak we are” (Headland, n.d., p. 116). In contrast, rather than view Meiji Japan as a paragon, conservatives argued that “For five thousand years the spirit of the sages has continued in China ... [we] absolutely must not do as the Japanese, who had dispensed with their own learning in favor of Western learning” (Weston, 2002, p. 108).1

Beginning in the second half of the 19th century, a modern (Western) educational track gradually developed in imperial China. Military arsenal schools, first established in the 1860s by the Qing government as part of a movement toward “self-strengthening,” translated Western scientific texts into Chinese, and provided training necessary for the adoption of Western military technologies (Elman, 2006). A small modern educational hierarchy, including high schools and colleges, developed as well, especially in the treaty ports controlled by Western powers. These modern schools were often staffed by missionaries, and taught foreign languages and Western math and science. Chinese students were also able to access Western knowledge through study abroad.

While the cultural, social, and political consequences of the China's Confucian education system and imperial civil service exams have received a great deal of attention (for example, Chang, 1955; Ho, 1962; Miyazaki, 1981; Chaffee, 1995; Elman, 2000), very little direct evidence exists on the consequences of the establishment of modern, Western schools; micro-level evidence is particularly scarce.2 Were reformers in the late Qing correct that the human capital produced by training in modern subjects—especially Western science and engineering—was crucial to the development of modern industry in China? Or was the rigorous academic training of the traditional education system useful and general enough to make traditionally-educated individuals productive even in modern, industrial firms?

In this work, I undertake a quantitative comparison of modern and traditional educational institutions in late imperial and republican China using micro-level data on individuals' educational backgrounds and their labor market outcomes. I use a sample of employee records from the Tianjin-Pukou (JinPu) Railroad that were compiled in 1929 to examine the associations between employees' educational backgrounds and their labor market outcomes—both their wages and occupations at the railroad.3 If the human capital produced in modern, Western schools was more productive in modern, industrial firms, one would expect to see large wage premiums paid to individuals trained in the modern education system, relative to individuals trained in the traditional system, ceteris paribus.4 If traditional and modern education provided very different skills, one would also expect individuals trained in the two systems to sort into different occupations.5

At the broadest level, I find that traditional and modern education are in fact associated with very similar wage premiums, relative to unskilled workers at the railroad. This suggests the traditional system did produce skills that were useful to modern, industrial firms. However, when educational background is disaggregated, one sees enormous premiums paid to modern university and, especially, engineering training, dwarfing the pay to individuals with even high levels of traditional education. University-trained engineers earned around 100 percent more, on average, than individuals trained at a high level in the traditional system; employees with modern university training in other fields (such as business, law, and economics) earned around 40 percent more than individuals trained at a high level in the traditional system. One also sees striking differences in occupations associated with educational background. Employees trained in the modern education system were significantly more often in managerial and railroad planning positions; traditionally-educated workers were disproportionately employed in clerical positions. These results suggest that modern education, indeed, produced differentially valuable human capital to modern, industrial firms. This human capital generated a higher wage, and was put to use in different occupations at the JinPu Railroad.

These findings from the JinPu Railroad contribute to a growing body of research aimed at understanding the economic development experiences of late imperial and republican China, both the sluggish modernization in the late imperial period, and the economic growth in the republican era. This literature builds on a large body of research on the Needleman Puzzle and the “Great Divergence”, which is focused on the questions of why Europe was able to economically and technologically surpass China, and why Europe, but not China, experienced an indigenous industrial revolution.6

Historians and economists have discussed the economic consequences associated with the traditional education system in the context of the “Great Divergence” literature: Huff (2003) argues that traditional Chinese education was too closely linked to the structure of the imperial government and the official ideology; thus, there was no insulated space for researchers to conduct potentially disruptive scientific

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1 Of course, such passion may have been due to a desire to maintain rents accruing to conservatives as much as it was due to a love of classical Chinese learning. Hon (2002, p. 96) writes that, “conservatives had many reasons to object to reform, especially political reform. Some were antiquarians; others were by nature skeptical of change. But a large number were ‘corrupt bureaucrats’ (sulf) who had a vested interest in preserving the political status quo.” Cantoni and Yuchtman (2013) discuss the political economy of educational reform in Qing China in more detail.

2 Bai (2014) shows that after the traditional civil service exams were abolished, prefectures sending more students to Japan for the study of modern subjects also experienced an increase in the establishment of modern firms.

3 The data are imperfect: the sample is a convenience sample, and some employees’ wages are not observed, but rather inferred from pay scales. Still, the data are extremely valuable: datasets containing information on individuals’ education and wages in the early 1900s are difficult to find even in the United States (see Goldin and Katz, 2000). Not only is it unusual to observe employee records that include information on education and salaries at this time, but it is even more remarkable to observe employees trained in both modern and traditional educational systems, allowing one to compare salaries and occupations depending on whether an employee studied traditional or modern subjects.

4 Throughout this work, I assume that differences in salaries represent differences in employees’ marginal product, and the existence of generally well-functioning, competitive labor markets. This is only a rough approximation in any labor market, though Rawski (1989) suggests that Chinese labor markets were quite well-functioning by 1929, the year the employee records I analyze were compiled. Still, this assumption requires further attention; I discuss differing degrees of friction in the labor markets facing individuals in the traditional and modern education systems below (see Section 4).

5 Roy (1951) presents a canonical model of sorting into occupations according to differences in productivity. In the empirical work below, I focus on sorting across occupations within a firm. Of course, individuals would be expected to select across firms (and industries) as well as across occupations within a firm; I discuss selection across firms and industries, and how these affect the conclusions that can be drawn from a single firm’s employee records, in detail below (see Section 4).

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