

In his book “The Level of Riches”, Joel Mokyr addresses the issue why some nations are economically speaking more successful than others. He tries to state reasons for economic success and technological development. For us, chapter nine is especially interesting. It covers the topic of technological development in China and Europe after 1400 and why China, despite of its technological superiority before 1400, was lagging behind Europe in terms of technological development after 1400. This essay is constructed as follows: we first give a brief overview of China and Europe’s main events during 1400-1850. We then discuss three major possibilities of China’s lagging behind Europe. Finally, we draw some conclusions.

The following table gives an overview over the main events in history during 1400-1850. The events in this table are reduced to the very major happenings during this time period.

	<b>China</b>	<b>Europe</b>
<i>Before 1400</i>	Song Dynasty	Holy Wars
<i>1400-1600</i>	Ming Dynasty	Discovery of the New World Imperialism
<i>1600-1850</i>	Qing Dynasty	Industrial Revolution

China’s technological supremacy during the Song dynasty was impressive. The economy was already well developed and featured entrepreneurs, merchants as well as a simple financial system. Their technology ranged from gunpowder, an astronomical clock tower, movable type printing, iron works, hydraulic engineering, among many others. Europe was still busy with fighting holy wars at that time and technological advance was very limited due to the absolute power of the church, which declared any innovation as witchcraft. However, after 1400, with the beginning of the Renaissance in Europe, China seemingly

seized to continue to come up with any new invention. Based on Joel Mokyr's book, we are going to propose three possible answers to this abrupt change.

The first argument goes that Chinese thinking was somehow not suited to scientific and technological progress. In Chinese philosophy and religion, harmony between society and nature is very important and the focus is on maintaining equilibrium between oneself and his or her environment. This can also be seen from the concept of Ying and Yang, where two forces in an equal proportion are necessary and that a balance between these two opposites is desirable. Yet, actual events showed that Chinese did not hesitate to tamper with their environment. In the 18<sup>th</sup> century, for example, a massive deforestation took place leading to soil erosion and other environmental issues. Still, European behavior was more aggressive than the more moderate behavior of Eastern civilizations. That also implies that Europeans did about everything to increase personal welfare and power. Moreover, the Western belief in a personal God, who favors personal development and approves the exploitation of resources, was clearly more in favor of unrestricted technological development than Chinese natural philosophy that, as mentioned earlier, tries to balance humanity and physical environment. Yet, Mokyr argues that the connection between natural philosophy and lagging technological progress has been disputed. Another difference between Chinese and Europe's thinking was that China failed to develop a system of formal logic. Instead, Chinese thinking involved a so-called fuzzy logic. But again, Mokyr says, "The correlation between scientific and technological development does not imply causation". In Europe, it was exactly a trial and error process that brought about technological progress. Therefore, the differences between Europe and China in this regard are not that big.

The second argument states that since China was a labor-intensive economy, there was less need for technological development than in Europe, which has traditionally been a labor-saving economy. Usually, population growth leads to the need of more agricultural work because more food is needed. Wet-rice fields resulted in far more yields than any other Western crops. However, output per person, remained only stable until 1800. Because of the labor-saving nature of Europe's economy, technological progress was needed in order to improve output per person per cultivated acre. Moreover, it was easier to mechanize Europe's larger-scale cereal- and livestock farms than China's small-scale rice paddies. Elvin argues that the Chinese economy was trapped in a high-level equilibrium. His model assumes that population growth shifted demand for technological inventions from nonagricultural goods to agricultural goods and that the possibility for progress in the agricultural sector was limited. Moreover, Elvin suggests that population growth led to a limitation of indispensable materials (e.g. wood and metals), which are needed for technological advance. Yet, the sharp decline in population during epidemics in China should have led to more inventions since more indispensable goods would have been available. Also, according to Mokyr, a decline in agricultural output per person did not occur, which speaks against Elvin theory. From nutrition's point of view one could argue that the heavy dependency on rice in the whole country led to protein deficiencies among the Chinese population. That in turn could have led to less available energy per person. Therefore, Chinese people were less productive and there was no surplus energy available. However, surplus energy was necessary for inventions, since inventing often demanded time and imposed a risk on the inventor, since no immediate gains were possible. So, the inventor

needed to sacrifice time and energy on his invention before he could earn the profits. Because no surplus energy was available, people were more reluctant to engage in risky activities, such as trying to invent something. One could even go further by saying that a nutrition deficiency led to a certain brain damage in the early childhood and that thus Chinese people were on average less clever than Europeans.

The third and last argument says that the tight bureaucratic system that was prevalent in China after 1400 was the major factor preventing the country from technological progress. Europe was under constant political pressure. Countries fought for power and if a country became slack another country would take this to its advantage. Moreover, political parties inside countries were feeling constant pressure as well since they needed to fight for support. In China, on the other hand, such pressure was absent after the new millennium started. With the rise of the Ming dynasty, a changing environment was regarded as displeasing. The rulers of the Ming dynasty preferred a stable and controllable environment and they regarded people promoting new or foreign ideas as troublemakers and tried to suppress them. This made it very hard for innovators to be socially accepted, which in turn led to less people willing or being interested in pursuing innovations. Moreover, the government did not allow the construction of large ships. This is in stark contrast to Europe, where many countries were exploring new continents. During that time period, for example, the New World has been discovered. Yet, the Chinese did not even have demand for foreign goods, whereas Europeans had a huge desire for foreign goods that Europeans were not able to produce. China seems to have valued stability more than Europe had. Mokyr defines technological progress as a positive-sum game, where total gains

exceed total costs. However, there are certain adjustment costs and possible political unrest related to the technological invention. Some societies might simply not be willing to pay these costs, even if the total gains would outweigh these costs. As suggested by Fei, the decline in the rate of technological progress in China could be attributed to a change in social preferences, i.e. a lower willingness to accept social costs. Chinese society could have change to the extent that social unrest was highly undesired. With the change of the dynasty, there was the possibility of a shift in the distribution of power between a more liberal group to a more conservative group that was more likely to suppress innovation. The Chinese guilds were very powerful at that time. Olson blames these guilds for blocking innovations in mining, transport, soybean-oil pressing, and silk reeling. Regarding this argument, the interesting topic of vested interest arises. It seems that in China vested interest opposition was stronger than market forces, which would have allowed technological progress, since progress is defined as benefits outweighing costs. Political status quo seems to have extinguished innovations and creativity, since the existing order was to be left undisturbed. The political leaders showed vested interest in keeping the balance of powers. Technological change threatening the current distribution of powers was thus avoided. In Europe, on the other hand, such vested interest was smaller, since there was no social group so powerful as in China. In the West, technological change was more a matter of private initiative and needed less the approval or intervention of the political ruler. Actually, there was a whole market for technology. The European government entered that market just as another buyer or seller. In China, on the other hand, the government was overseeing that "market"; thus, technological development was part of a

centrally planned economy. The planner simply wanted to avoid progress in order to secure his position in the country. Moreover, if a European government chose to intervene with technological change, i.e. suppressing it, the leaders had to face the consequences. It was quite possible that suppressing progress led to a decreased economical status, which then caused upheaval among citizens. In addition, it was quite easy to migrate between European states. First, the transportation system was quite developed and distances were relatively small compared to Chinese conditions. Also the geographical conditions favored migration in Europe over migration in China (e.g. impassable mountains). Second, there was a common language existent in Europe, i.e. Latin. Innovators were more likely to speak Latin since their level of education was likely to higher than average. Therefore, it was much easier for innovators to migrate in Europe than in China, if their current place of residence was intolerant for their invention. This resulted in competitiveness between countries, because if one country did not approve an innovation, another country was likely to get hold of it and thus gain advantage over the former country. This implies that governments were unlikely to banish innovations in order to keep their economical and political status in Europe. In China, this competitiveness was absent. Even later on, during the Qing dynasty, the government did not provide infrastructure essential to technological development, such as standardized weights, commercial law, roads, and police. Even though routine activity was carried out well, change was not favored by the government and infrastructure supporting change was thus not established. In China, the ruler of a society had a responsibility toward its citizen. The government thus monopolized trade in some goods in order to perform their responsibility. Before 1800, the Chinese

government directly intervened in the economy, partly due to their notion of being responsible for the people. European notion, in contrast, was different. Political leaders, such as kings or bishops, acted more like a buyer or seller in the market and were subject to market prices. One explanation why China was highly regulated by a central authority is that Chinese intelligentsia showed little interest in technology. This led to an empty space that needed to be filled by the state. Fei argues that the intelligentsia was only interested in the wisdom of the past, literature, and art. The intelligentsia is therefore regarded as a conservative force, searching for mutual adjustment rather than technological change, which leads to social disruption. Lastly, the Chinese government consisted of the most able people. Since the majority of intelligent people, who would be able to develop new technology, was “trapped” in a conservative government, the major force driving innovations was taken out of the game. Before the absolute and autocratic Ming and Qing dynasties, frequent coups d’état disrupted the political system and led to some competition in the Chinese political market.

In conclusions, there seem to be three theories to explain China’s lagging after 1400. The first argument tries to attribute this abrupt change in behavior to Chinese mentality, which favors consistency over change. The second argument says that because of China’s agricultural system, innovation was unlikely to occur. The third argument links the autocratic political system to the absence of technological progress. We personally find the last argument the most convincing one. First, the abrupt change in behavior falls together with the change of dynasties. The Sung and the Ming dynasties seem to be very different from each other. Second, if we consider the 20<sup>th</sup> century, we can see that as China has opened their market and introduced some competition, their growth rate

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*Essay*

exploded. Yet, it still seems very astonishing that the world's most developed and largest country could fall behind within a short amount of time.