Human capital in Qing China: economic determinism or a history of failed opportunities?

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Abstract

The traditional education system in Qing China has been widely debated over the past decades. Some have argued it was efficient and furthered economic growth, while others have stressed its inefficient nature, which led to the introduction of the modern education system in the closing decades of the 19th century, followed by its total collapse in 1905.

In this paper we make a first try to quantify above debate. Starting from the observation that below the well-known civil examination system there existed a whole system of popular and vocational education, we find that years of education in the population were still lower than in many European countries. More interestingly, whereas in European countries years of education increased strongly in the 19th century, our estimates of average years of education and the ABCC indices show that the level of education remained stable well into the 1920s when it accelerated. However, the main rise only occurred during the late 20th century.

This finding leads to an interesting question since per capita income only started to grow significantly since the 1950s. This means that the rise of education since the mid-1920s was not as such driven by per capita income. Apparently this was the same for both the traditional and modern education since the latter had already started to transform Chinese education from the 1890s onwards. Hence, we have to look at the question why persons decided to follow education, i.e. was it individually profitable to follow education (positive private returns)? However, testing for this latter hypothesis shows that, after correction for foregone earnings, life expectancy, and probability of passing the exams, only the below shengyuan level students actually had positive returns. For an ordinary person it was therefore uneconomical to join in the civil examination system. Apparently this did not change, not even after the introduction of the modern education system, until the 1950s.

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[1] This paper focuses on the pre-modern education system between 1744 and 1904. Although the modern schooling system was slowly introduced by Qing government from the 1860s onwards, it only really expanded after the abolishment of the civil service examination in 1905.

1. Introduction

Human capital is considered an important, if not the main, driver of economic growth (Lucas 1988; Romer 1990; Mankiw, Romer, Weil 1992). Studies in economic development in Europe have shown it to have a positive effect on economic development already in the Early Modern period (e.g. Baten and Van Zanden 2008; Van Zanden and Van Leeuwen 2011) even though its development is generally considered to have been exogenous. Yet, in those countries, the educational system was becoming increasingly more productive with rapidly rising levels of years of education and literacy combined with economic development. Indeed, Mokyr (2009, 60) already showed that, whereas during the first Industrial Revolution the role of education in inventions was small, this changed over time.

However, there is wide ranging discussion about similar trends in China. For example Rawski, (1979) and Li Bozhong (2003) argue that the pre-modern education system provided a source of economic progress. Directly opposite is the argument of Baten and Van Zanden (2007) who found in a Europe Asia comparison that, even though more human capital (i.e. book production in their analysis) led to higher per capita income, China was an anomaly with relatively high production of books and a relatively low per capita GDP (see also Allen et al. 2011). A similar observation is made by Van Zanden (2009) who found that, even though in Europe the skill premium (i.e. the difference between the skilled and unskilled wage) was smaller than in China, in Europe this led to more technological development and growth, while in China it did not. This is why Van Zanden (2009, 146) called China a continuous "enigma". This changed, however, during the course of the 17th and 18th century when the position of the artisans was not hereditary anymore and the tax obligation did no longer go from father to son (Moll-Murata 2005, p. 14) causing the skill premium to increase.

It becomes thus clear that people responded differently to education in Europe and China, at least after the first Industrial Revolution. In this paper we will aim to analyze how and why people responded to the possibility to follow education. However, little information on actual educational development in China is available. This makes it difficult to enter into any debate on the role of education. We might, in this respect, quote Ma (2004, 264) who, argues that "as is true of Chinese economic history in general, the scale and weight of the argument are an overfit for the amount of quantitative evidence presented." Indeed, except for age heaping measures presented in Baten et al (2010) and some stray observations from Rawski (1979), who put basic literacy level for Chinese male sin the late 19th century at 30-45% and for females at 2-10%, very little is known about education and literacy in Qing China. Therefore, in the next Section, we will present evidence on the stock of education in Chinese society between ca. 1744 and 1949. In Section 3, we move on to analyze If (and how) this education system stimulated more people to educate their children as happened in Europe and which (in Europe) ultimately led to skill biased technological development. We end with a brief conclusion.

2. Education development in the Qing dynasty

At the start of the twentieth century, the education system in China changed fundamentally. It moved away from a traditional system, to a standard system, with primary, secondary, and higher education. The basic idea was to lift china in the world economy had already started at the end of the 19th century under the Qing government. However, most people remained educated for the civil examination exam until 1905 after which this was officially abolished (even though certain schools for traditional education were maintained until 1950). This abolishment led to resentment under the

literati who lost their guaranteed jobs in the government and joined the revolution by Sun Zhongshan in 1911 which ultimately led to the fall of the Qing government.

Although its revision turned out to be too slow and too late for the Qing government, the traditional education system during the Qing dynasty had become more complicated than it had ever been before. The Qing government not only continued many policies of its predecessor, the Ming, but also issued several new educational decrees itself. The first such decree entailed the rebuilding of the civil service examination. This examination system was the most important educational institution which allowed people to enter the gentry class. As such, successful students were given titles and positions by the government. Three levels of examination existed. Those passing the first level of examination were called "shengyuan". Those who passed this exam might enter the provincial exams. Passing those would result in the title of "juren". In turn, those passing the provincial exams could participate in the national exams to gain the title "jinshi". Shengyuan was considered "low class of gentry" and both the juren and jinshi were considered "upper class gentry".

The second decree of Qing government regulated that students engaging in the civil service examination should follow education in official schools as had also been the case during the Ming dynasty. So it instituted a state-sponsored range of schools, which was integrated with the civil service examination. These official schools extended from the lowest administrative levels, the county government school(*Xian Xue*), to prefecture government school(*Fu Xue*). According to the Qing regulation, students ought to finish education in all levels of official schools before, after passing the first level examination, enrolling in the second level of examination (i.e. the provincial exams). In this way, the official schooling and the civil service examination became integrated.

The civil service examination, however, required a long time of study (see Table 1) and could therefore be called "elite education". But there was also education below the first level of civil service examination. This level of education has been ignored by scholars for a long time. Rawski's (1979) book had the ambition to look into this education. Using her study, we can gauge the extent of so called popular education below the shengyuan. Based on a broad segment of historical evidences, we can witness that in general a boy started by learning to read and write at a large range of popular school at his age of 6 or 7.These popular schools included not only private schools built by clans and families but also community and charitable schools endorsed by local governments. These schools generally taught students basic reading, writing and calculating rather than preparing them for the shengyuan exams directly. During their period in this type of school, they could acquire the comprehension of 1,500 words, basic approaches of calculation and use of abacus which was enough to deal with most affairs in their daily life. Only a small part of the students continued after this popular education to pursue the shengyuan examination. For this purpose, the local government established a sort of higher academies titled Shuyuan, as well as other advanced community schools, to further educate talented students from popular schools. With exception of the small part of talented students continuing their studies for the shengyuan examination, most students left popular schools to enter the local labor market in all kinds of different jobs varying from teaching in a primary school, to clerk to accountant in a shop or restaurant.

Yet, by comparing with modern and standard education, the traditional education lacked such standard requests as the age of student's enrollment, schooling time and age of student passing all levels of civil service examination. On the one hand, this was because reaching the level of jinshi

was no small task. Some lucky people got the title of jinshi when they were very young while others spent the same amount of time and never even passed the shengyuan exams. Besides fortune, the final success of getting the level of jinshi depended to a great extent on the financial situation of the student's family or clan. Some poor boys had to leave to get a job to support their family after following popular education for a short period. Some middle class or rich boys, however, could follow all levels of education being supported by the financing of their family or clan. In spite of the great difference of these private stories, we can still get the average estimates of the educational development in the Chinese population as we will discuss below

According to a large sample of Qing students' memoirs, children were encouraged to enroll in education at the ages of 6 or 7. They followed popular education during 5.5 years of study (varying by student from 3 to 8 years). A small part of talented students then carried on their preparation for shengyuan exam in the local higher academies for 10.5 or 11.5 years. After this exam, this student spent another 1.5 years in local schools followed by 5.5 years in private study or in higher academies like *shuyuan* to be able to enter the juren exam. After successful passing the juren exam, our student would spend another 4 years in private study. The estimates on the elite education come from the exam papers(考试卷）from the Qing archives by identifying the average age of literati with passing different levels of exams. This study path is reported in Table 1.
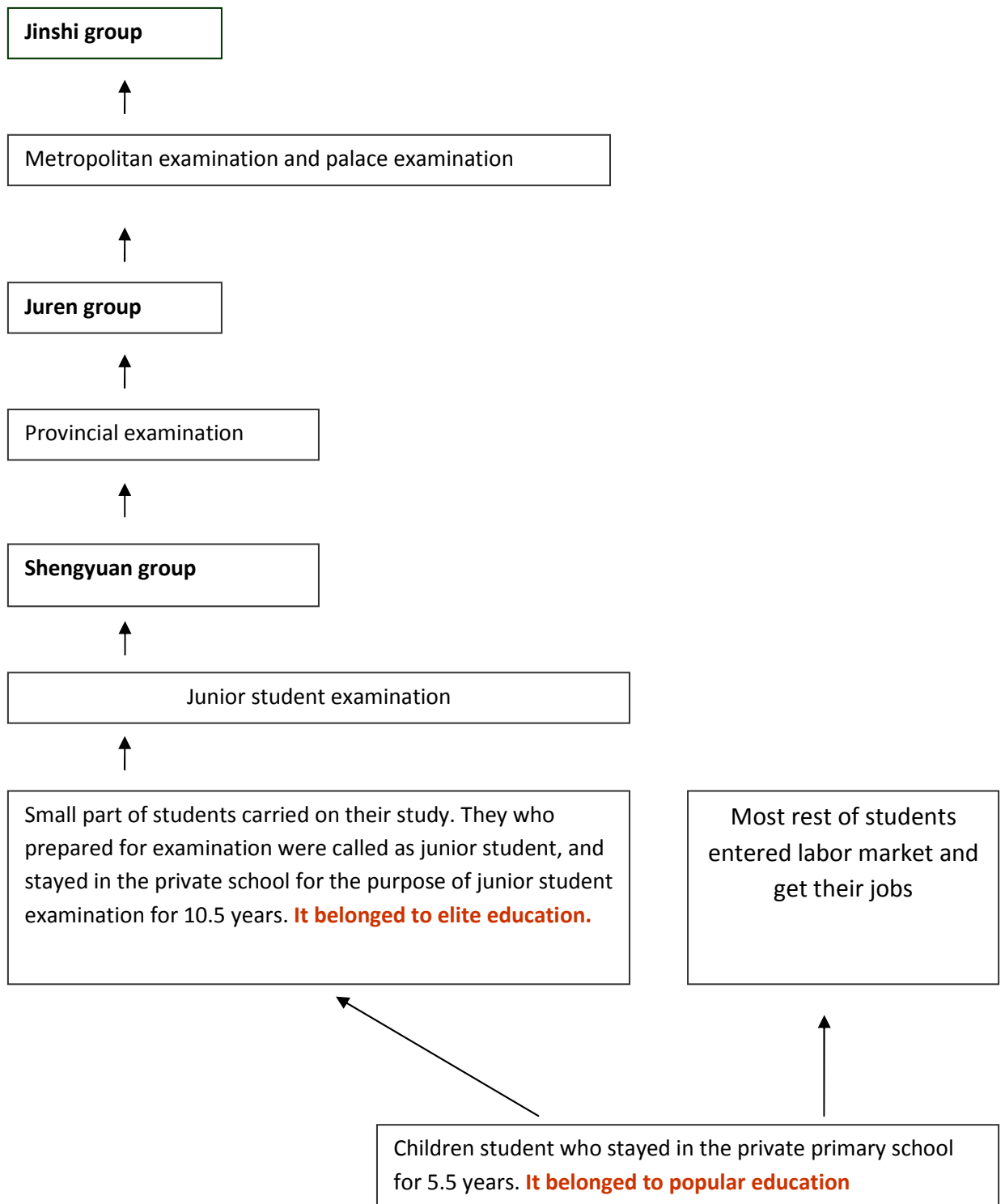
Table 1: Average age of admission to the 3 levels in the Qing dynasty and the average year of schooling education

Levels of examination	average age of successful candidates	Average years of formal schooling
The first level	23	16 years under shengyuan
The second Level	30	1.5 years under juren
The third Level	34	

Sources: average ages of admission to both levels of juren and jinshi come from *Gu Tinlong：qingdai zhujuan jicheng，taibei chengwen chubanshe，1992.*（顾廷龙主编：《清代朱卷集成》，台北成文出版社，1992 年。）average years of formal schooling after the juren exam come from *guangxu daqing huidian shili*(光绪《大清会典事例》）average age of admission to shengyuan and average years of formal schooling for shengyuan exam come from *Liu Zhaobin，qingdai keju，taibei dongda tushu youxian gongsi,1979.*（刘兆璸：《清代科举》，台北东大图书有限公司，1979 年。）

In sum, the traditional view was that there was only a sort of education system for the purpose of civil service examination which created a class of gentry and prepared for the future officials. Yet, according to our new exploration, Qing education had a complex system in which 5.5-year of popular education could be followed by either exit for the labour market, or 10.5 years for accessing the shengyuan exams (possibly followed by the juren and jinshi exams, also called "elite education"). Popular education thus serviced the elite- and vocational education (see Figure 1)

Jinshi group

↑

Metropolitan examination and palace examination

↑

Juren group

↑

Provincial examination

↑

Shengyuan group

↑

Junior student examination

↑

Small part of students carried on their study. They who prepared for examination were called as junior student, and stayed in the private school for the purpose of junior student examination for 10.5 years. **It belonged to elite education.**

Most rest of students entered labor market and get their jobs

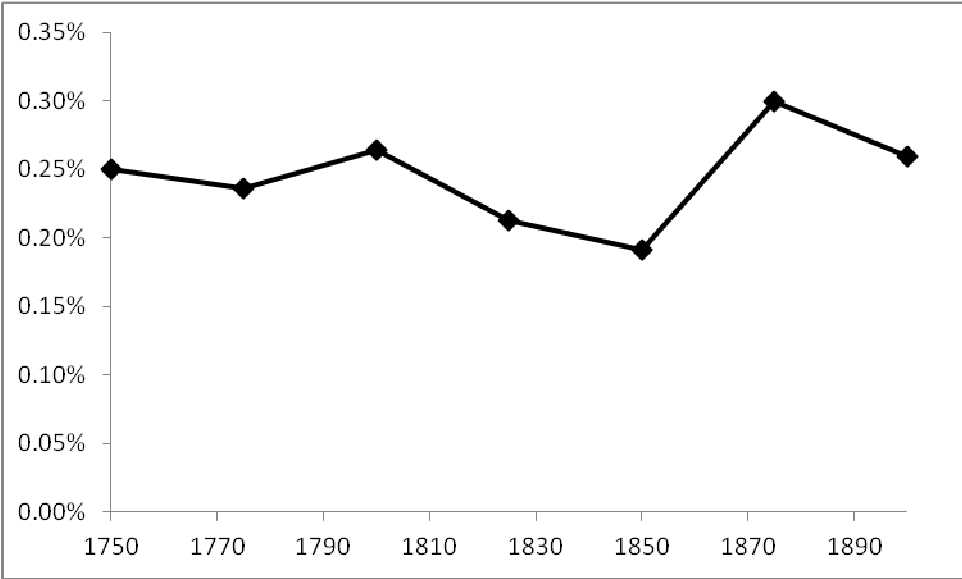Children student who stayed in the private primary school for 5.5 years. **It belonged to popular education**

Unfortunately, most of our data are from the civil exam candidates. All levels of exams included both civil and military exams. Whereas the civil exams intended to educated people for civil offices in the

Qing government, the military exams were intended to educate future officials of the army. The numbers passing the exams (the so-called quota) were set by the central government. These quota were generally based on the population and numbers educated in a region and the amount of tax coming from that region. This basically means that the quota moved in line with population (see Figure 2).

We mainly have access to these quota. For the shengyuan, we based ourselves on *qianlong xuezheng quanshu, jiaqing daqing huidian shili, daoguang daqing libu zeli, guangxu daqing huidian shili, guangxu daqing wuchang tiaoli and qingshilu(乾隆《学政全书》、嘉庆《大清会典事例》、道光《大清礼部则例》、光绪《大清会典事例》、光绪《大清武场条例》与清代各朝实录），*from which we collected the civil and military quota for the years 1744-1776, 1812, 1844, 1850, and 1875-1899. For the years 1900-1904 are assumed to be equal to 1899. For the juren, we based ourselves on the *qianlong daqing huidian, xianfeng daqing kechang tiaoli, guangxu daqing huidian shili and guangxu daqing wuchang tiaoli （乾隆《大清会典》、咸丰《大清科场条例》、光绪《大清会典事例》与光绪《大清武场条例》），*again including the civil and the military quota. These were for the years 1744, 1812, 1852, 1875-1899, the quota for 1900-1904 being assumed to be equal with those of 1899. Finally, based on *qingdai jinshi timulu and qingshilu （《清代进士题名录》与清代各朝实录,* we collected data on jinshi for all years between 1744 and 1904.

Figure 2: Ratio of successful exam candidates to the total population

Source: see text; Ho (1959); Cao (2001)

Now we should convert the number of gentry into the average years of education in the Chinese population. This can be done using a so-called Perpetual Inventory Method (PIM). Essentially, we just calculate the number of students per age class and sum them up over the years 15-65, taking account for age specific mortality (for the method see for example Van Leeuwen and Foldvari 2012). However, calculating the number of students is not straightforward because there were no records including the total number of so called popular schools or the enrollment of students in these schools. Hence, we used a proxy to calculate the number of students for popular

education (i.e. below the civil examination system) using the number of shengyuan. In doing so, we need to make 2 assumptions. First, a possible assumption is that all students that entered popular education entered the Shengyuan examns. If that assumption were true, can arrive at number of students for the first level of exam by taking the number of shengyuan divided by the ratio of passing the first level of exam. This requires us to know the percentage students failing the exam. Fortunately, there were 15 regional cases which reported the local ratio of passing the first level exam make us to get the average ratio of passing the first level exam for the whole country in Qing China (i.e. 3% of all persons entering shengyuan exams passed [Daqing huidian lishi and 4 gazzetter in jiangsu province]). However, this obviously is a minimum since, after their popular education, only small part of students could carry on their study for the shengyuan exam. Again making use of a set of 20 regional studies, we can estimate the average ratio between shengyuan and the total number of students (including those leaving popular education at an early stage). Finally, we can arrive at the total number of students by taking the successful shengyuan and correcting it for those failing the examns and dropping out earlier (i.e. 1 % of all persons starting popular education finally passed the shengyuan exams [10 Zhongguo shaoshu minzu shehui lishi diaocha ziliao congkan, 1996]).
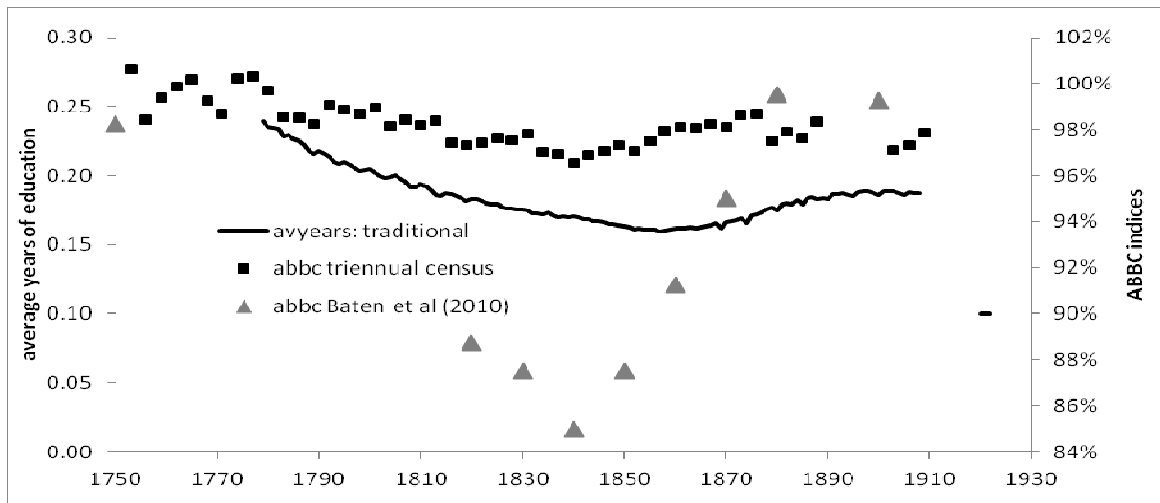
Additional information we need are, obviously, the numbers of juren and jinshi. These were corrected for drop outs and failed examns in a similar way as the shengyuan before. However, since their numbers were much smaller, they did not affect our calculations of average years of education that strongly.

Now we have for every year the number of students by level of education, and the average duration of their study. This will allow us to calculate a perpetual inventory method if we also have population by age class. Population by age class was calculated in the following way. First, we took the population estimates for the whole of China from Cao (2001) and interpolated it with the data from Ho (1959). However, it is difficult to calculate age classes due to lack of data. Hence, we took the age classes from the triennial census (Lee and Campbell 2010). Unfortunately, these data are all taken from Liaoning. Therefore, we took the ratio between the age classes of Liaoning (Mengxia and Qi 2009) and the whole of China (Van Leeuwen, Van Leeuwen-Li, and Foldvari 2011) around 1910 and used that to correct the age classes of the triennial census.

Combing the age classes with the number of students, we can calculate for every year the number of students per age class. Summing this up for 50 years (between ages 15 and 65) and correcting for age specific mortality results in the total educational attainment in society per year. This can be divided by the total population to arrive at the average years of education in society. The results are reported in Figure 3 below. We also included estimates for age heaping from Baten et al (2010). In addition, we included a measure from age heaping from the triennial census.[2] Both the heaping measures of Baten et al. and the triennial census were converted

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[2] People did not heap on multiples of 5, but rather on three. It remains therefore highly questionable if age heaping is of much use in China, but at leads they show the same pattern as average years of education so that both apparently are driven by about the same underlying factors.
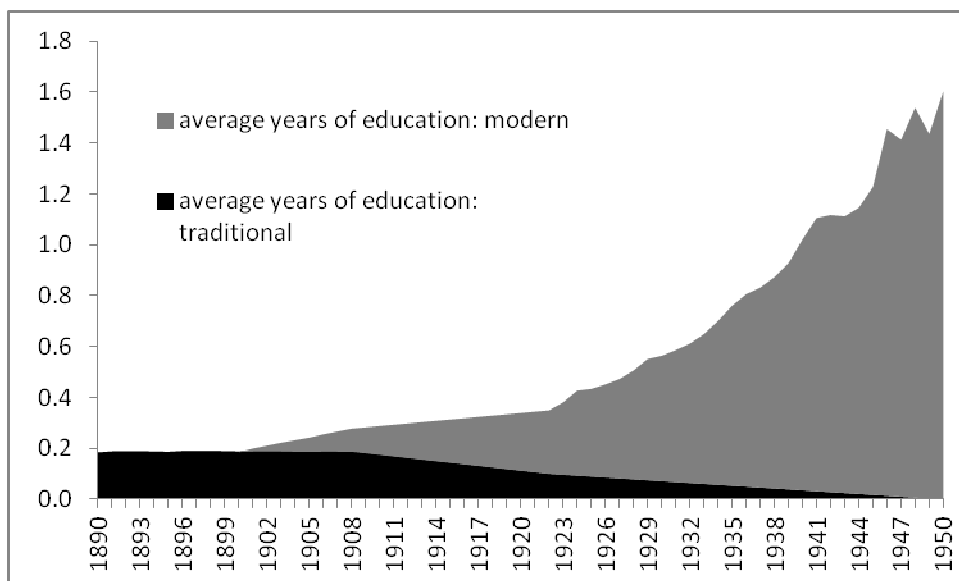
Figure 3: education and ABCC index

Source: this text.

in the ABCC index (a measure indicating the percentage of people in the population able to correctly state his/her age) for sake of easy comparison. We find that all series show about the same trend with a trough around the 1850s (the Taiping rebellion). This lends credence to our estimates about the change in educational attainments.

Indeed, we can find similar reassurance when reviewing the change from the traditional education system to the modern education system (see Figure 4). We find that,

Figure 4: switch from traditional to modern education system

Source: This text; Van Leeuwen, Van leeuwen-Li and Foldvari (2011).

even though the switch already started in the late 19th century, an increase in years of education only commenced in the late 1920s.

3. Education from individual perspective

In the previous Section we found that average years in the population remaind about constant over time. This suggests that there was at least no reinforcing trend with education and per capita income both increasing as may be found in Western Europe (see also Liu 2010). This apparently changed rom the 1920s when the demand for education among the population apparently rose without, however, showing signs of strongly improving per capita incomes.

The question is therefore why before the 1920s the demand for education among the population did not increase. In order to analyze this, we have to turn to private returns to education which may exist even in a static society, simply as an individual with more education usually have higher earnings, either reflecting their higher productivity or just their social status (for a recent

Table 2: annual wages in silver liang by level of education

	annual wage		
	1750	1850	1900
jobs requiring jinshi or juren examinations			
official service in central government or local government	3500	4000	5000
secretarial assistants to high provincial officials	1000	1200	1500
lecturer in large shuyuan(college)	250	300	350
jobs requiring shengyuan examination			
secretarial assistants to prefects and counties	100	150	250
scholar doctor in local community	80	100	200
service as gentry functions	80	100	120
teacher in local school	70	80	100
other services	70	80	100
jobs with less than shengyuan education			
skilled labour in silk-reel industry	50	60	76
teacher in local primary school	30	40	50
jobs requiring no education			
general unskilled labour in big city	8	10	15
general unskilled labour in small town or village	6	7	8

Source: Chung-li Chang (1962); Xuyi (2011); Zhang Dechang (1970).

example for the USA see for example Acemoglu and Angrist 2001). That is, investment in education may exist in a static, traditional society as well, at most, what we find is that the elite will not be able to expand relative to the size of the population and this is exactly what we found for China in Section 2.

It is generally suggested that the Chinese system of education and competitive examination system was a clear advantage over Europe and other cultures where education was inaccessible to the masses. In China, theoretically, anyone was eligible to follow education, and providing that he/she succeeded in the consecutive examination, at the highest level by the emperor himself, could achieve a very high and lucrative status. At least this is how the traditional story goes.

In order to review this, we need to look at relative wages, which are reported in Table 2. What becomes immediately clear is that wage differences were large: jobs requiring the higher levels of education could earn as much as 500 times the wage of an unskilled laborer.

This finding seems to suggest that it is very beneficial for a person to follow education. However, in order to analyze this, we do not only need wage differentials, but also the time a person spends in school. In addition, we need to add the costs of following education. For this reason we re-estimate the rate of returns to education with a correction not only for the duration of schooling, but also including the foregone wages (income that could have been earned if one had remained with

Table 3: rate of return by level of education corrected for foregone wages and life expectancy

	1750	1850	1900
jobs requiring jinshi or juren examinations			
official service in central government or local government	483%	432%	354%
secretarial assistants to high provincial officials	126%	118%	95%
lecturer in large shuyuan(college)	19%	17%	9%
jobs requiring shengyuan examination			
secretarial assistants to prefects and counties	11%	15%	24%
scholar doctor in local community	7%	7%	17%
service as gentry functions	7%	7%	6%
teacher in local school	5%	4%	4%
other services	5%	4%	4%
jobs with less than shengyuan education			
skilled labour in silk-reel industry	112%	110%	102%
teacher in local primary school	60%	67%	61%

the previous level of education), i.e. opportunity cost of education and also take account with the expected duration of the economically active period (duration of the cash-flow resulting from

education).[3] Unsurprisingly, once we correct for the foregone wages and time spent in education (see Table 3), the rate of return to additional school years declined strongly, nevertheless it still seems profitable for the individual to follow education. There is one factor, though, that we still miss: namely the higher earnings were accessible for only those who passed the examination, and the success ratio was extremely low, around 1.5% for the shengyuan and 1.65% for the jinshi and juren examinations. These low probabilities significantly reduce the expected gains from education.[4] Once we correct for this, the picture fundamentally changes (see Table 4).

Table 4: rate of return by level of education corrected for foregone wages and life expectancy, and the probability of successful examination

	1750	1850	1900
jobs requiring jinshi or juren examinations			
official service in central government or local government	−9%	−10%	−13%
secretarial assistants to high provincial officials	−14%	−15%	−15%
lecturer in large shuyuan(college)	−16%	−16%	−16%
jobs requiring shengyuan examination			
secretarial assistants to prefects and counties	−9%	−9%	−9%
scholar doctor in local community	−9%	−9%	−9%
service as gentry functions	−9%	−9%	−9%
teacher in local school	−9%	−9%	−9%
other services	−9%	−9%	−9%
jobs with less than shengyuan education			
skilled labour in silk-reel industry	110%	87%	60%
teacher in local primary school	59%	45%	29%

Now, that we corrected for opportunity costs, life expectancy, and the probability of successful exam, we have a better view about the profitability of studying in Qing China. However strange it may sound based on the high returns to education in Table 2, it is the expected rate of return that really matters for the decision making of the individual whether or not to follow education reported in Table 4. And Table 4 suggests that for a rational decision maker it was not profitable to take any exams. It was on the other hand a quite wise decision (from a purely profit perspective of course) to follow some education and leave the system before entering the shengyuan exam. Our finding thus implies that only the wealthy can study: it would have been economically

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[3] 24 year with jinshi or juren examination, 35 years with shengyuan examination,40 years for the rest
[4] In other words, we introduce expected lifetime earnings, whcih is the product of the succesful examination and the higher earnings.

more profitable to actually not follow education, or only below shengyuan. Education could thus be followed because of social status (since the ones doing the exams had money anyway).

This finding thus argues strongly against the vision that the education system was efficient in generating social returns. More interesting, it also suggests an explanation of the conundrum was the levels of education were relatively high (and the skill premium relatively low)) versus the GDP/cap in the 17th century compared to the data of most other countries. Until the 17-18th centuries, the position of an artisan was regulated by the government, including his income. In the 17th-19th centuries, this position was slowly becoming regulated by the free market. Since the relative low efficiency (also witnessed in relative high interest rates on capital), this was bound to lead to the high skill premia we found in this section and which match up better with the relatively low levels of GDP/cap.

4. Conclusion

The civil examination system in China has been a topic of wide debate over the past decades. Some have argued it was efficient and furthered growth (Rawski 1979; Li bozhong 2004; 2006), while others have stressed its inefficient nature, which led to the introduction of the modern education system in the closing decades of the 19th century, followed by its total collapse in 1905.

Yet, neither stance has been supported by much empirical evidence. Therefore, in this paper we made a first (and preliminary) attempt to analyze the development of the education system in Qing China. We find, as is well known in static societies, that the civil examination quota moved in line with total population. More interesting, both our estimates of average years of education in society and the ABCC indices show that the level of education decreased in the mid-19th century, before rising again, lending credence to our estimates of the stock of education.

Yet, we find indeed that society seems static till the mid 1920s, well after the modern education system had been introduced. Afterwards, a significant increase ein average years of education occurs without, however, accompanying per capita income growth. This begs the question why society remained static as regards to education up to the 1920s. In order to analyze this question, we have to look whether education was profitable on an individual level in Qing China. And indeed, the wide wage differences between education levels suggest that it was profitable to invest in education for the individual. Yet, after correction for foregone earnings, life expectancy, and probability of passing the exams, it turns out that only the below shengyuan level students actually had positive returns. For an ordinary person it was therefore uneconomical to join in this education system. Hence, the higher levels of the education system were only accessible for those who already possessed enough income.

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