Market Forces Shaping Human Capital
in Eighteenth-Century London[*]

Abstract

This paper draws on quantitative and descriptive data from Robert Campbell's widely cited manual for prospective apprentices, *The London Tradesman* (1747), to demonstrate the responsiveness of apprenticeship premiums in mid-eighteenth century London to market forces of supply and demand. It first shows that Campbell's data on mid-eighteenth century journeymen wages, apprenticeship premiums and masters' set-up costs in London are constant with other sources. It then applies IV regressions to estimate the elasticity of apprenticeship premiums with respect to journeymen wages and set-up costs, using Campbell's education and ability requirements, by trade, to instrument for wages. We find that premiums were highly responsive to both variables, with a unitary elasticity with respect to wages and an elasticity of 0.25 with respect to set-up costs, both statistically significant at a p-value less than 0.1%. We interpret these findings as supporting the thesis that apprenticeship played an important role in adapting the English workforce to the skill requirements of the Industrial Revolution. Furthermore, by demonstrating the internal and external consistency of Campbell's observations, our findings should encourage their use as an unparalleled source of detailed, trade-specific wage data from the early years of the Industrial Revolution.

I

The success of the Industrial Revolution in England was made possible by a large-scale redistribution of labor from agricultural employment to industrial and other non-agricultural employment, and growing specialization in manufacturing (Thomas and McCloskey, 1981; Crafts, 1985). The role played by the long-standing English system of apprenticeship, with its medieval roots, in this process of structural change has been the subject of historical debate. A critical tradition dating back at least to Adam Smith (1776) views apprenticeship primarily as a tool used by the craft guilds to maintain control over their respective occupations and exclude competition (Ogilvie, 2004; Rothschild, 2001). However, this view has been challenged over the last two decades by studies that highlight its important economic contribution to innovation (Epstein, 1998; Mokyr, 2009) and to labor mobility (Humphries, 2003, 2009; Wallis, 2008). As Humphries (2003; 2011, Ch. 9) shows in detail, the English system of apprenticeship contributed to the reallocation of labor by providing efficient training in skills directly relevant to the expanding branches of industry; by reducing transaction costs; and by easing liquidity barriers, thus enabling wider participation in the skilled industrial workforce.[1]

The present paper continues in this vein, drawing on quantitative and descriptive data from a unique source, Robert Campbell's widely cited manual, *The London Tradesman*, first published in 1747,[2] which provides explicit quantitative and qualitative information on the economic conditions of employment and on the terms and requirements of apprenticeship for a detailed classification of trades. We use this data to demonstrate through regression analysis that the variation across trades in the tuition or premiums that parents paid masters for their sons' apprenticeships were shaped by economic conditions, their level bounded from above by the expected benefits to the apprentice of acquiring the skills of the trade (Lane, 1996, p. 29); bounded from below by the expected net training costs to the master, taking into

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[1] Its role was especially important in the earlier years of the Industrial Revolution considered here. In her analysis of 600 working-class biographies, Humphries (2011, Table 9.1) finds that in her earliest group of cohorts, born between 1627 and 1790, at least two thirds and possibly as many as three quarters were apprenticed. In her latest cohort, born in the second half of the 19th century, this proportion falls to no more than 40% and perhaps as little as a quarter.

[2] We use a facsimile reprint from 2010.

account the delay before the apprentice becomes reasonably productive and the positive probability of the apprentice leaving prematurely (Wallis, 2008); and reflecting the relative bargaining power of master and parent.

This paper demonstrates that by the mid-eighteenth century, in London, the medieval institution of apprenticeship had developed a degree of responsiveness to the market forces of supply and demand, which enabled it to play an important role in adapting the English workforce to the changing skill requirements of the Industrial Revolution. This facilitated the "premature exodus of labor out of agriculture that [was] the hallmark of British exceptionalism" (Humphries, 2003, p. 99); and allowed sons to migrate out of their fathers' trades when these seemed to suffer from over-crowding or declining demand.

In addition, by demonstrating the consistency of Campbell's observations with other available data sources, and by establishing their internal consistency as a basis for quantitative analysis, our findings should encourage the wider use of this unique source of information in understanding the early stages of England's Industrial Revolution. Campbell's manual is well-known to historians studying the formation of industrial skills in eighteenth-century England and frequently cited. However, as far as we know, his detailed, trade-specific evidence on wages has not previously been incorporated in quantitative analyses of this period.[3]

Our theoretical analysis of the economic factors that shape apprenticeship premiums follows Wallis (2008) and Minns and Wallis (2013) in taking as its point of departure the hypothesis that "premium size served to mediate the likelihood of early departure among apprentices." The master bore a greater net cost of instruction—and the apprentice reaped greater net benefit—in the early years of the apprenticeship, anticipating that this advantage would be reversed in its later years when the apprentice became more skilled. These costs included the room and board that was generally provided,[4] the value of the master's time, and the cost of wasted or pilfered

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[3] We are not aware of later editions of Campbell's manual. Joseph Collyer (1761) published a similar manual fourteen years later, which though it does not mention Campbell's work appears to draw heavily on it, especially for its data on premiums, wages and set-up costs, and therefore cannot be considered an independent source to which Campbell's data might be compared for validation. We compare Campbell's quantitative data to other sources in Section 3.2 below.

[4] As Humphries (2011, Ch. 9) notes, bundling the principal training component of apprenticeship with room and board and supervision *in loco parentis* reduced transaction costs, especially for apprentices

materials. Premiums were necessary to guard the master against the possible but unforeseeable eventuality that an apprentice might leave before making good the master's initial investment.[5]

Building on their seminal effort, we posit that the actual premium paid for an apprenticeship in a given trade should lie within an interval that is bounded from below by the minimal value that a master of that trade would be willing to accept and bounded from above by the maximal value that parents would be willing to pay for an apprenticeship in that trade; and that the premium should be situated within this interval at a point reflecting the specific interests and relative bargaining power of master and parent. We hypothesize that the master's minimal acceptable premium is positively associated with factors that increase the likelihood of early departure, such as the opportunity cost to the apprentice of further time spent in the master's employ; and factors that delay the point at which the apprentice becomes productive, notably the complexity of the trade. We expect parents' willingness-to-pay for an apprenticeship to be positively associated with the pecuniary and non-pecuniary benefits of the trade that is to be acquired.

Historical accounts indicate that the market for apprenticeships in mid-eighteenth century London was reasonably competitive, except possibly in trades in which high set-up costs limited masters' entry and allowed them some market power. Humphries (2011, Ch. 9) recounts repeated instances of fathers using their extended family and trade contacts to "shop around" for a suitable apprenticeship for their sons at a premium within their means. In most cases, a parent apprenticing his son to a master would have been less affluent and more credit-constrained than the master, and therefore more sensitive to the level of the premium. This suggests that premium levels should more closely follow the expected net costs of apprenticeship to the master, except possibly where high set-up costs allow masters to command a greater share of the surplus.

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migrating from rural to urban areas.

[5] As Minns and Wallis (2013, p.) observe, "… the numbers of apprentices who were allowed freely to exit their contracts by local magistrates and courts far exceeded the number coerced into continuing service." This caused a potential holdup problem, as much of the human capital acquired through apprenticeship is general rather than specific. Masters anticipate the possibility of early departure preventing them from fully appropriating the fruits of their investment and are therefore reluctant to take on apprentices. Up-front premiums relieve their reluctance (but do not prevent early departure.)

This is the conceptual framework for our empirical analysis of 178 different trades that Campbell describes.[6] For each of these trades, Campbell provides quantitative data on the range of premiums paid, of journeymen's wages and of set-up costs for the master. In addition, he provides qualitative descriptions of each trade, which we have coded. These include personal qualities needed to succeed in the trade such as physical strength, ingenuity or artistic ability; prior training requirements, such as language skills; and special conditions of employment, such as health hazards. Our focus on variables that describe the economic and technical conditions of each trade complements Minns and Wallis' (2013) empirical analysis of individual apprenticeship contracts, which focuses on the personal circumstances of apprentice and master: the apprentice's age, his geographic origins and his father's occupational background as well as the master's prior experience with apprentices and his association with a guild.

From the parent's point of view, journeymen wages are an indication of the pecuniary benefits of the trade, and as such should be positively associated with parents' willingness to pay higher premiums. From the master's standpoint, they are a measure of the opportunity cost of the apprentice's time and hence an indication of the probability of early departure, again suggesting a positive association with premium levels. We interpret high set-up costs as an indicator of the opportunity cost of the master's time, and as a barrier to entry for masters indicating the master's market power vis-à-vis parents; both suggest a positive association with premium levels.

We estimate a regression of premiums on wages and set-up costs using a two-stage procedure, to allow for an endogenous effect of premiums on wages. In the first stage we use the specialized abilities required for each trade as instruments for journeymen wages. Thus trades requiring specialized drawing skills or knowledge of mathematics indicate higher wages. In the second stage we regress apprenticeship premiums on instrumented journeymen wages and masters' set-up costs (all three variables in logarithmic form) and on other qualitative indicators of each trade, across the 178 trades in our sample. We find that both journeymen wages and set-up costs have a

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[6] We exclude from our analysis over one hundred additional trades described by Campbell. These include trades with insufficient information for the purpose of our analysis as well as all shop-keeping trades and liberal professions. We expand on this in our description of the data.

substantial and highly significant positive effect on premiums, with a unitary elasticity for wages and an elasticity 0.25 for set-up costs. We also find that in trades requiring greater bodily strength premiums were about one quarter lower on average while the future political privileges of apprenticeship to a liveried trade did not have a significant effect on premiums.

In the next section we provide some brief background on Campbell's unique manual. Section 3 then describes the data we have drawn from it, and compares it to data from other sources; Section 4 presents our regression analyses; and Section 5 concludes.

II

Apprenticeship was the main formal system for acquiring skills in eighteenth century England. While its general structure can be traced back to the practices of guilds and cities in the Middle Ages, it was first regulated nationwide in 1563 in the *Statute of Artificers* which legally determined the core of English apprenticeship contracts (*indenture*s).[7] It involved a written contract binding master and apprentice for a pre-specified period, usually of seven years, during which the master undertook to teach the apprentice and introduce him to the *modus operandi* of his trade, provide him with board and lodging, and safeguard his moral welfare. Apprentices were under the quasi-parental authority of their masters: their manners, entertainment, and freedom to marry were limited. The apprentice, on his part, took it upon himself "duly and truly to serve"; and a *premium* or cash payment was commonly paid to the master at the beginning of the apprenticeship.

A considerable number of manuals providing guidance and advice to young apprentices began to appear in print from the early seventeenth century (Lane, 1996, p. 164). The advice in these manuals concentrated particularly on the child's dutiful relationship with the master and the host family. The manual we focus on here concentrates on advice to parents in their decision on choosing a trade for their child.

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[7] The act, although devised by central government, was administered almost entirely by local guilds. The clauses of the Statute limited masters to no more than three apprentices each; stipulated a minimal term of seven years; and required a written indenture for private apprenticeship. The Poor Law Act of 1597 gave Overseers of the Poor and Churchwardens the power to put out to pauper apprenticeships children who could not be cared for by their own family, thus reducing the poor rate in their parish.

It was published in 1747 by T. Gardner, in London, entitled: *The London Tradesmen* authored by Robert Campbell, esq., of whom little is known. It sets out its ambitious aims on its cover:

Being a Compendious View of All the Trades, Professions, Arts, both Liberal and Mechanic, now practiced in the Cities of London and Westminster. Calculated for the Information of Parents, and Instruction of Youth in their Choice of Business.

It is unique in setting out explicitly and in great detail the conditions of employment and range of wages earned by journeymen in each trade; the financial and other requirements a master would make of an entering apprentice; specific qualities each trade requires; the range of set-up costs required of a master; and in many cases the general profitability of the trade for a master.[8] Take the *gunsmith* as an example (spelling as in the original):

The Gun-Smith is a Compound of the Joiner and Smith; he works both in Wood and Iron: The Gun or Pistol Barrel is none of his making: they are made at the Foundery, and he buys them in Parcels, makes them and mounts them. It is a very ingenious Busines, requires Skill in the Tempering of Springs, a nice Hand at forming a Joint to make his Work close, and a good Hand at the File to polish it handsomely ... The Trade is not much over-stocked with Hands; and the Journeymen when employed earn Twelve or Fifteen Shillings a Week. A boy may be bound at Fourteen and requires no extraordinary Strength or Education. (Campbell, 1747, p. 242)

In an appendix, Campbell presents each of the occupations in a table, noting the Company it belongs to and whether it is a Livery Company; the range of premiums required for an apprenticeship; working hours; and the range of set-up costs required of a master.

Campbell surveys in his manual over 300 occupations, most in some depth, others more briefly, often noting of the latter that they have no demand for apprentices or that their conditions are very similar to those of another trade described more fully elsewhere. The quantitative information he provides on the conditions of employment

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[8] As Lane (1996) points out, the very existence of manuals such as Campbell's is in itself a strong indication that parents considered future earning potential in choosing a trade for their children.

and on the terms and requirements of apprenticeship for a detailed classification of trades is unparalleled for eighteenth-century England, and all the more so because it comes from the systematic observations of a single source. We have extensive Stamp Tax records on apprenticeship premiums paid to masters but nothing of similar scope and detail on journeymen wages or on the costs of setting up as a master in different trades.

In the following section we assess the accuracy of Campbell's data by verifying its external consistency with Stamp Tax data on apprenticeship premiums and with what other information we have on trade-specific wages and on setting up costs in mid-eighteenth century England. Though we know hardly anything about the author or the specific circumstances in which the manual was written, these comparisons indicate, as far as they can, that Campbell conducted a thorough and careful investigation.[9]

<h1 style="text-align:center">III</h1>

Of the 300 and some trades that Campbell surveys in his manual, we omit trades that do not take apprentices; trades for which Campbell fails to provide information on premiums, journeymen wages, and set-up costs; and shop-keeping trades that chiefly train apprentices in general book-keeping and related skills. We grouped the remaining 178 trades by occupational groups for the sole purpose of presenting summary data in Table 1 (no use is made of these groupings in our regression analysis). It presents mid-point values of the ranges provided by Campbell for journeymen wages, premiums and setting up costs, by occupational groups, as well as the coefficient of variation within each group (the standard deviation divided by the mid-point value). In the appendix we provide a full tabulation of the data for each of these 178 trades, with their assignment to occupational groups (Table A1).

 As Table 1 shows, average journeyman's wages by group range from a low of 9 shillings per week in clothing and upholstery to a high of 21 shillings per week for

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[9] This recalls Allen and O'Grada's (1988) examination of Arthur Young's research on English agriculture, which led them to conclude that it was conducted carefully and did not reflect the author's political views.

goldsmiths, jewelers and artists. Most groups are fairly homogenous internally, with the exception of weavers and "other manufactures". The weaver's trade, according to

Table 1. Premiums, journeymen wages, and setting-up costs

Occupational group	No. of trades (1)	Journeymen's wages *s/week*		Premium, £		Setting up costs, £	
		Mid-point (2)	Coeff of var* (3)	Mid-point (4)	Coeff of var* (5)	Mid-point (6)	Coeff of var* (7)
Instrument and machines	11	18	0.39	17	0.66	276	1.38
Goldsmiths, jewelers, artists	18	21	0.32	16	1.45	317	2.03
Carpenters, joiners, coopers	18	19	0.36	16	1.00	656	1.85
Weavers	10	16	0.62	16	0.22	351	0.81
Victualing and services	13	11	0.24	13	1.44	393	1.74
Leather and leather goods	17	14	0.29	12	0.59	384	1.15
Metalwork	19	13	0.30	11	0.67	154	1.00
Smiths and founders	17	16	0.17	10	0.47	322	1.20
Yarn and cloth	15	15	0.37	10	1.41	385	1.29
Building trades	7	11	0.03	10	0.48	271	0.69
Clothing and upholstery	11	9	0.33	9	0.33	232	0.96
Wood workers and turners	10	12	0.27	9	0.85	144	0.75
Other manufactures	12	14	0.58	21	1.92	694	1.62
Total	178	15	0.42**	13	1.23**	351	1.75**

Source: Table A1
* The coefficient of variation within each group, equal to the standard deviation divided by the mean
** This is the coefficient of variation between occupational groups

Campbell is *very extensive and divided into innumerable Branches: as many as there are different Fabricks of wrought goods*. The highest wage earners were the *tapestry weavers*, who could earn, according to Campbell: *from a Guinea to Three Pounds a Week, according to the Branch they are employed in.*[10] Other weavers earned considerably less, with the lowest wages earned by narrow weavers (weavers of ribbons, livery-lace, tapes, incles) who earned around 9 shillings per week and the weavers of simple carpets who earned less than 7 shillings a week. "Other manufactures" include both high wage earners such as compositors, enamellers and potters and low wage earners such as book binders, cork cutters and button makers.

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[10] Campbell (1747), p. 246.

We next compare Campbell's quantitative data on apprenticeship premiums, journeymen wages, and setting up costs to information from other available sources on these variables. The qualitative variables describing the conditions of employment and prior requirements of various trades that appear in the *The London Tradesman* have no counterparts in other systematic sources, as far as we know.
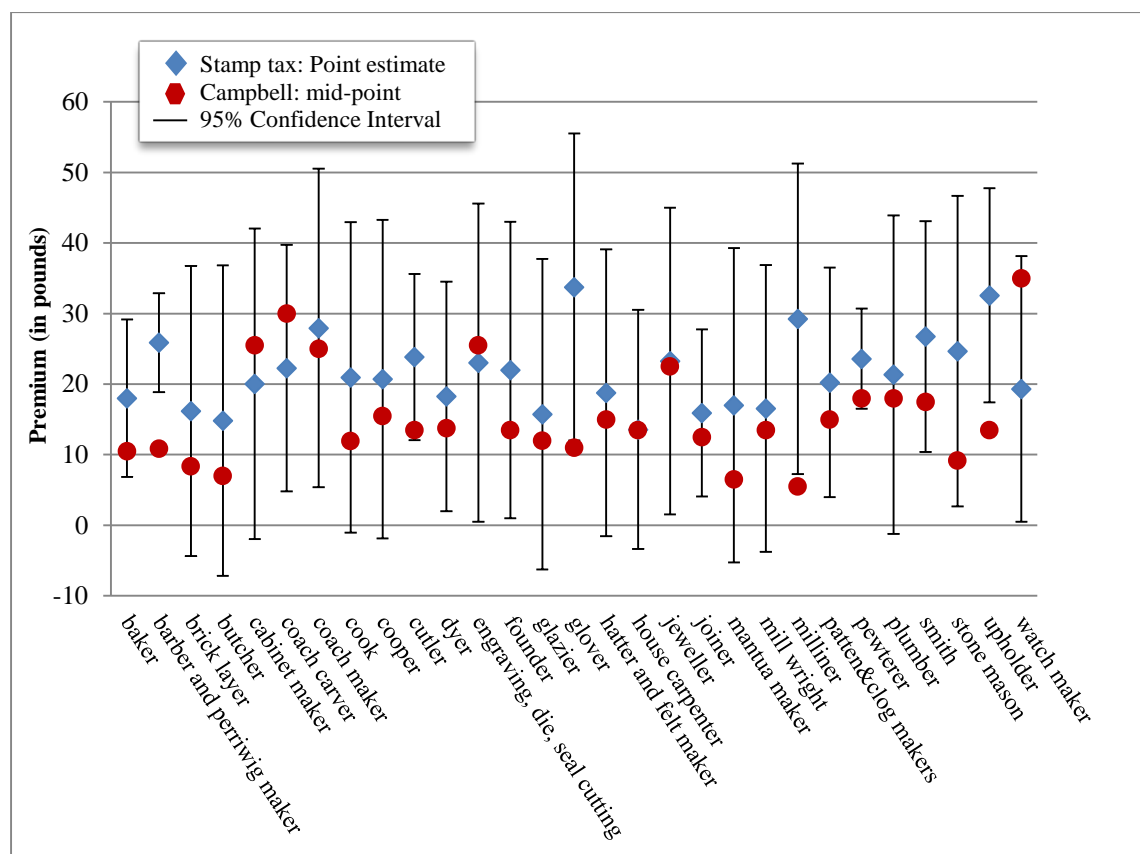

Premiums

Campbell's data on premiums, in pounds sterling, are collected in a summary table over several pages at the end of the book (pp. 331-340). We compare it to data from the payment register of the Board of Stamps. From 1710, following the introduction of a stamp duty payment on private indentures of apprenticeship, stamp tax registers recorded indenture premiums up until the first decade of the nineteenth century.[11]

As Campbell's observations refer to 1747 we limit our attention to tax register entries referring to premiums paid for apprenticeships in London between 1735 and 1755. We match trade definitions in the stamp tax register to Campbell's trade classification, and regress individual premiums on a constant with random trade effects. Figure 1 presents point estimates and 95% confidence intervals for each of 28 trades for which the tax register has at least 20 observations in the relevant period, along with the midpoint of Campbell's reported range of premium values. In all but three of these trades, Campbell's midpoint is within this confidence interval, and in roughly two-thirds Campbell's midpoint is close to the point estimate; in all cases Campbell's range of values (not shown on Figure 1) intersects the confidence interval derived from the stamp tax data. We take this as an indication of a high level of consistency between Campbell's observations and the stamp tax data.

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[11] The stamp tax registers are available on microfilm at the National Archives, Kew, in London under Series IR 1. In the early years of the twentieth century the Society of Genealogists compiled an index of these records for the period 1710-1774, recording in each case the date of apprenticeship, the name, location and trade of the master, the name and location of the apprentice, and the premiums paid. We use a stratified 14.3% sample dawn from this index comprising 50,200 entries. See Feldman and van der Beek (2013) for further details.

Figure 1. Premium comparison: Campbell and the stamp tax data

Source: For Campbell's mid-point estimates see Table A1; Stamp tax data from Feldman and van der Beek (2013, Table A1).

Journeymen's wages

We next compare Campbell's observations on trade-specific wages to what we know from other sources of wages in mid-eighteenth century England. Data on wages are interwoven in the text in several formats, most commonly in shillings per week but sometimes on an annual or daily basis. In the latter cases, we transformed the data into weekly wages in shillings, basing our calculation on the assumption of a five-day workweek and—allowing for holy days—46 weeks in the year.[12] Where journeymen were said to receive bed and board we added 5 shillings to the weekly wage; and where Campbell noted that work was available for only part of the year, say eight of twelve months, we adjusted the weekly wage pro rata.

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[12] Following Voth (2000), we assume two weekly rest days, Sunday and Monday, and 53 holy days some of which fall on weekly rest days. Voth shows that from 1750 to 1830 annual working hours increased by about a fifth in London and the northern counties; and that what drove the change was the demise of 'St Monday' and a plethora of religious and political festivals.

Several important studies have sought to trace the wage and price history of England from medieval times to the present. Nonetheless, data on the eighteenth century are scattered and scarce. Alternative sources from this period exist for building trades, compositors and shipwrights. A summary of the comparison of wages in these trades from different sources is presented in Table 2.

Table 2. Comparison of sources on mid-18th century wages in selected trades,

shillings per week, London 1747

	Phelps-Brown and Hopkins	Bowley and Wood	Clark	Campbell
Building trades (carpenters and plasterers)	*15*		*12*	*12-15*
Printing (compositors)		*19*		*21*
Shipwrights		*19*		*18-20*

Sources: On building trades: Phelps-Brown and Hopkins (1955) drawing on Bowley and Wood (1901) and Gilboy (1934); and Clark (2005, Table A2 and Figure A1). On compositors: Bowley and Wood (1899, Table 1). On shipwrights: Bowley and Wood (1905, Table 6). See text for details of adjustments for time and place. Campbell's data from Table A1 below.

The most reliable wage data we have from other sources pertains to the building trades. Phelps-Brown and Hopkins (1955) marshaled systematic wage data going back to 1264, basing their estimates for the eighteenth century on the earlier work of Arthur Bowley and G. H. Wood (1901) and Elizabeth Gilboy (1934). They estimate a craftsman's wage in 1740-49 to equal 24*d* for a ten-hour day, or 10*s* for a five-day week, in Oxford. This is based on an extrapolation of trends in London wages compiled by Bowley, and on his assessment that from 1700 to 1780 the Oxford rate was usually "London less a third". This implies a weekly craftsman's wage of 15*s* in London.

More recently, Gregory Clark amassed an extensive data set on which he based revised estimates that are somewhat lower (Clark, 2005; Table A2, Figure A1). He estimates wages in London in 1778 to equal 13*s* per five-day week; and that wages in the building trades rose 15% between 1740 and 1789, which if evenly distributed in this period implies an increase in building-trade wages of 9% between 1747 and 1778.

This implies a weekly wage of just under 12*s* in 1747, the year Campbell published his manual. Campbell indicates a range of 12-15*s* per week for journeymen in the building trades, the lower end of the range conforming to Clark's estimate and the higher end to Phelps-Brown and Hopkins'.

Information on eighteenth century wages for compositors and shipwrights is available for later periods from related work by Bowley and Wood. They estimate compositors' weekly wages in London to be 21*s* between 1777 and 1792 (Bowley and Wood, 1899, Table 1); and shipwrights' weekly wages to equal 21*s* between 1770 and 1793 (Bowley and Wood, 1905, Table 6).[13]

To gauge movement in wages in the 25-45 years between Campbell's observations in 1747 and the period covered by Bowley and Wood, we refer to Phelps-Brown and Hopkins (1955, Table 1) who estimate that wages in the building trade were initially constant, between 1736-1773, and then rose by about 20% in the following 20 years; and to Clark (2005, Table A2), who estimates a rise of 15% between 1740 and 1789. Both indicate a rise of 10% in wages between 1747 and 1782-85, the midpoint of the period covered by Bowley and Wood.[14] If the wages of compositors or shipwrights moved in tandem with wages in the building trades this would imply a weekly wage of about *19s* for both compositors and shipwrights. Campbell, in 1747, reports a mid-point of 21*s* for compositors' weekly wages, and that a ship's carpenter earns 18-20*s* a week in the dock yard, and a bolt and anchor smith "a guinea a week and upwards."

We conclude that Campbell's observations on journeymen wages are consistent with the limited information available from other sources on the period.

Setting-up costs

Setting up independently as a master required a considerable amount of capital, which usually implied dependence on credit. The *Sums necessary to set up as master* are

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[13] Bowley and Wood (1899, Table 1) find compositors' wages in London in 1777-1792 equal to 73% of their level in 1860, which Williamson (1982, appendix Table 4) finds equal to 28.7 *s* per week.

[14] As noted above, Clarke's estimate of 15% in 49 years, evenly distributed, implies an annual increase of 0.285%; this comes to 10% in the 35 years between 1747 and 1782. Phelps-Brown and Hopkins estimate no increase from 1736 to 1773 and 20% from 1773 to 1793, which if evenly distributed implies an increase of 10% from 1747 to 1783.

provided in Campbell's appendix, in a table entitled: *A General Table of the Several Trades mentioned in this Treatise*, which also includes apprenticeship premiums and information on companies. Campbell listed ranges of the amounts he estimated necessary for setting up in each trade. Schwarz (1992, Table 2.7) collected data on the mean and median of trade-specific insured values in policies against fire with the Sun Fire Office and Royal Exchange Assurance between 1775 and 1787, and compared them to Campbell's figures. He found them to "compare quite well" with the trade-specific insured values he reports (pp. 62-3), though remarking that they "were on the high side." He attributes this to a general decline in prices between 1747 and 1775-87, noting that insured values in most trades were "still tending towards the lower end of his [Campbell's] estimates."
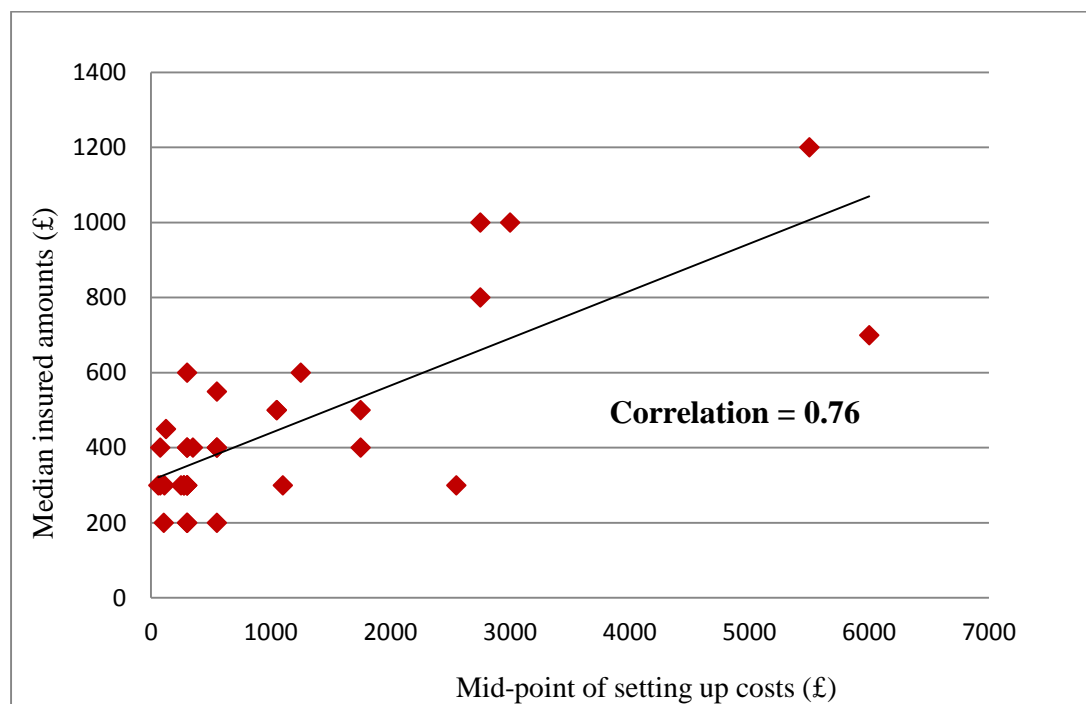
Table 3 presents a comparison between Campbell's and Schwartz' data for trades on which both report sums. The median sums insured fall within Campbell's range in 26 of the 34 trades we compare (76.5%). They are below the minimal cost in the case of *brewers* and *coach-makers*, and higher than the maximum for *vintners*, a*pothecaries*, *printers*, *butchers*, and, *clock- and watch-makers*. Figure 2 illustrates graphically the strong correlation, equal to 0.76, between Schwartz's median values and the mid-point of Campbell's range of values for each trade.

Table 3. Comparison of Campbell's setting up costs with insured values from insurance policies with the Sun Fire Office and Royal Exchange Assurance, in £

| | Insurance | | | Campbell | | |
Trade	no of policies	median	mean	Trade	min	max
Mercer	159	1200	1700		1000	10000
Distiller	73	1000	1993		500	5000
Draper	530	1000	1539	woolen draper	1000	5000
Bookseller	129	800	1064		500	5000
Brewer	282	700	1398		2000	10000
Pawn broker	243	600	1025		500	2000
Vintner	282	600	998		100	500
Upholster	48	550	908		100	1000
Goldsmith and Silversmith	235	500	680		500	3000
Haberdasher	504	500	729		100	2000
Stationer	152	500	845		100	2000
Apothecary	248	450	544		50	200
Bricklayer	453	400	586		100	1000
Coach maker	138	400	712		500	3000
Cooper	309	400	891		200	500
Glazier	181	400	458		100	500
Milliner	355	400	516		100	1000
Plumber	109	400	541		100	500
Printer	187	400	826	compositor	50	100
Baker	609	300	420		100	500
Butcher	554	300	364		20	100
Cabinetmaker	481	300	554		200	2000
Carpenter	1492	300	516		50	500
Cheesemonger	405	300	424		100	500
Clock and Watch maker	322	300	381		50	100
Jeweller	110	300	414		100	5000
Poulterer	81	300	409		20	200
Smith	227	300	479	anchor smith	100	500
Tailor	947	300	402		0	500
Turner	118	300	420		50	500
Chandler	983	200	235	wax chandler	100	500
Fishmonger	62	200	384		100	1000
Shoe maker	540	200	319		100	500
Peruke maker	270	200	273	barber and perriwig maker	10	200

Sources: For Campbell's estimate, Campbell (1747), p. 331. For insurance policies with the Sun Fire Office and Royal Exchange Assurance, Schwarz (1992), Table 2.7, p. 62.

Figure 2. Correlation and trend-line between the mid-point of Campbell's setting up costs and median insured values reported by Schwartz (1992, Table 2.7)

Livery-companies

By serving an Apprenticeship of seven Years, a Youth becomes Free of this great City and may hope one Day to be exalted to the Mayoralty. (Campbell, 1747, p. 303)

Freedom of the City of London was essential for anyone who wished to trade or exercise his craft within the City's bounds; apprenticeship to a freeman for seven years was one of the methods of acquiring it. Some trades were bound to specific companies while others had the liberty to bind and make free with any of the companies. Members of companies designated as Livery-Companies could vote in *chusing Magistrates in the City, or Members to represent it in parliament...*[15] Campbell provides a summary table in the appendix to his manual listing the company to which each trade belonged and whether it was a Livery Company. We will test whether the political privileges attached to a livery-company bore on the level of premiums.

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[15] Campbell (1747), p. 303.

Personal traits and prior skills

The chief purpose of Campbell's manual is to help parents choose a trade for their child and prepare him for it. His detailed description of the characteristics that each trade requires are geared to help parents identify the trades that are most suitable to their child's *Capacity, Disposition, and Constitution*; and to *cultivate his Understanding by all the Helps of Education, suitable to that Bent of Mind which they have discovered in him, and that in his most early Years.*[16] The requirements that he refers to most often—as present or absent—are physical strength, education, specific abilities (*e.g.* for drawing, mathematics), and ingenuity.

The most frequent abilities Campbell specifies are drawing and mathematics and recommends that children holding such abilities receive the relevant formal education. Of engravers, he observes, that no man can be *an accurate Engraver without the Knowledge of Drawing, and a Taste in Painting* but other than that they need *only to read and write English and understand common Arithmetic.*[17] To be bound to a pattern drawer a boy should have a *scrawling disposition,* in which case *he may be bound as soon as he has learned to read and write*;[18] *the Mathematical-Instrument-Maker ought to have a Mathematically turned Head*; potters and enamellers *...must acquire the Art of Drawing; and a sufficient Knowledge in Painting*;[19] an engineer *ought to learn Mathematics and Designing, of which it is absolutely necessary he should be perfec*t *Master.*[20]

Apart from such specific abilities certain trades require a more general ability which Campbell refers to as *ingenuity*. Most trades are described with regard to the degree of ingenuity they require. Thus: *The plain Silk Weaver requires but little Ingenuity, but the Weavers of flowered Silks, Damascs, Brocades and Velvets are very ingenious Tradesmen* [21] . The soap-boiler *is a laborious nasty Business, but abundantly*

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[16] *ibid*, p. 23

[17] *ibid*, p. 109-110.

[18] *ibid*, p. 116.

[19] *ibid*, p. 186.

[20] *ibid*, p. 249.

[21] *ibid*, p. 259.

profitable, and requires no great Share of Ingenuity[22] while the saddler *requires a large Share of Ingenuity and Invention.* [23] As we show in our estimation, these abilities are highly correlated with journeymen wages while having no direct effect on premiums other than through their effect on wages. This allows us to use them as instruments for journeymen wages, to identify the effect of wages on the apprenticeship premium.

Physical strength is mentioned in reference to 56 of the 178 trades we examine (including leather dressers, founders, smiths, plumbers, butchers, dyers, farriers, founders, and many more). For example, in reference to the butcher Campbell states that *It requires great Strength, and a Disposition no ways inclinable to the Coward.*[24] In such occupations, where apprentices are taken on only after they are physically developed, they can become productive in a relatively short period allowing masters to accept a lower premium to cover the risk of early departure.

We incorporate these verbal descriptions in our regression analyses by systematically coding them as separate indicator variables, one for each characteristic. As these variables are derived from loosely structured verbal descriptions, we cannot rule out the possibility of unintended omissions, or of intended omissions of characteristics the author saw as self-evident; and while much of the coding was straightforward there were cases in which we were required to exercise judgment, which others might have decided differently. "Reading and writing" provides an illustrative example of the difficulty in coding these observations. It appears as a requirement in only 20 of Campbell's trade descriptions yet as Humphries (2009) points out it seems to have been standard for most apprentices.[25] Indeed Campbell himself reminds parents, as a general comment, that *Reading and Writing are so useful, that we need not, it is presumed, use many Arguments to recommend Children being well founded in these before they are bound.*[26]

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[22] *ibid*, p. 263.

[23] *ibid*, p. 234.

[24] *ibid*, p. 281

[25] Humphries observes that only a few boys in her sample did not attend school at all (p.316).

[26] Campbell (1747), p. 20.

Conditions of employment

In most trades apprentices were bound at the age of fourteen or fifteen, especially where physical fitness was required, but in some trades apprentices could be bound at a younger age. There are twelve trades for which Campbell mentions that an apprentice could be bound before he is fourteen. They have in common that none requires great strength but other than that they vary greatly, from simple brush-making, which requires neither education, skill nor ingenuity, to complex trades such as watch making, optical instrument making and diamond cutting to which an apprentice may be bound younger than fourteen *if he is tolerably acute*.[27] In the case of silk-weaving, Campbell notes that *A Boy may be bound about Eleven or Twelve Years of Age. They are employed younger, but more for the Advantage of the Master, than anything they can learn in such Infant Years*.[28]

In later periods, some apprentices lived out during their apprenticeships (Humphries, 2011, Ch. 9) and this would certainly have had an effect on premiums. However, Campbell makes no mention of such a possibility and would surely have discouraged any such arrangement, as he repeatedly advises reader of the city's temptations imperiling the moral well-being of young apprentices.

Other conditions of employment may also have had an effect on premium levels. For example, masters working with expensive materials might demand higher premiums due to costly waste, which was inevitable when inexperienced apprentices learned their trade through trial and error, and due to the danger of theft. These might be positively associated with high set-up costs, which would include acquiring an initial stock of materials as well as making secure arrangements for their storage. Conversely, trades that were known to be hazardous to health might command lower premiums; to the extent that parents were aware of these hazards and were concerned for their sons' future health these might have a negative effect on premiums. Yet, since Campbell rarely mentions of these features in the text we do not account for them in our regressions.

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[27] *Ibid*. p. 252.

[28] *Ibid*. p. 260.

IV

We posit that apprenticeship premiums in a given trade are bounded from above by parents' willingness-to-pay and bounded from below by masters' anticipated net costs. Parents' willingness-to-pay reflects the difference in discounted lifetime income between the wages of a journeyman in the trade and the wages of a common laborer, plus the value of any non-pecuniary benefits associated with the trade, such as improved social standing, plus the probability of successfully setting up as a master multiplied by the net benefits thereof. A master's anticipated net costs are the expected difference between the costs associated with apprenticeship, including room and board, the time the master devotes to instruction, wastage of materials and so on, and the productive value of the apprentice's work under the master, *allowing for the possibility that the apprentice abrogates his contract with the master before term*. As Wallis (2008) and Minns and Wallis (2013) emphasize, this latter consideration leads the master to require a premium, as apprentices are typically more costly and less productive in the earlier years of their apprenticeship and enforcement of apprenticeship contracts was incomplete.

Comparing annual journeyman wages with premium levels leads one to conclude that for most trades the difference in discounted lifetime income between the wages of a journeyman and those of a common laborer exceeds typical premium levels, even before factoring in other benefits of acquiring a trade. To fix ideas, assume a youth enters into an apprenticeship of seven years on his fourteenth birthday and upon its completion begins working as a journeyman. Typical earnings for journeymen reported by Campbell range between twelve and fifteen shillings a week while a common laborer might earn five to seven shillings. The added earnings of a journeyman thus range between five to ten shillings a week, and assuming as before that both work 46 weeks a year, this comes to between £11 10s and £23 a year. Assume further that this continues until his fortieth birthday (the calculations are not sensitive to the number of working years as the contribution of later years is heavily discounted). The discounted present value at age 14 of the difference between a

journeyman's wages and those of a common laborer under these assumptions is tabulated for several possible combinations in Table 4:[29]

Table 4. Net present value of additional lifetime earnings of a journeyman, above those of a common laborer (in £)

Annual difference in income	Annual rate of discount		
	15%	20%	25%
12	26	14	8
18	40	22	12
24	53	29	17

The difference between these numbers and the premium levels in Table 1, which range between £10 and £20 for most trades, represent the net pecuniary benefits of apprenticeship to parents and their children. To this one should add non-pecuniary advantages such as improved social status and better working conditions, as well as the advantages of a wider dispersion of employment risk within the family. This suggests that the rate of discount employed by most parents of apprentices did not exceed 25% per annum.[30] Families with lower discount rates would have captured a large share of the surplus generated by apprenticeships, and indeed apprentices' autobiographies from this period indicate that they saw the value of apprenticeships in the labor market as far exceeding their cost (Humphries, 2009, pp. 263-8). This may have reflected parents' greater sensitivity to premium levels; the less than full weight that parents attached to benefits accruing to their children; and a competitive supply of apprenticeship opportunities in London, where masters were numerous, driving down price close to expected marginal cost.

Summarizing the preceding discussion on the effect of different variables on the level of premiums, we expect premiums to be positively associated with journeymen wages

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[29] Let $w - w_0$ denote the annual difference in income and r the annual discount rate. We calculate the net present value of incremental lifetime earnings at age fourteen as $NPV = (w - w_0) \int_{7}^{26} e^{-rt} dt$.

[30] Personal rates of discounting future gains would have varied widely across parents depending on their personal circumstances and preferences, notably their access to capital. Temin and Voth (2008) show that private bank credit in the early eighteenth century was cheap but not widely available.

across trades—on the part of the master because they increase the incentive for early departure; and on the part of the parent because they increase the benefit from acquiring the trade. As discussed above, in trades requiring greater physical strength apprentices became productive in a relatively short period, allowing masters to accept a lower premium to cover the risk of early departure and so should be associated with lower premiums. And we expect premiums to vary positively with set-up costs both because they are likely to be positively associated with the opportunity cost of masters' time and with the damage an inexperienced apprentice is likely to cause while learning the trade; and because they reflect entry barriers that limit competition and allow masters to capture a larger share of the surplus through higher premiums.

The model we wish to estimate across our 178 trades is thus:

$$(1) \quad \log(premium)_i = \beta_1 + \beta_2 \log(wage)_i + \beta_3 \log(setup)_i + \beta_4 Z'_i + \varepsilon_i$$

The dependent variable is the logarithm of apprenticeship premiums in trade i ($premium$), the mid-point of Campbell's range of premiums for that trade. The independent variables are the logarithm of journeymen's entry-level wages ($wage$), which we take as the lower bound of the interval reported by Campbell;[31] the logarithm of $setup$, the mid-point of Master's set-up costs reported by Campbell; and Z', a vector of other trade characteristics that affect the level of premiums.

However, as wages and premiums are simultaneously determined in equilibrium, $wage$ is endogenous and direct estimation of equation (1) using ordinary least-squares **(**OLS) will not yield consistent results,. We therefore estimate equation (1) in two stages, using special abilities required in various trades as instrumental variables for $wage$ in the first stage, specifically, $drawing$ ability and $ingenuity$.

The results are presented in Table 5. Columns (1) in Panel A report the OLS estimates of log premiums on wages and setting up costs, and in column (2) we add other trade characteristics. We find a significant and positive effect of both journeymen wages and set-up costs on premiums, with estimated elasticities of 0.35 for wages and 0.25 for set-up costs in both specifications, and in column (2) a reduction of 23% in the

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[31] We assume that an apprentice setting out as a journeyman before term would expect to earn wages at the low end of this range.

premiums charged in trades requiring physical strength; being apprenticed to a trade bound to a liveried company had no effect on premiums.

However, the Wu and Hausman test indicates endogeneity of wages on the right hand side of the equation for both OLS specifications, with F-statistics significant at a *p*-value of less than 5%. This leads us to estimate our equation in two stages. Column 3 in Panel B presents the first-stage regression. *Drawing* and *Ingenuity* are strongly correlated with log(*wages*) while other candidates are not statistically significant and do not affect the coefficients of our chosen instruments.[32] Panel A presents the second-stage regression results after instrumenting for wages. We find a sharp increase in the elasticity of premium levels with respect to wages, to about 1.0,[33] while the coefficients of the other right-hand variables remain largely unchanged.[34]

We interpret our results as showing that apprenticeship in eighteenth-century England was an efficient mechanism for the reallocation of labor, with parents of children with abilities valued by the market willing to pay higher premiums for the prospect of their children earning higher wages. *Ceteris paribus*, trades that required greater abilities paid more and were more expensive to acquire. The results also indicate that masters in trades with higher set-up costs could command higher premiums, although we cannot say to what extent this reflected higher training costs associated with such trades or, as high set-up costs were an entry barrier to the trade, the greater market power commanded by small number of masters able to extract a greater share of the economic surplus created by apprenticeships.

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[32] Both drawing and ingenuity satisfy the exclusion restriction (they are not significant in the regression in column 2), and are jointly significant in the first stage.

[33] The elasticity with respect to the difference between journeymen and laborer wages is smaller. If journeymen and laborer wages are respectively 12 and 6 shillings per week, a 1% increase in journeymen wages increases the difference between them by 2%, implying an elasticity of premiums with respect to the difference between journeymen and laborer wages of 1/2; if journeymen wages are 18 shillings per week a 1% increase in journeymen wages increases the difference between them by 1.5% implying an elasticity of 2/3.

[34] Other variables describing trade requirements, such as literacy or hazard to one's health, had no significant effect in either stage. As explained above, we cannot say if this is because they actually had no effect or because Campbell's description is less than complete or not fully explicit, or because our coding of his text did not faithfully capture his meaning.

V

This paper's main contribution is its demonstration that the supply of apprenticeships in eighteenth-century London and the demand for them were responsive to market forces. This lends support to the view advanced by Humphries (2003, 2011) and Wallis (2008), among others, that apprenticeships played an important role in adapting the English workforce to the changing skill requirements of the Industrial Revolution—as early as the mid-eighteenth century—allowing sons to migrate out of their fathers' trades in response to market signals conveyed by the relative wages of the various trades.

Drawing on the extensive information in John Campbell's (1747) manual for the parents of aspiring apprentices on the economic, technical and physical characteristics of the many trades practiced in London in the mid-eighteenth century, we estimate a regression of apprenticeship premiums on journeymen's wages and set-up costs in two stages, employing trade-specific personal qualities as instrumental variables in the first stage to identify variation in wages. We find a unitary elasticity of apprenticeship premiums with respect to wages and an elasticity of 0.23 with respect to a master's set-up costs. We also find that trades requiring physical strength commanded significantly lower premiums. These findings are consistent with premium levels that are bounded from above by parents' willingness-to-pay, and from below by the master's net expected costs of the apprenticeship, taking into account the possibility of an apprentice prematurely terminating his contract (Minns and Wallis, 2013).

A second important contribution of the paper is its demonstration that the detailed quantitative and qualitative observations offered by Campbell are both externally and internally consistent, offering an unparalleled source of information on trade-specific wages in mid-eighteenth-century London. Although Campbell's manual is well-known to historians studying the formation of industrial skills in eighteenth-century England, and frequently cited, as far as we know ours is the first systematic application of the quantitative evidence he provides; it should encourage its wider use in understanding the early stages of England's Industrial Revolution.

Bibliography

Allen, Robert, and Cormac Ó Gráda, 1988, "On the Road Again with Arthur Young: English, Irish, and French Agriculture during the Industrial Revolution", *The Journal of Economic History*, 48(01): 93-116.

Bowley, Arthur, and George Wood, 1899, "The Statistics of Wages in the United Kingdom During the Last Hundred Years (Part V.): Printer", *Journal of the Royal Statistical Society* 62(4): 708-715.

Bowley, Arthur, and George Wood, 1901, "The Statistics of Wages in the U.K. during the last Hundred Years: Wages in the Building Trades", *Journal of the Royal Statistical Society* 64(1): 102-112.

Bowley, Arthur, and George Wood, 1905, "The Statistics of Wages in the United Kingdom During the Last Hundred Year (Part X.): Engineering and Shipbuilding. A. Trade Union Standard Rates", *Journal of the Royal Statistical Society* 68(1): 104-137.

Campbell, Robert, 1747, *The London Tradesman*, London: T. Gardner. Reissued in facsimile form by Kessinger Publishing, Breiningsville, PA, 2010.

Clark, Gregory, 2005, "The Condition of the Working-Class in England, 1209-2004", *Journal of Political Economy* 113(6):1307-1340.

Collyer, Joseph, 1761. *The Parent's and Guardian's Directory and the Youth's Guide to the Choice of a Profession or a Trade*, London: R. Griffiths.

Crafts, Nicholas, 1985a, *British Economic Growth during the Industrial Revolution*, Oxford: Oxford University Press.

Epstein, Stephan, 1998, "Craft guilds, apprenticeship, and technological change in preindustrial Europe", *The Journal of Economic History* 58 (3): 684–713.

Feldman, Naomi and Karine van der Beek, 2013, "Mechanization and skill complementarity on the eve of the British industrial revolution, 1710-1770", Working Paper.

Gilboy, Elizabeth, 1934, *Wages in Eighteenth Century England*. Cambridge, MA: Harvard University Press.

Humphries, Jane, 2003, "English apprenticeship: a neglected factor in the industrial revolution", in: Paul David and M. Thomas (Eds.), *The Economic Future in Historical Perspective*, Oxford University Press, pp. 73–102.

Humphries, Jane, 2011, *Childhood and Child Labour in the British Industrial Revolution*, Cambridge University Press.

Lane, Joan, 1996, *Apprenticeship in England, 1600-1914*, London: UCL Press Ltd.

Lindert, Peter and Jeffrey Williamson, 1982, "Revising England's social tables 1688-1812", *Explorations in Economic History*, 19(4): 385-408.

Minns, Chris and Patrick Wallis, 2013, "The price of human capital in a pre-industrial economy: premiums and apprenticeship contracts in 18th century England", *Explorations in Economic History*, http://dx.doi.org/10.1016/j.eeh.2013.02.001

Mokyr, Joel, 2009. *The Enlightened Economy: An Economic History of Britain, 1700–1850*. Yale University Press, New Haven.

Ogilvie, Sheilagh, 2004, "Guilds, efficiency, and social capital: evidence from German proto-industry", *The Economic History Review* 57(2): 286–333.

Phelps Brown, Edmund and Sheila Hopkins, 1955, "Seven Centuries of Building Wages", *Economica* New Series 22(87): 195-206.

Schwarz L. D., 1992, *London in the age of industrialization: entrepreneurs, labour force and living conditions, 1700-1850*, Cambridge: Cambridge University Press.

Smith, Adam, 1776, *An Inquiry into the Nature and Causes of the Wealth of Nations*, London: W. Strahan.

Rothschild, Emma, 2001, *Economic Sentiments: Adam Smith, Condorcet, and the Enlightenment*, Cambridge, MA: Harvard University Press.

Temin Peter and Hans-Joachim Voth, 2008, "Private Borrowing during the Financial Revolution: Hoare's Bank and its Customer, 1702-1724" *The Economic History Review* 61(3): 541-64

Thomas, Robert Paul and Donald McCloskey, 1981, "Overseas Trade and Empire", in Roderick Floud and Donald McCloskey (eds.), *The Economic History of Britain since 1700*, Cambridge, U.K.: Cambridge University Press, pp. 128– 42.

Voth, Hans-Joachim, 2000, *Time and Work in England 1750-1830*, Oxford: Oxford Historical Monographs, Clarendon.

Wallis, Patrick, 2008, "Apprenticeship and training in pre-modern England", *The Journal of Economic History* 68 (3): 832–861.