

# The skill premium and the ‘Great Divergence’<sup>1</sup>

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## Summary

The paper studies the long-term development of the skill premium of construction workers in Europe in a global perspective. It shows that this price of human capital declined sharply between ca 1350 and 1450, and, in particular in the North Sea region, remained on a relatively low level since. It is also demonstrated that in other parts of Eurasia – with the possible exception of parts of China – the skill premium was much higher than in Europe. These developments and regional patterns are explained using insights from human capital theory, focussing on the role played by interest rates and by the efficiency of institutions for the training of apprentices. It is argued that the low skill premium characteristic of western Europe in the early modern period is the result of favourable conditions for human capital formation in general, and that high levels of human capital formation in early modern Europe help to explain the ‘Great Divergence’ between Europe and the rest of Eurasia during the 19<sup>th</sup> century.

## I

Relative prices are the DNA-prints of an economy. They are basic units of information that reflect and define its structural features. In particular in the period before the mid 19<sup>th</sup> century, when other sources of information (such as historical national accounts) are relatively difficult to acquire and subject to large margins of error, relative prices and wages are crucial sources of information about the structure of the economy and its level of development.

The study of relative prices should therefore allow us to understand more fully the backgrounds and the dynamics of the ‘Great Divergence’ that occurred in the century after the Industrial Revolution. Was the exceptional performance of the European economy after about 1780 a more or less accidental by-product of developments occurring during these decades, such as the rise of steam power, or the result of patterns of economic change which began many centuries before the 1780s – perhaps already during the Middle Ages? The traditional view on this, shared by David Landes, Eric Jones, Immanuel Wallerstein and Angus Maddison, is that the roots of European uniqueness are to be found already in the (late) Middle Ages. Maddison has produced estimates of the development of GDP per capita that are consistent with such an interpretation, showing that already around 1800 Europe was much more developed than the rest of the world. More recently however, Kenneth Pomeranz developed the argument that until the middle of the 18<sup>th</sup> century, Western European levels of income and welfare did not differ in a fundamental way from those in China and Japan (and perhaps India), and that the ‘Great Divergence’ therefore occurred in the centuries after

1750 (or perhaps even 1800). More importantly perhaps, he also argued that this divergence was not the product of fundamental differences between the two parts of Eurasia, but the to some extent fortuitous by-product of a developments which happened to take place in Western Europe during the 18<sup>th</sup> century: easy access to coal (at the right places), and the fact a few countries in Western Europe controlled huge colonies.<sup>2</sup>

A team of scholars led by Peter Lindert has recently been put together to find out if the study of relative prices and wages can contribute to this discussion. A first and highly preliminary results of the ‘global history of prices and incomes’ presented in Buenos Aires in 2002, suggested that already during the Early Modern Period the structure of relative prices in North-western Europe was distinctive in a number of respects. Lindert et.al. formulated the working hypothesis that ‘Northwest Europe led in the development of non-agricultural productivity concentrated in the capital-goods and knowledge-intensive sectors’. The paper hypothesized that capital goods and knowledge intensive products were relatively cheap in this part of the world (and interest rates were relatively low), whereas foodstuffs/agricultural products (and land) were relatively expensive there.<sup>3</sup>

This article investigates one aspect of this broader hypothesis, namely concerning the remuneration of human capital. It tries to elaborate the Lindert et.al idea that northwest Europe had a comparative advantage in knowledge intensive sectors by looking at the long-term development of the skill premium in Europe and parts of Asia. It takes a rather limited view at this ‘skill premium’ by focusing on the difference in daily wages between skilled craftsmen (carpenters and masons) and unskilled labourers in the construction industry, a skill premium about which we are relatively well informed. An added advantage of this skill premium is that technological change in the

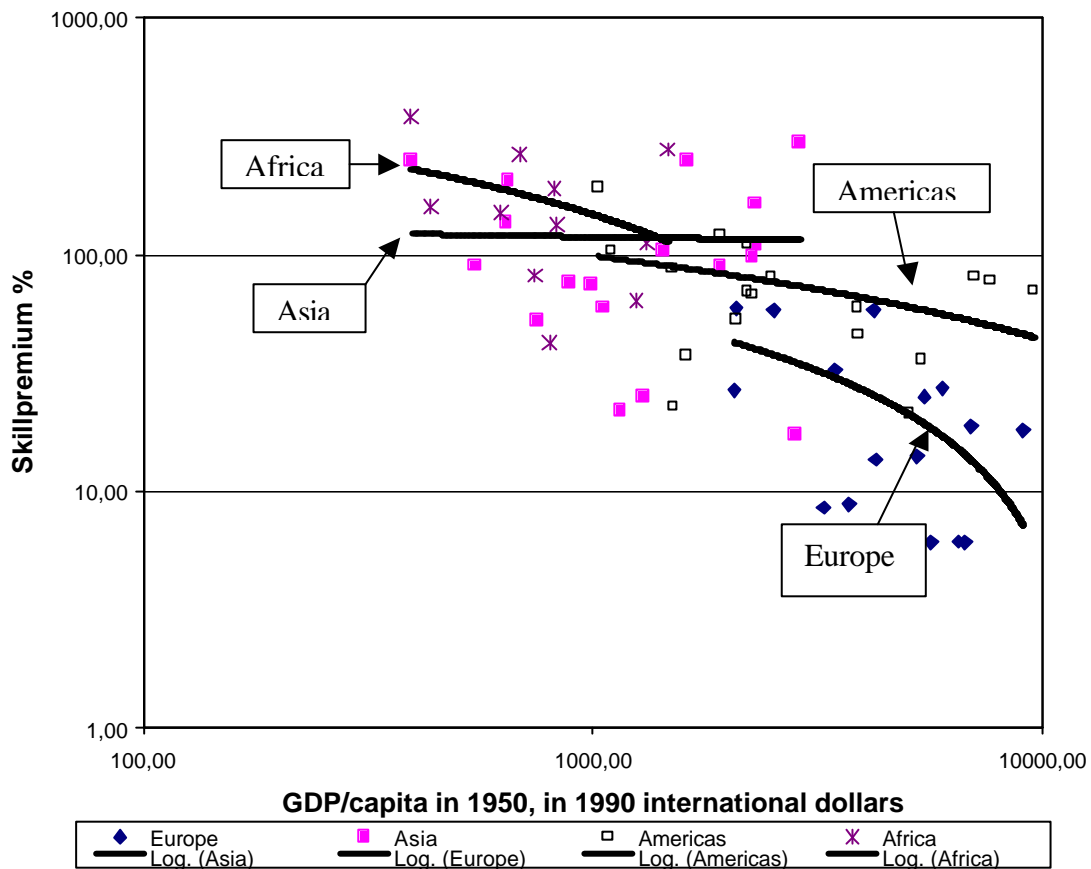
construction industry was relatively slow – in particular until the second half of the 19<sup>th</sup> century – meaning that the skills acquired by those craftsmen did not change much in time, and were also more or less identical in different regions of the world (although some variation did occur, of course). It can also be argued that carpenters and masons possessed quite strategic skills. Masons were the architects (and other the entrepreneurs) of almost all early modern buildings (famous architects such as for example Palladio were trained as masons).<sup>4</sup> Similarly, carpenters were the engineers of a technology consisting mainly of wood, and shipwrights, millwrights, wheelwrights and other specialized carpenters were responsible for an important part of new inventions. The relative price of these skills was therefore important, not only for the construction industry (which was the most important supplier of capital goods) but for the economy as a whole. Finally, it will be argued that studying this segment of the labour market can lead to insights into the conditions for human capital formation in the economy as a whole, and that the skill-premium of construction workers can in be used to develop and test ideas about the relative efficiency of institutions in general.

The hypothesis to be tested is that in Europe the skill premium was already relatively low during the Early Modern Period (in fact, as I will show, since the late Middle Ages). More important is to understand and explain this phenomenon: why did the skill premium in European construction industry decline rapidly between 1350 and 1450, and why did it remain stable at a very low level during the next five and a half centuries? I will use standard explanations of the skill premium, focusing on the one hand on interest rates and the efficiency of capital markets, and on the other hand on institutions for training and for wage setting in an attempt to explain the patterns found.

## II

But let us begin by looking at some 20<sup>th</sup> century data about the skill premium in the construction industry. Since the 1930s the ILO publishes, in its annual publication on International Labour Statistics, data of the yearly ‘October census’, an inquiry more or less the same in all countries involved, which produces data on wage levels of different occupations in industry.<sup>5</sup> For 1950 the number of countries covered by this census is sufficiently large to make it possible to study the variation of the skill premium in construction on a global scale.<sup>6</sup> Freeman and Oostendorp, who used the same October census to reconstruct wage differentials in manufacturing at about 1990, found a strong correlation between different measures of the degree of variation in the wages paid (or in wage rates) and GDP per capita. In Figure 1 the same relationship is shown, including trend lines for different regions. The same relatively strong, negative relationship between GDP per capita and skill premium in construction industry is evident from it, which suggests that this measure of the skill premium reflects the same kind of forces as the more complex and integral measures developed by Freeman and Oostendorp. But this relationship was not exactly the same for all regions, however. Wage inequality in the Americas (north and south did not make a difference here), in Asia and Africa was higher than in Europe. Regressions with the data conform this picture (where skill premium is the dependent variable and GDP per capita the independent variable): dummies for Europe consistently had a negative sign (and are highly significant), whereas dummies for the other continents had a positive signs.<sup>7</sup>

**Figure 1 The relationship between GDP per capita and the skill premium of building craftsmen (c. 1950)**



These data suggest that Europe was different, that the level of the skill premium was lower there than in the rest of the world – even much lower than in North-America. The standard explanation for the negative link between wage inequality and level of economic development is that the supply of human capital increases more rapidly than demand for it during the process of ‘modern economic growth’. This hypothesis can, however, not explain the low level of the skill premium in Europe in 1950; levels of human capital formation in the US and Canada, for example, were probably higher than in Western Europe, and certainly not lower.<sup>8</sup> The variables that may help to explain this gap are of an institutional nature and related to the level of corporatism of the western

European economy. Unfortunately, statistics measuring these institutions are unavailable (on a global scale) for the 1950s.<sup>9</sup>

### III

The work by Allen and Özmucur and Pamuk on wages of construction workers in European cities in the very long run, makes it relatively easy to construct time series of the skill premium in this industry between c 1300 and 1914.<sup>10</sup> Figure 2 compares the skill premium in Western Europe (the average for London, Oxford, Amsterdam/Holland, Gent/Antwerp, Paris and Strasbourg) with the available estimates for Japan, India and Korea.<sup>11</sup> It shows that during the first half of 14<sup>th</sup> century the skill premium in parts of Europe was relatively high at between 100 and 150% of the wage of an unskilled labourer. From the evidence available for England it appears there may have been an increase in wage inequality during the first decades of the 14<sup>th</sup> century, and that already in the 1330s (after the Great European Famine of 1315-1322) a decline set in.<sup>12</sup> After the Black Death decline to the middle of the 15<sup>th</sup> century when a level of about 50 to 60% was reached; it remained strikingly constant during the next 450 years.<sup>13</sup>

The observations we have for other parts of Eurasia – for India, Japan, Korea and Indonesia (the latter not shown in Figure1) – suggest that the skill premium was much higher there than in Europe. Unfortunately these data do not go back to the period before 1600, but for the latter half of the period they are very clear. In Japan the skill premium seems to have fluctuated between 150 and 250 percent; a typical observation is that in 1802/04 a day labourer in Kyoto earned 0.92 momme per day, while the wage

of a carpenters in the countryside (in Kami-Kawarabayashi) was 2.6 momme and that for Osaka carpenters 4.3 momme per day.<sup>14</sup> A few 17<sup>th</sup> and 18<sup>th</sup> century observations for India and Indonesia suggest similar high levels.<sup>15</sup> Russia fits into the same picture; the data published by Hellie for the 17<sup>th</sup> century point to a 100% (carpenter/unskilled labourer) to 167% (mason/unskilled labourer) skill premium.<sup>16</sup>

The significant exception appears to be China. The detailed wage data available for 1769 – the result of government regulation of public construction – show that in large parts of China (Hunan, Gansu, Jiangsu) the skill premium was only about 25%. In these regions the median daily wage of a craftsman was set at about .05 tael and that of an unskilled labourer at about .04 tael per day. But in Zhili province, in particular in and near Beijing, both nominal wages and skill premiums were much higher than elsewhere. Nominal wages in the capital were three times as high as in the other regions for which data are available, and the skill premium was as high as 80 to 100 %.<sup>17</sup> Other evidence related to construction workers in Beijing in 17<sup>th</sup>, 18<sup>th</sup> and 19<sup>th</sup> centuries tell a similar story of a standardized skill premium of 100%.<sup>18</sup> For other regions I could not yet compare the 1769 regulations with other sources; it is a bit tricky to rely on too much on these sources because they contain prices set by the state, and it is not completely clear to what extent the quoted prices and wages reflected market values.<sup>19</sup>

It is also possible to compare between different parts of Europe (see Figure 3). I distinguish three clusters of six cities each: Western Europe (Gent/Antwerp, Amsterdam, Oxford, London, Paris, and Strasbourg), Southern Europe (Florence, Milan, Naples, Valencia, Zaragoza/Madrid and Istanbul) and Central Europe (Augsburg, Leipzig, Vienna, Danzig, Cracow and Warsaw). Not all time series are of equal length, however. For the 14<sup>th</sup> century the western European pattern is based on data from England and from the Low Countries (Holland and Gent); for southern

Europe in the 14<sup>th</sup> century we have only data for Florence and Zaragoza. But from the 15<sup>th</sup> century onwards data become more abundant. Figure 3 shows that both in Western Europe and in southern Europe the skill premium declined rapidly after 1350; in the south the fall is even more spectacular than in the north-west. The Zaragoza series already peaks in the 1310s, but in Firenze and the Low Countries the decline of the skill premium begins after 1348. But from the mid 15<sup>th</sup> century onwards the wage inequality in the south tends to go up, a pattern that can also be found in the east (Poland and Germany). Whereas the skill premium is between 50 to 60% in the north-west after 1450, it tends to increase to as much as 80 to 100% in eastern and southern Europe during the 19<sup>th</sup> century. And whereas in the rest of Europe, the skill premium seems to move more or less with the rhythm of population growth – increasing during the 15<sup>th</sup> century, stabilizing in the 17<sup>th</sup> century, and increasing again in the 18<sup>th</sup> and 19<sup>th</sup> century – there is remarkable stability in western Europe. The divergence that occurs in particular after 1650 can still be found in 20<sup>th</sup> century data: in 1936/37, according to the ILO data, the average for 6 eastern European countries was 56% (range: 28 and 95%), of three southern European countries 45% (25 to 64%) and for four western European countries 22% (12 to 28%).<sup>20</sup>

These two figures raise a number of questions about the remuneration of human capital in early modern Europe. The first and perhaps most striking development is the sudden and spectacular decline in the skill premium in the century after the Black Death. The result was that during the Renaissance - between 1400 and 1550 – there was an exceptionally low level of remuneration for human capital. The stability of the skill premium in Western Europe between c 1450 and 1914 is the second striking phenomenon; how is it possible that in those four-and-a-half centuries relative pay of

craftsmen became 'frozen' at such a low level? The divergence of the south and the east in the centuries after 1650 is perhaps the third remarkable development; this occurred during a period in which in terms of real wages (according to Robert Allen) and of GDP per capita (my own estimates) the countries around the north sea began to diverge from those in east and south.<sup>21</sup>

#### IV

According to standard economic theory the skill premium is the remuneration for investing in human capital, eg. for not earning an income during the period in which the apprentice was undergoing training and for the payment of fees to the master craftsman who trained the apprentice. Therefore, the skill premium is in the long term determined by (1) the costs of the training, such as number of years that are needed for acquiring the specific skills (the unearned wage income during these years), and the fees paid, (2) the interest rate linking the higher future earnings to the present, and (3) the expected higher income after finishing the training period: the chances of earning the higher income of a skilled worker and the number of years that one can expect to enjoy the skill premium. This may seem a very modern idea, and the approach therefore perhaps slightly anachronistic, but it can already be found in Adam Smith (as always), who wrote about the skilled labourer that 'the work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expense of his education, with at least the ordinary profit of an equally valuable capital... The difference between the wages of skilled labour and those of common labour is founded upon this principle'.<sup>22</sup>

The outlines of the apprenticeship system in Europe are relatively well known, and seem not to have changed fundamentally in the period under study.<sup>23</sup> Therefore it is possible to roughly simulate the relationship between the ‘equilibrium’ skill premium and the return on human capital, which will be related to the interest rate. The following assumptions are used in this simulation:

- a 7 years apprenticeship period – the standard in English contracts – at ages 14 to 21;<sup>24</sup>
- the unearned income of the apprentice is estimated at 20% of the annual wages of an unskilled labourer at age 14, increasing via 40% (15 years), 60% (16 years), 70% (17), 80% (18), 90% (19) to 100% at age 20;<sup>25</sup>
- after finishing their apprenticeship they will earn the wages of skilled craftsmen for 45 years, at ages 21 to 65;

Three variants have been calculated: 1/ assuming that that an apprentice has a 100% chance of becoming a craftsman after finishing his seven years of training; 2/ assuming that this chance is 75%, and that there is a 25% chance that he will earn the income of an unskilled labourer only; 3/ it is additionally assumed that the apprentice has to pay a premium of 50% of the annual wage of an unskilled labourer up-front. Figure 4 gives the relationships between skill premium and return on capital invested in training that can be derived from these assumptions. It shows for example that a decline of the skill premium from 135% (in 1325) to 60 % (in 1450) would be consistent with a decline of the return on human capital from 19% to 10% in the first version, from about 15,5% to 8% in the second version, and from almost 14% to 7% in the third variant.<sup>26</sup> Als added to Figure 4 are the very rough estimates of interest rates and skill premiums for a number of countries for the early modern period (explained more in detail below).

Given the fact that becoming a carpenter or a mason meant acquiring the same skills before and after the Black Death, the simplest explanation for the post 1350 decline of the skill premium in construction is that interest rates in Europe declined dramatically in this period. This is consistent with the evidence: all over Europe interest rates seem to have declined in the century or so after the Black Death. The evidence relates to actual interest rates on loans and on the public debt (collected by Sidney Homer), on the yield on investment in land (put together by Clark and Epstein), and can be derived from what we know about the seasonal fluctuations in grain prices, from which McCloskey and Nash and Poynder have derived estimates of Medieval interest rates.<sup>27</sup> The exact degree of the decline of interest rates in Europe is not precisely known however; for England Clark suggests a fall by perhaps as much as 50 to 60%, from 10 to 11% before 1350 to 4 to 5% in 1450-1500, but the number of observations for the latter period is small.<sup>28</sup>

The returns on investment in human capital estimated by the model are somewhat higher than these interest rates on capital market; the latter are related to the more formal parts of the capital market, in which land was (or could be) used as a collateral. Obviously, investment in human capital was more risky than investment in land, but this risk premium was – if we are to believe these calculations – surprisingly small in early modern Europe. Significantly, McCloskey and Nash also found a more radical decline of interest rates on rural capital markets in their study of the seasonal variation in grain prices.<sup>29</sup> The evidence presented here and their study perhaps indicates that the spread of interest rates between ‘formal’ and ‘informal’ capital market was also declining during the 1350-1450 period.

The ‘standard’ explanation for falling interest rates after 1350 is that the Black Death caused an exogenous fall in population levels, which – given the fact that the

capital stock and the cultivated land remained the same - resulted in a more favorable capital/labour and land/labour ratio, which induced the fall in interest rates (and led to increased levels of consumption, given the rise in wealth per capita). This then, it can be argued, induced households to increase their investments in human capital, leading to the strong decline in the skill premium in the same years.

What is also striking is that in western Europe both interest rates and the skill premium remained more or less constant (or showed an almost unnoticeable declining trend) after 1450, and did certainly not rise again to the pre 1350-level, in spite of a strong growth of population numbers and a subsequent decline of the land/man ratio in the centuries after 1450. In fact, population growth after 1450 was particularly rapid in those countries – in the Netherlands and England – where the skill premium remained frozen at the 50-60% level. This means that the explanation for the fall in interest rates and skill premium that focuses on the decline of population after 1348 as the determining factor is incomplete. The evidence suggests that at the same time changes in the institutional setting of capital markets occurred, leading to increases in efficiency in those markets (i.e. the fall of transactions costs), which resulted in a long term increase in the supply of savings and a stabilization of interest rates in the very long run. That in the centuries after 1450 interest rates and skill premiums did not increase again but continued to low and perhaps even decline somewhat further during the 18<sup>th</sup> and 19<sup>th</sup> centuries, is arguable the most significant development distinguishing Western Europe from the rest of the Continent.<sup>30</sup> That the demographic downturn after 1348 was perhaps of secondary importance - and perhaps only helped to attain a new equilibrium in the capital market characterized by low transactions costs, high savings and low interest rates - can also be argued on the basis of the case of Holland, where a long-term *expansion* of the (urban) population between 1350 and 1500 coincided with a

decline of the skill premium (from about 100% in the 1340s to 40 to 50% in the early 1500s) and a similar fall in interest rates.<sup>31</sup> It is beyond the scope of this paper to analyze the causes of these changes in detail, but my argument is that the decline of interest rates and the skill premium were fundamental for the long-term evolution of the European economy in the centuries after 1350; in fact, as the data for 1950 show, the regime of low interest rates and low skill premium is still with us today, as much as the regime of high interest rates and high wage inequality still characteristic of South-East Asia.

But how to explain long-term stability of the skill premium between 1450 and 1914? Why did not the Dutch Golden Age, the Industrial Revolution or any other major transformation of the economy of western Europe in these centuries lead to changes in the demand and supply of skilled labour resulting in changes in their relative prices? Part of the answer is that this did happen, but on other segments of the labour market. De Vries and Van der Woude, Van Zanden (for salaried employees) and Williamson (but contested by Feinstein) found evidence of increases in the skill premium in other parts of the labour market, in particular related to relatively highly skilled employees.<sup>32</sup> These reflected bottlenecks in the supply of skilled labour, the result of accelerations in economic growth and the transformation of economic structures. It is not clear how exceptional such a rise in the skill premium was. I also collected wage data for another group of highly skilled craftsmen, the composers and printers working in the printing industry that arose after the invention of movable type printing by Gutenberg in the 1450s. In a way these printers were the ICT-workers of the late medieval and early modern period, operating and developing the new techniques of mass production of information. Book production grew dramatically in Europe from the 1470s onwards and the demand for their skills must have been growing very rapidly.

But this did not lead to excessive wage levels; the most reliable data available, for the large firm Plantin in Antwerp for the period 1560-1800, show that in this booming centre of the printing industry wages of these highly skilled and literate workers were at the same level as those of construction workers. Because many printers were recruited from abroad – in particular from Germany – this must have been indicative of wage trends elsewhere.<sup>33</sup> This shows the relative flexibility of the supply of skilled labourers in early modern Europe and suggests that the low skill premium found in the construction industry may be indicative of the efficiency of the training system in general.

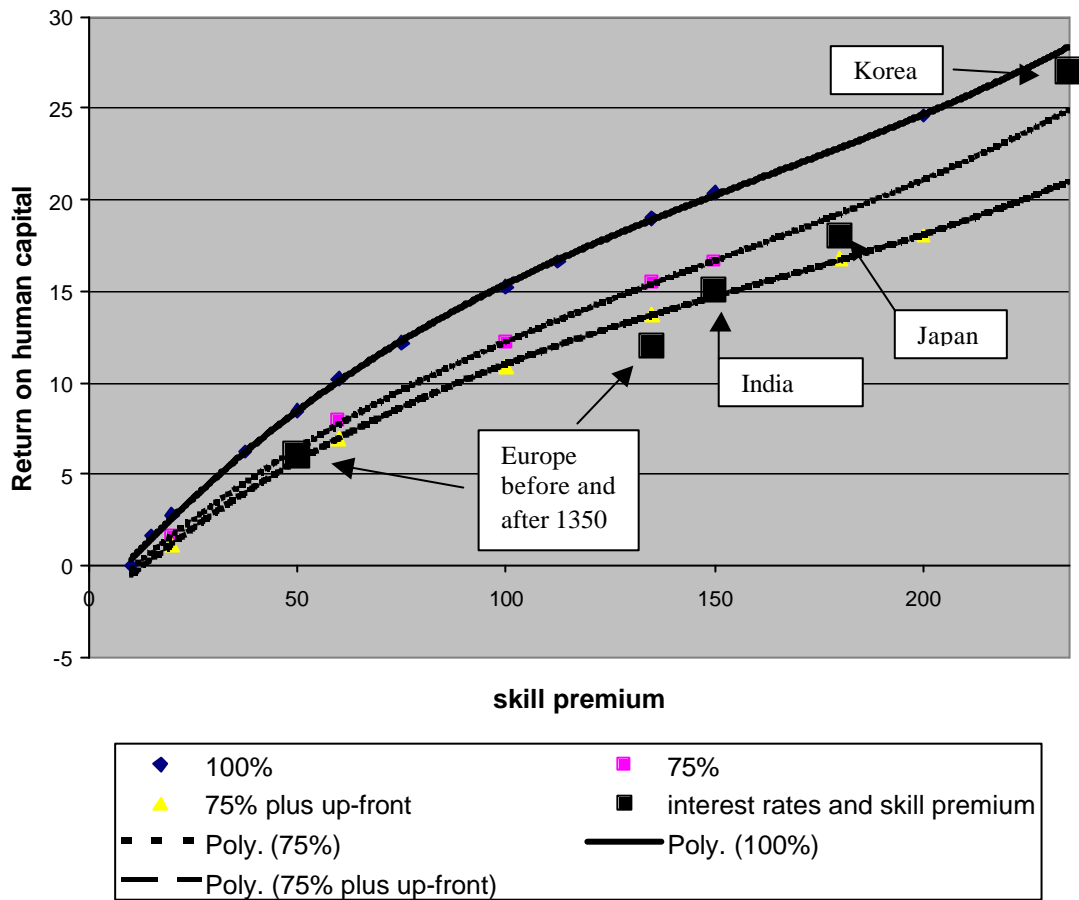
Can interest rates differentials also explain the gap in wage inequality between Europe and the rest of Eurasia? Evidence that interest rates in Europe were lower than elsewhere on the Eurasian continent is fragmentary, but the general tendency seems to be that from the late Middle Ages onwards capital markets in Europe were more efficient and developed – broader and deeper - than elsewhere.<sup>34</sup> Adam Smith was already convinced of the fact that interest rates in Europe – in particular in Great Britain and Holland - were much lower than in China and the ‘Mahometan’ nations: ‘twelve per cent accordingly is said to be the common interest of money in China’, he stated, whereas he considered 3 to 4.5 per cent to be normal in Great Britain.<sup>35</sup>

The extreme of the spectrum of interest rates was probably South-East Asia; recently a discussion started about the causes of the ‘high interest rates/thin capital markets’ equilibrium trap, in which the region was caught as early as the 17<sup>th</sup> century.<sup>36</sup> The ‘normal’ interest rate found by Boomgaard, for example, in an in-depth study of the capital market in Buitenzorg (near present day Jakarta) in 1805 was between 40 to 50%.<sup>37</sup> In another paper on interest rates in 17<sup>th</sup> century South and South-East Asia he

shows that these rates were usual for South East Asia, but that they were lower in India (12-18% in Coromandel and Bengal, somewhat lower in Surat).<sup>38</sup>

The available data for Korea also point to a link between high interest rates and high skill premiums; according to Jun and Lewis the interest rate in 18<sup>th</sup> and 19<sup>th</sup> century Korea fluctuated between 25 and 50%, with an average of 37% (see Figure 4). For Japan, finally, there are some data from Osaka from the 1830s onwards showing that official interest rates fluctuated between 8 and 10%; the same source adds, however, that in practice interest rates were often closer to 18 to 20%.<sup>39</sup> These examples show that there existed a big gap between western Europe on the one hand, and Asia on the other hand. Figure 4 shows that, assuming that the costs of training young apprentices are similar everywhere, the large differences in skill premiums between the rest of Eurasia and post-1348 Europe can easily be explained by this gap in interest rates. The efficiency of capital market institutions seems to explain the price of human capital.

**Figure 4 Modelled relationship between skill premium and return on human capital; three variations.**



Interest rates are only part of the story, of course. The efficiency of institutions regulating the training of apprentices also plays a role. The contract between an apprentice and his master is a highly complex one, involving different remunerations for services spread out over a lengthy time period.<sup>40</sup> Workers may fear, when they pay for their training up-front, that they will not get the quantity and quality of training necessary for becoming a skilled worker or an independent craftsman. Masters may fear that after the apprentice has been a net liability for his household during the first years of the contract, he will quit, before becoming a net source of income during the second half of his term.<sup>41</sup> When the master himself controls access to the ranks of skilled craftsmen, trainees may also fear that he may renege on his promises.<sup>42</sup> These by definition ‘incomplete’ contracts may therefore result in underinvestment in human capital; an efficient levels of human capital formation requires 1/ trust between both parties, and/or 2/ third-party involvement, i.e. institutions that guarantee the fair execution of the apprentice-contract.

In Europe guilds traditionally were the institutions that regulated the training of apprentices; in England the state also began to regulate apprenticeship (from 1563 onwards), but this was entirely based on the rules already applied by the craft guilds.<sup>43</sup> This meant that guilds almost everywhere operated as the ‘third’ party that saw to the fair treatment of apprentices. The exceptionally low skill premium of post 1450 Europe is therefore a testimony of the efficiency of the guilds (and, in England, of the additional institutions guarantees supplied by the national organization of the apprentice contract). If the guilds had been less efficient, if they had functioned as cartels of skilled labour restricting the entry to the ranks of craftsmen, the skill premium would have been much

higher (or, in other words, the gap between the return on human capital and the interest rate on the capital market would have been much higher). These conclusions are relevant for the ongoing debate about the relative efficiency of the guilds in early modern Europe. The traditional literature was very critical of the role of guilds, but more recent literature has suggested that their role was much more positive, in particular in the supply of training.<sup>44</sup>

The structure of labour relations may also help to explain the near-constant level of the skill premium in Western Europe between 1450 and 1914. Knotter and De Vries and Van der Woude has characterized the pre-modern labour market as consisting of two segments.<sup>45</sup> The first segment – the ‘internal’ labour market – was relatively small in scale, and was characterized by stable labour relations and more or less fixed wages. The second segment – the ‘external’ market – had different characteristics: labourers, who were often seasonal migrants from the other parts of the Netherlands or Germany, were employed on a project basis, changed employment frequently, and their wages fluctuated much more than wages of the first segment. The second segment acted as a buffer for fluctuations in the demand and supply of labour. The near-stability of wage rates we find in sources about the construction industry is a feature of the first segment of the labour market. Here, employment was a long-term relationship, and the costs of renegotiating the wage on a regular basis (apparently) outran the benefits that both parties could reap from such frequent renegotiations.<sup>46</sup> Other mechanisms were used to support employees in times of famine, such as a bonus payment at the end of the year to compensate for dearth. The stability of nominal wages – Amsterdam shipwrights, for example, complained in 1869 that their wages had remained the same for more than 200 years! – was therefore embedded in these long-term employment relationships. The very

stable skill premium should be seen against this background; stable nominal wages of both skilled and unskilled labourers obviously resulted in a stable skill premium.

Of course, these institutions could not guarantee the long-term stability of the skill premium at the 50 to 60% level if interest rates would go up or guilds became less efficient in training apprentices. This may be the explanation for the divergence of Southern and Eastern Europe between c 1450 and 1900 (and in particular after 1650). The divergence of the skill premium in these regions compared to western Europe shows a (not particularly strong) relationship with population growth: it increases in the sixteenth century, followed by convergence during the 17<sup>th</sup> century crisis, and is again followed by increases of skill premiums in the south and the east in the 18<sup>th</sup> and 19<sup>th</sup> centuries (Figure 3). Whereas in western Europe this link between demography and skill premium seems to be cut after 1450, it continues to exist in the rest of Europe. So it can again be argued that the ‘real’ problem to be explained is why the skill premium in western Europe remained at the very low level attained in 1450.

It is clear that an efficient system of training, organized by the guilds, was a precondition for the low skill premium we find in western Europe. But can it also be argued that institutions for training were inefficient elsewhere? A systematic study comparing systems of apprenticeship in different parts of the world is beyond the scope of this paper, but a few observations can be made. Guilds or similar institutions organizing craftsmen with the same skills existed outside Europe, in particular in China and Japan, but they in general do not seem to have had the same independent status – as a corporate entity with their own rights and obligations – as the guilds of western Europe. Institutions for training apprentices in Japan are depicted by Saito as being rather rigid – with a training period up to 20 years for apprentices in merchant firms –

which may have played a role in keeping the skill premium at a high level.<sup>47</sup> Castes to some extent fulfilled the same function in India, and their role in restricting access to specific skills has been criticized, but the evidence for this is limited.<sup>48</sup> Finally, in south-east Asia similar institutions for the training of apprentices were not well developed, or even totally absent; there, a large part of the skilled workforce consisted of Chinese immigrants and their descendents.

So perhaps it can be claimed that the rest of Eurasia did not have the guild system that was characteristic for Europe, but the estimates presented in Figure 4 do not suggest that variations in the efficiency of training system are an important explanation of large differences in the skill premium. The upper line of Figure 4 can be interpreted as an efficiency frontier, combining each skill premium with the highest return to human capital (or, in other words, with the lowest costs of training). The closer a country moves towards this curve, the more efficient the training system will be. Europe does not distinguish itself in this respect – Korea (in particular), India and Japan are as close to the efficiency frontier as western Europe (after 1350). Of course, the underlying estimates of interest rates and skill premiums – both for Europe and for the rest of Eurasia<sup>49</sup> - are rather weak, but the pattern that emerges seems to be consistent.

An aspect that is related to this brief sketch of the structure of the labour market is the status of the unskilled labourers in different parts of the world. In Europe these unskilled construction workers were full time urban inhabitants who were active on this first segment of the labour market. In Japan, India and Indonesia one gets the impression that unskilled labourers are basically *agricultural* labourers – coolies is the term used in South Asia – who were part-time active in construction and other urban activities. Saito in his study of the Japan labour market stressed the links between the

urban market for unskilled labourers and the situation in agriculture; unskilled labourers in cities earn about the same wage as ‘male springtime farm workers’, which means that no big urban-rural wage gap existed.<sup>50</sup> We have already seen that in China wages in Beijing were much higher than in the south and west of the country, suggesting a big urban-rural wage gap. The situation in Indonesia and India was perhaps similar; the big gap we find between the wages for skilled and for unskilled labour may therefore result from the fact that the non-European measures of the skill premium also include the urban-rural differential.

In Western Europe these differentials were surprisingly small. During the 16<sup>th</sup> and 17<sup>th</sup> centuries agricultural wages in Holland were more or less on par with those of unskilled workers in the building industry.<sup>51</sup> In England we find the same picture between 1300 and 1700 – with some (in itself quite significant) fluctuations, nominal wages in agriculture were at the same level as the wages of unskilled labourers in construction.<sup>52</sup> It appears therefore that western Europe was not only characterized by very low skill premium, but also by the fact that the wage gap between town and countryside was remarkably small.

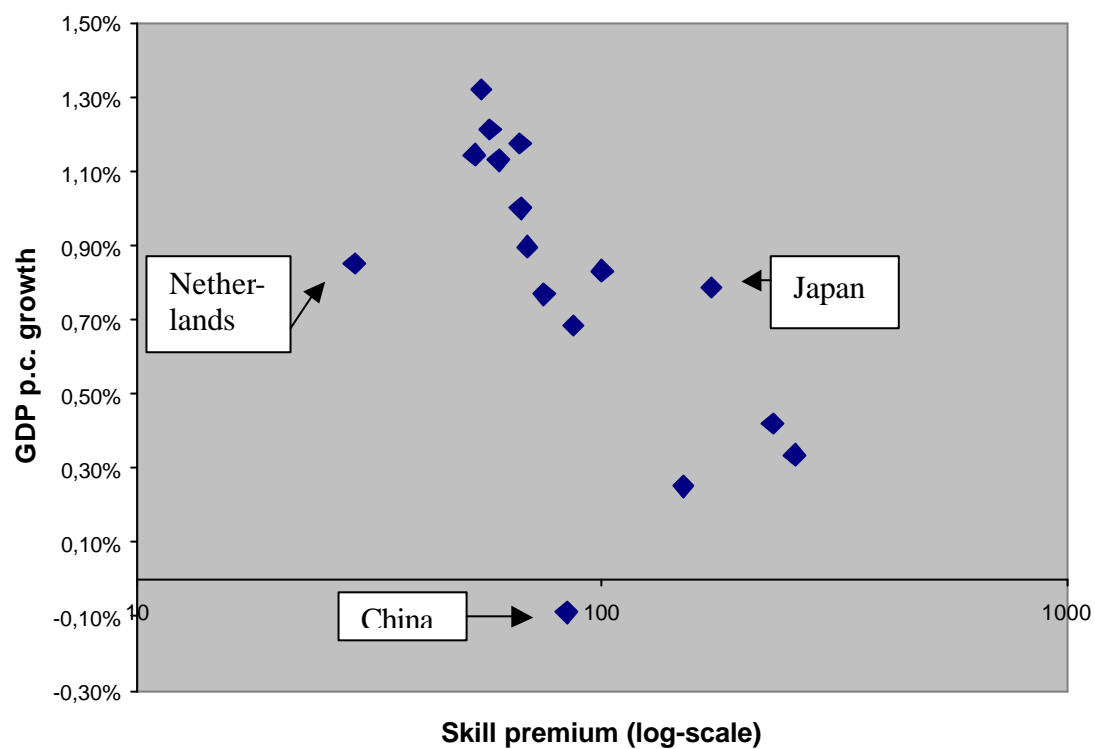
## VI

New growth theory postulates that human capital formation is one of the determinants of long-term economic growth. If this is correct, one would expect that the different conditions for human capital formation, reflected in the differences in the skill premium analysed in this paper, have affected long term economic growth. For the early modern period this is difficult to test, because of the poor quality of the estimates of GDP in this

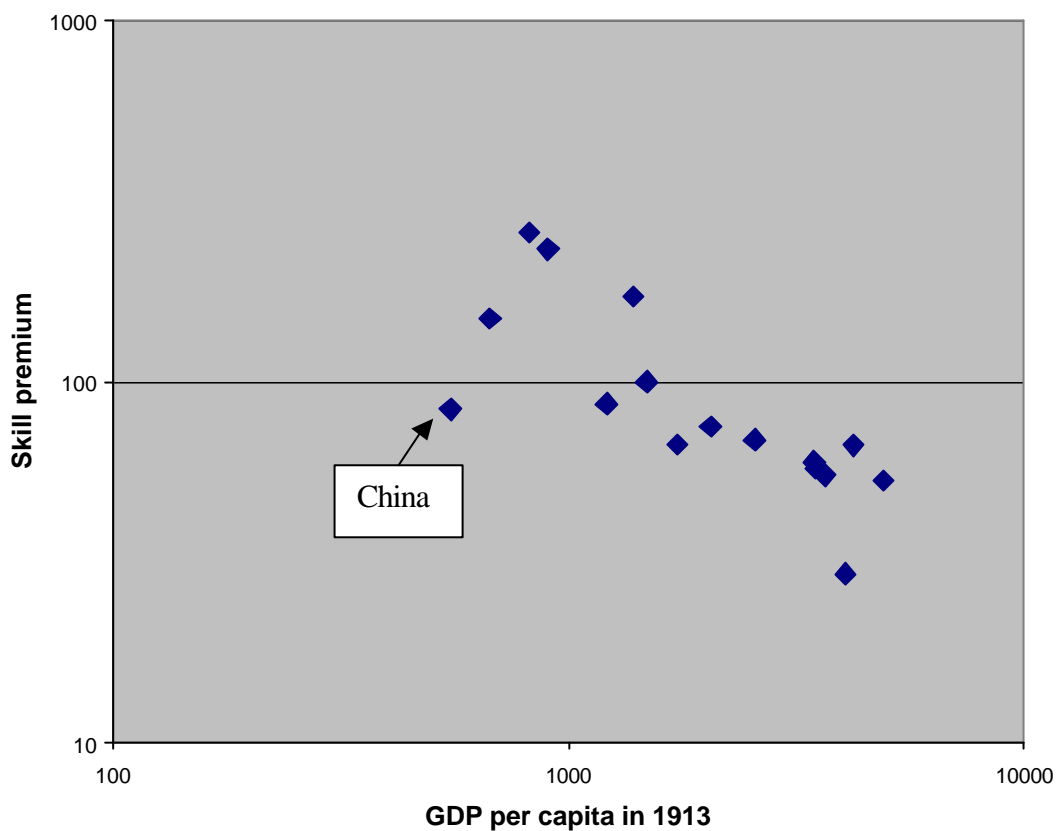
period, but the fact that the skill premium was the lowest in the most dynamic parts of Western Europe – the region around the North Sea – is significant. Moreover, the low skill premium seems to precede the expansion of these economies by one or two centuries. The Dutch Golden Age began after about 1580, and the acceleration of the English economy occurred during the middle decades of the 17<sup>th</sup> century, that is, 130 or 200 years after skill premiums (and interest rates) had fallen to their historic minimum.<sup>53</sup>

But the more important question is probably if the differences in the price of human capital can explain the ‘Great Divergence’ after about 1780. This idea is tested in two ways. Figure 5 shows the relationship between the average skill premium in the period 1750-1820 and the growth of GDP per capita during the 19<sup>th</sup> century (the period 1820-1913) according to the estimates by Maddison.<sup>54</sup> Because the 1820 estimates of levels of GDP are relatively weak and subject to much debate – the revisionists claiming that the gap between Europe and China was much smaller than estimated by Maddison – I also correlated the absolute level of GDP per capita in 1913 on the skill premium in the period 1750-1820 (Figure 6).

**Figure 5. The average skill premium of construction workers between 1750 and 1820 and GDP per capita growth in 1820-1913**



**Figure 6 The skill premium in 1750/1820 and GDP per capita in 1913 (log-scale)**



Both relationships are quite strong. There are two significant outliers in Figure 5, China and the Netherlands (and Japan has a somewhat higher rate of growth than might be expected on the basis of its skill premium at about 1800).<sup>55</sup> China is the only country with a declining GDP per capita (according to Maddison) and continues to be the enigma of this paper. Growth in the Netherlands was relatively slow because it started from a rather high level. The Dutch anomaly disappears in Figure 6. China is the only significant outlier in Figure 6.<sup>56</sup>

These relationships can also be tested econometrically. Table 1 shows how robust this explanation of the differences in growth rates and the levels of GDP in 1913

is. These results show that differences in conditions for human capital formation, which already arose during the late Middle Ages, are an effective explanation of the ‘Great Divergence’ during the 19<sup>th</sup> century.

## VII

The argument that has been developed in this paper is that the skill premium measured in this relatively simple way – as the difference between the wages of carpenters and masons on the one hand and those of unskilled labourers in construction on the other hand – is probably a good proxy of the quality of the institutional framework of an economy. This follows from the analysis of the main factors determining it:

- the level of interest rates, as paid by/used as a shadow price by (urban) households; it is generally accepted that interest rates are good indices of the quality of the institutional framework of an economy, but they are difficult to measure in a standardized way; the skill premium offers an elegant alternative measure;
- the efficiency of institutions for the formation of human capital, in particular apprenticeship-contracts, the guilds in which they are embedded, and the degree of trust between apprentice and master that results from these institutions – again we deal with strategic variables for measuring the quality of the institutional framework

In other words, a low skill premium shows that households have access to relatively cheap capital (the result of their own savings or of borrowing on a capital market) and that institutions for the formation of human capital are efficient. The long-term effect will be that investment in human capital will be high and that its level will be close to the socially optimal level (reflecting social costs and profits). This will obviously have

long-term consequences for economic growth; one expects growth to be strongest in economies with high levels of human capital formation and a low skill premium. The differential growth of the economies of early modern Europe, on which we have concentrated in this paper, seems to confirm this hypothesis. But even more striking are the high correlations between international differences in the skill premium at about 1800 and growth during the 19<sup>th</sup> century. Therefore, the skill premium is not only a very good measure of the quality of the institutional framework on an economy, but also a good predictor of growth in the long run.

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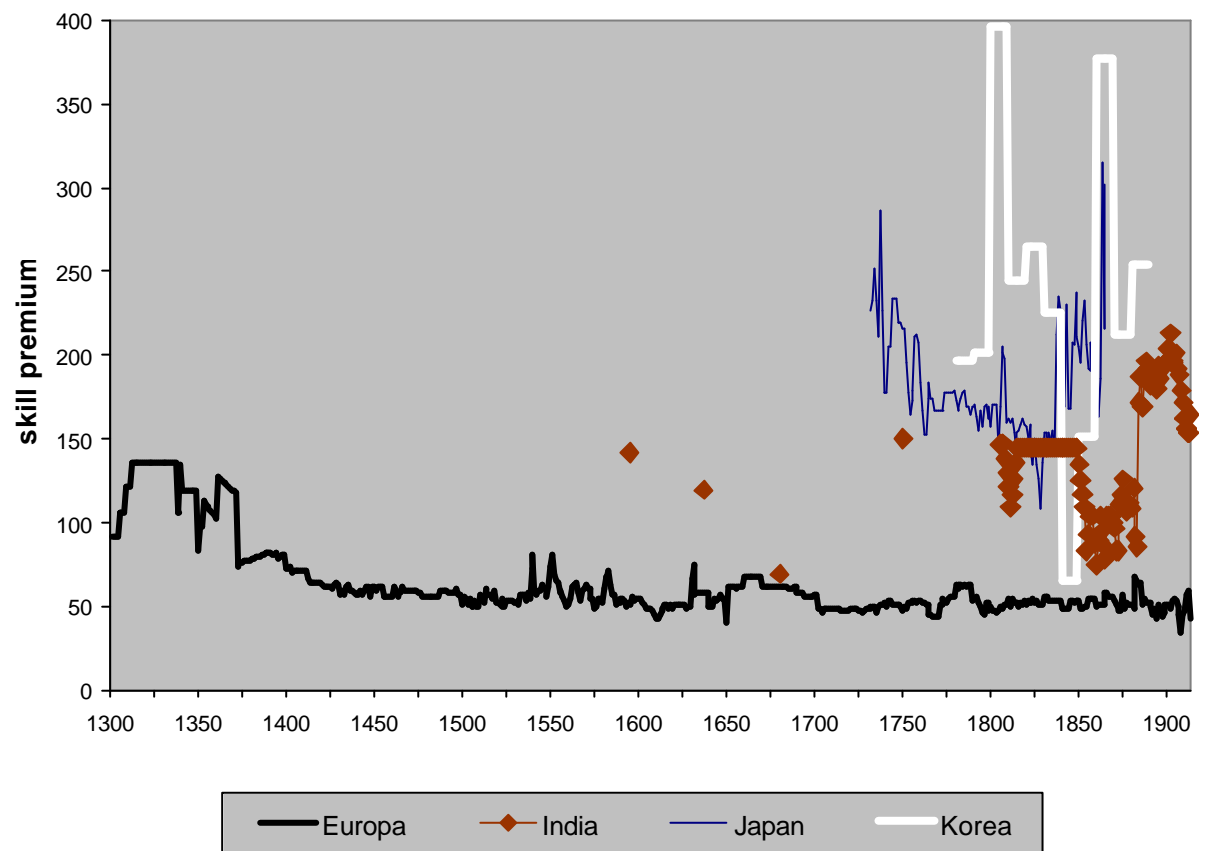


Table 1. Explaining the Great Divergence with international differences in the skill premium

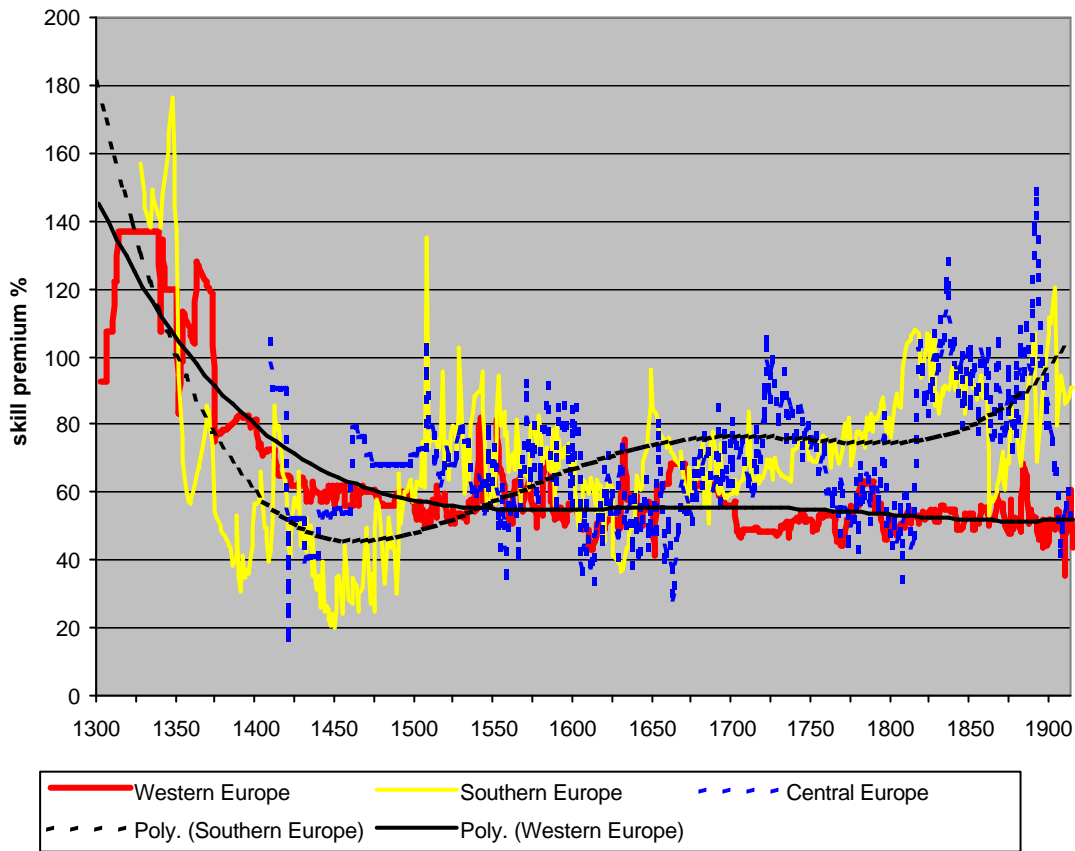
Dependent variable:	GDP p.c. growth 1820-1913		GDP p.c. in 1913	
Independent variable:		(t-value)		(t-value)
Constant	3.306	8.29	11.787	17.30
Skill premium	-.542	-6.19	-.937	-6.19
China dummy	-.995	-5.57	-1.320	-3.74
Holland dummy	-.621	-3.04	-	
R <sup>2</sup>	.847		.800	

Note: all variables as logs, except for the growth rates of GDP per capita

**Figure 2 The skill premium of craftsmen in construction in Western Europe, India, Japan and Korea, 1300-1914**



**Figure 3 The skill premiums of craftsmen in construction in western, southern and central Europe, 1300-1914**



<sup>1</sup> I thank Peter Koudijs for helping me to collect the data for this paper, Bas van Leeuwen for assisting me with a few econometric experiments, and the participants at the conference Towards a Global History of Prices and Wages in August 2004 at Utrecht University, and in particular Bob Allen, Bas van Bavel, Greg Clark, Najaf Haider, Phil Hoffman, Seong Ho Jun, Jan Lucassen, Paolo Malanima, Christine Moll-Murata, Sevket Pamuk, Peter Lindert and Johan Söderberg for their valuable comments.

<sup>2</sup> Discussion about these issues has ‘taken off’ since the publication of Kenneth Pomeranz, *The Great Divergence* in 2000; see also Bin Wong 1997.

<sup>3</sup> Lindert et al 2002.

<sup>4</sup> For the role of masons see Richard Goldthwaite 1990 pp. 125 ff.

<sup>5</sup> Freeman and Oostendorp 2001 give an historical overview of the october census.

<sup>6</sup> Sources: ILO, Yearbook of Labour Statistics, 1946-1954 (for a few countries wage data from years close to 1950 had to be used); GDP: Maddison 2001.

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<sup>7</sup> A number of regressions were run, using different definitions of regions; the only region of which the dummy did not have a positive sign – apart from Europe – was Oceania, with only two observations (Australia and New Zealand); the Asian country that fitted well into the European pattern was, unsurprisingly, Israel (wages Jews).

<sup>8</sup> The first data in the global dataset by Barro and Lee are for the 1960s and show that average years of schooling in the US and Canada were more than 8, a level only attained by Germany and Denmark, the other European countries fell clearly behind this; in 1950 the gap between both sides of the Atlantic must have been even bigger.

<sup>9</sup> Regressions with data from the 1990s about the degree of corporatism or the degree of unionization of the non-agricultural labour force suggest strong negative links between these institutional variables and the skill premium, but in almost all cases the dummy for Europe remains negative and significant.

<sup>10</sup> Sources: Allen 2001 (I used the underlying series published at <http://www.economics.ox.ac.uk/Members/robert.allen/WagesPrices.htm>); for Istanbul from Özmucur and Pamuk 2002 (published at <http://www.iisg.nl/hpw/istanbul.xls>); additional data for the Low Countries 1347-1500 are from Van Bavel and Van Zanden 2004, and for Zaragoza in the 14<sup>th</sup> and 15<sup>th</sup> century from Palacio 1994, pp. 362-3.

<sup>11</sup> Sources: Japan: Saito 1978 and Saito 2003; India: Van Leeuwen 2004; Broadberry and Gupta 2003; Korea: Jun and Lewis 2004.

<sup>12</sup> Cf Clark 2004b for a slightly different timing of the decline of the skill premium in England; the decline after 1350 has already been noted by Beveridge and by Postan; see Phelps Brown and Hopkins, 1981: 8.

<sup>13</sup> After 1914 it declined to an even lower level, to about 25% in 1936: Phelps Brown and Hopkins 1981: 8-12; also ILO Yearbook, 1936.

<sup>14</sup> Saito 2003; Nishikawa 1978: 80-1 also gives wages for skilled and unskilled workers in saltmaking in Choshu in the 1840s which indicate a similar skill premium (4.6 momme for a skilled workers against 1.6 momme for an unskilled worker and .8 momme for an unskilled female labourer).

<sup>15</sup> See on India: Broadberry and Gupta 2003; for Indonesia: Van Zanden. 2003.

<sup>16</sup> Hellie 1999: 413-74.

<sup>17</sup> My estimates based on the 1769-documents published by the project Staat, Handwerk und Gewerbe in Peking, 1700-1900 (at <http://www.uni-tuebingen.de/sinologie/project/shp/databases.html>) results in, in tael per day (Jiangsu data acquired from Christine Moll-Murata):

	N =	Masters	Labourers	Skill premium (%)
Hunan	10	.050	.039	29
Jiangsu	63	.051	.040	26
Gansu	50	.057	.047	21
Zhili/ Shuntian	24	.141	.077	84
Zhili/Baoding-Tiajin	34	.112	.071	59
Zhili/other prefectures	82	.081	.054	49

<sup>18</sup> Moll-Murata 2003, 2004, and presentation of the latter paper, in which regulations of wages of construction workers were discussed from 1659, 1665, 1723 and 1736 all showing the same skill premium of 100%.

<sup>19</sup> Mazundar 1998: p. 54 gives a few wage data for 18<sup>th</sup> century Guangzhou which also suggest a rather high skill premium; a paper press worker in South China received 750-900 cash per month, whereas an agricultural worker earned 450-500 cash per month, from which a skill premium of 50 to 100% can be calculated.

<sup>20</sup> ILO, Yearbook of Labour Statistics, 1938.

<sup>21</sup> Allen 2001; Van Zanden work in progress.

<sup>22</sup> Smith 1776/1976: 203-4.

<sup>23</sup> Epstein 1991 is the best survey of the medieval system; for England: Humphries 2003.

<sup>24</sup> See Humphries 2003: 75; also Epstein 1991: 142 who gives a seven years apprenticeship period for carpenters in 13<sup>th</sup> century Genoa, but shorter periods for masons (5 or 6 years).

<sup>25</sup> These rough estimates are based on two sources: the wage profile of printers in Antwerp (Plantin) in the 16<sup>th</sup>-18<sup>th</sup> century from Scholliers 1959 and Impens 1965, and the age-profile of textile workers in England in the first half of the 19<sup>th</sup> century from Johnson 2003.

<sup>26</sup> The extremely low skill premium of 20-25% found in large parts of China would be consistent with interest rates of 1 to 3%.

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- <sup>27</sup> Homer and Sylla 1996: 99-100, 106-8; Clark 1988: 268-76; Epstein 2000: 18-25, 60-61; McCloskey and Nash 1984; Poynder 1999.
- <sup>28</sup> Clark 1988; also Epstein 2000: 61.
- <sup>29</sup> McCloskey and Nash, 1984.
- <sup>30</sup> Epstein 2000 and Clark 1988 speculate about these changes but do not yet give adequate explanations.
- <sup>31</sup> The fall in interest rates is documented by still unpublished research by Jaco Zuyderduyn (Ph D student Utrecht University).
- <sup>32</sup> De Vries and Van der Woude 1997: 632-4; Van Zanden 1995; Williamson 1985; Feinstein 1988.
- <sup>33</sup> Data from Scholliers 1959 and Impens 1965
- <sup>34</sup> See Pomeranz 2000: 178-9; Sylla and Homer 1996: 610-615.
- <sup>35</sup> Smith 1976: 198.
- <sup>36</sup> See Henley 2004.
- <sup>37</sup> Boomgaard 1986; also Van Zanden 2003 for Java in the 19<sup>th</sup> century;
- <sup>38</sup> Boomgaard 1996; other 17<sup>th</sup> century interest rates from this paper, which is based on data from loans supplied by (and in a few cases obtained by) the East India Company: Thailand about 24%; Jambi (on Sumatra) 24-36%; Banten (on Java) 18-24%, whereas in the Netherlands the VOC could easily borrow at 3.5 to 5% during the 16<sup>th</sup> century.
- <sup>39</sup> Myomoto 1963: 344.
- <sup>40</sup> Humphries 2003.
- <sup>41</sup> See Epstein 1991: 102 ff; almost all contracts contained clauses forbidding the apprentice to quit before the contract period had ended.
- <sup>42</sup> Humphries 2003: 81-2.
- <sup>43</sup> Humphries 2003; Epstein 1991.
- <sup>44</sup> An overview of the debate stressing the role guilds played in training in Epstein 1998.
- <sup>45</sup> Knotter 1984; see also De Vries and Van der Woude 1997: 636-47.
- <sup>46</sup> The basic assumption underlying this, was that prices in the long run were stable.
- <sup>47</sup> Saito 2002.
- <sup>48</sup> Cf. the discussion in Haider 2004.
- <sup>49</sup> Sources of interest rates: Western Europe/England: Clark 1988; India: Boomgaard 1996; Japan: Myomoto 1963; Korea: Jun and Lewis 2004.

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- <sup>50</sup> Saito 1978: 88; Saito 2003 gives for the base period 1802–4 that the mean money wages for agricultural labourers in the countryside was 1.0 momme and for Kyoto day labourers 0.92 momme per person-day;
- <sup>51</sup> Van Zanden 2002
- <sup>52</sup> Clark 2004
- <sup>53</sup> But one can also argue that the expansion of the North Sea economy began earlier, for example in the 16<sup>th</sup> century (with the growth of the Antwerp economy) or in the late medieval period (see Van Bavel and Van Zanden 2004 for the latter argument concerning Holland); that would mean that both processes – the decline of the skill premium and the first phases of economic growth – coincided.
- <sup>54</sup> Maddison 2001; for the Chinese skill premium I took the Beijing figure for 1769 (84%); taking a lower skill premium would make China an even more extreme outlier.
- <sup>55</sup> It is significant that the Japanese skill premium fell strongly during the second half of the 19<sup>th</sup> century, especially during the 1880s; see Van Leeuwen 2004; for China I used the skill premium of Beijing in 1769, for two reasons: it is probably more representative of overall levels of wage inequality than the other 1769-data, and I also used data from the big cities of other countries (the Netherlands is represented by Amsterdam etc.).
- <sup>56</sup> But Chinese GDP per capita in 1913 level is also underestimated; see Ma et.al (2004).