
‘A Town Built on Migration?’ Calculating the Human Capital Value of Migration to Reading, 1851–1871

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Abstract

This article provides an estimate of the human capital value of migration to Reading in the period 1851-1871 to the town's economy. This is determined by estimating total net migration to the town across this period by age and sex and assigning all migrants a value for expected lifetime economic output less expected lifetime consumption costs. The final figures are contextualised by comparison with the value of social overhead capital used to fund significant local infrastructure projects in the same time period and show that, from a human capital perspective, the value of migration to Reading was very significant. This article thus addresses significant historiographical gaps in the study of Victorian labour migration to southern provincial towns and provides an original perspective to studies of the economic value of migration and its role in the growth of such communities.

Introduction

This article sets out a quantitative evaluation of the human capital value of migration to Reading between the 1851 and 1871 censuses. This period is chosen for several reasons, both practical and historical. It was only up to 1871 that the Registrar General's consolidated reports split births data between males and females. The techniques used in this study, as set out below, rely fundamentally on sex-specific births data and so going further forward in time using these sources would not be possible. In addition, the boundaries of the Reading Registration District, which is used here to stand for the town of Reading, remained unchanged from 1851 to 1871.² The main urban area of Reading formed a triangle to the north of the Registration District (Figure 1), with most industry concentrated in this area. While the Registration District did contain some less developed areas to the south (and therefore there would have been some instance of migration from here to the urban area), it is quite small, being dwarfed in geographical area by the more rural registration districts surrounding it. Moreover, the percentage of agricultural labourers among working-age men within the Reading Registration District, according to the Registrar General, was only 3.11 per cent in 1861—less than a tenth the proportion in any surrounding district—

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2 B. Langston, 'Reading Registration District', in *UK BMD – Births, Marriages, Deaths and Censuses on the Internet*, 2017 <https://www.ukbmd.org.uk/reg/districts/reading.html> [accessed 30 December 2017]; A. Alexander, *Borough Government and Politics: Reading 1835–1985* (London, 1985), p. 8.

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Figure 1 Reading and surrounding registration districts, 1851–1871



and had only been a little higher (5.74 per cent) in 1851.³ The Reading Registration District can therefore stand as a good approximation for the town itself, as its rural population is likely to be fairly insignificant. The term ‘migrant’, therefore, refers here to any person (from whatever location) coming to reside from without to within the boundaries of the Reading Registration District.

This period 1851–1871 was crucial in the history of Reading’s industrial expansion. Not only did the town’s population grow by over 50 per cent over these two decades, from 22,175 in 1851 to 25,876 in 1861 and 33,340 in 1871, Alan Alexander recognises this as the genesis period for mass industry in the town.⁴ In the preceding years, he writes, ‘Reading was essentially a market town and agricultural centre’, noting a distinct lack of industry in the first half of the nineteenth century.⁵ As Tony Corley notes, Reading had several firms at this time which later became famous, both nationally and internationally, but it was only after the early 1840s that many of them were able to generate cash for business expansion and from the 1850s that he observes any notable rise in their turnovers.⁶ Employee

3 Cambridge Group for the History of Population and Social Structure (hereafter CAMPOP), *Populations Past – Atlas of Victorian and Edwardian Population*, <https://www.populationspast.org/sc8/1861/#9/51.4540/-1.0217>, <https://www.populationspast.org/sc8/1851/#9/51.4540/-1.0217> [accessed 10 October 2019].

4 Great Britain Historical Geographical Information System (hereafter GB historical GIS), ‘Total population, Reading PLU/RegD’, in *A Vision of Britain Through Time* http://www.visionofbritain.org.uk/unit/10174764/cube/TOT_POP [accessed 19 November 2017].

5 GB Historical GIS, ‘Total Population, Reading PLU/RegD’, in *A Vision of Britain Through Time* http://www.visionofbritain.org.uk/unit/10174764/cube/TOT_POP [accessed 19 November 2017]; Alexander, *Borough Government*, p. 50.

6 T.A.B. Corley, ‘The celebrated Reading Sauce: Charles Cocks and Co. Ltd. 1789–1962’, *Berkshire Archaeological Journal*, 70 (1979–80), pp. 97–106, here at p. 100. T.A.B. Corley, ‘Barrett, Exall & Andrewes’ Iron Works at Reading: the partnership era 1818–64’, *Berkshire Archaeological Journal*, 67 (1973–74), pp. 79–87, here at p. 87.

numbers at Huntley and Palmers biscuit manufacturers—the dominant local business by the end of this time—rose from 143 in 1851 to approximately 2,500 in 1873, while turnover grew by over 1,700 per cent over the same period.⁷ The company began a period of substantial capital investment in a new factory and facilities in 1864, while Simonds' Brewery also undertook significant plant investment in 1857.⁸

These burgeoning industrial firms certainly employed migrant labour. Seven out of every ten workers at Barrett, Exall and Andrewes' Iron Works in 1861 had been born outside Reading, while research by Corley shows that Huntley and Palmer was a strong employer of young male migrants at this time.⁹ These firms did not represent the only employment opportunities in Reading, but empirical data show a high proportion of skilled manual labourers and a very low proportion of unskilled workers in the Reading Registration District compared with the largely rural districts west of London that surrounded it.¹⁰ Literary sources give us some impression of the town's status in the popular imagination. Elihu Burritt called the town 'vigorous' and 'energetic' in 1864.¹¹ While slightly beyond the timeframe of this study, Charles Dickens Jr.'s description of Reading in 1883 as 'important and flourishing' conveys its growth in stature; by 1894, Thomas Hardy's *Jude the Obscure* captures some of Reading's lure for young migrants, portraying it in direct contrast with its nearest major city, Oxford (both settlements renamed Aldbrickham and Christminster respectively) as a substantial town promising anonymous refuge and modest work for his transgressive protagonists.¹² 'The more you have the better in Aldbrickham, which is a finer town than all your Christminsters[...]. Aldbrickham is a much bigger town—sixty or seventy thousand inhabitants.'¹³

Nonetheless, there are significant academic gaps in historical studies of migration, both to Reading and to provincial southern English towns generally, which this article seeks to address. On a local level, there is a distinct lack of studies focusing on Victorian migration

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- 7 T.A.B. Corley, *Huntley & Palmers of Reading 1822–1972: Quaker Enterprise in Biscuits* (London, 1972), pp. 96, 304, 306.
 - 8 University of Reading Special Collections and Museum of English Rural Life (hereafter 'MERL') Records of Huntley and Palmers, HP 160; 'Opening of Messrs. Huntley and Palmers new premises', *Berkshire Chronicle*, 2 July 1864; 'Extension of the biscuit factory', *Berkshire Chronicle*, 14 August 1869; 'The biscuit factory railway', *Berkshire Chronicle*, 9 April 1870; T.A.B. Corley, 'Simonds' Brewery at Reading 1760–1960', *Berkshire Archaeological Journal*, 68 (1976), pp. 77–88, here at p. 81.
 - 9 Corley, 'Barrett, Exall & Andrewes', p. 85; Corley, *Huntley & Palmers*, pp. 41 and 97.
 - 10 CAMPOP, *Populations Past – Atlas of Victorian and Edwardian Population*, <https://www.populationspast.org/hc3/1851/#9/51.5463/-0.8844>, <https://www.populationspast.org/hc3/1861/#9/51.5463/-0.8844>, <https://www.populationspast.org/hc5/1851/#9/51.5463/-0.8844>, <https://www.populationspast.org/hc5/1861/#9/51.5463/-0.8844> [accessed 13 October 2019]. This is based on the HISCLASS categorizations of socioeconomic status. Although the Registrar General's figures on unskilled manual labourers for surrounding districts are quite different, this is because agricultural labourers are separated into their own category.
 - 11 E. Burritt, *A Walk from London to Land's End and Back* (London, 1865), cited in A. Sowan, *A Much Maligned Town* (Reading, 1997) pp. 15–16.
 - 12 C. Dickens, *Dictionary of the Thames* (London, 1883), cited in Sowan, *Much Maligned*, p. 17; P. Ingham, *The Language of Gender and Class: Transformation in the Victorian Novel* (Hove, 1996), p. 165.
 - 13 T. Hardy, *Jude the Obscure*, Project Gutenberg, <http://www.gutenberg.org/files/153/153-h/153-h.htm> [accessed 30 December 2017].

to Reading; Corley uses his brief analysis of migrant labour at Huntley and Palmers noted above to comment on the short-distance nature of nineteenth century labour migration; however, his sample sizes are really too small to draw any meaningful conclusions, and his conclusions are therefore shaped to fit prevailing labour migration theories, rather than offering any fresh insight.¹⁴ Stephen Yeo offers evidence of the disruptive impact a transient population had on religious institutions in the late nineteenth century, but this is a fleeting reference.¹⁵ And yet, despite this lack of insight, popular sources do not hesitate to acclaim the economic importance of nineteenth century migration to Reading. Martin Salter, then an MP for the town, wrote in 2006 of ‘a town built on migration’.¹⁶ He depicts Victorian workers flocking inward for employment opportunities ‘not available to them in more economically depressed areas’. *The Daily Telegraph* too, in 2010, freely embraced the idea that ‘Reading has always been a town built on immigration, from the Industrial Revolution on’.¹⁷ As these recent non-academic sources demonstrate, nineteenth century migration is engrained in the popular consciousness of Reading’s history. But there is a real scholarly incongruity here. While the book for which Salter wrote is focused on social impacts of twentieth century international migration to Reading, he is clearly making an economic statement, attributing Reading’s nineteenth century economic growth to labour migration. But he is doing so without a meaningful academic basis; there has been no systematic study of the economic importance of nineteenth century migration to Reading.

Reading as a setting highlights a broader historiographical gap in the impact of migration on southern provincial towns in the nineteenth century. Notwithstanding locally-focused articles in *Local Population Studies*, most general studies of labour migration focus either on northern areas or, as in Cheryl Bailey’s recent article, migration to London.¹⁸ In Sidney Pollard’s view, southern migrants tended to move to London and ‘did not move to industrial towns at all’.¹⁹ George Boyer’s study of labour migration in the south and east follows in a long historiographical tradition of focusing squarely on London and northern cities as migrant destinations, dating to Ravenstein’s ‘The laws of migration’ and E.H. Hunt’s conclusion that the southern labour force ‘moved overwhelmingly in one direction – towards London’.²⁰ This article finds that Reading—a southern urban area—was, in numerical and human capital terms, a significant net recipient of migration, and is there-

14 Corley, *Huntley & Palmers*, p. 98.

15 S. Yeo, *Religion and Voluntary Organisations in Crisis* (London, 1976), pp. 125–6.

16 A. Westgarth (ed.), *Routes to Reading: Stories of Immigration*, (Reading, 2006), p. 7.

17 E. Grice, ‘Reading: a Babel of dialects’, *The Daily Telegraph*, 10 February 2010 <https://www.telegraph.co.uk/education/7199249/Reading-a-Babel-of-dialects.html> [accessed 15 December 2017].

18 C. Bailey, ‘I’d heard it was such a grand place: mid-19th century internal migration to London’, *Family and Community History*, 14 (2011), pp. 121–40.

19 S. Pollard, ‘Sheffield and Sweet Auburn – amenities and living standards in the British industrial revolution: a comment’, *Journal of Economic History*, 41(1981), pp. 902–4, here at p. 902.

20 G. Boyer, ‘Labour migration in southern and eastern England, 1861–1901’, *European Review of Economic History*, 1 (1997), pp. 191–215; E.G. Ravenstein, ‘The laws of migration’, *Journal of the Statistical Society of London*, 48 (1885), pp. 167–235, here at pp. 205–6, cited in Boyer, ‘Labour migration’, p. 193; E.H. Hunt, *Regional Wage Variations in Britain 1850–1914* (Oxford, 1973), pp. 281–2, cited in Boyer, ‘Labour migration’, pp. 193–4.

fore as valid a subject for critical evaluation of the impact of migration as London and the northern cities.

This article will take steps towards filling these scholarly gaps. It will offer an original local perspective on the general topic of Victorian labour migration and provide fresh insight into a critical part of Reading's history.

Human capital theory

Human capital is defined as the sum of all knowledge, skills and abilities that determine an individual's labour productivity.²¹ Put simply, it is the worth of people as economic assets. Just as fixed capital—land, plant or machinery—can be ascribed a relevant value, so can a person on the basis of their expected contribution to economic output. There are two principal methods for making this valuation.²² First, the *retrospective method* calculates expenditure incurred on education up to the point of valuation. For example, if calculating the capital value of a nine-year-old boy, it would be necessary to sum up all expenditure incurred on that boy's education up to that point. If (as in an aggregated study) the calculation is of an *average* nine-year-old boy's capital value, some form of estimation or aggregation of education costs would be necessary. Second, there is the *prospective method*. For the same child, this method involves calculating the total wages that the nine-year-old could expect to receive over the rest of his life. The fundamental difference is that the first method looks at *input* costs, whereas the second considers expected *output* of the person in question.

Jeffrey Williamson draws on elements of both methods in his study of British urban migration in the Industrial Revolution.²³ However, in his specific calculation of the human capital value of child migration to urban Britain, he employs the retrospective method to calculate the saved input rearing costs for cities of drawing in children. There is one important difference in his method from that set out by Greasley and colleagues.²⁴ Education and skill-formation costs are, for reasons of simplicity, disregarded; instead, Williamson uses the commodity and consumption costs involved in rearing a child.²⁵ Essentially, he is calculating the cost saving to urban areas of children introduced from rural areas being, fed, clothed and reared elsewhere. Williamson justifies this on the basis that the commodity and consumption costs involved in rearing a child are more significant than the costs of education. However, the difficulty in settling on a clear measure of costs—his and Greasley *et al.*'s choices are mutually exclusive—do call the reliability of the retrospective method into

21 'Human capital', in J. Black, N. Hashimzade and G. Myles (eds), *Oxford Dictionary of Economics* 5th edn (Oxford, 2017) <https://www.oxfordreference.com/view/10.1093/acref/9780198759430.001.0001/acref-9780198759430-e-1467?rskey=pMsu8n&result=1564> [accessed 2 November 2019].

22 D. Greasley, N. Hanley, J. Kunnas, E. McLaughlin, L. Oxley and P. Warde, 'Human capital in Britain, 1760-2009', paper presented at the Annual Conference of the Economic History Society, York, 2013.

23 J. Williamson, *Coping with City Growth during the British Industrial Revolution* (Cambridge, 1990).

24 Greasley *et al.*, 'Human capital in Britain'.

25 Williamson, *Coping with City Growth*, p. 60.

question. Moreover, Williamson's calculations (notwithstanding his rigour and original employment of source data) possess one fundamental limitation. An analysis of saved rearing costs of migrants can only be fully relevant when considering, as he does, the value of child migrants (or, at most, childhood rearing costs for all migrants). Consider the lifetime consumption costs incurred thus far by two migrants, aged one year and ninety years respectively. Patently, the latter's past costs are colossal in comparison with the former (and so the retrospective method would value them far more highly). Yet the chances of the average ninety-year-old offering any kind of net economic output in the future are very remote (such a person would, almost certainly, be a net commodity consumer) whereas a one-year-old—despite some commodity costs to come has potentially a lifetime's productive work ahead of him or her.

This study therefore prefers the prospective method, to complete the gaps left by Williamson's calculations and to give a fuller economic valuation of migration to Reading. It employs a formula outlined by Burton Weisbrod, which aims to calculate the expected capital value of a person as the sum of his or her economic output, less consumption costs, from any given age for the rest of his or her life.²⁶ In a simplified example, if a man has an expected steady annual output of £30 and consumption of £20, the starting point is to add up the difference of £10 net output (or 'productivity', as Weisbrod terms it) per remaining year of his life. However, this must be adjusted for two key factors. First, there is no guarantee he will live for any particular number of years: for each future year, the chances of surviving must be taken into account. Supposing the chance of surviving from the current year to the next is 95 per cent: the man's net output of £10 per year becomes £9.50 for year two, which is 95 per cent of the expected net output if he does survive. If the chance of surviving a further year is 94 per cent, the net output to add from year three is £8.93, being the starting figure of £10, times a 95 per cent survival rate into year two and a 94 per cent survival rate into year three (the two survival rates must be compounded as, from the starting point of year one, the chance of surviving into year three necessarily depends on surviving into year two).

A further adjustment must be made for a future rate of discount. The rate of discount (or 'discount factor') is the standard accounting method of recognising the lower value of an asset in the future. Put simply, if you are offered £100 today or £100 in a year, it is nearly always better to accept the cash today, due to inflation, the earlier ability to use the cash and the possibility that, if you wait, you might die before receiving the money.²⁷ The rate of discount quantifies the impact of this timing difference by reducing the value of future net output. As with survival rates, the rate is compounded and the impact will increase progressively for years furthest into the future.

26 B. Weisbrod, 'The valuation of human capital', *Journal of Political Economy*, 69 (1961), pp. 425-36.

27 'Discount factor (present-value factor)', in J. Law (ed.), *Oxford Dictionary of Accounting*, 5th edn (Oxford, 2016) <https://www.oxfordreference.com/view/10.1093/acref/9780198743514.001.0001/acref-9780198743514-e-1187?rskey=6PXvc8&result=1291> [accessed 1 November 2019].

This calculation is represented by Weisbrod in the following equation:

$$V_a = \sum_{n=a}^{\infty} \left(Y_n P_a^n \frac{1}{(1+r)^{n-a}} \right)$$

‘where Y_n = value of productivity of a person at age n ; P_a^n = the probability of a person of age a being alive at age n ; and r = the rate of discount.’²⁸ In this equation, V_a is the total human capital value of a person aged a .

Output (and hence productivity) here is measured using wages, which is a notable simplification. While pure labour market theory might contend that this is fair—companies and workers may be expected, in free negotiation, to fall in natural equilibrium to the market level of wages as a fair reflection of a worker’s economic output—another commentator might argue that employers were more likely to exploit the imbalance of power and labour market inefficiencies to pay less than the true worth of labour. Nonetheless, wages are at least a consistent and statistically independent measure of the cost to business of the productive input provided by workers and do, in that respect, represent an actual cost to Reading’s economy of economic production. Therefore, in the absence of a more accurate measure, this study follows Weisbrod in using wages as a measure of human productivity.

This points to another, more theoretical, gap in Weisbrod’s equation. It fails to take account of two crucial economic externalities of migration: the value of entrepreneurship from wealthier migrants and the worth of (mainly female) unpaid domestic work in the home.²⁹ The first point is especially relevant for Reading, as the town does seem to have acted as a magnet for families with money to invest and heads for business. The founding members of six of Reading’s most successful nineteenth century industrial firms came from families that migrated into Reading from surrounding counties.³⁰ However, Tony Corley has already written at great length on these families and the entrepreneurial foundation of all these businesses. Therefore, an evaluation of the worth of this kind of migration would add little to understanding of migration’s economic impact on Reading. Instead, the conclusions of this article may be read in conjunction with Corley’s works to fully appreciate migration’s economic value to the town. The second gap, in the quantification of female labour, is harder to justify on this basis. There have been no studies on the value or general experience of female migrants to Reading in the nineteenth century. However, while it may be possible to compile estimates of the value of unpaid domestic labour, there is a certain logic to not doing so. Domestic work can be classed as cost-free rearing and consumption services for workers. If the value of this is quantified and included as a posi-

28 Weisbrod, ‘Valuation of human capital’, p. 427.

29 This is, of course, different from the productive output of paid females working as domestic servants which should be captured by Weisbrod’s equation.

30 T.A.B. Corley, ‘Reading’s nineteenth century industrial families: an enquiry’, *Berkshire Family History*, 5 (1982), pp. 93–102. Here at p. 102.

tive economic benefit of migration when performed by migrants, it must also be recognised as a cost to the recipient worker as well, increasing the worker's rearing costs and thus balancing out in the human capital equation. Theoretically, if a migrant woman marries a native man and provides him with domestic services worth £100 in her lifetime, this could be considered an economic benefit to Reading of £100, as a 'worker' from outside the town has moved in to take on these responsibilities. However, the opposite would also be true if a migrant man marries a native woman. He is producing, other things being equal, an equal £100 drain on Reading's human capital resources by taking native domestic labour for his benefit. Therefore, this can be said to just even itself out: the gap between male and female migration is not high enough to justify a detailed adjustment, which would in any case be highly theoretical based on an approximate valuation of female domestic labour at different ages.

Finally, the calculations in this article work specifically with the value of *net* migration to Reading; the difference between inward migration to the town and outward migration away from it. Gross migration must have been extremely significant; the competitive drawing power of London observed by Boyer meant Reading needed to draw a high *gross* number of migrants to have a positive level of net in-migration.³¹ Nonetheless, this article is focused on the value of migration in the round. Without the overall process of migration, Reading would have been left with a static, naturally reproducing population, increasing only by any excess of births over deaths. Net migration allows analysis of the results of migration as an overall phenomenon and therefore is preferred for this study.

The following sections outline in turn the inputs used for the human capital valuation.

Calculation of migration

The first step is to quantify net migration to Reading across the relevant period. This can be calculated using the demographic accounting equation. This method, which is well-founded in quantitative studies of migration, involves taking the total population of a settlement in a census year, adding births and subtracting deaths for the next decade using supplementary data such as the Registrar General's records or birth and death rates, to give an estimated population assuming no migration for the next census year.³² The difference between the estimated population in the second census year and the actual population in that year, other things being equal, represents total net inward migration. For this study, birth and death figures were transcribed directly from the Registrar-General's *Annual Reports*.³³

31 Boyer, 'Labour Migration'.

32 For an application of this approach to nineteenth century England see R. Lawton, 'Population changes in England and Wales in the later nineteenth century: analysis of trends by registration districts', *Transactions of the Institute of British Geographers*, 44 (1968), pp. 55–74; the method is described in A. Hinde, 'The components of population change', *Local Population Studies*, 76 (2006), pp. 90–6.

33 The *Annual Reports* of the Registrar General are available through *Histpop - Online Historical Population Reports* [http://www.histpop.org/ohpr/servlet/Browse?path=Browse/Registrar%20General%20\(by%20date\)&active=yes&treestate=contract&titlepos=0](http://www.histpop.org/ohpr/servlet/Browse?path=Browse/Registrar%20General%20(by%20date)&active=yes&treestate=contract&titlepos=0) [accessed 2 November 2019]. To guard against transcription errors, male, female and total figures were all transcribed separately; a check was then made that male plus female totals for each year equalled exactly the 'total' figures transcribed separately.

Of the two main data sources used, the census population data are reliable for Reading from 1851–1871 as there was no change to the Reading Registration District’s boundaries in this period.³⁴ While, as Edward Higgs observes, the census presents many individual problems of accuracy and interpretation, the sheer numerical scale of aggregated data averages out many individual flaws in its composition.³⁵ Moreover, the censuses of 1851–1901 have in common a distinct consistency of transcription and question topics, making them especially appropriate for comparative analysis. The 1851 census, for instance, was the first to ask for information on birthplace, marital condition and the exact ages of all individuals and also the first to follow a consistent administrative pattern, centrally controlled by the Government Record Office under the supervision of the Home Office until 1871.³⁶

Registration districts represent ideal administrative areas for calculations of births and deaths, given that Registrar General’s data contain aggregated statistics for exactly these areas. Bernard Deacon and Andrew Hinde, in the absence of more specific data, use registration district birth and death rates to quantify migration levels in smaller geographic areas contained within these districts. This presents the possibility of inaccuracies due to variation and anomalies between different areas within the registration district, which is avoided here.³⁷ However, the Registrar General’s data present two other specific challenges. First, there was a likely undercount of births prior to the Registration Act of 1874.³⁸ Williamson adjusts his natural increase for a quantification of the undercount, as calculated by E.A. Wrigley and R.S. Schofield.³⁹ However, while he applies the national Wrigley and Schofield adjustment rate uniformly (which he acknowledges as a weakness in his analysis), the figures for Reading in this study are adjusted for the more localised rates calculated later by Michael Teitelbaum, who provides birth undercount adjustment rates for each county by decade.⁴⁰ Those used here are 1.039 for 1851–1860, 1.008 for 1861–1870, and 1.018 for 1871–1880. These are the rates for the registration county of Berkshire, which incorporated the Reading Registration District; this is therefore not a perfect adjustment, but likely to be more accurate than either the national adjustment rate or unadjusted figures.

The second challenge is a timing discrepancy. Censuses took place part way through the year, on 30 March 1851, 7 April 1861 and 2 April 1871 whereas, up to 1890, the Registrar General’s births and deaths data were recorded by calendar year, not inter-censal periods.⁴¹ For this study, as deaths data were published for a ten year period and the discrepancy between this and the inter-censal period is only around three months either side, this should

34 Alexander, Borough Government, p. 8.

35 E. Higgs, *Making Sense of the Census* (London, 1989), pp. 49–97.

36 Higgs, *Making Sense*, pp. x, 15, 19.

37 B. Deacon, ‘Reconstructing a regional migration system: net migration in Cornwall’, *Local Population Studies*, 78 (2007), pp. 28–46; Hinde, ‘Components of population change’.

38 Williamson, *Coping with City Growth*, p. 54.

39 Williamson, *Coping with City Growth*, p. 12; E.A. Wrigley and R.S. Schofield, *The Population History of England, 1541–1871: a Reconstruction* (London, 1981), p. 636, cited in Williamson, *Coping with City Growth*, p. 12.

40 Williamson, *Coping with City Growth*, p. 54; M.S Teitelbaum, *The British Fertility Decline: Demographic Transition in the Crucible of the Industrial Revolution* (Princeton, NJ, 1984), p. 64.

41 Higgs, *Making Sense*, p. 105.

make little difference and no adjustment has been made; however, as births are analysed year by year, a time-apportionment of births, between pre- and post-census dates, was applied.

Migration must be further broken down by sex and age group. As noted above, age is crucial to calculating an individual's future output and consumption potential. Sex is also fundamental to assessing an individual's economic output during this time, due to the far higher employment and earning rates of men than women.⁴² Breaking migration down by sex presents no particular problems: both the census and the Registrar General's *Annual Reports* for this period split the input data by males and females, so all the following calculations can be carried out separately for each sex. However, age presents several particular difficulties which warrant detailed consideration.

The aggregated census returns do not give the exact age of each particular individual in Reading; they give the population broken down by age brackets. Given that this study is attempting an approximate calculation of an aggregated human capital value (and an exact figure would be theoretically and technically impossible), calculation of migration by age groups is an acceptable approximation. However, it is not sufficient crudely to apply the demographic accounting equation to each age band individually. Consider a girl who died between 1851 and 1861 and who was in the age group 5–9 years when she died. Had she not died, then at the time of the 1861 census, depending on her date of birth, she might have appeared in one of three different age groups: 5–9 years, 10–14 years or 15–19 years. Therefore, subtracting this death from the 5–9 year age group at the subsequent census is quite likely to be wrong. For most age groups, this is not a particular problem, as death rates in Reading did not usually vary greatly between adjacent age brackets. It can simply be assumed that the population and deaths are spread evenly within each of the brackets, with each person being of the median age for each year, and the population can be aged accordingly. However, this does not work for the very young and the very old, due to high infant and old age mortality rates. Put simply, if 50 people aged 75–84 years are alive in 1861, it is clear that both a higher proportion will be at the lower end of that age group and that the death rate will be higher at the upper end of the age group. Likewise for young children in the age group 0–4 years, far more deaths occur in the first year of life than in subsequent years.⁴³ Therefore, a simple age-proportionate allocation of deaths for the very young and very old yields incorrect results. This study deals with this problem in two ways. For the elderly, it is assumed that migrants arriving after age 75 years are no longer economically productive and they are discounted from the calculations. This may slightly overstate the final figures as the consumption costs of those aged over 75 years are not taken into account. The numbers involved, however, are so small as to be quite insignificant in an

42 J. Humphries and J. Weisdorf, 'The wages of women in England, 1260–1850', *Journal of Economic History*, 75 (2015), pp. 405–47.

43 Great Britain Historical Geographical Information System, 'Decennial cause of death by age for under 5s, PLU/RegD', in *A Vision of Britain Through Time* <http://www.visionofbritain.org.uk/unit/10174764/theme/VITAL> [accessed 19 December 2018].

aggregated result (and the impact is offset by the assumption, for simplicity's sake, that children did not become economically productive until the age of 15 years). For those aged under 5 years, it is fortunate (and unique for this age bracket) that deaths data are available in the Registrar General's *Annual Reports* for each separate year of life. Therefore, a more precise allocation of deaths and population movement within this age group is possible.

A similar (but simpler) issue occurs for births. Two babies, born in 1851 and 1860 respectively, will both appear in the 1861 census; however, they will be of very different ages and therefore should appear in different age brackets in the estimated 1861 (CY2) population. In this study, therefore, babies born between censuses have been aged more accurately, based on the actual number of births each year in the Registrar General's *Annual Reports*, when computing the estimated CY2 population figures.

In the light of these challenges, the method for ageing the population from census to censuses was as follows. Deaths for each age were allocated assuming an even proportion of deaths across the entire inter-censal period and that each person was of the median age for their year. For example, for deaths of girls aged four years last birthday between 1851 and 1861, it was assumed that one in twenty deaths represented girls aged between four and a half and five years dying in the final six months (therefore representing those who would have been aged under five years at the 1861 census). Next, on the basis that more deaths were likely to have occurred later in the period, when the population was higher, the total deaths allocated to each age were given a weighting based on the estimated population of that age bracket at the time, assuming even population change between the censuses (infant mortality rates, which might also have caused significant variations in deaths across the period, barely changed between 1851 and 1871 so were not weighted for).⁴⁴ A worked example of this weighting process is given at step (iii) in Figure 2. The weighted aged total deaths were then deducted from the sum of total births allocated to that age bracket and the population of the age bracket(s) ten years younger in the previous census year to give the estimated population.

The worked example in Tables 1 and 2 shows how net female migration was calculated for the age group 0–4 years between 1851 and 1861, bringing together all the steps set out above. Figure 3 shows the final figures for net inter-censal migration to Reading for each age band, by gender, up to age 74 years.

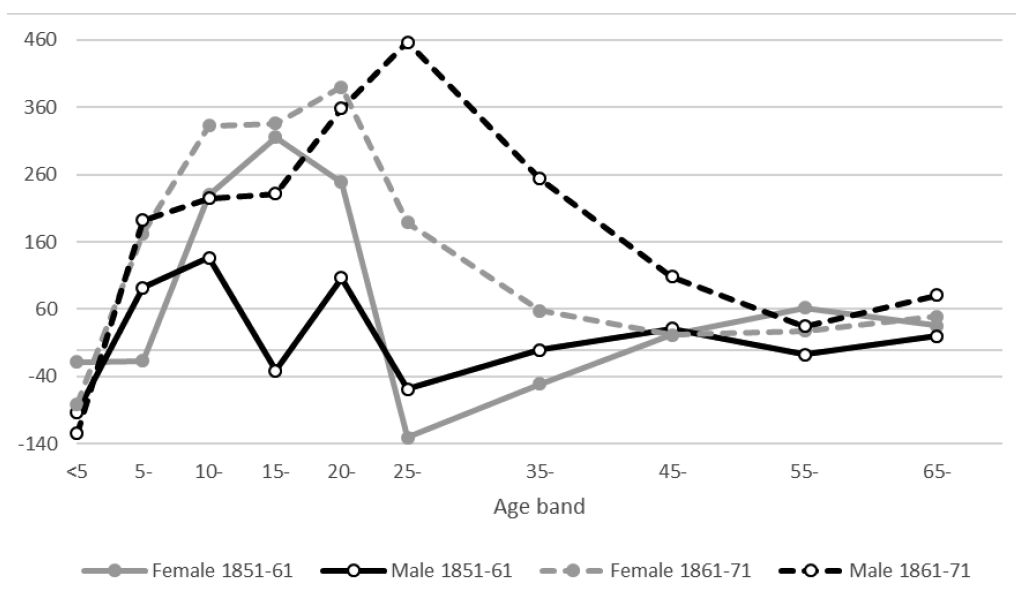
The results are consistent with Williamson's findings that that most urban migrants in Victorian England were young adults, though Reading also seems to have received a fair number of child migrants aged over five years as well.⁴⁵ Also notable are the striking increase in net male migration between the two decades and the higher age at which male migration peaked, compared with female, suggesting that women may, on average, have migrated to Reading at a younger age than men. These observations, based as they are on net migration figures, are equally dependent on emigration patterns and any conclusions

44 Cambridge Group for the History of Population and Social Structure, *Populations Past – Atlas of Victorian and Edwardian Population*, <https://www.populationspast.org/imr/1871/#9/51.4848/-0.7361> [accessed 16 October 2019].

45 Williamson, *Coping with City Growth*, pp. 39–51.

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Figure 2 Net inter-censal migration to Reading by age group and sex, 1851–1871



Note: The horizontal axis is linear in age, but some totals represent five-year age groups and some ten-year age groups, depending on the available population data. This means that migration levels look twice as high, relatively speaking, for ten-year age groups than five-year age groups

can only be tentative on this evidence alone. Nonetheless, the results do correlate with Williamson’s national conclusions that, in the 1850s, ‘females in their teens and early twenties were much more likely to emigrate from rural England than males’, along with direct evidence from Andrew Hinde’s reconstitution analysis of sex- and age-related migration patterns in the rural Wiltshire village of Berwick St James between 1841 and 1871.⁴⁶

To give estimated migration figures for each individual year of life, the totals were divided equally for each yearly age bracket. For example, of the 390 1861–1871 female migrants aged 20–24 years, it is assumed that one fifth, or 78, arrived when they were aged 20 years last birthday (and another fifth were aged 21 years last birthday, and so on).

Wages

The next stage was to calculate the gross wage of an average man and average woman in Reading for each year of life. Williamson uses an urban subsample of census data to estimate male and female age-related urban wages in 1851.⁴⁷ The overwhelming benefit of Williamson’s approach is that he separates out earnings for urban migrants, assessing the

46 Williamson, *Coping with City Growth*, p. 71; A. Hinde, ‘The population of a Wiltshire village in the nineteenth century: a reconstitution study of Berwick St James, 1841–71’, *Annals of Human Biology*, 14 (1987), pp. 481–2.

47 Williamson, *Coping with City Growth*, p. 115.

Table 1 Migration worked example: females aged 0–4 years, 1851–1861

Summary calculation		Notes
1851 census population	0	None of those aged 0–4 years in 1861 were born in 1851
1861 census population aged 0–4 years estimated from survivors of births in period 1851–1861	1,965	See calculation below
Deaths before 1861 of those born 1851–1861 who would have been aged 0–4 years in 1861	314	See Table 2.
Estimated number of survivors aged 0–4 years in 1861	1,651	Equal to 1,965 – 314
Actual census population in 1861 aged 0–4 years	1,632	Taken from 1861 census
Net inward migration among cohort aged 0–4 years in 1861	–19	Equal to actual population minus expected population, hence 1,632 – 1,651
<hr/> Calculation of births <hr/>		
Births in 1856 that would have been aged under 5 years exact on date of 1861 census (i.e. births between 7 April and 31 December 1856)	293	Taken from Registrar General's <i>Annual Report</i> but excluding those estimated to have been born before 7 April 1856 (who would be aged more than 5 years exact in 1861). Adjusted for potential undercount.
Births in years 1857 to 1860	1,560	Taken directly from Registrar General's <i>Annual Reports</i> . Adjusted for potential undercount.
Births in period 1 January – 7 April 1861	112	Taken from Registrar General's <i>Annual Report</i> but excluding those estimated to have been born after 7 April 1861. Adjusted for potential undercount.
Total estimated births in five years before 1861 census	1,965	

occupations that this demographic group tended to occupy and applying wage data for each industry accordingly. However, this sample is relevant for Reading only inasmuch as it covers urban areas only. It does not directly reflect local labour market conditions. Nonetheless, it is possible to test how far Reading wage rates may have varied from these averages using comparative data on wage rates in major urban centres, collated by the Board of Trade Labour Department.⁴⁸ These statistics were gathered by trade unions, mainly in

⁴⁸ D.R. Gilbert, I. Gregory and H.R. Southall, *Great Britain Historical Database: Labour Markets Database, Statistics of Wages and Hours of Work, 1845–1913* [data collection] Colchester, England, UK Data Archive [distributor], 1999. SN 3710 <https://discover.ukdataservice.ac.uk/catalogue?sn=3710> [accessed 17 August 2018].

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Table 2 Calculation of deaths to females who would have been aged 0–4 years in 1861

Age bracket	Total number of deaths between 1851 and 1861 in age bracket	Estimated deaths among those who would have been aged 0–4 years in 1861, had they survived
Under 1 year	441	210.6
1 year	160	60.0
2 years	110	29.8
3 years	65	10.7
4 years	47	2.6
Total		313.7

Note: The details of the calculations may be illustrated using the age bracket 4 years. There were 47 deaths to persons in this age bracket. However only half of those who died in the last year before the 1861 census could have been aged under 5 years exact in 1861. Assuming deaths to those in this age bracket are evenly distributed across the intercensal period this produces an estimate of $47/20 = 2.35$ deaths. But the population of those aged under 5 years was increasing during the decade 1851 to 1861 so, assuming constant age-specific death rates, the actual number of deaths in the last year of the decade to those in the age bracket 4 years would have been more than 2.35. The population aged 0–4 years between 1851 and 1861 increased from 1,307 to 1,632, which equates to an increase of 1.12 per cent every six months. This implies that the population aged 0–4 years in the middle of the last year before the 1861 census was 1.106 times the average population aged 0–4 years in the decade 1851–1861. Multiplying the estimated number of deaths assuming a constant population (2.35) by 1.106 gives a final estimate of 2.60. Similar calculations may be used for the other age brackets.

artisan trades, for the Department’s unpublished report on *Rates of Wages and Hours of Labour in Various Industries in the United Kingdom for a Series of Years*.⁴⁹ They show standard weekly trade union wage rates for 24 occupations in 87 towns from 1845 to 1906: any union member earning less than these levels was entitled to request the difference from their union. These data are not, of course, intended to be accurate reflections of actual average wage rates as experienced by the population as a whole. Unlike Williamson’s data, which is based on a stratified urban sample, these wage rates do not offer any weighting for the importance of each profession in the local labour market (nor for the potential local strength of unions). Nonetheless, these standard wage rates specifically allow comparison between expectations in local urban labour markets and entitlements for those in need, suggesting they reflect with some accuracy local market wage rates and subsistence costs. This makes them very useful for comparison and honing the sampled wage data collected by Williamson.

Reading first appears in the Board of Trade data in 1864. However, the town is only represented by one profession (compositors) until 1871. In 1871, there are five professions—compositors, fitters, patternmakers, smiths and turners—along with 99 sets of

⁴⁹ See Great Britain Historical Geographical Information System, ‘Weekly wages rates for selected occupations (pence), Reading LabMkt’, in *A Vision of Britain Through Time* http://www.visionofbritain.org.uk/unit/12828639/cube/WEEKLY_WAGES [accessed 19 December 2018].

comparative weekly wage rates for these professions across England and Wales. This year is therefore the base for comparison of Williamson’s wage data for Reading, as it offers the largest comparison pool within the time frame of this study.

It was also necessary to weight the comparative wage data by local populations from the 1871 census, to prevent anomalously high or low wages in relatively small urban areas skewing the comparison. The following equation is used to weight weekly wage to population, by urban area and profession:

$$\textit{Weighting of weekly wage to population} = x \frac{a}{b}$$

where x = weekly wage in pence of the urban area for that profession, a = population of the urban area, and b = population of all urban areas for that profession. This produces the weighted average wages for each profession shown in Table 3.

Table 3 also shows Reading’s wage figures for each profession as a percentage of this weighted average. Wage rates for each profession were notably lower than the national weighted averages, with a strong consistency in the difference. Apart from composers, the gaps vary by less than two percentage points. This concurs with Corley’s separate findings from a slightly later period that most workers in Reading in the late Victorian times were poorly paid compared with workers in other urban areas. It should of course be remembered that Reading, being surrounded by areas with high numbers of unskilled and agricultural labourers, may still have represented an attractive regional option for employment.⁵⁰ Given that these wage rates were the expected minimum acceptable pay (and not reflective of actual wages) there is no particular need to weight the results further for the actual number of people employed in each profession in Reading. A simple mean of all figures can be taken, to give a reasonable guide for Reading wages as 82.18 per cent of those of urban areas as a whole in England and Wales. This figure is used to adjust wage rates down from Williamson’s national urban worker wage rates. The adjustment is allocated both to

Table 3 Reading wages as a proportion of weighted averages of wage rates in other urban areas

Profession	Average wage, weighted for population (pence per week)	Reading wage (pence per week)	Reading as percentage of weighted average
Compositors	380.19	288	75.75
Fitters	399.03	336	84.20
Patternmakers	428.63	360	83.99
Smiths	406.29	336	82.70
Turners	398.84	336	84.24
<i>Overall</i>			82.18

⁵⁰ T.A.B. Corley, ‘Eighteenth century and Victorian times’ in M. Petyt (ed.) *The Growth of Reading* (Stroud, 1993), pp. 83–107, Here at p. 105.

male and female wages; while unfortunately the union standard wage rates deal exclusively with male-dominated professions, it is still reasonable, given the uniformity in the results across all professions and that the data based on expected minimum wages reflect local subsistence costs (and not necessarily actual wages), to consider this adjustment indicative of general wage trends and expectations in Reading.

Consumption

In assessing age-related consumption costs, Williamson uses, as his base, W.A. Mackenzie's assessment of household budgets in 1860.⁵¹ He draws from this a full adult male annual consumption cost and then applies this to different ages using data from other studies on age-related consumption costs. To illustrate: if a man aged 20 years has a maximum annual consumption cost of £10, while a female aged nine years has a relative consumption cost ratio of 0.4, called her *adult male consumption equivalent* (AMCE), her annual consumption cost will be £4.

As Williamson concedes, a full review of rearing costs should also include training and education costs. However, he sees these costs as unimportant due to the largely unskilled nature of migrants in the mid nineteenth century.⁵² Although there was no mandatory national provision of schooling, formal education—when it did occur—represented a sizeable investment. David Mitch estimates that the commonly-paid private subsidies for children attending school in the early and mid nineteenth century could typically amount to 5–7 per cent of an adult male head of household's income.⁵³ Combined with this, David Cressy's study of literacy based on the ability to sign the marriage register suggests a vast increase in literacy rates from 1850 onwards.⁵⁴ Together, these estimates may challenge Williamson's assumptions of education and training being immaterial costs in human capital. However, given that this study uses wages as the simplest, most effective and important measure of human capital output, Williamson's similarly streamlined approach will be followed to human capital costs by only considering commodity costs.

Williamson reproduces the results of two studies calculating AMCEs, each with different results. He expresses no preference for using either measure over the other in his calculations, nor does he make any qualitative comparison between the two. Instead, he cites one

51 W.A. Mackenzie, 'Changes in the standard of living in the United Kingdom, 1860-1914', *Economica*, 1 (1921), pp. 211–30.

52 Williamson, *Coping with City Growth*, p. 60.

53 D. Mitch, 'Education and skill of the British labour force', in P. Johnson and R. Floud (eds), *The Cambridge Economic History of Modern Britain* (Cambridge, 2004), pp. 332–56, here at p. 351. There is local evidence that Dame and Sunday schools may also have been instrumental in raising literacy levels (for example, R. Crone, 'Educating the labouring poor in nineteenth-century Suffolk', *Social History*, 43 (2018), pp. 161–85; and B. Duffy, 'The progress of education in the northern coalfield before 1870', *Northern History*, 55 (2018), pp. 178–205). However, Mitch's national findings strongly dispute this; D. Mitch, 'The impact of subsidies to elementary schooling on enrolment rates in nineteenth-century England', *Economic History Review*, 2nd series, 39 (1986), pp. 371–91, here at pp. 380–1.

54 D. Cressy, *Literacy and the Social Order: Reading and Writing in Tudor and Stuart England* (Cambridge, 2008), p. 177, cited in Mitch, 'Education and skill', p. 344.

as representing the upper bound of this measure and the other as representing the lower bound. This lack of evaluation is surprising, given how divergent each study's results are (for example, infants aged under one year old have an ACME of 0.350 in one study, compared with 0.220 in the other). An independent choice must therefore be made for this article. The first study cited by Williamson is Prais's and Houthakker's review of family food expenditure costs, the second Sydenstricker's and King's analysis of 140 family budgets from twenty cotton mill villages in South Carolina in 1917.⁵⁵ The former only considers food costs, whereas the latter analyses actual costs incurred out of family budgets on family-members of different ages. Sydenstricker's and King's study has some limitations: its evidence base is quite removed, in space and time, from the period of this article (and, indeed, of Williamson's study). It is also potentially subject to local bias, given the small and closely concentrated sample. Nonetheless, this allocation of costs is preferable to Prais's and Houthakker's as it considers all household expenditure, not just food. In addition, Sydenstricker and King's results show a consistency across income levels, in that *relative* expenditure on food for each family member tends not to change much with income, but just the actual amounts spent.⁵⁶ Therefore, Sydenstricker and King's AMCEs can reasonably be extrapolated across aggregated data. For these reasons, this study uses their results for calculation of relative consumption costs at different ages.

The AMCEs for each age group are applied to Williamson's baseline 1860 adult male consumption cost. Williamson makes a small error in his application. He assigns the maximum consumption value in the Sydenstricker-King scale to a 20-year-old adult male and apportions all other consumption values against this maximum. In fact, a 20-year-old adult male has relative expenditure of 0.976 of the maximum adult male consumption (which occurs at 24 and 25 years old). Therefore, Williamson's figures are all slightly inaccurate and, in this study, have been reworked using the original AMCE scales. The AMCEs and resulting calculated consumption costs are shown, for men and women, in Figures 3 and 4. These consumption costs can then be subtracted from wages to give an approximate net productive value for each year of life.

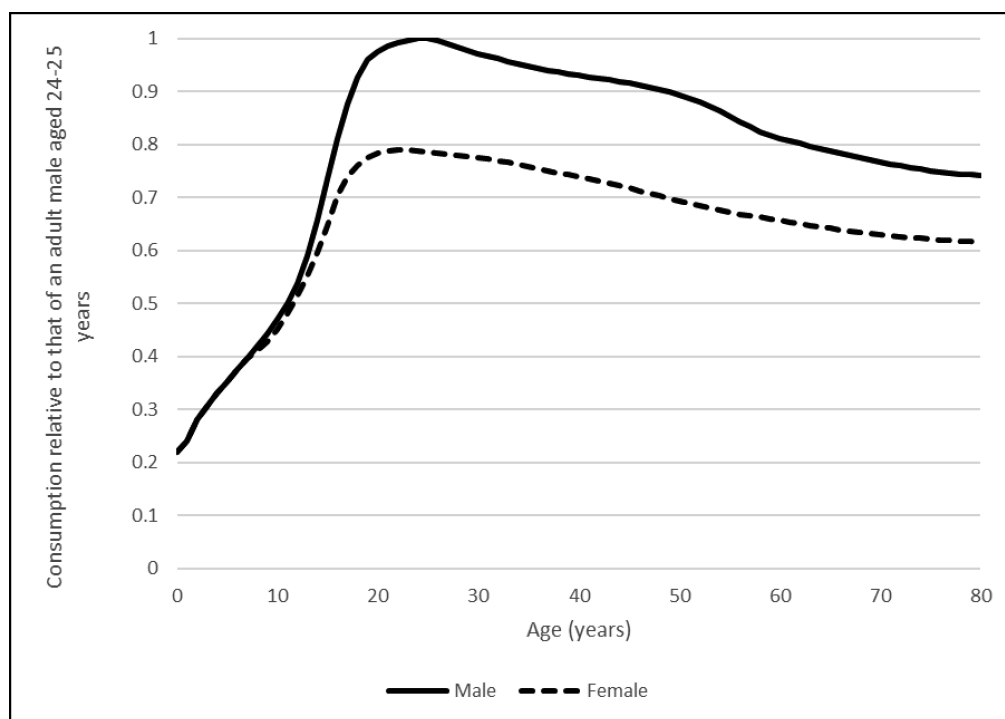
Survival rates

The first step to calculating survival rates in this case is to ascertain the death rates for each age group. For those aged five years and over, these are calculated by dividing the total deaths in Reading for the relevant age group between 1851 and 1861 by the town's mean population for the same age group during that time (that is, the mean of the 1851 and 1861 populations). The result is allocated to each year of life contained within that age group to give a death rate for each year of life. For those aged under five years, high infant mortality rates required a

55 H.S. Houthakker and S.J. Prais, *The Analysis of Family Budgets* (Cambridge, 1955); E. Sydenstricker and W.I. King, 'The classification of the population according to income', *Journal of Political Economy*, 29 (1921), pp. 571–94.

56 Sydenstricker and King, 'Classification of the population', p. 589.

Figure 3 Adult male consumption equivalents by age and sex



Note: The values plotted here are the consumption of males and females of various ages relative to that of an adult male aged 24–25 years.

Sources: Based on W.A. Mackenzie, ‘Changes in the standard of living in the United Kingdom, 1860–1914’, *Economica*, 1 (1921), pp. 211–30; J. Williamson, *Coping with City Growth during the British Industrial Revolution* (Cambridge, 1990); and E. Sydenstricker and W.I. King, ‘The classification of the population according to income’, *Journal of Political Economy*, 29 (1921), pp. 571–94.

different calculation method. This involved, first, dividing the deaths of those aged under one year by total births, then dividing the deaths of those aged one by the number of survivors (that is, total births minus the deaths at age under one year) and so on until age four years.

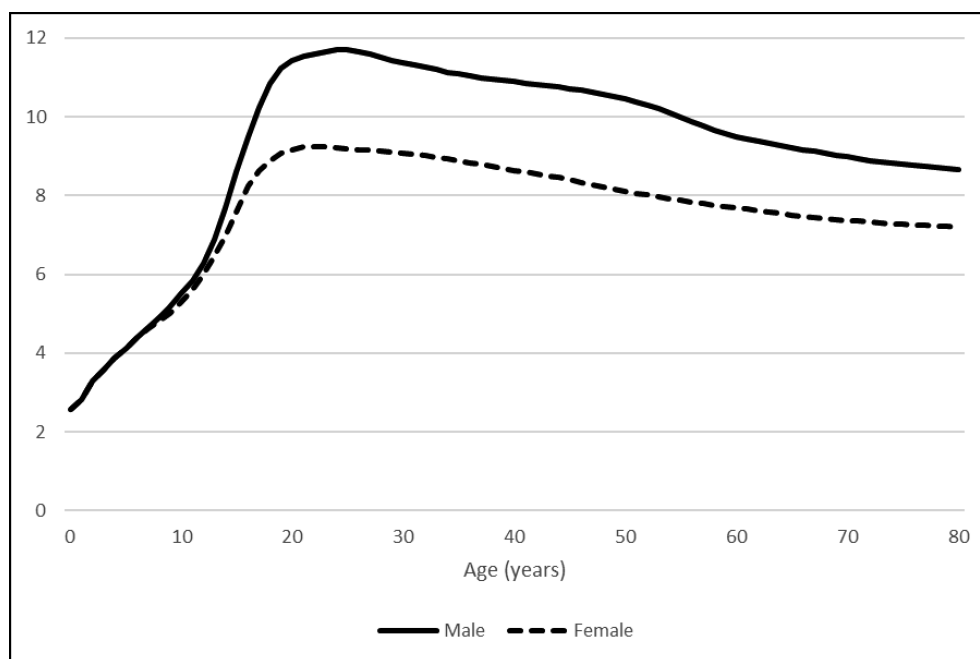
Survival rates are then calculated as the complement of these death rates, since the probability of surviving a year of life is equal to 1 minus the death rate. The results are shown in Tables 4 and 5.

Rate of discount

The basis for the discount rate is highly arbitrary and therefore the most difficult factor to value precisely. Weisbrod makes sound arguments for both 10 per cent and a 4 per cent rate, based on return to private investment capital and long-term borrowing costs respectively.⁵⁷

⁵⁷ Weisbrod, ‘Valuation of human capital’, p. 431.

Figure 4 Actual annual consumption costs (in pounds) by age and sex



Sources: Based on W.A. Mackenzie, 'Changes in the standard of living in the United Kingdom, 1860-1914', *Economica*, 1 (1921), pp. 211-30; J. Williamson, *Coping with City Growth during the British Industrial Revolution* (Cambridge, 1990); and E. Sydenstricker and W.I. King, 'The classification of the population according to income', *Journal of Political Economy*, 29 (1921), pp. 571-94.

Williamson also uses a range of discount rates from 3 to 10 per cent, all with independent justification, settling on 5 per cent, on the basis that this is within a range of plausible investment return rates in British securities and capital.⁵⁸ This study also uses 5 per cent, on the basis that it sits almost exactly on the yield realised on British Securities from 1870 to 1913 cited by Williamson.⁵⁹ Government backed investment yields represent an entirely reasonable expectation of passive capital growth and therefore the amount by which the monetary value of invested cash may have been expected to grow in the late nineteenth century. In addition, this is the rate of discount used by Huntley and Palmers in its balance valuations of fixed capital in the 1850s, 1860s and 1870s, so is particularly relevant in a local context.⁶⁰

58 Williamson, *Coping with City Growth*, pp. 76-7.

59 M. Edelstein, *Overseas Investment in the Age of High Imperialism* (New York, 1982), cited in Williamson, *Coping with City Growth*, p. 77.

60 MERL, HP 160, HP OS 429.

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Table 4 Reading death rates by age group: ages five years and over

Sex		5–9 years	10–14 years	15–19 years	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years	65 years and over
Male	Mean population	1,339	1,160	1,101	1,005	1,674	1,302	949	618	338
	Deaths	109	43	75	104	188	196	226	214	258
	Death rate	0.08	0.04	0.07	0.10	0.11	0.15	0.24	0.35	0.76
	Chance of dying by year of life	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.08
	Survival rate by year of life	0.98	0.99	0.99	0.98	0.98	0.98	0.98	0.97	0.92
Female	Mean population	1,294	1,275	1,347	1,279	2,056	1,551	1,126	804	473
	Deaths	108	64	104	91	197	173	167	241	299
	Death rate	0.08	0.05	0.08	0.07	0.10	0.11	0.15	0.30	0.63
	Chance of dying by year of life	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.03	0.06
	Survival rate by year of life	0.98	0.99	0.98	0.99	0.99	0.99	0.99	0.97	0.94

Sources: *Annual Reports of the Registrar General*, available through *Histpop - Online Historical Population Reports* [http://www.histpop.org/ohpr/servlet/Browse?path=Browse/Registrar%20General%20\(by%20date\)&active=yes&treestate=contract&titlepos=0](http://www.histpop.org/ohpr/servlet/Browse?path=Browse/Registrar%20General%20(by%20date)&active=yes&treestate=contract&titlepos=0) [accessed 2 November 2019].

Results and local social overhead capital

The final calculations, following the parameters set out above, produce an estimated value of net migration to Reading from 1851–1871 of £1,387,838, representing a mean yearly human capital boost of around £69,400 to the town. The value of the net migration of males was £1,135,102.29, and that of females was £252,735.89. See the Appendix Tables A1 and A2 for details of the calculations which led to these totals.

This value of net migration can be set in context against capital amounts raised or authorised to fund significant infrastructure projects affecting Reading around 1850–1870. The Reading, Guildford and Reigate Railway, which opened in 1849, was a significant undertaking for a branch line, underwritten by £800,000 fully paid-up ordinary share capital.⁶¹ Covering approximately 45 miles, it connected the county towns of Berkshire and Surrey (along with a

⁶¹ House of Commons, *Return by each Railway Company of Authorised Share and Loan Capital, Debenture Stock and Funded Debt*. British Parliamentary Papers (hereafter BPP) 1860 LVII [C. 477], p. 28.

Table 5 Reading death rates at ages under five years

Sex		0 years	1 year	2 years	3 years	4 years
Male	Number of births, subtracting deaths in previous years of age	4,048	3,506	3,294	3,199	3,141
	Deaths	542	212	95	58	37
	Chance of dying by year of life	0.13	0.06	0.03	0.02	0.01
	Survival rate by year of life	0.87	0.94	0.97	0.98	0.99
Female	Number of births, subtracting deaths in previous years of age	3,816	3,375	3,215	3,105	3,040
	Deaths	441	160	110	65	47
	Chance of dying by year of life	0.12	0.05	0.03	0.02	0.02
	Survival rate by year of life	0.88	0.95	0.97	0.98	0.98

Sources: *Annual Reports of the Registrar General*, available through *Histpop - Online Historical Population Reports* [http://www.histpop.org/ohpr/servlet/Browse?path=Browse/Registrar%20General%20\(by%20date\)&active=yes&treestate=contract&titlepos=0](http://www.histpop.org/ohpr/servlet/Browse?path=Browse/Registrar%20General%20(by%20date)&active=yes&treestate=contract&titlepos=0) [accessed 2 November 2019].

multitude of smaller intervening settlements) with four significant main lines.⁶² The Berks and Hants Extension Railway, which opened in 1862, was a slightly more modest enterprise. Backed by £298,000 share capital and authorisation to borrow £99,300, it extended the existing Berks and Hants line running from Reading to Hungerford, a further 24 miles to the Wilts, Somerset and Weymouth Railway junction at Devizes.⁶³ It is difficult to allocate a specific proportion of railway investment costs to one particular town, given the considerable geographic areas and multiple settlements each railway covered. Moreover, enumeration of the productive economic benefit of railway investment is an extremely difficult task. Nonetheless, it is clear from analysis of goods receipts from the two railway companies operating services in Reading at this time that they offered a significant service for business and industry (even before the external benefits of passenger receipts, such as business travel and freer movement of people, are considered). Just over a quarter (27 per cent) of the South Eastern railway's £1.2 million receipts for 1863, the first year that their Berks

62 G. Bradshaw, 'Section I', in *Bradshaw's Handbook 1863* (Oxford, 2014), p. 28; 'Reading, Guildford and Reigate Railway', *The Illustrated London News*, 28 August 1847.

63 House of Commons, *Reports of Board of Trade on Railway and Canal Bills*. BPP 1859 XI [C. 71] p. 52.

and Hants extension was in full operation, came from goods traffic; this figure was 43 per cent of the Great Western Railway's receipts in 1862.⁶⁴

The £35,000 starting capital of the Reading Union Water Company represents a more locally appropriate comparison, inasmuch as Reading was intended as the whole and exclusive beneficiary of the project to construct a water supply for the town. It seems clear that the new water works was associated with improvements in the health of Reading's population. While visitors to Reading in the 1840s described the town as 'nothing more than a cesspool' and noted that almost half its households had no water supply, with around 10 per cent using the river Kennet—effectively a public sewer—for their water, some of the diseases and epidemics which contributed to a death rate well in excess of the national average were significantly reduced by the 1860s.⁶⁵ While this does not represent a purely economic benefit (in the sense that the construction had consequences and intentions not simply related to trade, production and industry), J.A. Hassan demonstrates that nineteenth century businesses gained, both directly and indirectly, from the introduction of reliable and clean water municipal supplies; not least from the improved health of workers.⁶⁶ Therefore, the capital encompassed in this project represents a fair—even if not direct—contextual comparison with the human capital value of migration. When defined specifically as the human capital surplus derived from net inbound migration, the economic value of migration to Reading from 1851–1871 can be seen as approximately commensurate with the investment raised for several significant regional infrastructure projects.

Conclusions

The calculations presented in this article estimate the human capital value of migration to Reading in the period 1851–1871 to be approximately £1.39 million. It is important that these figures not be applied literally or taken out of context. As the preceding sections have shown, it is impossible to quantify exactly the inputs for this valuation. Therefore to say that migration literally provided a certain cash benefit is simply nonsensical. Rather, this study has attempted to set out justifiable parameters so that a realistic approximation of the value of net migration in a local area can be quantified within a reliable order of magnitude. While subject to caveats and assumptions, these figures represent the most important step into this enquiry and an original local approach to the historical field of human capital and migration research. The total compares strongly with the social overhead capital raised to fund significant local infrastructure projects in the same time. These results suggest that

64 House of Commons, *Return by Railway Companies in England and Wales, Scotland and Ireland of Traffic in Passengers and Goods, Working Expenditure, Share and Loan Capital, Amalgamation, Sales of Leases and Powers of Purchase 1863*. BPP 1864 LIII [C. 20], pp. 20–1; House of Commons, *Return by Railway Companies in England and Wales, Scotland and Ireland of Traffic in Passengers and Goods, Working Expenditure, Share and Loan Capital, Amalgamation, Sales of Leases and Powers of Purchase 1862*. BPP 1863 LXII [C. 492], pp. 22–3.

65 Alexander, *Borough Government*, pp. 19, 41, 44.

66 J.A. Hassan, 'The growth and impact of the British water industry in the nineteenth century', *Economic History Review*, 2nd series, 38 (1985), pp. 531–47.

migration to Reading in the period 1851–1871 was fundamental to the town’s industrial growth and easily stands comparison with other sources of financial investment and capital when measured in monetary terms.

Various secondary conclusions can also be drawn. On a demographic level, the level of net inward migration to Reading, split by age and sex, has been quantified to show that migrants to Reading were overwhelmingly young, that females probably tended to migrate at a younger age than males and that net male migration rose strikingly between 1851–1861 and 1861–1871. Wage expectations appear to have been markedly lower in Reading across a range of artisan trades than in other British urban areas.

The above conclusions fill significant scholarly gaps in the historiography of Reading in the mid and late nineteenth century, add to popular understanding of the town’s history in this era and support assertions of the importance of migration in this time. Moreover, they challenge a general scholarly attitude towards late Victorian migration in the south of England, suggesting that the prevailing London-centric academic focus misses an important element of migration’s impact on the industry of other urban areas of southern England. Further research into the human capital value of migration to other towns and cities would help reveal whether migration was valuable in relative, as well as absolute, terms to Reading and whether its significance varied in more established industrial towns and cities. In addition, if the limitations of the source data can be overcome, it would be useful to compare the human capital boost from migration from 1851–1871 with that experienced over other time periods to determine whether migration was unique as a catalyst for industrial growth in Reading. Many inputs for these calculations, such as the use of wages to represent all economic output of labour, may also be open to improvement. Nonetheless, the findings here lend the first detailed academic credence to the idea of Reading as ‘a town built on migration’, in respect of the enormous capital boost provided by net migration into the town.

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Appendix

Table A1 Human capital value of net male migration to Reading, 1851–1871

Age	Wages	Wages adjusted for Reading	Survival rate	Consumption	Discount rate	Net productivity for year	Number of migrants	Net productive value of a migrant (£)	Total net productive value of all migrants (£)
0	0	0.00	0.88	2.57	5%	-2.57	-43.49	92.33	-6,132.42
1	0	0.00	0.88	2.82	5%	-2.82	-43.49	114.39	-7,617.56
2	0	0.00	0.88	3.29	5%	-3.29	-43.49	141.22	-8,701.23
3	0	0.00	0.88	3.58	5%	-3.58	-43.49	174.05	-9,615.57
4	0	0.00	0.88	3.88	5%	-3.88	-43.49	214.28	-10,524.52
5	0	0.00	0.98	4.12	5%	-4.12	56.90	263.06	14,966.85
6	0	0.00	0.98	4.39	5%	-4.39	56.90	287.01	16,329.25
7	0	0.00	0.98	4.64	5%	-4.64	56.90	312.91	17,803.13
8	0	0.00	0.98	4.90	5%	-4.90	56.90	340.90	19,395.59
9	0	0.00	0.98	5.17	5%	-5.17	56.90	371.15	21,116.52
10	0	0.00	0.99	5.50	5%	-5.50	72.22	403.79	29,161.45
11	0	0.00	0.99	5.84	5%	-5.84	72.22	435.15	31,426.03
12	0	0.00	0.99	6.28	5%	-6.28	72.22	468.75	33,852.53
13	0	0.00	0.99	6.90	5%	-6.90	72.22	504.84	36,458.81
14	0	0.00	0.99	7.69	5%	-7.69	72.22	543.76	39,269.88
15	50.15	41.21	0.99	8.61	5%	32.60	40.09	585.86	23,487.53
16	50.15	41.21	0.99	9.50	5%	31.71	40.09	591.46	23,711.99
17	50.15	41.21	0.99	10.25	5%	30.96	40.09	598.37	23,989.24
18	50.15	41.21	0.99	10.86	5%	30.35	40.09	606.55	24,316.84
19	50.15	41.21	0.99	11.23	5%	29.98	40.09	615.81	24,688.13
20	68.58	56.36	0.98	11.42	5%	44.94	92.99	626.10	58,214.60
21	68.58	56.36	0.98	11.54	5%	44.82	92.99	625.60	58,167.59
22	68.58	56.36	0.98	11.61	5%	44.75	92.99	625.19	58,129.32
23	68.58	56.36	0.98	11.65	5%	44.70	92.99	624.83	58,095.76
24	68.58	56.36	0.98	11.70	5%	44.66	92.99	624.54	58,067.77
25	68.58	56.36	0.98	11.70	5%	44.66	39.88	624.27	24,891.26
26	68.58	56.36	0.98	11.65	5%	44.70	39.88	625.13	24,925.16

Table A1 continued

Age	Wages	Wages adjusted for Reading	Survival rate	Consumption	Discount rate	Net productivity for year	Number of migrants	Net productive value of a migrant (£)	Total net productive value of all migrants (£)
27	68.58	56.36	0.98	11.58	5%	44.77	39.88	626.01	24,959.97
28	68.58	56.36	0.98	11.51	5%	44.84	39.88	626.89	24,994.78
29	68.58	56.36	0.98	11.44	5%	44.91	39.88	627.90	25,034.78
30	69.07	56.76	0.98	11.37	5%	45.39	39.88	628.91	25,074.83
31	69.07	56.76	0.98	11.31	5%	45.45	39.88	629.49	25,097.64
32	69.07	56.76	0.98	11.31	5%	45.45	39.88	630.05	25,119.66
33	69.07	56.76	0.98	11.20	5%	45.56	39.88	630.66	25,140.86
34	69.07	56.76	0.98	11.14	5%	45.62	39.88	631.27	25,164.58
35	69.07	56.76	0.98	11.09	5%	45.67	25.43	631.86	16,063.60
36	69.07	56.76	0.98	11.04	5%	45.72	25.43	627.71	15,957.11
37	69.07	56.76	0.98	11.00	5%	45.76	25.43	623.19	15,841.82
38	69.07	56.76	0.98	10.96	5%	45.80	25.43	618.31	15,717.11
39	69.07	56.76	0.98	10.93	5%	45.83	25.43	613.21	15,586.96
40	70.88	58.25	0.98	10.89	5%	47.35	25.43	607.70	15,446.29
41	70.88	58.25	0.98	10.86	5%	47.39	25.43	600.17	15,253.98
42	70.88	58.25	0.98	10.82	5%	47.42	25.43	592.05	15,046.91
43	70.88	58.25	0.98	10.79	5%	47.46	25.43	583.31	14,824.05
44	70.88	58.25	0.98	10.75	5%	47.50	25.43	573.69	14,578.66
45	70.88	58.25	0.98	10.72	5%	47.53	13.88	563.36	7,812.73
46	70.88	58.25	0.98	10.67	5%	47.58	13.88	557.22	7,726.97
47	70.88	58.25	0.98	10.62	5%	47.62	13.88	550.54	7,633.67
48	70.88	58.25	0.98	10.58	5%	47.67	13.88	543.27	7,532.23
49	70.88	58.25	0.98	10.52	5%	47.73	13.88	535.84	7,428.38
50	75.26	61.85	0.98	10.46	5%	51.39	13.88	527.68	7,314.49
51	75.26	61.85	0.98	10.39	5%	51.46	13.88	514.87	7,135.94
52	75.26	61.85	0.98	10.30	5%	52.36	13.88	500.92	6,941.42
53	75.26	61.85	0.98	10.21	5%	51.63	13.88	484.84	6,729.56
54	75.26	61.85	0.98	10.11	5%	51.74	13.88	468.21	6,498.86

Table A1 continued

Age	Wages	Wages adjusted for Reading	Survival rate	Consumption	Discount rate	Net productivity for year	Number of migrants	Net productive value of a migrant (£)	Total net productive value of all migrants (£)
55	75.26	61.85	0.97	9.99	5%	51.86	2.76	450.12	1,240.10
56	75.26	61.85	0.97	9.87	5%	51.97	2.76	435.25	1,199.12
57	75.26	61.85	0.97	9.76	5%	52.09	2.76	418.86	1,153.96
58	75.26	61.85	0.97	9.65	5%	52.19	2.76	400.82	1,104.27
59	75.26	61.85	0.97	9.57	5%	52.28	2.76	380.14	1,047.29
60	63.81	52.44	0.97	9.50	5%	42.94	2.76	357.50	984.91
61	63.81	52.44	0.97	9.44	5%	43.00	2.76	342.99	944.95
62	63.81	52.44	0.97	9.38	5%	43.05	2.76	327.11	901.20
63	63.81	52.44	0.97	9.32	5%	43.11	2.76	309.73	853.33
64	63.81	52.44	0.97	9.27	5%	43.17	2.76	290.72	800.94
65	63.81	52.44	0.92	9.22	5%	43.22	10.06	269.93	2,715.69
66	63.81	52.44	0.92	9.17	5%	43.26	10.06	258.39	2,599.66
67	63.81	52.44	0.92	9.13	5%	43.31	10.06	245.19	2,466.87
68	63.81	52.44	0.92	9.08	5%	43.36	10.06	230.10	2,314.99
69	63.81	52.44	0.92	9.03	5%	43.41	10.06	212.84	2,141.34
70	63.81	52.44	0.92	8.99	5%	43.45	10.06	193.11	1,942.88
71	63.81	52.44	0.92	8.94	5%	43.50	10.06	170.58	1,716.16
72	63.81	52.44	0.92	8.89	5%	43.55	10.06	144.84	1,457.21
73	63.81	52.44	0.92	8.86	5%	43.58	10.06	115.45	1,161.53
74	63.81	52.44	0.92	8.82	5%	43.62	10.06	81.91	824.13
Total									1,135,102.29

Table A2 Human capital value of net female migration to Reading, 1851–1871

Age	Wages	Wages adjusted for Reading	Survival rate	Consumption	Discount rate	Net productivity for year	Number of migrants	Net productive value of a migrant (£)	Total net productive value of all migrants (£)
0	0	0.00	0.89	2.57	5%	-2.57	-19.84	4.30	-195.54
1	0	0.00	0.89	2.82	5%	-2.82	-19.84	8.35	-299.25
2	0	0.00	0.89	3.29	5%	-3.29	-19.84	13.47	-398.32
3	0	0.00	0.89	3.58	5%	-3.58	-19.84	20.10	-511.10
4	0	0.00	0.89	3.88	5%	-3.88	-19.84	28.31	-631.03
5	0	0.00	0.98	4.12	5%	-4.12	31.17	38.42	1,197.43
6	0	0.00	0.98	4.39	5%	-4.39	31.17	45.80	1,427.34
7	0	0.00	0.98	4.63	5%	-4.63	31.17	53.98	1,682.46
8	0	0.00	0.98	4.82	5%	-4.82	31.17	63.01	1,963.80
9	0	0.00	0.98	5.02	5%	-5.02	31.17	72.86	2,270.69
10	0	0.00	0.99	5.28	5%	-5.28	112.62	83.62	9,416.33
11	0	0.00	0.99	5.63	5%	-5.63	112.62	94.77	10,672.14
12	0	0.00	0.99	6.01	5%	-6.01	112.62	107.00	12,049.55
13	0	0.00	0.99	6.47	5%	-6.47	112.62	120.41	13,560.46
14	0	0.00	0.99	6.97	5%	-6.97	112.62	135.02	15,205.70
15	27.02	22.20	0.98	7.58	5%	14.62	130.29	151.09	19,685.91
16	27.02	22.20	0.98	8.25	5%	13.96	130.29	146.02	19,024.27
17	27.02	22.20	0.98	8.65	5%	13.56	130.29	141.30	18,409.96
18	27.02	22.20	0.98	8.89	5%	13.31	130.29	136.69	17,808.81
19	27.02	22.20	0.98	9.08	5%	13.13	130.29	132.02	17,200.91
20	25.39	20.86	0.99	9.16	5%	11.70	127.71	127.23	16,248.72
21	25.39	20.86	0.99	9.23	5%	11.63	127.71	123.49	15,770.12
22	25.39	20.86	0.99	9.24	5%	11.62	127.71	119.56	15,268.81
23	25.39	20.86	0.99	9.24	5%	11.62	127.71	115.38	14,735.27
24	25.39	20.86	0.99	9.22	5%	11.65	127.71	110.88	14,160.67
25	25.39	20.86	0.99	9.20	5%	11.67	5.90	106.06	625.87
26	25.39	20.86	0.99	9.17	5%	11.69	5.90	100.40	592.51
27	25.39	20.86	0.99	9.15	5%	11.72	5.90	94.37	556.91
28	25.39	20.86	0.99	9.13	5%	11.74	5.90	87.93	518.93

Table A2 continued

Age	Wages	Wages adjusted for Reading	Survival rate	Consumption	Discount rate	Net productivity for year	Number of migrants	Net productive value of a migrant (£)	Total net productive value of all migrants (£)
29	25.39	20.86	0.99	9.10	5%	11.76	5.90	81.08	478.46
30	17.19	14.13	0.99	9.08	5%	5.05	5.90	73.76	435.30
31	17.19	14.13	0.99	9.04	5%	5.08	5.90	73.13	431.56
32	17.19	14.13	0.99	9.01	5%	5.12	5.90	72.42	427.37
33	17.19	14.13	0.99	8.97	5%	5.15	5.90	71.63	422.69
34	17.19	14.13	0.99	8.93	5%	5.20	5.90	70.76	417.57
35	17.19	14.13	0.99	8.88	5%	5.25	0.75	69.79	52.61
36	17.19	14.13	0.99	8.83	5%	5.29	0.75	68.81	51.88
37	17.19	14.13	0.99	8.79	5%	5.34	0.75	67.73	51.06
38	17.19	14.13	0.99	8.74	5%	5.39	0.75	66.52	50.15
39	17.19	14.13	0.99	8.69	5%	5.43	0.75	65.22	49.17
40	15.06	12.38	0.99	8.65	5%	3.73	0.75	63.78	48.08
41	15.06	12.38	0.99	8.60	5%	3.78	0.75	64.06	48.29
42	15.06	12.38	0.99	8.55	5%	3.82	0.75	64.30	48.47
43	15.06	12.38	0.99	8.51	5%	3.87	0.75	64.51	48.63
44	15.06	12.38	0.99	8.46	5%	3.92	0.75	64.74	48.80
45	15.06	12.38	0.99	8.40	5%	3.98	4.47	64.93	290.43
46	15.06	12.38	0.99	8.34	5%	4.03	4.47	65.31	292.14
47	15.06	12.38	0.99	8.28	5%	4.09	4.47	65.66	293.68
48	15.06	12.38	0.99	8.23	5%	4.15	4.47	65.96	295.04
49	15.06	12.38	0.99	8.17	5%	4.21	4.47	66.29	296.53
50	15.56	12.79	0.99	8.11	5%	4.68	4.47	66.58	297.79
51	15.56	12.79	0.99	8.06	5%	4.73	4.47	66.36	296.84
52	15.56	12.79	0.99	8.01	5%	4.77	4.47	66.08	295.55
53	15.56	12.79	0.99	7.97	5%	4.82	4.47	65.71	293.91
54	15.56	12.79	0.99	7.93	5%	4.87	4.47	65.26	291.89
55	15.56	12.79	0.97	7.87	5%	4.91	8.98	64.72	581.43
56	15.56	12.79	0.97	7.83	5%	4.96	8.98	65.08	584.70

Table A2 continued

Age	Wages	Wages adjusted for Reading	Survival rate	Consumption	Discount rate	Net productivity for year	Number of migrants	Net productive value of a migrant (£)	Total net productive value of all migrants (£)
57	15.56	12.79	0.97	7.79	5%	4.99	8.98	65.42	587.73
58	15.56	12.79	0.97	7.76	5%	5.03	8.98	65.74	590.64
59	15.56	12.79	0.97	7.72	5%	5.06	8.98	65.88	591.91
60	18.44	15.15	0.97	7.69	5%	7.47	8.98	66.00	592.95
61	18.44	15.15	0.97	7.65	5%	7.50	8.98	63.52	570.66
62	18.44	15.15	0.97	7.62	5%	7.54	8.98	60.79	546.14
63	18.44	15.15	0.97	7.58	5%	7.57	8.98	57.79	519.18
64	18.44	15.15	0.97	7.55	5%	7.61	8.98	54.49	489.58
65	18.44	15.15	0.94	7.51	5%	7.64	8.41	50.88	427.83
66	18.44	15.15	0.94	7.48	5%	7.68	8.41	48.58	408.53
67	18.44	15.15	0.94	7.44	5%	7.71	8.41	45.97	386.51
68	18.44	15.15	0.94	7.42	5%	7.74	8.41	42.98	361.44
69	18.44	15.15	0.94	7.39	5%	7.76	8.41	39.61	333.04
70	18.44	15.15	0.94	7.37	5%	7.78	8.41	35.79	300.92
71	18.44	15.15	0.94	7.35	5%	7.81	8.41	31.47	264.60
72	18.44	15.15	0.94	7.32	5%	7.83	8.41	26.59	223.56
73	18.44	15.15	0.94	7.31	5%	7.84	8.41	21.08	177.24
74	18.44	15.15	0.94	7.29	5%	7.86	8.41	14.87	125.07
Total									252,735.86