Innocence and experience: early childhood education as an externality in eighteenth-century London

By Louis Henderson*

Draft: January 23, 2025

While historians have argued that school-entry age norms did not exist until the era of compulsory education (Lassonde 2013), the life-cycles of the poor were shaped by material scarcity. In eighteenth-century London, this difference was reflected in late and highly irregular enrolment ages for elite children, while poor children attended school progressively earlier between 1760-1830. I argue this acceleration in poor children's school enrolment reflected rising demand for childcare as household labour supply increased and present evidence that earlier learning better aligned these children's school years with a developmental 'sensitive period' for language development.

JEL: I25; J13; N33

Keywords: early childhood education; economic development

It was not always obvious at what age a child should be sent to school. Before states built up formal consensus through the normal schools, 'systems [of] Education were supported upon uncertain Theories and Speculation and were as contradictory and capricious as the diversity of Tastes and the wildness of imagination could invent'.[1] Indeed, European teacher manuals rarely considered

* LSE, Department of Economic History, Sardinia House, London, l.henderson2@lse.ac.uk. Thanks to participants at the Economic History Society Residential Training Course, the LIVES International Conference, the LSE graduate seminar, the Economic History Society meeting 2024, and the Social Science History Meeting 2024 for helpful comments on earlier drafts of this paper and to Jane Humphries, Brian A'Hearn, David Mitch, and Stephen Broadberry for their contributions to my D.Phil. thesis, on which this article draws.

[1] M.S. draft of letter from R.L. Edgeworth to the *Gentleman's Magazine*, n.d., qtd. in Woodley (2009) pp. 31-5

Table 1—Statutory admission ages in charity school charters

School	Date	Admission age
Halsham Free School, Yorkshire[a]	1579	6-14
Great Marlow Free School, Buckinghamshire[a]	1624	10-14
Latimer's School, Hammersmith[b]	1627	7-12
Yarmouth Charity School, Norfolk[c]	1713	8-14
Raine's Charity School, London[d]	1716	8+
Joye's Charity School, London[d]	1717	7+
Catherine Bayley's School, Coventry[e]	1751, 1768	9-10
Birmingham Bluecoat School[f]	1756	7+
Hendon Free School, Suffolk[g]	1852	7-12

a: Jordan (1961), pp. 56, 319; b: Jordan (1960), pp. 240; c: NRO Y/ED/269; d: Rose (1991), pp. 39; e: CHC 368/1/1; f: WC MS 1622 1/1/1/2; g: SABSE FL590/11/3.

age as a formal organising principle until the late nineteenth century (Caruso, 2023). Lassonde (2013) argues that compulsory education, by creating a cohort of children who progress through school simultaneously, gradually gave rise to the modern phenomena of developmental age norms and classroom age grading.

Prior to these developments, enrollment decisions could seem irregular. Take, for example, Walter Powell, who first enrolled his eldest sons at the Monmouth Free School in April 1627 aged 19 and 15. The following year, he enrolled for the first time Thomas, aged 12, Richard, aged 10, and Charles, aged 8 (Powell, 1907). It also seems that people believed school enrolment should occur relatively late, reflected in, for example, charity school foundations whose purpose was to encourage basic literacy among the poor but nonetheless barred the youngest children from attending (table 1). To Ariès, examples of this kind throughout Early Modern Europe suggested arbitrariness and led him to conclude that 'the idea of childhood did not exist' (Aries, 1962; Koops, 1996). In what follows, I advance a somewhat different hypothesis: differences in school enrolment age may be attributed to differences in child-care demand.

Notice the pattern of sibling coenrolment. Madoc-Jones (1977), in a study of a London National School in the early nineteenth century found that siblings of any age entered and left the school register at the same time. As classes

were not age-graded, the younger sibling was presumably exposed to the same lesson as the elder. In a context where poverty was the median experience during the early family life-cycle (Horrell, Humphries and Weisdorf, 2022) and school attendance occurred for only two or three years on average (Humphries, 2010; Pleijt, 2016), it is not obvious why ostensibly credit-constrained families would enroll their children simultaneously and not consecutively. One explanation is that such families used schools as a child-care service (Burnette, 2008; Roberts, 1972). When the marginal benefit of carers' efforts was greater in the labour market, the children they would otherwise be caring for appeared at once on the school ledger.

This article develops the school–child care hypothesis through a case study drawn from archival documents comparing two populations in London in the (long) eighteenth century. I first consider children who attended Merchant Taylors, a London 'public' day school in the peculiar sense: fee-charging and catering to elite families (Allen, 1982). I demonstrate that these pupils entered elementary 'petty' classes at very late and irregular ages, and they continued to do so well into the nineteenth century. These elite households contained non-working members who could provide care or they could afford to hire nurses and governesses at home; their enrolment patterns must therefore largely reflect school-entry age norms or their absence. In contrast, for the London poor, elementary education occurred at increasingly younger ages between 1760 and 1830. Changes in the labour market in this setting increased the demand for women's and children's labour. As household labour supply increased, demand for child care rose, and poor families increasingly turned to schools to provide care for their young children. In this sense, early childhood education arose as an externality to increased household labour supply.

Further, I argue that this externality was likely positive. A large theoretical literature would regard late enrolment as inefficient due to 'sensitive periods' for learning in early life. These are phases of neurological development during

which the brain more readily integrates certain kinds of environmental stimuli. For example, contemporary research suggests children should achieve basic literacy by about age seven or eight or risk falling permanently behind their peers (Horowitz-Kraus et al., 2017). High quality early childhood education can also, as demonstrated by a series of famous randomized trials, improve cognitive and non-cognitive skills in later life (Cunha et al., 2006; Almond and Currie, 2011; Heckman, Pinto and Savelyev, 2013; Almond, Currie and Duque, 2018; Heckman and Karapakula, 2019). If the demand for child care could more closely align children's educational careers with these sensitive periods, their education might become more efficient and lead to greater human capital accumulation, holding other educational inputs constant.

Although strict causal inference cannot be maintained upon the relevant archival materials, extant evidence is nonetheless consistent with such a process occurring in eighteenth-century London. Using methods developed for survival analysis with censored data, I show that pauper children who began to learn to read aged 4 to 6 took 1.76 fewer years to acquire basic literacy than those who began aged 7 to 9.

This intriguing finding generates an hypothesis aimed squarely at a gap in unified growth theory. In Galor's (2011) model, between the 'Malthusian' world, in which technological innovations introduce only temporary improvements in well-being that are quickly diluted by population growth, and the 'modern' world, in which technology is increasing in the level of human capital, is the 'Post-Malthusian' world, the key features of which are a rapidly growing stock of technology, slowly rising per capita incomes, little human capital investment, and a rapidly growing population. In this transitory phase of economic growth, the rate of technological development does not depend on human capital but increases in the level of population (Galor, 2011).

This 'transitional' positive relationship between population and growth is usually described as 'Smithian' if the mechanism is the growth of markets and an

accelerated division of labour or 'Boserupian' if the mechanism is regional specialization, urban growth, and more sophisticated consumer tastes (Broadberry et al., 2015). These mechanisms, however, also likely affected the demand for child care through increased household labour supply. For instance, a Smithian division of labour possibly separated skilled from unskilled components of the labour process, opened labour market opportunities to women and children, and eroded male artisans' status and earnings, as occurred in late eighteenth-century London (Ball and Sunderland, 2001) Alternatively, if Boserupian urbanisation improved women's and children's access to labour markets, or if supplying the objects of growing consumer desire was a task outsourced to domestic manufacturers, this would strain time-budgets and lead many families to seek extra-familial care (Berg, 1993; Erickson, 2008). The school–child care hypothesis brings human capital accumulation, the key component of 'modern' economic growth, back in to the picture during 'Post-Malthusian' growth through the re-allocation of education to an earlier period of childhood in response to increased child-care demand.

I. Conceptual Framework

The possibility that a re-allocation of education across periods of childhood may be productive follows from a model developed by Cunha and Heckman (2007) to formalize the concept of 'dynamic complementarity' in human capital investment. Reflecting the empirical observation that 'on average, the later remediation is given to a disadvantaged child, the less effective it is', dynamic complementary is the notion that earlier investments increase the subsequent efficacy of later investments. For example, those enjoying relatively enriched early environments will reap greater returns from follow-up investments than those who did not enjoy the same high-quality early childhood environment. On the other hand, this same principle of complementarity implies that high early childhood investment must be followed-up with comparably high investment at a later stage in order to reap the full benefit. This implies an optimal distribution of education over the

life-course exists. Cunha and Heckman (2007) operationalize this idea using a two-period constant elasticity of substitution (CES) model.

The Cunha-Heckman model is flexible enough to accommodate a wide range of investments, from formal education to informal socialization in the household. I discuss the issue of formal versus informal human capital investment in more detail below and for the moment adopt a simple educational interpretation in which human capital is produced according to

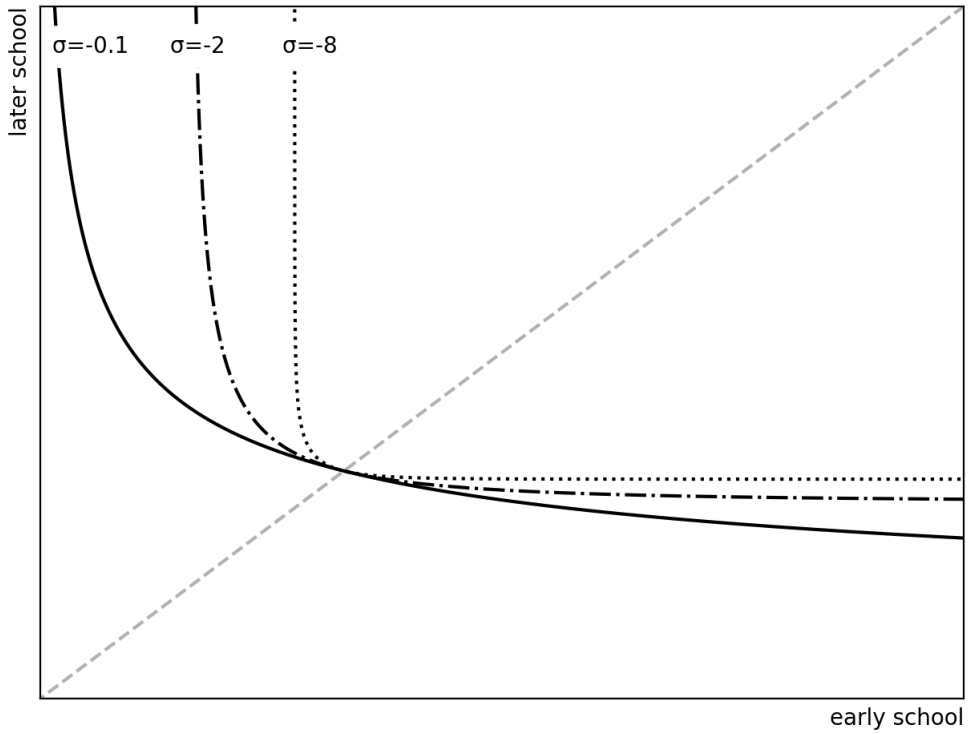
$$f(s_0, s_1) = \left[\alpha s_0^{\sigma} + (1-\alpha) s_1^{\sigma}\right]^{\frac{1}{\sigma}}, \tag{1}$$

where α is a parameter capturing the weight of early childhood education in producing final outcomes, $0 \leq \alpha \leq 1$, s_0 is early childhood education, s_1 is later education, and $\frac{1}{1-\sigma}$ is the elasticity of substitution between early and late education, with $\sigma \leq 1$. Lower values of σ produce greater complementarity in the model.

To illustrate the importance of complementarity, figure 1 depicts a level curve for equation (1) at three different values of σ, with $\alpha = 0.25$. The relatively low productivity of early childhood education in this example (low α) causes the curve to bend towards the y-axis when σ is relatively high (i.e., low complementarity), but as σ decreases, the curve becomes increasingly parallel about the $x = y$ line, and the low weight given to early education becomes increasingly irrelevant. Moreover, as σ decreases, the curve increasingly approximates a right angle. When early and late education are strong complements (low σ) therefore, they must increase in equal stride to increase overall human capital, and the lesser factor will increasingly limit the efficacy of the greater. This implies that with greater complementarity, it will be increasingly optimal to invest in early and late periods in equal proportion.

This is demonstrated more formally by maximizing (1) subject to a budget

FIGURE 1. VISUALIZING COMPLEMENTARITY IN HUMAN CAPITAL INVESTMENT



constraint

$$x = p_0 s_0 + p_1 s_1, \tag{2}$$

where x is expenditure, p_0 is the cost of early education, and p_1 is the cost of later education. From the first-order conditions,

$$-\frac{p_0}{p_1} = -\frac{\alpha}{1-\alpha}\left(\frac{x_0}{x_1}\right)^{\sigma-1},$$

which gives the optimal ratio of early to late school when rearranged,

$$\frac{x_0^*}{x_1^*} = \left(\frac{p_0(1-\alpha)}{p_1\alpha}\right)^{\frac{1}{\sigma-1}}. \tag{3}$$

As σ approaches $-\infty$ in (3), this ratio is equal to one in the limit. Therefore, in the model, greater complementarity produces an optimal strategy that increasingly favours investment in early and late education in equal measure.[2]

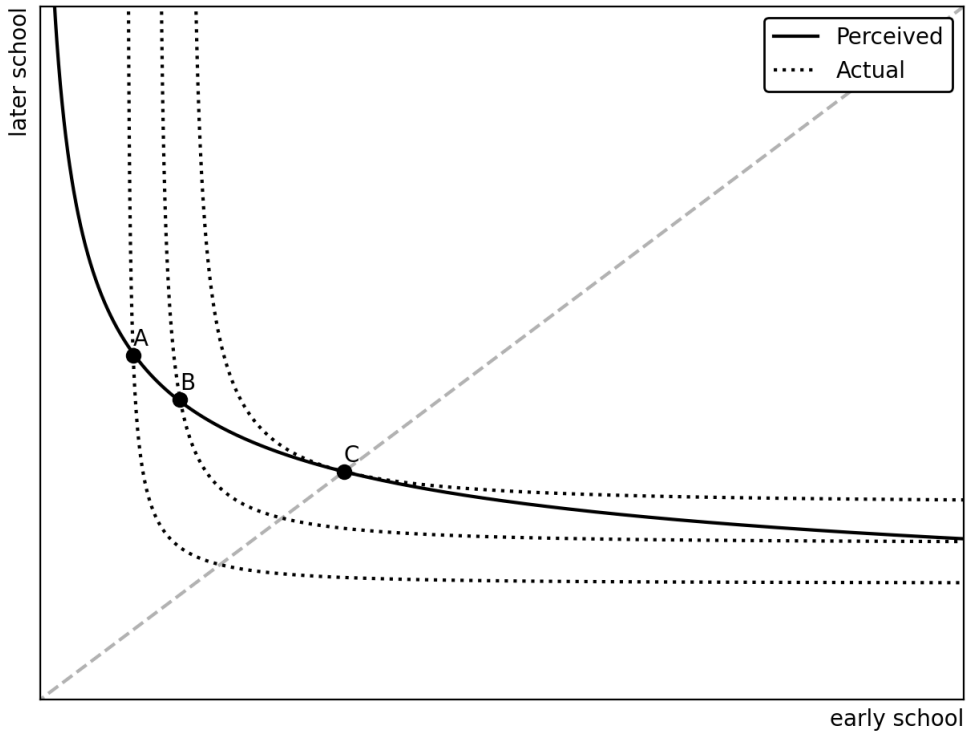
I extend the Cunha-Heckman model to predict the effect of households underestimating the amount of complementarity between early and late school, which I call the 'mistaken complementarity' effect. Historians have advanced the argument that prior to the eighteenth century, childhood was not given special consideration as a phase of the life-course requiring any different or separate treatment across a range of social domains, including school (deMause, 1980; Stone, 1977; Tilly and Scott, 1987). I do not take so extreme a position, which in terms of the human capital model would suggest that early and late education were viewed as perfect substitutes. I make the less extreme argument that parents underestimated the degree of complementarity between early and late education.[3]

The "mistaken complementarity" effect is depicted visually in figure 2. Consider first the "perceived" curve on its own. Assume parents impart a fixed level of human capital to their children, and households face a "perceived" trade-off between early and late school and a set of costs in so doing. The notion of a fixed level of human capital is analytically useful to isolate the effect of substituting early school for later school or vice versa, but it is also plausible to imagine a family wanting their child to learn some fixed ability, say reading, and forming judgements about the relative productivity of early and late school in doing so (the "perceived" trade-off). Indeed, this is how Madoc-Jones has characterised parental schooling decisions in this period, observing, 'when a child had reached the minimum level of accomplishment in the three Rs thought desirable by the parents, then the time had arrived for the termination of schooling, regardless of the child's age' (Madoc-Jones, 1977). Cost-minimizing parents would adopt the least-costly combination of early and late school, given relative costs, which

[2]Cunha et al. (2006) develop a similar model incorporating credit and an overlapping generations framework and reach a similar conclusion.

[3]There is contemporary evidence suggesting parents still do this. See List, Pernaudet and Suskind (2021)

FIGURE 2. THE 'MISTAKEN COMPLEMENTARITY' EFFECT



includes various opportunity costs and transaction costs, that led to their desired outcome. For instance, if early school were relatively costly, households would choose a combination like point A, which combines more later school with less early school to produce the fixed educational outcome. If early school were to become less costly, households would move to combinations represented by points B or C instead.

However, in the model, the "perceived" trade-off is not the same as the "actual" trade-off because households underestimated the degree of complementarity between early and late school. Thus a household at point A, believing its chosen combination of early and late school will produce their desired outcome, will in fact be facing the "actual" trade-off represented by the dotted curve intersecting point A. They may find that the combination of early and late school they

have chosen on the "perceived" curve represents a lower level of human capital on the "actual" curve; i.e., they may find that their child performs worse than expected, or struggles to learn. Suppose now that early school becomes relatively less costly. The household will target the same fixed outcome but will shift from a combination of early and late school represented by point A to one more like point B. Although they have not left the "perceived" curve, still thinking they have selected a combination giving the same set amount of human capital, they will now be on a new, higher "actual" curve, and the same is true of a move from B to C. However, increases in early school along the "perceived" curve beyond point C (where early school is equal to later school) will again decrease the level of "actual" human capital. In general, the "mistaken complementarity" effect predicts that substituting early for late school along a "perceived" human capital curve will increase human capital as long as households underestimate the amount of complementarity and are initially using more late school and less early school (i.e., later enrolment) before the substitution. This is demonstrated formally in section A.A1 of the appendix.

Under these two assumptions, increases in early school relative to later school will, according to the model, lead to more human capital accumulation. As noted, the first assumption is based on the historical thesis that childhood was an undifferentiated phase of human life in early modern Europe (Aries, 1962), although it only requires that developmental psychology was not well understood.[4] The second assumption, i.e., that delayed school enrolment was relatively common in the past, is related to the first. Without a strong belief in how the educational sequence should connect to biological age, more idiosyncratic beliefs and cost differences determined when children entered school.

A variety of factors may have delayed school entry. Parents may have taken pleasure or found purpose in caring for their children, delaying the painful moment

[4]For a more detailed intellectual history of developmental psychology relevant to the theory of dynamic complementarity, see Henderson (2024*b*)

of separation (Stone, 1977). Less careful parents may have simply lost track of their children's age (A'Hearn, Crayen and Baten, 2009). Particularly for upper-class families, children may have been withheld from school to maintain stricter control over their socialization at home, and certainly, eighteenth-century diarists expressed a variety of ideological reasons for maintaining young children at home to be cared for by their mothers (Cohen, 2015; Stone, 1977).

More systematically, what may be broadly classed as transaction costs, risks to health and welfare connected to school attendance, were likely more salient for younger children. First, school attendance introduces principal-agent risks because it is costly for parents to monitor teacher behaviour (Ensminger, 2001). Older children are more capable of holding agents (i.e. teachers) to account or reporting opportunistic or harmful behaviour. This may explain, for instance, why levels of interpersonal trust predict the use of extrafamilial child-care for young children in contemporary societies (El-Attar, 2013). Further, risk of harm from bullying was prevalent in all kinds of schools and could be remarkably violent, including in elite public schools (Humphries, 2010; Stone, 1969). Finally, parents were keenly aware that schools raised their children's exposure to communicable disease (Gardner, 1984). Parents may have felt that older children were more robust in these hazardous environments (Cooper, 1971). Without a compelling reason to act otherwise, these transaction costs would tend to encourage deferral of school entry.

On the other hand, it was commonly alleged that very young children were at school because working families used these institutions as a form of child care (Humphries, 2010; Rose, 2002; Mitch, 1992). It is both theoretically understood (Blau and Robins, 1988; Greenwood, Guner and Vandenbroucke, 2017) and empirically well-founded (Blau and Robins, 1991; Apps et al., 2016) that child-care demand in the early life-cycle is related positively to maternal wages and negatively to the costs of child care. Applying this insight historically, however, it must be borne in mind that mothers and elder siblings were both commonly called

upon to provide familial care. Children's labour supply is therefore also relevant. Further, in this historical context, child-care costs declined steeply with age, and children were left on their own or entered the labour market at young ages (Burnette, 2008). Carers therefore faced very high childcare costs when young children were present in the household, but these fell over the household life-cycle. Over time, these costs might fall below the marginal benefit of market work and induce the carer to work and purchase care in the market. If the carer's wage, her opportunity cost, were higher, this moment would occur earlier in the life cycle. Thus higher women's and children's wages would be associated with greater child-care demand in the early life-cycle, as in contemporary economic theory. [5]

Schools had at least two important advantages over informal childcare to explain why families preferred them. On the one hand, economies of scale in child-care may exist, as children interact with and entertain one another (Browning, 1992); on the other hand, there are limits to the number of children to whom one person can provide adequate care and attention (Rockoff, 2009). This implies an optimal number of children per carer exists, and by bringing together children from different households, schools were less constrained in realizing this outcome. However, a private child-minding service would have the same advantages, making the provision of education redundant. Indeed, that so-called 'dame schools' almost universally incorporated some kind of reading lesson is often ignored (Henderson, 2024*a*), as historians have interpreted these popular institutions as strictly child-minding services (Burnette, 2008). However, given the principal-agent problem in care, I argue that basic literacy served as a signal to indicate children were not neglected (Henderson, 2024*b*; Bacharach and Gambetta, 2001). Education and care were thus complementary for young children, and schools that combined both services were tremendously popular (Roberts, 1972). By solving these problems, dame schools were an institutional prerequisite for an expansion of

[5] A formal model of child-care demand over the life cycle is developed for this historical setting in Henderson (2024*b*)

child-care demand brought on by greater household labour supply. Further, under the assumptions above, such an expansion would produce a positive human capital externality.

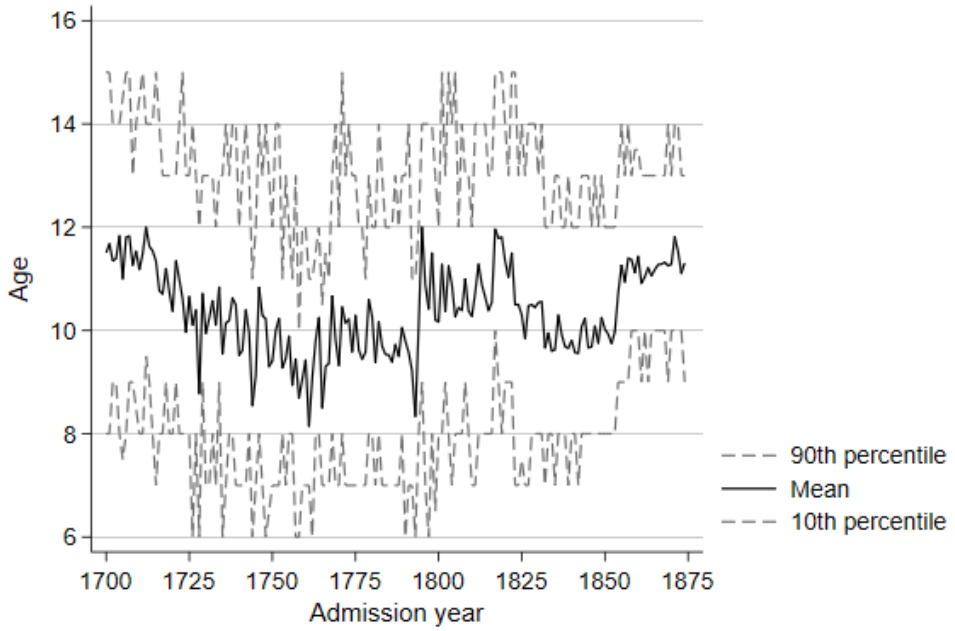
II. Merchant Taylor's School

Students attending Merchant Taylor's school, however, were not likely to have attended dame schools. Households who enrolled their children here were relatively affluent and socially elite. Horrell and Humphries (1995) find that a neoclassical model describes household labour supply in this period, at least insofar as women's and children's participation declines in the earnings of male household heads. Affluent households would therefore be expected to contain non-working members available to provide care, or alternatively, such households may have hired domestic servants and governesses. Rather, student enrollment at Merchant Taylor's is interpreted as a more direct reflection of the ideal enrollment age that would prevail absent material constraints affecting household labour supply and will be evidence of the plausibility (or not) of the assumption that school enrollment occurred relatively late and that age norms were ill-defined.

Merchant Taylor's was a grammar school taking day pupils in London that admitted children into its petty classes if they were insufficiently prepared in English-language reading and writing to begin in Latin (DeMolen, 1976; Curtis and Boultwood, 1966). Although Merchant Taylor's was probably the least distinguished of the 'great' public schools, this was nonetheless a very select club. After about 1740, the sons of artisans and labourers very rarely entered the school, making up only 6 per cent of students in the period 1825-50 (Tompson, 1971; Allen, 1982). Figure 3 presents the admission age of all boys admitted to Merchant Taylor's between 1700 and 1874, which is extracted from a digitized copy of the school's registration books (Robinson, 1883). Overall, this sample describes the enrolment of 10,888 pupils at the school.

For the whole eighteenth century, there was an approximately six-year difference

Figure 3. Age of enrolment of children at Merchant Taylor's school, London



between the youngest decile and the eldest decile of admitted boys. Although boys entering the grammar school were likely older than boys entering the petty school, which would account for some of the variation, the extent of variation is nonetheless remarkable. Wide variation in the age of enrolment is also replicated at Eton and Bury St. Edmunds, schools which did not admit petties.[6] To some extent variation at the secondary level represented by the grammar school must also have reflected variation at the more elementary levels of education, as children completed their earlier schooling and advanced to the grammar school at very different ages. At Merchant Taylor's, the mean school-entry age was also relatively late, ranging from about nine to twelve years old. The youngest decile entered the school, likely admitted to the petty classes, around age seven. Moreover, while

[6]DeMolen reports age distributions for these schools which imply mean admission age in the seventeenth century was 12.7 years with a standard deviation of 1.7 years in Bury St. Edmunds and 12.3 years with a standard deviation of 1.6 years at Eton; see DeMolen (1976)

there was more change over time at the top of the age distribution, the bottom decile changed very little before about 1850 (see figure 3).

It is possible to gain insight into the share of students admitted to the petty classes by examining the effects of a school reform. In 1854, the new schoolmaster closed the petty school and changed the admission criteria to only admit those above nine years old who could read and write in English and understood basic Latin grammar (Draper, 1962). This change of policy appears in figure 3 as a sudden jump in mean enrolment age in 1854. Figure 4 depicts the histogram of enrolment ages for the five-year period before the reform, from 1849 to 1853 inclusive, overlaid on the histogram for the five-year period after the reform, from 1855 to 1859 inclusive. The year of the reform itself, 1854, I exclude as I expect admissions in that year to have been a mix of admissions practices from both regimes. Intuitively, if the petties made up a small share of admissions, the distribution should not have changed much after the reform. However, the post-reform distribution shifts visibly to the right. Subject to conservative assumptions, it is possible to follow this intuition to arrive at a quantitative sense of the share of petties in enrollment.

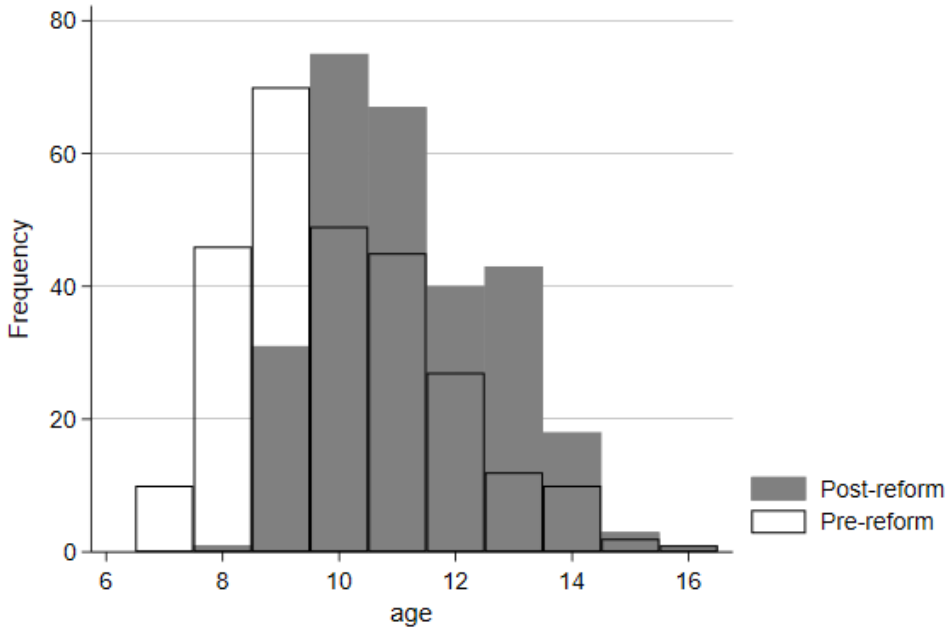
The mean pre-reform enrollment age will be a weighted mean combining the mean petty and grammar school admissions

$$\mu = w_p \mu_p + (1 - w_p)\mu_g, \tag{4}$$

where μ is the mean pre-reform enrollment age, 10.0, w_p is the share of petties among admissions, μ_p is the mean admission age of petties, and μ_g is the mean admission age of grammar students. I assume that the post-reform mean, 11.2, is equivalent to the mean grammar school enrollment age before the reform.[7]

[7]Note that I do not account for the exclusion of under-nines after the reform. Examining the distribution in figure 4 suggests the post-reform mean will consequently overestimate the pre-reform grammar school mean. Equation (4) can be rearranged to $\mu_p = \frac{\mu}{w_p} + \mu_g(1 - \frac{1}{w_p})$. Because $w_p < 1$, μ_p is clearly decreasing in μ_g. Because ignoring truncation should overestimate μ_g, it should therefore tend to underestimate μ_p.

FIGURE 4. AGE DISTRIBUTION BEFORE AND AFTER CLOSURE OF PETTY CLASSES, MERCHANT TAYLOR'S



Further, I assume that petties are strictly the youngest students admitted. That is, if petties form w_p of the distribution of students, they form exactly the bottom w_p of the age distribution. Under these conservative assumptions, the values of w_p and μ_p that are consistent with the data, in the sense that the empirical mean of the bottom w_p is equal to the analytical derivation in (4), are 0.44 and 8.44 respectively.

This suggests that even petties enrolled relatively late and made up a large share of those admitted. Corroborating evidence for this view comes from the appendix of the Clarendon commission, which inspected the students of Merchant Taylor's in December 1861. By this time, only nine boys were still enrolled at the school who had been admitted in the pre-reform period. Of these, seven had been admitted into the petty school, or roughly 77 percent, and their mean age of admission was 9.05 (, 1864). At least circa 1850, therefore, it seems safe to

conclude that at least 44 per cent of boys admitted to Merchant Taylor's entered as petties, possibly more. From their large share in enrollment, it follows that petties also accounted for a large share of the variation in the age distribution. Thus, even boys entering the most elementary classes offered at Merchant Taylors enrolled relatively late and with a large variance in age.

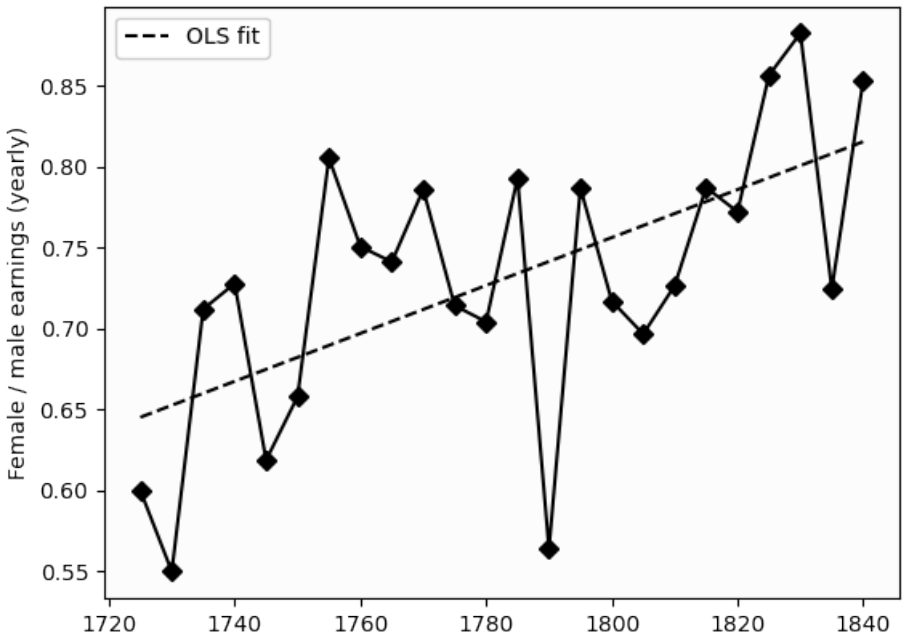
Although it is not possible to read the minds of those making these decisions, this enrollment pattern is consistent with the assumptions made above. The wide variance, even among those entering elementary classes, suggests very little consensus about school-age norms. Further, the late enrollment age of such students presumably reflects decisions about the relative merits and costs of late entry. If this decision was made without accounting adequately for dynamic complementarity, this would be inefficient, and shifting education earlier could produce better outcomes.

III. Child Care and Education among London's Poor

Unlike the parents of children at Merchant Taylor's school, the London poor regularly sought out a variety of forms of child care during the working day (Shepard, 2023). Above, I predicted that demand for child care will arise earlier in the household life-cycle where women's and children's wages are high relative to men's. London at the turn of the eighteenth century underwent structural changes that likely increased the demand for household labour at the expense of male earnings, creating conditions for examining the school–child care hypothesis.

Historians have convincingly made the case that London was caught up in and part of the wider economic changes associated with the industrial revolution(Ball and Sunderland, 2001; Barnett, 1998; Schwarz, 1992). While the metropolis may not have held the large mills of the northern textile cities, 'The assembly line ran through the street', and the diversification of the London economy should not detract from the fact that many of its trades underwent 'industrial' transformation(Schwarz, 1992). For women and children working, this transformation

Figure 5. Women's earnings relative to men's, St. Clement Danes



expanded and accelerated an established order of work. Outworking opportunities grew, and the division of labour intensified(Ball and Sunderland, 2001). Shoemaking, dressmaking, sewing, furniture-making, bookbinding, and an array of smaller trades all provided employment for women (Alexander, 1983).

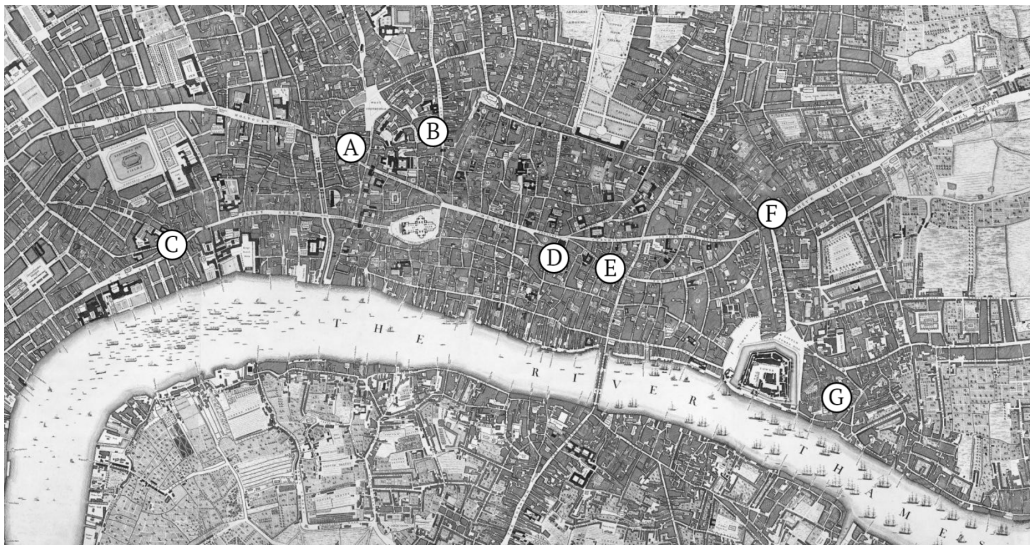
There is considerable debate among historians over whether women's access to labour markets in the city improved over the eighteenth century, much of which depends on what kind of evidence can be marshalled for women's work in the seventeenth century for comparison (Earle, 1989). Using a mix of records from the Old Bailey, the livery companies, and Christ's Hospital, Amy Erickson has recently demonstrated that married women in eighteenth-century London nearly all had an occupational identity (Erickson, 2008). On balance, the composition of women's work seems to have changed little over the eighteenth century; women

performed more or less the same jobs as they had before (Schwarz, 1992). However, lacking a census prior to 1801, and this lacking any meaningful measure of women's labour force participation, it is difficult to reach definitive conclusions about the absolute size of the female workforce, still less about wages or the intensity and regularity of work. Shepard has recently demonstrated the various intensive margins along which married women in eighteenth-century London creatively combined care work, paid work, and purchased care (Shepard, 2023). Occupational titles miss this intensive variation, which was plausibly subject to change over time. What seems much clearer, however, is that male real wages in the city were stagnating and possibly declining from the mid-eighteenth century to about 1820, corresponding with a rise in labour disputes among male artisans concerned with a loss of status (Ball and Sunderland, 2001; Green, 1995; Schwarz, 1985) Indeed, Keith Snell reports yearly earnings gleaned from settlement examinations in St. Clement Danes, Westminster, that suggest female earnings caught up to about 80 per cent of male earnings between 1740 to 1840 (table 5) (Snell, 1985).

Meanwhile, Levene's (2010) evidence from parish apprenticeships suggests that young children were increasingly employed in manufacturing in London into the early nineteenth century. Parish apprentices were also becoming younger. Levene (2010) argues that because these families would usually accept whatever arrangement parish authorities proposed or risk losing relief, such changes predominantly reflected shifting labour demand. At the turn of the eighteenth century, then, an accelerated division of labour in London undermined male earnings and created tasks for which demand for household labour was high (Ball and Sunderland, 2001).

To investigate empirically whether these structural changes affected school age, I make use of a set of documents produced by several London parishes in the second half of the eighteenth century and into the nineteenth. In 1767, Westminster passed an act requiring extramural London parishes to keep records of

Figure 6. Locations of included parishes within London



Finsbury: (A) St. Sepulchre (B) St. Botolph Aldersgate
The Strand: (C) St. Clement Danes
The City: (D) St. Stephen's Walbrook (E) Allhallows Lombard Street
East London: (F) St. Botolph Aldgate (G) St. Katharines's
Source: 1746 John Rocque Map from *Locating London's Past*, version 1, December 2011, www.locatinglondon.org.

the children under age 14 in their care (Taylor, 1985; Hutchins, 1940; Levene, 2012). The legislation was a response to efforts by Jonas Hanway, a director of the Foundling Hospital, to ameliorate the poor standard of care provided for parish children (George, 1951). Hanway's earlier efforts targeted high mortality among infant children in the care of parish nurses and led to legislation in 1762 requiring the employment of county nurses away from the metropolis's unhealthy influence (Hutchins, 1940). In making his case, Hanway took a strongly empirical approach, recording and reporting statistics on, for example, the high rate of infant mortality among parish children, and this spirit found its way into the legislation he advocated (Hutchins, 1940). Social ills could be cured by exposure to the light of voluminous public fact. Detailed and standardized *Registers of Infant Poor* were stipulated by the earlier law, while the 1767 act provided abstracts of the registers it expected each parish to complete and deliver yearly to the Wor-

shipful Company of Parish Clerks, subject to a £5 fine for failure to comply (, 1767; Hitchcock, Shoemaker and Howard, 2018*b*). The range of information that parish clerks were required to collect was expanded, described in the standardized "schedule B' (Hitchcock, Shoemaker and Howard, 2018*a*).

One column in these standardized *Registers of Poor Children under Parish Care*, presumably arising from a concern for children's spiritual welfare, asks whether parish children were able to read and recite their prayers. These accounts therefore provide data on reading ability over the whole span of childhood from birth to early teenage years, and in some parishes such records continue until around the time of the New Poor Law of 1833. As records, they are unique in several respects. Unlike signatures evidence from marriage documents, which generally reflect writing ability at a moment in early adulthood, i.e., after this skill is typically learned, the documents cover prime learning years. They therefore exhibit changes in reading ability with age. Unlike charity records that targeted the needs of specific constituencies, such as the Marine Society (of which Hanway was also a founder) that offered naval and merchant marine apprenticeships to poor boys and consequently whose records only relate to older boys of an eligible age, the *Registers of Poor Children* are not truncated from below (Taylor, 1985). In fact, many parishes continued to keep records of children beyond the prescribed age of fourteen. Thus they provide important information about reading ability in early childhood and beyond. Finally, by recording reading ability and not writing, the source avoids methodological issues with signature rates (Henderson, 2024*b*,*a*). Most pertinently, young children could not be trusted with a pen knife so writing instruction was usually deferred till later childhood (Henderson, 2024*b*; Neuburg, 1970).

The source's shortcomings relate primarily to sample selection. The *Registers* were only kept in London. Although the city attracted a wide pool of migrants, the source can not be taken as representative of the whole country. It is likely that London parishes primarily provided care to the children of parents with a

settlement in the city, although it is not possible to verify this as the *Registers* offer no information about place of birth (Levene, 2012). Second, the children included in the sample must have been to some extent 'poor'. Material hardship drove families to seek parish welfare. General accounts of the old poor law have emphasized how people used the system strategically and flexibly, according to need in an 'economy of makeshifts' that often fell short (King and Tomkins, 2003). There is some evidence of this in the *Registers*. Tim Hitchcock has described how single mothers in London turned to the parish for temporary child care, placing and withdrawing their children from the workhouse according to need (Hitchcock, 1997). More recently, Alysa Levene's extensive analysis of this same source has uncovered that children were maintained by the parish for longer periods, with children resident for longer than a year in 77 per cent of cases in St. Martin in the Fields and in 58 per cent of cases in St. Clement Danes, and that the majority of poor children came to the parish as a result of parental loss (Levene, 2012). In St. Mary Lambeth, between 1810-21, for instance, poverty was attributed to parental death, usually of the father, in 62.2 per cent of children's cases (Levene, 2012). Across the whole population in the eighteenth century approximately 30 to 40 per cent of children experienced the loss of a parent (Humphries, 2010). Therefore, while pauper children suffered a particularly acute misfortune, they were not selected from some extremely destitute minority. While not every child experienced the loss of a parent, there were many more households for whom such an event would have triggered immediate material hardship and possibly an application for relief (Horrell, Humphries and Weisdorf, 2022). Thus while the sample is drawn from a population vulnerable to poverty, this was not necessarily an exceptional group. Indeed, it may be fairly representative of the population for whom child-care demand rose in response to life-cycle variation in labour supply.

Assuming that those who have learned to read will not later forget, it is possible to use this source to estimate the mean age at which pauper children learned to read from the share of those able to read at each age. In particular, I use a

method of survival analysis borrowed from epidemiology and demography, where this kind of data is referred to as current-status data, a special case of interval-censored data (Diamond and McDonald, 1991; Klein and Moeschberger, 2005). The models developed for this kind of data assume that an individual observed to have experienced an event at a certain time must have experienced the event in the interval between the observation time and the beginning of the study, which in this case is the beginning of life, while an individual observed not to have experienced the event will experience it at some time between the observation time and ∞, or more practically age 100. With observations on whether children could read and their age, it is possible to adapt these methods to estimate modal measures of how long children took to learn to read from birth.

I conducted a search of surviving "schedule B" records held at the London Metropolitan Archive, some of which have also been digitized and are available online.[8] Seven parishes had suitable records.[9] St. Sepulchre and St. Botolph Aldersgate were located northwest of the City in Finsbury. St. Clement Danes was a large parish west of the City on the Strand, an important commercial road connecting London to Westminster (White, 2012). St. Stephen's Walbrook and Allhallows Lombard Street were small intramural City parishes located only a few streets apart. Finally, St. Botolph Aldgate was a large parish in East London, and St. Katharine's was just to the south in the dockyards (see figure 6). Exclusive of the city parishes, these were among the poorest and most crowded places in London. The Education Committee described Saffron Hill, an area neighbouring and partially encompassing Saint Sepulchre parish, as 'proverbially the dirtiest in London; very possibly the dirtiest in the world' (Education Committee, 1843). Poverty in London generally ran from east to west, but even St. Clement Danes, in Westminster, was fever-prone and crowded, for which it was subjected to a whitewashing campaign at the end of the eighteenth century (George, 1951).

[8]See bibliography for full reference. Some parishes' records had been digitized but were illegible in parts, and these will appear twice where I consulted the originals to verify missing pages.

[9]Many more parishes have the earlier registers, but these only record children up to age four.

Table 2—Balanced cohorts for product-limit estimation of mean reading age

Parish	Cohort 1	Cohort 2	Cohort 3
St. Botolph Aldgate	1755-1773	1774-1800	1801-1835
St. Sepulchre	1755-1775	1776-1795	1796-1825
St. Clement Danes	1755-1768	1769-1795	
Allhallows Lombard Street			1796-1825
St. Botolph Aldersgate			1806-1835
St. Katharine's	1755-1775	1776-1805	

The three extramural regions included in my sample were situated in what Sally Alexander characterizes as London's 'industrial belt' (Alexander, 1983). Casual day labourers found many opportunities for work in East London's docks, and Whitechapel Street, which ran through St. Botolph Aldgate, was at the centre of a large silk industry employing more than 40,000 men, women and children into the nineteenth century (White, 2012). Outwork was common throughout London, particularly in tailoring (Ball and Sunderland, 2001; Alexander, 1983). The seamstresses working in The Strand generally received the more common run of 'slop work,' while small workshops proliferated throughout the area north of the city (Alexander, 1983). The City, on the other hand, was the commercial centre of London, although many master craftsmen continued to live within the walls of the City above their workshops at the end of the eighteenth century (White, 2012).

To convert current-status data on reading and age from these London parishes into estimates of the mean age at which children learned to read, I use the Turnbull product-limit estimator (PLE) of the survival function for reading status (i.e. the estimated proportion yet to learn to read) when children first appear on the *Register of Poor Children*.[10] I take observations of children's reading ability when they first enter the *Register* to capture pauper children's likely educational experiences outside of the poor law system. The merits of this approach are

[10] A full description of the algorithm used to calculate the estimator is available in Klein and Moeschberger (2005)

that it allows a reliable estimate to be made of each individual parish-cohort group so that trends can be explored at this level. The method assumes very few restrictions on the form of the survival function, key among which is that the probability of knowing how to read is non-decreasing with age in the population of interest. The shape of the survival function is otherwise unrestricted. I must also assume that censoring times are independent of reading age, i.e., that the age children are exposed to parish welfare and are observed in the dataset is unrelated to the age at which they would learn to read (Klein and Moeschberger, 2005). As discussed above, pauper children in this sample were most commonly in receipt of relief due to the death of a parent. Although it is possible that parental mortality risk is related to children's reading age, I assume this misfortune could broadly happen at any age.

However, as the estimator is only evaluated at the time (age) values in the underlying data, it performs poorly if the range of ages upon which it is estimated are unevenly distributed or patchy in their coverage, and it is undefined beyond the range of the underlying data (Klein and Moeschberger, 2005). Therefore, where I have defined successive cohorts to track change over time, I select year of birth ranges that make the underlying age distribution as even as possible both within and between cohorts. The process of selecting cohorts is described in more detail in the appendix, where histograms of the age distribution in each cohort are also presented. The selected cohorts for each parish are reported in table 2. Although not every parish has surviving data for each cohort, the three cohorts roughly correspond to children born in the third quarter and fourth quarter of the eighteenth century and the first quarter of the nineteenth century.

For each cohort-parish group, I estimate a survival function using the Turnbull PLE. From the survival function, I calculate the mean age at which children in each sample learned to read, making an adjustment to allow for a proportion of children who never learn to read.[11] In the language of survival analysis, some

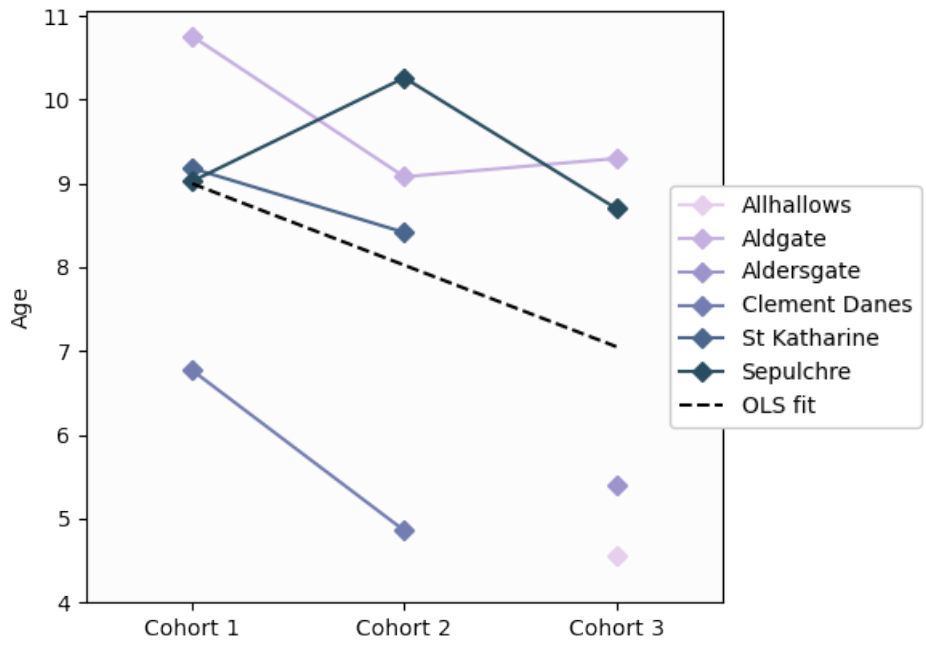
[11]The algorithm for calculating the survival function assumes that all children learn to read at the

subset of the population may be 'at risk' of an event while another is not. I assume, in this case, that the estimated value of the survival function at the right-most point of its underlying support (i.e., the age of the eldest child in the cohort) represents the proportion of the population not 'at risk' of learning to read. For most cohorts, this is equivalent to assuming that children older than about 12 or 13 will never learn to read. In fact, some children did learn to read at older ages than this (Mitch, 1992). However, as my argument concerns changes in the age of school enrolment as a response to child-care needs for young children, I ignore this population of teenage learners in the present analysis. Figure 7 can thus be taken to indicate changes in the mean age at which children learned to read among the population 'at risk' of learning to read during childhood.

The trend in figure 7 may be interpreted by considering the parishes together as a group or separately. The fitted trend for all parishes suggests a decline of nearly two years across the three cohorts. Because the asymptotic distribution of this statistic is not well-defined in the literature, I calculate bootstrap confidence intervals, resampling with replacement by parish and cohort. This gives a 95-percent confidence interval of -0.696 to -1.669 for the decline in mean reading age with each successive cohort. However, perhaps because of doubts that the surviving parish records represent a random sample, it may be preferable to favour evidence of change over time within each parish. For three of the four parishes for which there are sufficient records to address this question, mean reading age declined. Consider first the difference between cohorts one and two. In St. Botolph Aldgate, mean reading age declined by 1.68 years; in St. Katharine's, it declined by 0.77 years; in St. Clement Danes, it declined by 1.91 years; and in St. Sepulchre, it rose by 1.23 years. This gives an average decline of 0.78 years per cohort, still within the confidence interval identified for the whole sample. Only two parishes have consistent records across cohorts two and three, and these sug-

last period (age) in the underlying data. I modify this step in the algorithm to define the population 'at risk' of learning to read to be equal to the value of the survival function evaluated at the second-to-last period

FIGURE 7. ESTIMATE OF MEAN READING AGE ACROSS COHORTS, 1755-1835 (PLE)



gest little change. Thus taking the more conservative methodological approach nonetheless suggests mean reading age declined, albeit primarily in the interval between cohorts one and two and somewhat less sharply than the whole sample suggests.

The one parish that did not register a decline, St. Sepulchre, is exceptional in other ways that suggest an explanation. When the London Statistical Society sent surveyors to the district of Saffron Hill, an area west of St. Sepulchre across the Fleet Ditch that partly overlapped the parish, they reported, 'The ... district was searched by three of your committee's agents on three several occasions at considerable intervals of time, but no dame school or common day school was found by either' (Education Committee, 1843). The absence of these schools, which I argue were the primary institution providing early care, in this part

of London where reading ages did not decline, suggest this was the exception to prove the rule. Possibly, local labour markets in this neighbourhood offered limited employment to elder siblings, another group of would-be carers. Parish apprentices in St. Sepulchre had the highest average age at binding in Levene's sample, suggesting a limited demand for child labour (Levene, 2010). Absent this alternative, children in this part of London were possibly more likely to substitute for schools in providing care.

Around the turn of the nineteenth century, then, poor children in London acquired elementary literacy earlier because the demand for care arose sooner. This was related to changes in women's and children's opportunities for work, but equally to declining male real wages over the same time period.

The *Registers* also provide evidence that earlier learning placed children into a sensitive period for acquiring literacy. The *Registers* were completed annually for all children still under parish care. Thus it is possible to construct a panel data set with repeated observations of children, including a measure of their reading ability over time. This tracks the persistence of illiteracy across childhood, or equivalently, how quickly children learned to read. In particular, this source can provide insight into differences in the time it took children to learn to read by age.

Hanway's law, however, required that London parishes treat children differently depending on their age. Being primarily concerned with infant mortality, Hanway's law was designed to remove young children from London's supposedly harmful environment to the care of private 'nurses' residing in the more healthful suburban villages fringing the city (Taylor, 1985). The law specified that children under six should be removed in this way, while older children remained in the city workhouses (, 1767). Thus the parish delivered a different welfare package, and a different 'treatment', to children depending on their age. Unfortunately, six is around the age that important developmental effects are thought to operate on literacy, and this aspect of Hanway's policy makes it impossible to separate the

effect of age from the effect of differential treatment in parishes that followed the policy to the letter (Horowitz-Kraus et al., 2017).

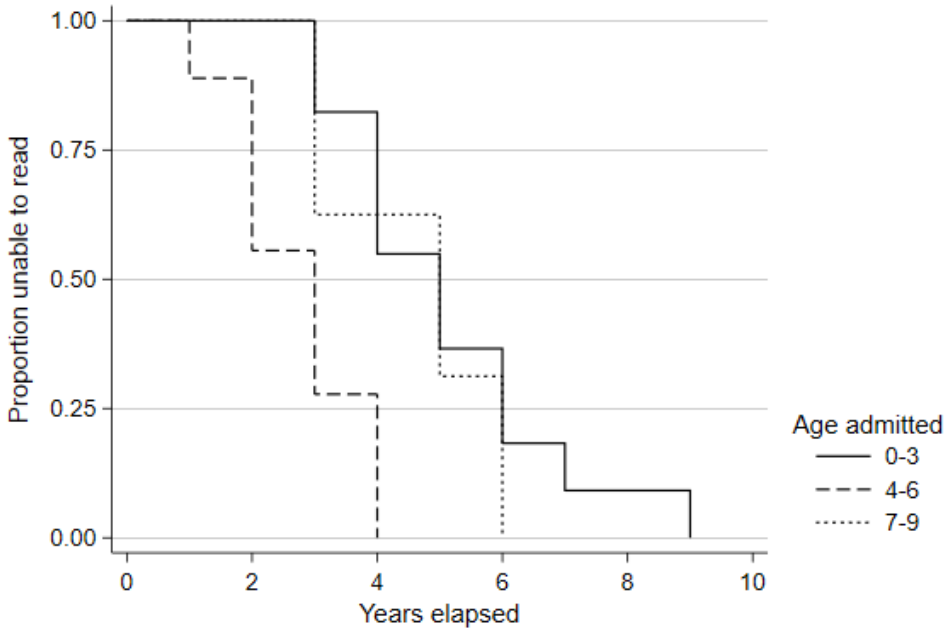
St. Clement Danes, exceptionally among the parishes in the sample, had not constructed a workhouse when the registers were first introduced. It therefore adopted a policy of sending children in its care to private 'nurses' irrespective of age until the workhouse was constructed in 1773.[12] Differential outcomes by age in this parish, for the group admitted before the construction of the workhouse, therefore do not simply reflect age differences in the application of welfare policy.

Figure 8 illustrates the estimated survival curves for the duration of time between admission and when children are first reported able to read, broken down by age group when admitted. This is constructed using a product-limit estimator adapted to account for right-censoring as children left parish care, typically when their parents' material circumstances improved and they became no longer eligible for parish welfare. The raw data is presented in the appendix, along with a more detailed description of the method used to construct the estimator (Klein and Moeschberger, 2005). Crucially, as did the earlier method, this method assumes that censoring times and event times (learning to read) are independent.

The first thing to note from figure 8 is that nurses taught children to read. Across all age groups, the estimated proportion of children who were unable to read declined the longer children were in nurses' care. Alyssa Levene cites specific instances from parish accounts of parish nurses writing to the parish guardians for books and learning materials, and it seems the nurses employed by St. Clement Danes were following a similar practice (Levene, 2012). Moreover, there were important differences by age. Those who were unable to read and admitted to the care of parish nurses aged four, five, or six took an average of 2.82 years before they were first able to read.[13] In contrast, children admitted at ages seven, eight, or nine took an average of 4.56 years to learn to read. The hypothesis that these

[12]This is indicated in the header of the printed registers.
[13]The mean is calculated by summing across the survival function.

Figure 8. Time to literacy acquisition by age when taught (Kaplan-Meier)



two means are equal can be rejected at the 95-percent level.[14] Children admitted below age four took an average of 5.10 years to learn to read.

I interpret these differences as a reflection of sensitive period effects in literacy development. Contemporary research linking literacy to the stages of cognitive and linguistic development suggests children should achieve basic literacy by about age seven or eight (Horowitz-Kraus et al., 2017). Children entering parish nurses' care between the ages of four and six, taking about three years to learn how to read, fell within this sensitive period. At earlier ages, children's brains will not have sufficiently developed to master literacy—and nurses may not have attempted it—while children whose reading is delayed beyond these ages have likely experienced some environmental deficiency or neurological impairment (e.g. dyslexia) (Horowitz-Kraus et al., 2017). Although I can not rule

[14]Stata calculates standard errors for this statistic, and their derivation is described in Klein and Moeschberger (2005), pp. 117-22.

out the latter explanation for delayed learning in the older group of parish children, I simply note that it was not uncommon for children to begin to learn to read in later childhood. Indeed, in the first cohort of children at St. Clement Danes, which corresponds most closely to this group of children admitted prior to the completion of the workhouse, the mean age at which children learned to read was about seven. At the elite Merchant Taylor's school, virtually no elementary petty scholar was admitted younger than seven. Late learners were by no means a small minority. However, as the earlier evidence showed, this outcome became less common in successive cohorts of poor children.

Private nurses, paid by the parish, apparently taught children how to read while under their care. If the most damning of critiques of parish nursing were true, i.e., that nurses cynically collected fees from the parish only to neglect their charges, it is difficult to understand this behaviour (Pinchbeck and Hewitt, 1972; Levene, 2012). Indeed, there is evidence that parish nurse-inspectors understood education as a signal of care quality. The nurse-inspector in St. Dunstan in the West, for instance, was instructed to 'examine the Children & bring a Report in Writ[in]g stat[in]g How the Children are in Health Cloaths & in resp[ec]t of Cleanliness and their Learn[in]g', and in addition to the general cleanliness of nurses' homes, inspectors in other parishes regularly commented on the progress of children's education.[15] Parishes subsequently rewarded nurses' diligence with yearly bonuses and removed children from those suspected of neglect (Levene, 2012).

This aspect of parish nursing—the principal-agent problem inherent in trusting another person to care for children—was also common to the private 'dame' schools that served as joint providers of child-care and education for young children outside of the parish. There, too, a common criticism centred on the possibility of neglect (Rose, 2002). The quality of these schools deserves further

[15]St Dunstan in the West, Committee of the Guardians of Poor Children, 27 April 1790, qtd. in Levene (2012)

attention (Henderson, 2024*b*), but for the moment, I simply note that the educational provision of parish nurses and of dames was likely very similar. Where direct evidence survives on the teaching provided by parish nurses, it suggests they focused on elementary literacy, from both religious and secular reading materials, with a minority also teaching writing, just as the dames did (Levene, 2012; Henderson, 2024*a*). However, whereas dame schools did not produce records of their activities, the poor law left an abundance of documents, particularly in London. Absent direct evidence from the dame schools, children's experience with these parish nurses is probably the closest analogue for the wider institutions that provided early child care in this period.

Rather than a detriment to children's human capital, the evidence above suggests early child care was more like a positive externality arising from carers' greater labour supply in response to rising relative household earnings. The story of an accelerating division of labour, loss of adult male status, and degraded male earnings at the turn of the nineteenth century in London is not often told as a happy one for its protagonists (Green, 1995), but I argue that the consequent rise in demand for child care at young ages provided children with a rather effective education. Children placed in child-care between the ages of four and six found themselves inadvertently in a 'sensitive period' for learning, and these children learned to read in less time than their elder peers by nearly two years.

IV. Conclusion

This historical episode in London provides micro-level evidence of the interaction between household labour supply, child-care demand, and education. In particular, comparing two populations with very different patterns of household labour supply revealed differences in school enrollment age. The affluent households who sent their children to Merchant Taylor's school enrolled their sons at an advanced age, and this did not change over time. In contrast, poor children in London learned to read, presumably in school, at progressively younger ages over the

study period. Case studies such as this cannot prove phenomena with general validity, but they are well-suited to developing novel hypotheses (Morgan, 2012). In this case, rising demand for household labour in London is proposed to explain the difference between these two populations, as poor households increasingly turned to schools for child care.

Moreover, this shift created a possible externality. Households underestimating the importance of early childhood education could improve their children's human capital outcomes by adopting earlier school enrollment in response to a change in relative costs. The earnings of household members who turned to schools for child care reduced the effective cost of early enrollment. Such households, if the evidence from parish nursing is a suitable analogue for the more common dame schools, may have inadvertently aligned their children's education with a sensitive period for literacy acquisition between ages 4 and 6. The school–child care hypothesis therefore also provides a channel for human capital accumulation, so important for modern economic growth, in response to stagnant male wages and rising household labour supply—exactly the conditions that were also developing around the contemporary textile factories and manufacturing districts (Horrell and Humphries, 1997).

Manuscript and archival sources

Allhallows in Lombard Street, Annual Register of the Parish Poor Children Under Four Years of Age, 1814-1831, *Ancestry* (www.ancestry.co.uk, accessed September 2021) London Metropolitan Archive, P69/ALH4/B/056/MS10777/003

Birmingham, Wolfson Centre for Archival Research, MS 1622 1/1/1/2: draft minute book.

St. Botolph Aldgate, Registers of Poor Children under 14 years in Parish Care, 1774-1787, *London Lives, 1690-1800*, GLBARC108040006 (www.londonlives.org, version 2.0, March 2018), London Metropolitan Archive, P69/BOT2/B/060/MS02657/001.

St. Botolph Aldgate, Registers of Poor Children under 14 years in Parish Care, 1788-1805, *London Lives, 1690-1800*, GLBARC108050006

(www.londonlives.org, version 2.0, March 2018), London Metropolitan Archive, P69/BOT2/B/060/MS02657/002.

St. Botolph Aldgate, Registers of Poor Children under 14 years in Parish Care, 1769-1779, *London Lives, 1690-1800*, GLBARC108000008 (www.londonlives.org, version 2.0, March 2018), London Metropolitan Archive, P69/BOT2/B/057/MS02655/001.

St. Botolph Aldgate, Registers of Poor Children under 14 years in Parish Care, 1780-1791, *London Lives, 1690-1800*, GLBARC108010008 (www.londonlives.org, version 2.0, March 2018), London Metropolitan Archive, P69/BOT2/B/057/MS02655/002.

St. Botolph Aldgate, Registers of Poor Children under 14 years in Parish Care, 1792-1805, *London Lives, 1690-1800*, GLBARC108020008 (www.londonlives.org, version 2.0, March 2018), London Metropolitan Archive, P69/BOT2/B/057/MS02655/003.

St. Botolph Aldgate, Registers of Poor Children under 14 years in Parish Care, 1806-1838, *London Lives, 1690-1800*, GLBARC108030008 (www.londonlives.org, version 2.0, March 2018), London Metropolitan Archive, P69/BOT2/B/057/MS02655/004.

Bury, St. Edmunds, Suffolk Archives, FL590/11/3: school register 1747-1871.

St. Clement Danes, Registers of Poor Children under 14 years in Parish Care, 1767-1786, *London Lives, 1690-1800*, WCCDRC365000002 (www.londonlives.org, version 2.0, March 2018), Westminster Archives Centre, STC/B/1/5/1258-1260.

St. Clement Danes, Pauper Settlement, Vagrancy and Bastardy Exams, *London Lives, 1690-1800*, WCCDEP358020308 (www.londonlives.org, version 2.0, March 2018), Westminster Archives Centre, STC/B/1/3.

Coventry, Coventry History Centre, 368/1/1: Trustees' minute and account book.

London, London Metropolitan Archive, Saint Botolph Aldersgate, P69/BOT1/B/041: Annual registers of parish poor children.

London, London Metropolitan Archive, Saint Botolph Aldgate, P69/BOT2/B/057: Annual registers of parish poor children not yet apprenticed out.

London, London Metropolitan Archive, Saint Botolph Aldersgate, P69/BOT1/B/041: Annual registers of parish poor children.

London, London Metropolitan Archive, Saint Katharine by the Tower (Hospital), CLC/199/TC/032/MS02660: Annual registers of parish poor children not yet apprenticed out, 1772-1802; and register of apprentices placed by the parish, 1772-1801.

London, London Metropolitan Archive, Saint Mary, Islington: Upper street, Islington, P83/MR1/0265: Records of the parish schools: printed rules governing admission of children, behaviour and parents' responsibilities.

Norwich, Norfolk Record Office, Y/ED/269: Bluecoat school, minute and account book.

London, London Metropolitan Archive, Saint Sepulchre, Holborn, P69/SEP/B/2/055: Registers of parish poor children and apprentices

St. Stephen Walbrook, Annual Register of the Poor Infants in Care of the Parish, 1784-1787, *Ancestry* (www.ancestry.co.uk, accessed September 2021) London Metropolitan Archive, P69/STE2/B/044/MS08144/002.

REFERENCES

A'Hearn, Brian, Dorothee Crayen, and Jörg Baten. 2009. "Quantifying Quantitative Literacy: Age Heaping and the History of Human Capital." *Journal of Economic History*, 69(3): 783–808.

Alexander, Sally. 1983. *Women's Work in Nineteenth-Century London: A Study of the Years 1820-50.* London:The Journeyman Press.

Allen, Edward A. 1982. "Public school elites in early-Victorian England: the boys at Harrow and Merchant Taylors' schools from 1825 to 1850." *Journal of British Studies*, 21(2): pp. 87–117.

Almond, Douglas, and Janet Currie. 2011. "Human Capital Development before Age Five." In *Handbook of Labor Economics*. Vol. 4b, 1315–1486. Elsevier.

Almond, Douglas, Janet Currie, and Valentina Duque. 2018. "Childhood circumstances and adult outcomes: act II." *Journal of Economic Literature*, 56(4): pp. 1360–446.

An act for the better regulation of the parish poor children, of the several parishes therein mentioned, within the bills of mortality. 1767. 7 Geo. III c. 39.

Apps, Patricia, Jan Kabátek, Ray Rees, and Arthur van Soest. 2016. "Labor supply heterogeneity and demand for child care of mothers with young children." *Empirical Economics*, 51: pp. 1641–77.

Aries, Philippe. 1962. *Centuries of Childhood: A Social History of Family Life.* New York:Alfred A. Knopf.

Bacharach, Michael, and Diego Gambetta. 2001. "Trust in signs." In *Trust in society.* , ed. Karen S. Cook, pp. 148–184. New York:Russell Sage Foundation.

Ball, Michael, and David Sunderland. 2001. *An Economic History of London 1800-1914.* London:Routledge.

Barnett, David. 1998. *London, Hub of the Industrial Revolution.* London:Tauris Academic Studies.

Berg, Maxine. 1993. "What Difference Did Women's Work Make to the Industrial Revolution?" *History Workshop*, 35: 22–44.

Blau, David M., and Philip K. Robins. 1988. "Child-Care Costs and Family Labor Supply." *The Review of Economics and Statistics*, 70(3): 374–381.

Blau, David M., and Philip K. Robins. 1991. "Child care demand and labor supply of young mothers over time." *Demography*, 28(3): pp. 333–51.

Broadberry, Stephen, Bruce M. S. Campbell, Alexander Klein, Mark Overton, and Bas van Leeuwen. 2015. *British Economic Growth 1270-1870.* Cambridge:CUP.

Browning, Martin. 1992. "Children and Household Economic Behaviour." *Journal of Economic Literature*, 30(3): 1434–1475.

Burnette, Joyce. 2008. *Gender, Work and Wages in Industrial Revolution Britain.* Cambridge:Cambridge University Press.

Caruso, Marcelo. 2023. "The coming of 'age': educational and bureaucratic dimensions of the classification of children in elementary schools (Western Europe, 19th century)." *European Educational Research Journal*, 22(3): pp. 394–412.

Cohen, Michèle. 2015. "The pedagogy of conversation in the home: "familiar conversation" as a pedagogical tool in eighteenth and nineteenth-century England." *Oxford Review of Education*, 41(4): 447–463.

Cooper, Thomas. 1971. *The Life of Thomas Cooper.* Leicester:Leicester UP.

Cunha, Flavio, and James Heckman. 2007. "The Technology of Skill Formation." *American Economic Review*, 97(2): 31–47.

Cunha, Flavio, James J. Heckman, Lochner Lance, and Dimitriy V. Masterov. 2006. "Interpreting the Evidence on Life Cycle Skill Formation." In *Handbook of the Economics of Education.* Vol. 1, , ed. Eric A. Hanushek and Finis Welch, 698–812. Elsevier.

Curtis, S. J., and M. E. A. Boultwood. 1966. *An introductory history of English education since 1800.* London:University Tutorial Press.

deMause, Lloyd. 1980. "The evolution of childhood." In *The history of childhood.* , ed. Lloyd deMause, pp. 1–74. London:Souvenir Press.

DeMolen, Richard L. 1976. "Ages of Admission to Educational Institutions in Tudor and Stuart England." *History of Education*, 5(3): 207–219.

Diamond, I. D., and J. W. McDonald. 1991. "The analysis of current status data." In *Demographic applications of event history analysis.* , ed. J. Trussell, R. Hankinson and J. Tilton, pp. 231–50. Oxford:Oxford University Press.

Draper, F. W. M. 1962. *Four Centuries of Merchant Taylors' School: 1561-1961.* London:Oxford University Press.

Earle, Peter. 1989. "The Female Labour Market in London in the Late Seventeenth and Early Eighteenth Centuries." *Economic History Review*, 42(3): 328–353.

Education Committee. 1843. "Report of the Education Committee of the Statistical Society of London on the Borough of Finsbury." *Journal of the Statistical Society of London*, 6(1): 28–43.

El-Attar, Mayssun. 2013. "Trust, Child Care Technology Choice and Female Labor Force Participation." *Review of Economics of the Household*, 11: 507–44.

Ensminger, Jean. 2001. "Reputations, trust, and the principal agent problem." In *Trust in society.* , ed. Karen S. Cook, pp. . 185–201. New York:Russell Sage Foundation.

Erickson, Amy Louise. 2008. "Married Women's Occupations in Eighteenth-Century London." *Continuity and Change*, 23(2): 267–307.

Galor, Oded. 2011. *Unified Growth Theory.* Princeton, NJ:Princeton University Press.

Gardner, Phil. 1984. *The Lost Elementary Schools of Victorian England.* London:Croon Helm.

George, Dorothy. 1951. *London Life in the Eighteenth Century.* London:London School of Economics.

Green, David R. 1995. *From Artisans to Paupers: Economic Change and Poverty in London, 1790-1870.* Aldershot:Scolar Press.

Greenwood, Jeremy, Nezih Guner, and Guillaume Vandenbroucke. 2017. "Family Economics Writ Large." *Journal of Economic Literature*, 55(4): 1346–1434.

Heckman, James J., and Ganesh Karapakula. 2019. "Intergenerational and intragenerational externalities of the Perry Preschool Project." Vol. 25889. Cambridge, Mass.:National Bureau of Economic Research.

Heckman, James, Rodrigo Pinto, and Peter Savelyev. 2013. "Understanding the Mechanisms through Which an Influential Early Childhood Program Boosted Adult Outcomes." *American Economic Review*, 103(6): 2052–86.

Henderson, Louis. 2024*a*. "The expansion of basic education during 'deskilling' technological change in England and Wales, c. 1780–1830." *Economic History Review*, Early View.

Henderson, Louis. 2024*b*. "Innocence and experience: early childhood education and industrialisation in England and Wales, 1767-1876." PhD diss. University of Oxford, Oxford.

Hitchcock, Tim. 1997. ""Unlawfully begotten on her body": illegitimacy and the parish poor in St Luke's Chelsea." In *Chronicling poverty: the voices and strategies of the English poor, 1640-1840.* , ed. Tim Hitchcock, Peter King and Pamela Sharpe, pp. 70–86. Basingstoke:Macmillan.

Hitchcock, Tim, Robert Brink Shoemaker, and Sharon Howard. 2018*a*. "Parliamentary Reform."

Hitchcock, Tim, Robert Brink Shoemaker, and Sharon Howard. 2018*b*. "Registers of Poor Children under Fourteen years in Parish Care (RC)."

Horowitz-Kraus, Tzipi, Rachelle Schmitz, John S. Hutton, and Jayna Schumacher. 2017. "How to create a successful reader? milestones in reading development from birth to adolescence." *Acta Paediatrica*, 106(4): pp. 534–44.

Horrell, Sara, and Jane Humphries. 1995. "Women's Labour Force Participation and the Transition to the Male-Breadwinner Family, 1790-1865." *Economic History Review*, 48(1): 89–117.

Horrell, Sara, and Jane Humphries. 1997. "The Origins and Expansion of the Male Breadwinner Family: The Case of Nineteenth-Century Britain." *International Review of Social History*, 42: pp. 25–64.

Horrell, Sara, Jane Humphries, and Jacob Weisdorf. 2022. "Beyond the male breadwinner: life-cycle living standards of intact and disrupted English working families, 1260-1850." *Economic History Review*, 75(2): pp. 530–60.

Humphries, Jane. 2010. *Childhood and Child Labour in the British Industrial Revolution.* Cambridge:Cambridge UP.

Hutchins, John H. 1940. *Jonas Hanway, 1712-1786.* London:Society for Promoting Christian Knowledge.

Jordan, W. K. 1960. *The Charities of London, 1480-1660: The Aspirations and the Achivements of the Urban Society.* London:George Allen and Unwin.

Jordan, W. K. 1961. *The Charities of Rural England, 1480-1660: The aspirations and achievements of the rural society.* London:George Allen and Unwin.

King, Steven, and Alannah Tomkins, ed. 2003. *The Poor in England 1700-1850: An economy of makeshifts.* Manchester:Manchester University Press.

Klein, John P., and Melvin L. Moeschberger. 2005. *Survival Analysis: Techniques for Censored and Truncated Data.* . 2 ed., New York:Springer.

Koops, Willem. 1996. "Historical developmental psychology: the sample case of paintings." *International Journal of Behavioral Development*, 19(2): pp. 393–414.

Lassonde, Stephen. 2013. "Age, Schooling, and Development." In *The Routledge History of Childhood in the Western World.* , ed. Paula S. Fass, 211–228. Abingdon:Routledge.

Levene, Alysa. 2010. "Parish Apprenticeship and the Old Poor Law in London." *Economic History Review*, 63(4): 915–941.

Levene, Alysa. 2012. *The childhood of the poor: welfare in eighteenth-century London.* Basingstoke, Hamps.:Palgrave Macmillan.

List, John A., Julie Pernaudet, and Dana Suskind. 2021. "It All Starts with Beliefs: Addressing the Roots of Educational Inequities by Shifting Parental Beliefs." Vol. 2021-127. Chicago, IL:University of Chicago.

Madoc-Jones, Beryl. 1977. "Patterns of Attendance and Their Social Significance: Mitcham National School, 1830-39." In *Popular Education and Socialization in the Nineteenth Century.* , ed. Phillip McCann, 41–66. London:Methuen.

Mitch, David. 1992. *The Rise of Popular Literacy in Victorian England: The Influence of Private Choice and Public Policy.* Philadelphia:University of Pennsylvania Press.

Morgan, Mary. 2012. "Case studies: one observation or many? Justification or discovery?" *Philosophy of Science*, 79(5): pp. 667–77.

Neuburg, Victor E. 1970. "Literacy in eighteenth century England: a caveat." *Local Population Studies*, 4: pp. 44–6.

Pinchbeck, Ivy, and Margaret Hewitt. 1972. *Children in English Society.* Vol. 1, London:Routledge and Kegan Paul.

Pleijt, Alexandra de. 2016. "Human Capital Formation in the Long Run: Evidence for Average Years of Schooling in England, 1300-1900." *Cliometrica*, 12.

Powell, Walter. 1907. *The diary of Walter Powell of Llantilio Crossenny in the county of Monmouth, gentleman, 1603-1654.* Bristol:John Wright.

Report of Her Majesty's Commissioners Appointed to Inquire into Revenues and Management of Certain Colleges and Schools: Appendix. 1864. *Report of Her Majesty's Commissioners Appointed to Inquire into Revenues and Management of Certain Colleges and Schools: Appendix.* Vol. ii, London:Her Majesty's Stationery Office.

Roberts, A. F. B. 1972. "A New View of the Infant School Movement." *British Journal of Educational Studies*, 20(2): 154–164.

Robinson, Charles J. 1883. *A register of the scholars admitted into Merchant Taylor's School, from A.D. 1562 to 1874.* Vol. vol. 2, Lewes:Farncombe & Co. HathiTrust.

Rockoff, Jonah. 2009. "Field Experiments in Class Size from the Early Twentieth Century." *Journal of Economic Perspectives*, 23(4): 211–230.

Rose, Craig. 1991. "Evangelical philanthropy and Anglican revival: the charity schools of Augustan London, 1698-1740." *The London Journal*, 16(1): pp. 35–65.

Rose, Jonathan. 2002. *The Intellectual Life of the British Working Classes.* New Haven:Yale UP.

Schwarz, L. D. 1985. "The Standard of Living in the Long Run: London, 1700-1860." *Economic History Review*, 38(1): 24–41.

Schwarz, L. D. 1992. *London in the Age of Industrialization: Entrepreneurs, Labour Force and Living Conditions, 1700-1850.* Cambridge:Cambridge University Press.

Shepard, Alexandra. 2023. "'Working mothers' in eighteenth-century London." *History Workshop Journal*, 96: pp. 1–24.

Snell, K. D. M. 1985. *Annals of the Labouring Poor: Social Change and Agrarian England, 1660-1900.* Cambridge:Cambridge University Press.

Stone, Lawrence. 1969. "Literacy and Education in England 1640-1900." *Past and Present*, 42.

Stone, Lawrence. 1977. *The family, sex and marriage in England 1500-1800.* London:Weidenfeld and Nicolson.

Taylor, James Stephen. 1985. *Jonas Hanway, founder of the Marine Society: charity and policy in eighteenth-century Britain.* London:Scolar Press.

Tilly, Louise, and Joan W. Scott. 1987. *Women, Work, and Family.* London:Methuen.

Tompson, Richard S. 1971. *Classics or charity? the dilemma of the 18th-century grammar school.* Manchester:Manchester University Press.

White, Jerry. 2012. *London in the Eighteenth Century: A Great and Monstrous Thing.* London:The Bodley Head.

Woodley, Sophia. 2009. "'Oh Miserable and Most Ruinous Measure': The Debate between Private and Public Education in Britain, 1760-1800." In *Educating the Child in Enlightenment Britain: Beliefs, Cultures, Practices.* , ed. Mary Hilton and Jill Shefrin, 21–40. Farnham, Surrey:Ashgate.

Appendix

A1. Mistaken complementarity

To demonstrate the mistaken complementarity effect formally, consider that the "actual" production function of human capital, as in (1), takes a CES functional form

$$f(s_0', s_1') = \left[\alpha s_0'^{\sigma} + (1-\alpha) s_1'^{\sigma}\right]^{\frac{1}{\sigma}}, \tag{A1}$$

while the "perceived" production function is

$$g(s_0, s_1) = \left[\alpha s_0^{\phi} + (1-\alpha) s_1^{\phi}\right]^{\frac{1}{\phi}}, \tag{A2}$$

and $\sigma \neq \phi$. In other words, households do not accurately perceive the degree of complementarity between early and late school. The "actual" value of human capital will then be a function of the variables chosen in the "perceived" human capital curve

$$f(s_0, s_1). \tag{A3}$$

Take the total derivative of (A3) with respect to s_0,

$$\frac{df}{ds_0} = f_1(s_0, s_1)\frac{\partial s_0}{\partial s_0} + f_2(s_0, s_1)\frac{\partial s_1}{\partial s_0}, \tag{A4}$$

where $\partial s_1 / \partial s_0$ is the trade-off between late and early school along the "perceived" human capital curve. Effectively this breaks down the change in "actual" human capital into that part contributed by early education and that part contributed by the substitution of later school for early school according to the "perceived" human capital function. Substituting values from (A1) and (A2) into (A4) yields

$$\frac{df}{ds_0} = \zeta s_0^{\sigma-1} - \zeta s_1^{\sigma-1}\left(\frac{s_0}{s_1}\right)^{\phi-1}, \tag{A5}$$

where

$$\zeta = \alpha\left[\alpha s_0^{\sigma} + (1-\alpha) s_1^{\sigma}\right]^{\frac{1}{\sigma}-1}.$$

Because $\zeta \geq 0$ by construction, as long as $\zeta \neq 0$, (A5) will be positive if

$$s_0^{\sigma-1} > s_1^{\sigma-1}\left(\frac{s_0}{s_1}\right)^{\phi-1},$$

which can be simplified to

$$s_0^{\sigma-\phi} > s_1^{\sigma-\phi}.$$

Taking the log yields the following condition under which the "mistaken complementarity" effect will be positive

(A6) $$(\sigma - \phi)ln(s_0) > (\sigma - \phi)ln(s_1).$$

Now consider the case where households underestimate the complementarity of early and late school (i.e., $\sigma < \phi$). In that case, $\sigma - \phi < 0$, and because of the multiplication property of inequalities, (A6) will be true if $s_0 < s_1$. This case agrees with the intuition presented in figure 2. To reiterate, then, the "mistaken complementarity" effect on human capital will be positive so long as: (1) households underestimate the degree of complementarity ($\sigma < \phi$) and (2) are initially using more late school than early school ($s_0 < s_1$).

A2. Construction of survival function for illiteracy in St. Clement Danes

Table A1—Ability to read by years of exposure to nurses' care by age group

Time	At risk	Failed	Censored	Survivor Function
		Aged 0 to 3		
1	53	0	24	1.00
2	29	0	12	1.00
3	17	3	5	0.82
4	9	3	0	0.55
5	6	2	0	0.37
6	4	2	0	0.18
		Aged 4 to 6		
1	17	1	8	0.94
2	8	3	1	0.59
3	4	2	1	0.29
4	1	1	0	0.00
		Aged 7 to 9		
1	12	0	2	1.00
2	10	0	2	1.00
3	8	3	3	0.63
5	2	1	0	0.31
6	1	1	0	0.00

Table A1 presents the raw data underlying the estimates of the time it took children of different age groups to learn to read while under the care of parish nurses. Time is the number of years elapsed since entering parish care. The number 'at risk' is the number of children who were in parish care in the preceding year. The number who 'failed', adopting the terminology of survival analysis, represents the number of children who learned to read in the preceding year. The number of 'censored' observations represents the number of children who left parish care. Finally, the survivor function represents the estimated proportion of children who have yet to learn to read after a given number of years.

I describe the construction of the estimated survivor function for the group of children aged 4 to 6 as a worked example. Initially, there are 17 children unable to read in this age group. After one year, one of these children is able to read. Thus I estimate that $\frac{16}{17}$, or 94 per cent, of children are still unable to read after one year. Eight children leave parish care and are therefore censored. The method assumes that these children would have learned to read at some later point. However,

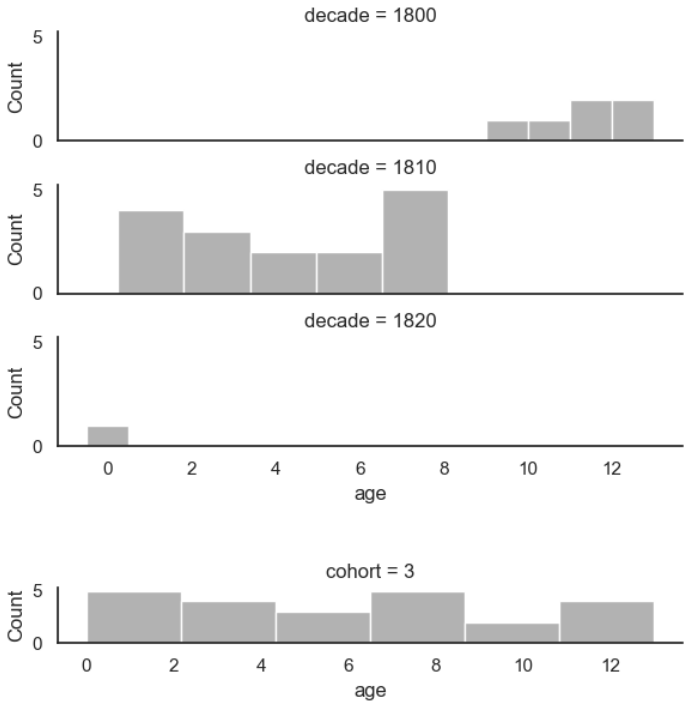
because they are no longer observed, they are removed from the pool of children 'at risk' of learning to read, along with the one child who learned to read in the preceding year.

In the second year, three additional children are able to read. Only eight children remain 'at risk' of learning to read in this period. Thus five-eighths of children 'at risk' remain unable to read after another year. In total, I thus estimate that $\frac{16}{17} \times \frac{5}{8}$, or 59 per cent, of children are still unable to read after two years. One child leaves parish care and is censored. Therefore, in the third year, four children remain 'at risk' of learning to read. Two additional children are able to read in the third year. Thus, extending the logic developed above, I estimate that $\frac{16}{17} \times \frac{5}{8} \times \frac{2}{4}$, or 29 per cent, of children remain unable to read after three years. One child leaves parish care, leaving only one child 'at risk' of learning to read. In the fourth year, this child learns to read, and I estimate that 0 per cent of children remain unable to read after four years. This describes the entire survival function, and a similar process is carried out to estimate the survival function for the other two groups.

A3. Selection of cohorts for mean reading age analysis

For each parish, I begin by examining the age distribution of children born around each 10-year interval. I then merge these groups together with the goal of forming cohorts with as even an age distribution as possible, although the process is done by eye and remains imperfect. At a minimum, I define cohorts so that the eldest child in the cohort is at least 12 years old.

FIGURE A1. ALLHALLOWS LOMBARD STREET



NOTE: For Allhallows Lombard Street, I defined the cohort (1796-1825) to include all children in the sample.

FIGURE A2. ST. BOTOLPH WITHOUT ALDGATE

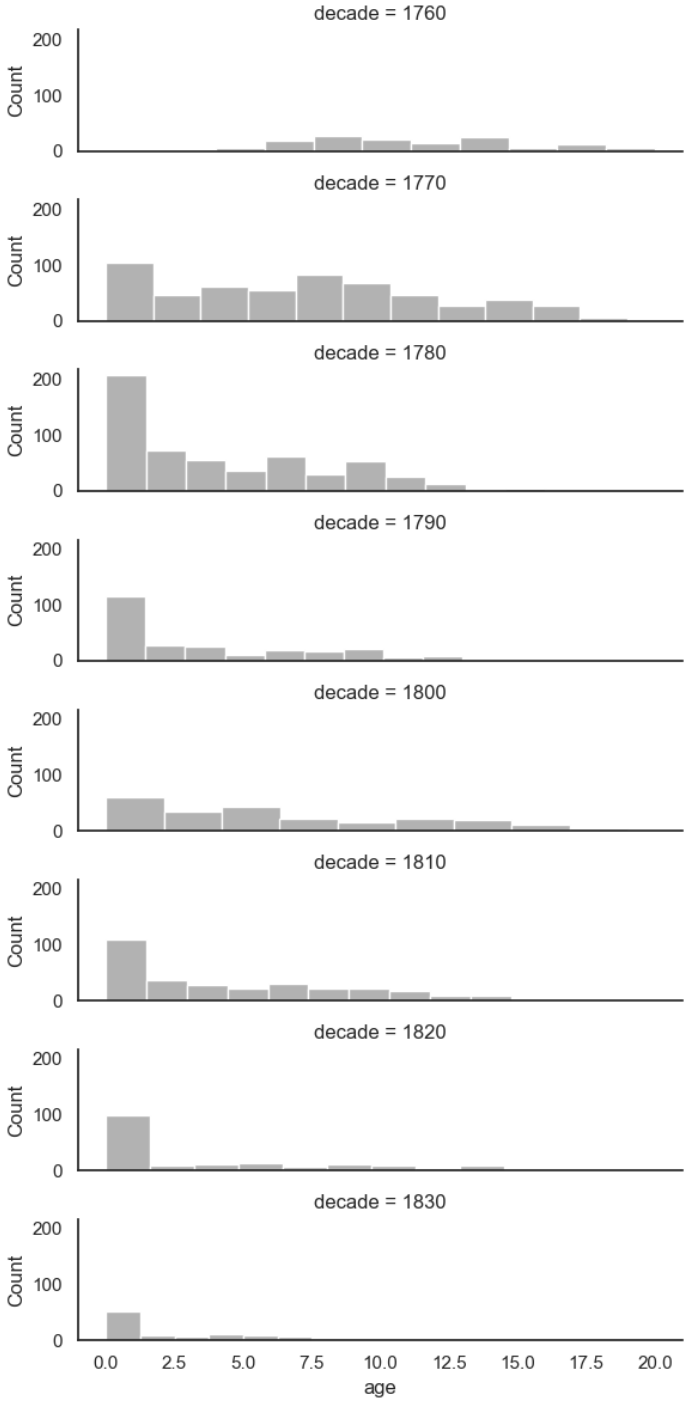
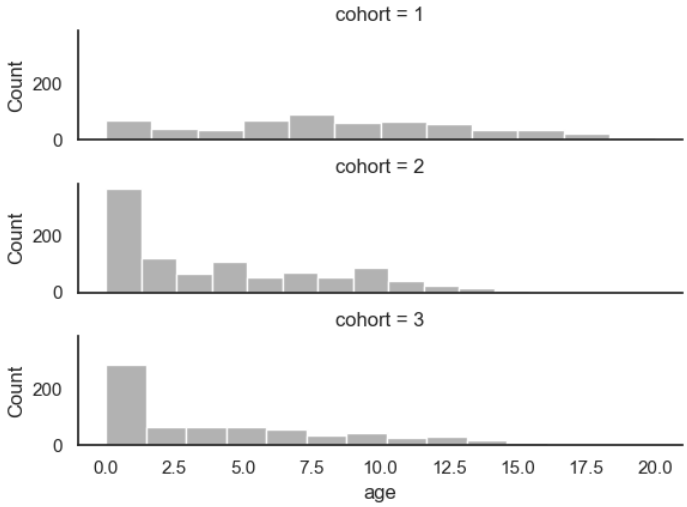
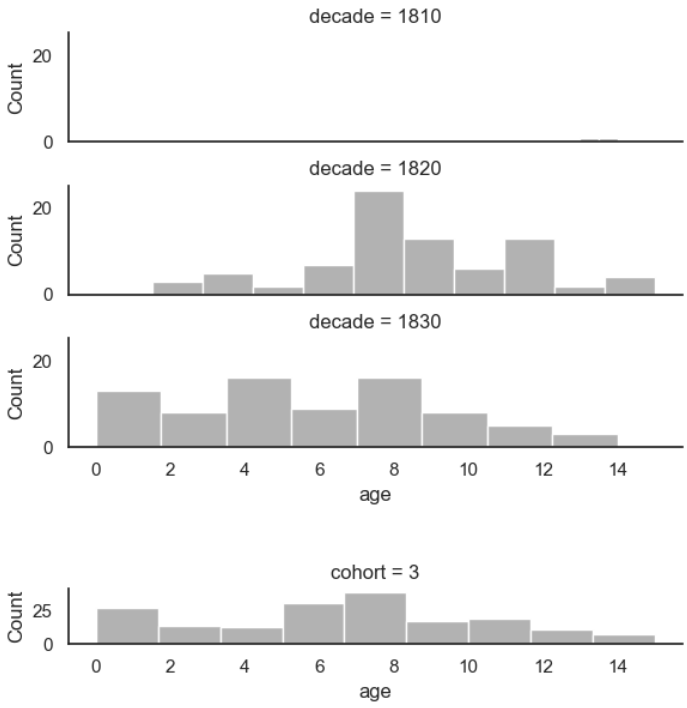


FIGURE A3. ST. BOTOLPH WITHOUT ALDGATE, CONTINUED



NOTE: For St. Botolph without Aldgate, I defined three cohorts: (1) 1755-1773, (2) 1774-1800, and (3) 1801-1835.

FIGURE A4. ST. BOTOLPH WITHOUT ALDERSGATE



NOTE: For St. Botolph without Aldersgate, I defined the cohort (1806-1835) to include all children in the sample.

Figure A5. St. Sepulchre

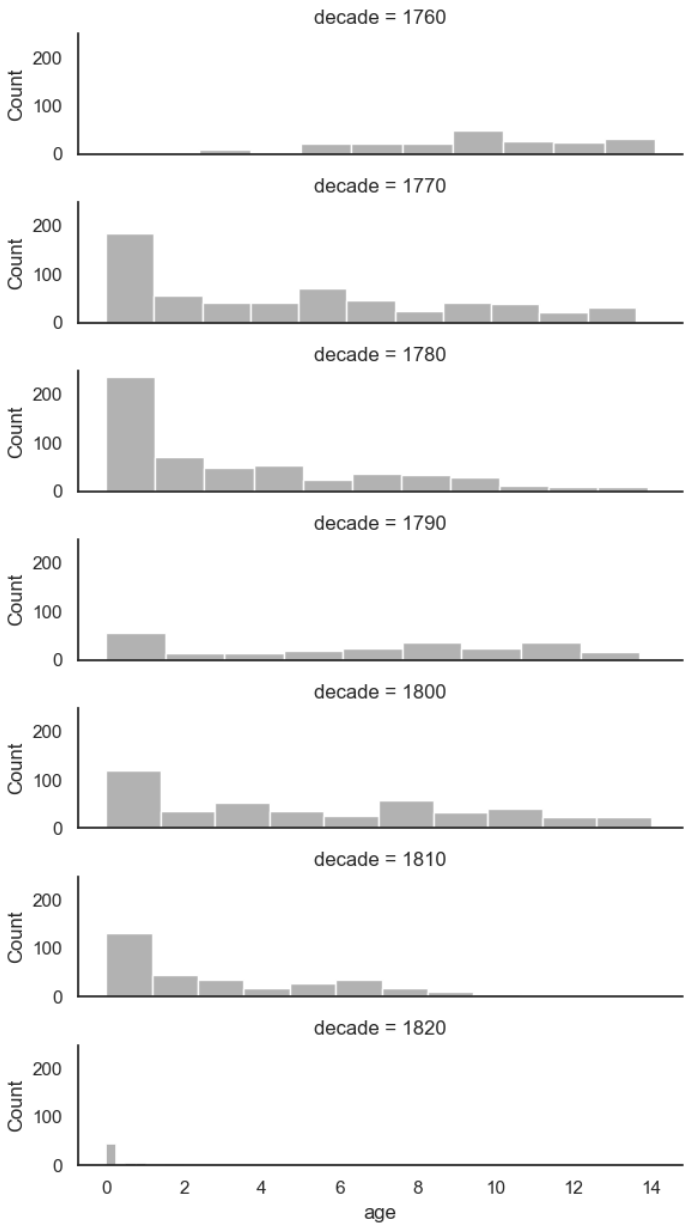
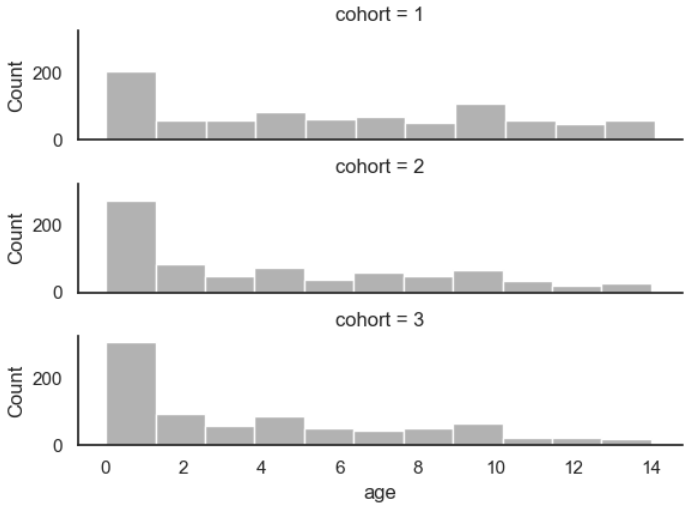
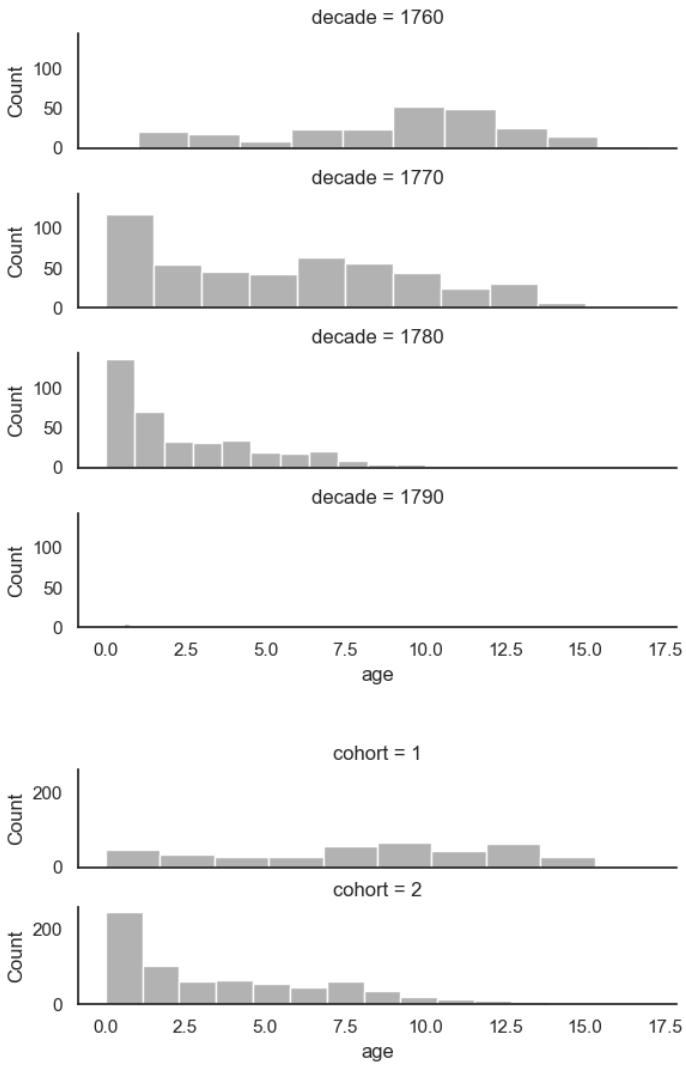


FIGURE A6. ST. SEPULCHRE, CONTINUED



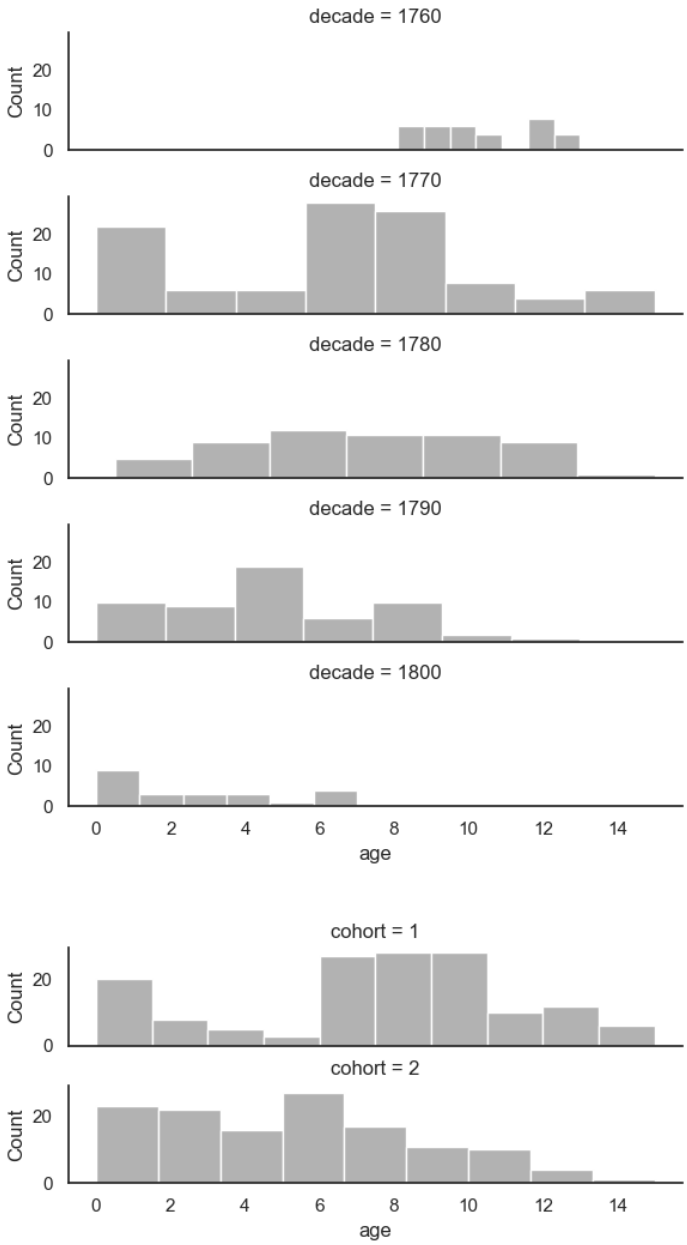
NOTE: For St. Sepulchre, I defined three cohorts: (1) 1755-1775, (2) 1776-1795, and (3) 1796-1825.

FIGURE A7. ST. CLEMENT DANES



NOTE: For St. Clement Danes, I defined two cohorts: (1) 1755-1768, and (2) 1769-1795.

FIGURE A8. ST. KATHARINE'S BY THE TOWER



NOTE: For St. Katharine's by the Tower, I defined two cohorts: (1) 1755-1775, and (2) 1776-1805.