




RESEARCH ARTICLE

# Work and earning in the nineteenth century: Townley Colliery as a case study

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(Received 3 July 2022; revised 27 November 2022; accepted 4 January 2023)

## Abstract

This article demonstrates the varied and unpredictable nature of earning in the nineteenth century. Using 12,000 fortnightly pay entries from Townley Main Colliery in the north-east of England as a case study, it explores the extent to which the availability of work fluctuated between years, and how workers reacted to this phenomenon. It then considers the frequency with which these individuals undertook the work which was available, and discusses the implications for our understanding of the length of the working year.

## 1. Introduction

The topic of wages in the industrial revolution is by no means new, but recent research has somewhat shifted away from the ‘optimists’ versus ‘pessimists’ debate (which gained major traction in the 1980s) towards a concentration on the cost of labour relative to energy, the role of the family, and workforce participation.<sup>1</sup> The monetary aspects of wages – in particular, the rate at which work was paid – are undoubtedly an important area of research, but the comparatively more limited consideration of the frequency and availability of work is problematic because employment remained uncertain and unpredictable in many industries beyond the onset of industrialisation. Such uncertainty was not only challenging for the short-term decision-making processes of workers, but also had a noteworthy longer-term influence by encouraging the adoption of risk-minimising practices.

This article takes an important step in addressing this problem by examining the unpredictable nature of work in one case study colliery, located in the north-east of England. Approximately 12,000 fortnightly pay entries dating between 1852 and 1856 are utilised, allowing detailed consideration of these issues and an examination of macro-level trends in a micro-economic context. The article undertakes two main activities: first, quantitatively demonstrating the extent of this highly variable employment environment; and second, evaluating the different participation levels of those in the same employment. Both make a direct contribution to our understanding of work in the nineteenth century, but they also have

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methodological implications; the extent to which individuals within the same employment saw different outcomes is important for establishing the potential influence of survivorship bias in historical pay records.

The Emma Pit of Townley Main Colliery, which provides the data for this article, was located near the village of Ryton in County Durham (close to the Northumberland border) and part of the 'Great Northern Coalfield'.<sup>2</sup> The latter was historically significant for its relatively integrated labour market, organisations, and working practices.<sup>3</sup> In this period, Townley was owned and operated by the Stella Coal Company. The Emma Pit – which provided access to the Townley and Five Quarter seams – opened in the mid-1840s, and had therefore been operating for a little less than a decade by the case study period. As an established, mid-sized colliery (employing approximately 200 men and boys underground each fortnight) on the River Tyne with fairly typical geological characteristics, the Townley data provide a representative starting point for investigating mining in the north-east. Peter Kirby argues that the 'technically advanced, highly capitalized' nature of mining in this region may well under-represent irregular working compared to elsewhere in Britain, although further research is required to fully establish the accuracy of this claim.<sup>4</sup>

The Townley data indicate that by the 1850s, whilst the length of the working year was usually around 240–260 days for this group of workers, there was considerable variability in the employment environment – both in terms of earnings and the regularity of workforce participation.

## 2. Literature

This article exists within two inter-related strands of literature, both of which find their roots in E. P. Thompson's iconic work on time and industrialisation. Thompson argues that industrialisation brought with it a transition to 'time-discipline', whereby individuals moved from task-based, irregular working patterns to a more regular and disciplined work structure.<sup>5</sup> His ideas have been hugely influential, but important questions over the extent and timing of this change have been raised.

One response to Thompson's work has been to study the history of time-use, and the structure of the working week (which has often incorporated the debate around the decline of St Monday and other customary absences). Another – which has gathered pace more recently – has focused on the shape and frequency of the working year in the longer term. In both cases, the ultimate goal has been to understand how much work people were undertaking – and in many regards, the boundary between these two broad focuses is blurred – but as the length of the working year has become increasingly important to debate surrounding real wages and standard-of-living, approaches have generally (although not exclusively) trended towards the latter.<sup>6</sup>

Both of these themes come together as part of the broader concept of the 'industrious revolution', first proposed by Jan de Vries. The core aspect of his argument – that people undertook more regular and consistent work in order to participate in a growing market for consumer goods – is often used to help explain the transformations in the British labour force during the industrial revolution.<sup>7</sup> Over the long-eighteenth century, de Vries argues that households opted to reduce time allocated

to leisure (as well as the production of goods they consumed directly) in favour of undertaking more waged labour, which could then be used to purchase goods and services.<sup>8</sup> If this was the case, then it should be possible to observe an increase in the frequency and uniformity of workforce participation over the course of this transition. This point becomes all the more critical in the face of Alexis Litvine's argument that the rise of the concept of 'industriousness' does not align with de Vries' timeline.<sup>9</sup>

De Vries is explicitly European (and North American) in focus, as well as taking the family (rather than the individual) as the core economic unit. But the availability of data – and diversity of experience – mean it is difficult to engage with the issue of working time on such a grand scale, and historians have therefore frequently sought to understand the nature of work on a more local level.

Major contributions to the history of time-use and the structure of the working week have been based on a variety of source materials. The decline of St Monday – the practice of being absent from work on this day – has been a key element of this research.<sup>10</sup> Douglas Reid – on the basis of various newspaper articles, government reports, and other literary sources – has found that St Monday persisted in Birmingham and the Black Country until the mid-nineteenth century, but was eventually 'eroded' by the rise of a half-day on Saturdays.<sup>11</sup> Eric Hopkins – for the same general geography (although emphasising a quicker pace in the former than the latter) – argues the second half of the nineteenth century witnessed St Monday's decline, noting also the influence of shorter working days and Bank holidays, in addition to the half-day on Saturdays.<sup>12</sup>

In a later article, Reid concludes that the timing of weddings (employed as a proxy measure for leisure time) show important differences between a set of case-study towns and cities, but that St Monday seemingly declined 'unevenly, and protractedly' over the nineteenth century.<sup>13</sup> Jeremy Boulton – also on the basis of wedding data – argues that the seventeenth century working week might be characterised as 'less regular', while the nineteenth century showed evidence of 'a more intensive working week and a weekend centring around Sunday and Monday', but with some indication of a Saturday half-day growing in popularity.<sup>14</sup>

Mark Harrison, using newspaper articles to identify gatherings of crowds in Bristol, demonstrates 'a distinctive "weekend", comprising a working Saturday, domestic Sunday and recreational Monday' between 1790 and 1835, and a 'reflection' of time-discipline in these events.<sup>15</sup> Matteo Tiratelli has since used a comparable approach (with a broader source base and time period), to argue that St Monday persisted until the early-nineteenth century before 'waning in some industrial towns by the 1820s, with the rest of the country following a few decades later'.<sup>16</sup>

Hans-Joachim Voth suggests a somewhat different timeline of St Monday. His well-known study uses court depositions to approximate a 'random-hour recall' method, where witnesses stated what they were doing at a particular time.<sup>17</sup> He argues that St Monday had abated – at least, in London, as it was never popular in the north – by the start of the nineteenth century, having been prevalent in the mid-eighteenth century.<sup>18</sup> This results in a fairly small window for the prominence of St Monday, especially given that Mark Hailwood and Steve Hindle both find little evidence of this practice prior to 1700.<sup>19</sup> Anne Murphy also finds

no evidence of St Monday in 1783 (although noting that senior men did take additional leisure time), but it may be that the focus of her case study – Bank of England clerks – demonstrates a different pattern to other workers.<sup>20</sup>

The length (and structure) of the working week therefore has important implications for the length of the working year, but it is not an inherently simple task to infer the latter from the former. Evidence regarding the decline of St Monday in the nineteenth century suggests more consistent and structured work, but that this could vary dramatically by industry and location. In addition, customary absences are only one aspect of this relationship – the availability of work might also play a role, and it is therefore important to consider the extent to which the ‘working week’ varied over the course of the year.

The consistency of work over the year (and the influence this had on income) poses a key challenge for historians. The nature of employment and record-keeping in this period mean that data are often fragmentary – providing short-term views of earnings and wages. For this reason, traditional methods of calculating annual wages involve multiplying the rate at which short term work was paid by a constant number of days per year – usually, 250.<sup>21</sup> This approach has the advantage of requiring relatively few data points for each year in question, and therefore facilitates the construction of long-running wage series from day wages (more commonly found in surviving sources). However, the disadvantage is that the amount of work undertaken is typically held constant, and therefore changes in the wage series are driven by the rate at which work was paid (and its relationship with the price of goods).

There have been important efforts to improve upon this method.<sup>22</sup> More recently (and most notably employed by Robert Allen and Jacob Weisdorf) the number of days worked in any given year has been allowed to vary, but only insofar as determining the frequency with which an individual needed to work in order to attain a pre-determined consumption benchmark.<sup>23</sup> This method does demonstrate greater sensitivity to the frequency of work as a variable, but it still largely neglects the pressures and demands that uncertain and inconsistent work placed upon the individual, which may have led them to break with ‘rational’ economic behaviour when considered in the longer-term.

One of the most influential efforts to consider the availability of work as a factor in income is that of Gregory Clark and Ysbrand van der Werf. They propose a method of assessing days worked over the year by calculating how many days of labour would be required to reach the same earnings as those of workers in annual employment, in addition to using anecdotal evidence from farm records. Their research – focused on agriculture and rural craftsmen between the thirteenth and nineteenth centuries – ultimately suggests ‘little sign of an industrious revolution’, primarily as a consequence of their argument that medieval workers were already undertaking a high number of days worked per year.<sup>24</sup>

Jane Humphries and Weisdorf – employing a comparable method but in relation to a substantial body of evidence on annual wages – have shown that accounting for the number of days worked in a year has a significant influence on the long-term trajectory of British wages from the early modern period. Employing annual and day wages from different groups of agricultural workers, they demonstrate that in order to earn the same as someone employed on an annual contract, a

worker paid by a daily rate was generally required to undertake less than 250 days of work in the mid-eighteenth century, increasing to nearly 350 days by 1850.<sup>25</sup> In subsequent work with Sara Horrell, they have extended this work (in combination with other data) to explore lifecycle effects, including the impact of under- or unemployment of a male breadwinner.<sup>26</sup>

Kathryn Gary and Mats Olsson adopt a similar approach in a Swedish context. Considering low-skilled workers employed by cities, manors, and churches in the period 1500 to 1850, they compare the wages of casual and annual workers in southern Sweden – finding that while both groups saw variable year-on-year income, casual workers required relatively fewer (150–200) days of work to match the income of an annually employed worker until the ‘mid-to-late eighteenth century’ (when rising prices and stagnant wage rates led to a reversal of this situation), before days required declined back to mid-eighteenth century levels by the 1840s.<sup>27</sup>

This type of approach is undoubtedly an improvement on the ‘ahistorical and arbitrary guesstimate’ of 250 days per year, but there are still important caveats.<sup>28</sup> First, it is somewhat dependent on the assumption that workers were able to directly compare the relative labour and pay of annual and day contracts, and possessed the market power to resist employer demands should a discrepancy appear between the two.<sup>29</sup> Additionally, the idea that there were directly comparable roles for annual and day workers does not always hold – which is particularly important for industries such as coalmining, where workers were less ‘homogeneous and mobile’ between different types of work.<sup>30</sup> Payment by the piece – largely the case for workers in the coal industry – also has the potential to complicate this picture, as pay was derived from effort as well as time, and in practice this could be an imperfect substitute for a day rate – with large variations between individuals.<sup>31</sup>

Attempts to measure working days directly using micro-data encounter different issues, particularly relating to the selection of case studies. Judy Stephenson’s work (concerning building labourers and craftsmen at St Paul’s Cathedral in the eighteenth century) examines the account books of contractor William Kempster, enabling her to track the work of specific individuals over the year. Noting that building employment was both seasonal and ‘stage-dependent’, she concludes that only ‘men who had continual employment, and no search for work’ could have completed more than 240 days of work in a year, and she emphasises the importance of inter-personal employment relationships to the frequency that these men worked (on the specific building site in question).<sup>32</sup>

Stephenson’s work provides much needed insight regarding working days over the year, and her sensitivity to the ‘unique seasonal and frictional constraints’ associated with employment in the building industry demonstrates the importance of uniting the social and economic aspects of employment.<sup>33</sup> However, her tracking of individuals is dependent on these men remaining in Kempster’s employ – something which she highlights was not necessarily the case.<sup>34</sup> This in itself is important for evaluating labour force mobility, but it makes estimating the total work individuals were undertaking over the course of the year – including any economic activity they may have been undertaking elsewhere – more difficult. This issue is particularly pertinent, given that London after the Great Fire likely offered competing opportunities for construction work.

Joyce Burnette's work on farm labourers encounters similar challenges. Her research considers agricultural workers on eight English farms between 1835 and 1844, demonstrating that although seasonality was present in both labour requirements and wages, this was not uniform across each of her case studies.<sup>35</sup> However, she also considers the regularity of work over the year more generally, showing that while there were examples of individuals working in excess of 300 days, there were also many who worked far fewer.<sup>36</sup> Unfortunately, while this is an important finding, it is not possible to ascertain the extent to which individuals not consistently employed in farm work were economically active elsewhere, and therefore questions remain over the length of the typical working year.

Burnette also considers the consistency of work in an American textile factory in 1883, using a method with significant parallels to that employed here; linking the wages of individuals in account books to generate sets of individual earnings by the day.<sup>37</sup> Primarily focused on absenteeism, she finds that only 14 percent of her sample worked a minimum of 250 days in 1883 (although she acknowledges this figure is influenced by turnover – and also notes there are some prolonged absences, which presumably mean an individual might have been working elsewhere). However, she also argues that there is more evidence of a demonstrable leisure preference than economic motivations with regards to missing days of work. Her findings emphasise the important point that days of operation for a firm or enterprise did not inherently equal the days of work that an individual was willing to undertake – regardless of customary absences.<sup>38</sup>

Overall, while progress has been made in this area, further empirical research is required regarding how much work was actually being undertaken by individuals over the course of the year. Case studies of individual employment histories have the potential to shed light on this issue, but there are a number of confounding factors – most importantly, the possibility of workers undertaking economic activities outside of those recorded by the source materials. In this regard, the coal industry is a good candidate – pits were often relatively isolated, the nature of contracting arrangements (in this period, being bound on a monthly basis) meant that men were not often employed simultaneously elsewhere, and opportunities to do so were often limited by housing being tied to continued employment in the colliery.<sup>39</sup> Townley – by virtue of being located along the Tyne – was less isolated than some of the very rural collieries in this period. However, the nearest population centres of Ryton and Crawcrook were small, and this was prior to the rapid growth resulting in the 'industrial conurbation' described by Martin Daunton after the turn of the century.<sup>40</sup> Workers also stood to gain from knowledge of the particular geological conditions associated with each pit, and although the drawing of work position by lot (known as the 'cavil') introduced some randomness to this element of work, it could still provide an incentive to remain under many circumstances.<sup>41</sup>

### 3. The coal industry

The coal industry may not have been as large as the agricultural or manufacturing sectors, but it still formed an important part of the British economy. The industry as a whole was producing coal to the value of £16 million per year by the mid-1850s.<sup>42</sup> Roy Church estimates it employed approximately 218,000 individuals

in England, Wales and Scotland as of 1851 (the vast majority of these being male) – just under 18 per cent of these in the north-east – and national employment proceeded to grow by more than a third over the following decade.<sup>43</sup> Coal was important for both domestic and industrial use in Britain, as well as a valuable export – with the north-east being the largest international export region in this period.<sup>44</sup>

To understand the nature of coalmining work in the mid-nineteenth century, it is important to highlight that the industry was undergoing rapid growth as a consequence of increasing demand, brought about by industrialisation. Church's figures show that production significantly expanded, so that while 32.0 million tons of coal were produced per year between 1830 and 1834, this had risen to 201.9 million tons in the final years of the nineteenth century. The 1850s were themselves a period of noteworthy increases; Church estimates that 68.3 million tons were produced in 1852, rising to 79.0 million tons in 1856.<sup>45</sup> The north-east was particularly well placed to take advantage of this demand – not only because of its prominence in the history of the trade and the high reputation of its coal, but because of the relatively easy access to the coalfield by the major rivers of the region.<sup>46</sup> This also meant that, whilst railways became increasingly important over the nineteenth century, it was able to exploit coastal shipping markets – particularly, London.<sup>47</sup>

For the coal industry, the increased demand for labour which accompanied this expansion of production also necessitated a shift in its cultural character. The north-east (generally regarded as the leading coal-producing region during this period) sought to recruit mainly from the sons of existing miners in the earlier part of the nineteenth century, believing them to be of superior stock. John Buddle, a well-respected colliery manager (known as a 'viewer'), was quoted in 1842 as saying that 'Our peculiar race of pitmen [...] can only be kept up by breeding' and 'could never be recruited from an *adult population*'.<sup>48</sup> Given that the north-east saw significant recruitment of adult male labour from outside of the industry during the 1860s and 1870s, this was evidently not – or ceased to be – the case.<sup>49</sup> Robert Colls argues that a key point in the deskilling of the industry in the north-east was 1844 (with the abolition of the annual contract – known as the Pitman's Bond – in favour of a monthly hiring agreement, and the changes this brought to the labour market), after which there was a growth in the recruitment of adult male labour from other industries.<sup>50</sup>

The deskilling of the trade undoubtedly had an impact by the end of the nineteenth century, but the extent to which this had taken place by the 1850s – and how far it had influenced working practices – is less clear. The north-eastern hewer (the main adult worker in the mine, tasked with winning coal from the face) in the period of study continued to enjoy control over his own work effort and pace, receiving relatively little supervision until the adoption of the 'longwall' method.<sup>51</sup> It was only after the introduction of this technique that the more significant changes to labour organisation took place, with more direct supervision, increased specialisation, and the necessity of increased co-operation between individuals.<sup>52</sup> The north-east was fairly slow to move to this system (in part because it was less well suited to the coal seams of the region) and therefore continued to mostly employ the 'bord-and-pillar' method until the end of the period of study.<sup>53</sup>

In the north-east, a coalminer in the 1850s was therefore occupying the uneasy middle ground between labourer and artisan. He retained significant control over

his work pacing, attendance, and effort, meaning that individuals had the potential to see very different levels of production, and – by extension – earnings. However, at the same time he was coming under increasing scrutiny from supervisory positions. Many of the historical privileges associated with working in the industry (within living memory) had been stripped away, but his craft still retained certain benefits and incentives not usually available to other workers.<sup>54</sup> His possession of colliery-provided housing, however, created a dependency on continued employment in order to retain his accommodation. His craft (and by extension, his community) was increasingly open to outsiders, yet still maintained a strong hereditary element in recruitment.<sup>55</sup> These factors all played an important role in the way men interacted with the labour market in this period.

Women in coalmining families were less likely to undertake paid employment than on average. James Jaffe (north-east), Colls (north-east), Angela John (Wigan) and Church (nationally) argue for limited paid employment opportunities – although this has been challenged in some regards by Andrew Walker (Yorkshire) and Amanda Milburn (Shropshire and Merthyr Tydfil).<sup>56</sup> Nonetheless, they were certainly active in what Colls terms ‘an informal economy of mutual exchanges and penny rewards’, as well as other tasks necessary for the household to function – particularly, the provision of fuel and water.<sup>57</sup> Despite the often-emphasised physical toll of working in the pit, men likely participated in these activities to some extent, although the scope of this – and how far it acted as a deterrent to maximising waged work – remains somewhat unclear.<sup>58</sup>

The problem of uncertain work – both in terms of working days and payment by the piece – has long been identified, but there have been few attempts to directly grapple with the issue within the context of the coal industry prior to the late-nineteenth century. Colls highlights that a ‘major earnings variable obviously was the difference in the strength and skill of pitmen’, but his efforts to examine the influence of this factor are restricted to a single pay fortnight at Ouston Colliery in the 1830s.<sup>59</sup> Church notes that ‘differences in work pace allowed two workers operating in identical conditions to receive unequal wages’ and that ‘identical work pace might also produce contrasting earnings under different geological conditions’.<sup>60</sup> He concludes that ‘the historian is faced with intractable difficulties, rendering the measurement of those elements in the miners’ standard of living which allow quantification more difficult methodologically than those for other workers’.<sup>61</sup> In an effort to track long-term trends in wages, he utilises the imperfect substitute of earnings per shift instead.<sup>62</sup>

Kirby’s work provides the most direct effort to consider these factors. Using pay-bills from Wylam Colliery, he uses daily output to measure work effort and attendance in the first half of the nineteenth century.<sup>63</sup> Kirby’s emphasis is more on changes in work effort (such as short time working) than overall work undertaken, in part because of his focus on St Monday – which he characterises as fitting with both ‘the chronology of decline in customary attendance described by Reid’ in his analysis of marriages, and ‘the findings of Voth that whole days of absence were very rare’.<sup>64</sup> Nonetheless, he argues that in the mid-nineteenth century, the working patterns of coalminers shifted in response to increased work intensity; this resembled the modern working week, with short time working particularly prevalent at week-ends rather than the previous customary pattern.<sup>65</sup> Absences can be explained by



the 'requirement among hewers for weekly respite from increasingly gruelling labour'.<sup>66</sup> Kirby's findings are therefore important for understanding the patterns of – and changes in – attendance over the nineteenth century, but they do not provide insight into how much work each individual was undertaking over the year.

#### 4. Data

Many of the problems which arise when considering the consistency of work stem from a lack of suitable source material. Pay records are often fragmentary, which makes engaging with patterns of work over the year difficult, and it is typically challenging to track individuals through multiple records. However, as pay in the coal industry was (predominantly) based on piece rates, it was necessary for collieries to record each individual's output in significant detail, and this allows for in-depth investigation of the issues discussed above. The focus of this article rests on 'hewers', the most numerous adult workers, who account for approximately half of all underground fortnightly entries in the primary documents.<sup>67</sup> In the north-east, hewers were paid by the 'tubs' of coal they were able to produce. In other regions, there were small differences in the system of payment and tasks of the hewer (or the regional variant of that role), but for the most part this was comparable in all British coalfields. The number of tubs produced by a hewer was recorded for each day that individual worked in fortnightly documents known as 'paybills', with their overall value for each two-week period totalled.<sup>68</sup> It is these paybills which provide the majority of the data for this article.<sup>69</sup>

With the shift from an annual to a monthly 'Bond' (the contract which specified terms of employment in the north-east) in the 1840s, workers were technically able to leave collieries at much shorter notice than they had previously, and colliery management were able to remove undesirable men.<sup>70</sup> However, in practical terms, social factors – such as colliery housing – prevented a particularly rapid turnover. While there were some men who did circulate around the coalfield in search of the best rates, there were advantages to be gained from knowledge of the specific geological conditions associated with each mine. This – in combination with social factors, such as kinship networks – provided incentives to remain at the same colliery for extended periods. As a result – demonstrated by [Table 1](#) – the data provide a relatively large sample of individuals with a high number of fortnightly entries for each year.

The core methodology underpinning this work can be understood as follows: individuals were identified in each paybill and linked to instances where that same individual appeared in other paybills, thus tracking their employment over multiple pay periods. The length of these reconstructed employment histories varies considerably; some individuals appeared in only a few paybills, while data for others spanned several years. Hewers with employment histories containing less than six fortnights were excluded from the sample.<sup>71</sup> Some of these individuals would have been transitory workers, while others are a consequence of difficulties in matching data. While this does skew the sample towards long-term workers, this is necessary to facilitate the objective of considering working patterns over the year.

Linkages were established primarily on the basis of surname and forename, including common abbreviations and misspellings. There were a number of

**Table 1.** Sample characteristics of hewers at Townley Colliery, by year (1852–1856)

Year	Hewers	Average number of fortnights	Hewers recorded with a secondary occupation	Percentage of sample hewers with a secondary occupation
1852	117	20	13	11
1853	107	22	8	7
1854	99	22	1	1
1855	126	22	19	15
1856	124	22	16	13

*Notes:* To be recorded as having a secondary occupation (within the colliery), a man needed to acquire over 10 per cent of his annual earnings in that occupation. This prevents infrequent work from artificially inflating the number of individuals demonstrating mixed employment. The extent to which men were working outside the colliery is unknown, but likely limited.

*Source:* All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

occasions where individuals were employed in more than one role during a pay period, and therefore had multiple entries in the same document; those with multiple entries saw all of their earnings included in the overall value for that pay period.<sup>72</sup> This typically took two forms: firstly, where hewers recorded multiple instances of hewing in different seams; and secondly, a limited number of cases where hewers were also employed in some other job in the mine. The latter has some minor implications for assessments of productivity, but – as Table 1 demonstrates – this was only a problem for a limited number of hewers in any given year.

This method of reconstructing employment histories is therefore able to track the attendance, output, and earnings of the same individuals over multiple pay periods, as well as compare differences between named individuals over the same period. This allows for a detailed comparison of participation rates not available to most methodological approaches. By taking individuals as the starting point and ensuring that they are linked across each seam and pit if necessary, it is also able to allay some of Kirby's concerns surrounding the use of paybills to consider absenteeism on the grounds that a man may have been working elsewhere in the colliery.<sup>73</sup>

## 5. Understanding the average

There were three main determinants of earnings in the coal industry: output, piece rates, and work frequency.<sup>74</sup> First, as will be discussed below, individuals did not always work at full capacity, and few worked all of the days on which the colliery opened; this led to differences between the fortnightly earnings of individuals. Second, the output of each hewer also varied. This was not static (the same hewer saw fluctuations in his productivity in different pay periods as a consequence of geological conditions and work effort), but some hewers were generally more skilled than others. Being paid by a piece rate allowed those who were more successful to exceed the earnings of other hewers. Third, piece rates also played an important role in stratifying earnings. Townley frequently offered four rates at any one

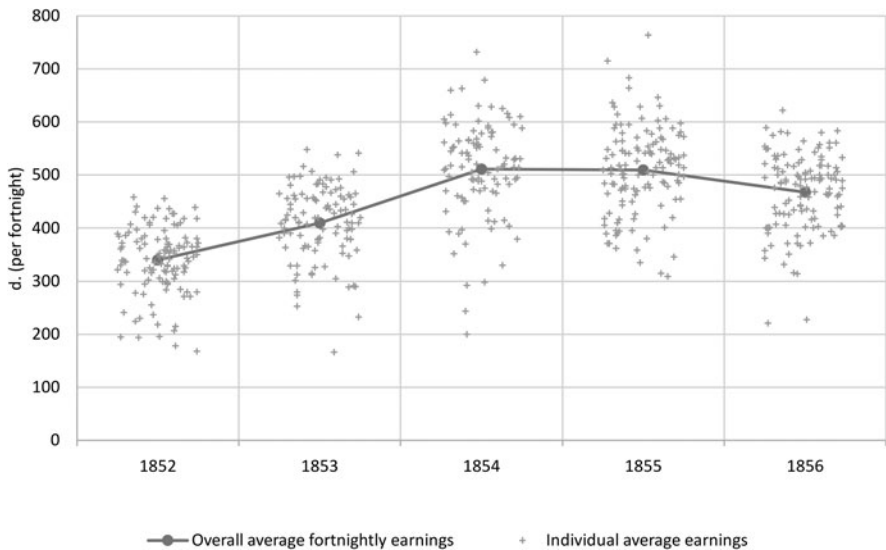
time – usually dependent on working position in the colliery – and by 1856 there could be in excess of one-and-a-half shillings per score of tubs between the highest and lowest rates. In theory, these different rates were allocated in order to balance out geological conditions in each seam, but – in reality – this was not a perfect solution and environmental factors could influence productivity even within the same seam. The combination of these three factors resulted in substantive differences between the average fortnightly earnings of the individuals employed.

The extent of this issue is demonstrated by [Figure 1](#). Although the construction of the series differs from mainstream methodological approaches, it is still possible to analyse these data on a year-by-year basis. As the solid line in [Figure 1](#) demonstrates, average fortnightly earnings at Townley saw considerable inter-year movement. The low point of the series is 1852 (340d. per fortnight) rising to a high point around 1854 and 1855 (the latter being 509d. – twopence per fortnight less than the former), before dropping off in 1856 (to 468d. per fortnight).<sup>75</sup> This trend not only fits with the broadly cyclical nature of earning in the coal industry during this period, but also the pattern of Church's existing wage estimates (which also demonstrate a rise to the middle years of the 1850s, followed by a decline).<sup>76</sup> This enables confidence in this dataset as a representative sample.

However, a deeper analysis demonstrates that average values provide limited understanding of these earnings. While there are certainly outliers – individuals who obviously do not represent a 'typical' experience – there were also large numbers of hewers who averaged notably above or below the mean values (the extent of this is visualised by the scatter plot in [Figure 1](#)). One method of quantifying this dispersion is to calculate the standard deviation of the average fortnightly earnings for each year, which confirms that individual hewers could earn to substantially different levels. Taking 1854 as an example, one standard deviation either side of the mean – as [Table 2](#) shows – would have meant a difference between earning 420d. (or £1.15s.) and 602d. (£2.10s.2d) per fortnight. These were large differences in earnings – especially for individuals employed in the same job at the same colliery – which would have resulted in very different purchasing power.<sup>77</sup>

Although the standard deviation is important for relating the dispersion of earnings around the mean to actual monetary values, higher mean earnings would inherently lead to higher absolute variation in fortnightly earnings (assuming the extent of the variation remained unchanged, and therefore increased proportionally). Indeed, the coefficient of variation ([Table 2](#)) shows that the general level of variation is fairly consistent between years, falling between 16 and 19 per cent. This suggests that the substantial variation between the average fortnightly earnings of individuals was a consistent feature of earnings for these workers, rather than a one-off phenomenon in any particular year.

The extent of the variation between the earnings of individuals is important because it highlights how those employed in the same role could earn very differently, and this has implications for using average industry wages as a basis for wider analyses. The earnings of Sep Kidd in 1853 (£49.5s.1d.) may have been comparable to those of Jonathan Tiplady (£44.18s.5d.) but differed considerably from those of Robert Smith (£39.14s.10d.) or George Purvis (£27.7s.3d.) in the same year, all of whom worked primarily as hewers in each pay fortnight. Although the precise causes of these variations may be specific to the coal industry, it is likely that similar



**Figure 1.** Average fortnightly earnings at Townley Colliery, by year (1852–1856).

*Notes:* Data density requires that random offsets are introduced to the ‘Individual average earnings’ series for clarity. Therefore, x-axis positioning has no significance beyond the indication of year.

*Source:* All data derived from DRO, ‘Emma Pit Pay Bills, Stella Coal Company’, NCB I/SC 154–162. For further details on methodology, see [section 4](#).

trends were present in other industries paid by the piece, as workers in all occupations had different skill levels and attitudes to work. Therefore, the difference between being on the breadline and affording luxury items may not have been as simple as the industry in which an individual was working or the long-term trajectory of wages in that industry. With this being the case, there are far-reaching implications for the ongoing collection and usage of archival sources; namely, the need to identify data with comparable detail to that employed here, in order to further investigate these factors. One important – potential – explainer for these differences is the frequency with which individuals undertook work.

## 6. The availability of work

The paybills not only give fortnightly earnings, but also list daily coal production by individual. This can be used to assess both attendance (by focusing on particular hewers) and the maximum length of the working year (by observing all days on which the colliery operated). Historians – such as Kirby – have highlighted the potential issues with using daily coalmining data as a proxy for attendance. They argue that just because a man does not appear in a paybill it does not mean he was not present at the workplace; he might potentially be employed in another underground role or working in a different seam (the latter of which may have been recorded in a separate document).<sup>78</sup>

There are good reasons for undertaking the following analysis in spite of these cautions. First, hewers being paid by the piece meant that it was important to

**Table 2.** Fortnightly earnings at Townley Colliery, by year (1852–1856)

Year	Mean (d.)	One standard deviation below the mean (d.)	One standard deviation above the mean (d.)	Coefficient of variation (percent)
1852	340	277	404	19
1853	410	339	481	17
1854	511	420	602	18
1855	509	427	591	16
1856	468	396	541	16

Source: All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

record this (and therefore attendance) accurately. Second, the linking of individuals between seams in the employment histories somewhat prevents the problem of 'losing' men. While it is technically possible that men may have been employed in other pits for which records are not available, the effect of this on the current data is limited, despite still causing some methodological concern.<sup>79</sup> Third, the employment histories covering work in all occupations for a given individual reduces the impact of men being employed in multiple capacities and demonstrates work attendance which might otherwise have been omitted. Therefore, while these data may have some shortcomings, they still provide an unparalleled opportunity to interrogate the attendance of the individuals that make up the dataset.

The first question is how many days of work were actually available to coalminers in a given period. In this context, this is equivalent to how many days the pit opened in each fortnight. The normal working pattern for a colliery was based on a fortnightly cycle. The first Saturday of the pay period was 'pay Saturday', and therefore not commonly worked. Church argues that in the north-east most hewers also did not work on the following (in other words, the second) Monday, although Kirby claims that this had changed by the 1850s with men preferring to work less on 'the working Saturday and the following Monday' instead.<sup>80</sup> Sundays were never worked. It was therefore usual for the colliery to operate on Monday to Friday in the first week and Monday to Saturday in the second (with varying degrees of voluntary absences on each day, if men chose not to work). However, short-term pit closures were common, and there was a complex interplay between the customary practices described above in relation to Saturdays and Mondays, and complete closures of the colliery on these days. Unfortunately, the data provide little direct information regarding the reasons for these stoppages. Jaffe suggests that they could be a consequence of 'repairs or maintenance', but also cites evidence from the 1830s suggesting that such a practice could be used to limit the supply of coal and consequently increase prices – although efforts to fix prices in the north-east had diminished after 1844.<sup>81</sup> Nonetheless, by considering the extent and nature of total work stoppages, it is possible to demonstrate how many days the mine actually operated in any given period without this being influenced by voluntary absenteeism.

Most days on which the colliery was closed are clear in the data, as hewers did not record any tubs of coal produced on those days. This is not to say that all work

ceased; overmen – who were usually occupied with supervising the men – were often paid (although the nature of their work was altered), and there is evidence that some other jobs (such as maintenance work) could also be undertaken. However, for the majority of the workforce who were paid by a piece rate, no coal being produced resulted in no earnings. Pit closures therefore had a direct influence on pay.

The Townley data largely support the established working pattern described above, but it is notable that this could be broken when necessary. Of the 128 fortnightly pay periods available between the start of 1852 and the end of 1856, only four show evidence of the pit being open on the first Saturday. Two of these are at the very extremes of the year, although two are not – suggesting that the latter were genuine work days, rather than an anomaly of the record keeping – but both showed lower overall output than the other days in that pay period. There are 12 occasions where the second Saturday of the pay period recorded no production, but the majority show evidence of normal working.

Of more interest are the working patterns of the colliery during the expected working week. The first Monday of the pay period was the most common to see no production; 24 of the 128 pay periods saw the pit closed (Table 3). This partially fits with Kirby's data and would effectively have meant that hewers had two days off work, having (usually) worked the Saturday beforehand. However, while it might initially appear that working the second Saturday simply shifted the rest days of hewers, the strength of this pattern should not be overstated. 24 of 128 entries only accounts for 19 per cent of pay periods, and the high preponderance of Mondays in the second week also seeing production cease (17 occasions, or 13 per cent) suggests that stoppages on the first Monday of the pay period were not necessarily related to working the Saturday prior. It is also important to note that all days saw unexpected closures at some point in the period of study, which introduced notable uncertainty into the working patterns of hewers – being unable to predict these stoppages posed a risk to their earnings.

More fundamentally, there were sizable differences in work stoppages by year, which go some way to explaining the variation in average fortnightly earnings seen in Figure 1. As Table 4 demonstrates, 1852 was a particularly variable year; conversely, 1853 and 1855 (most likely 1854 as well, although a full picture is seemingly slightly obscured by data loss) saw largely consistent work availability.<sup>82</sup> 1852 saw the lowest average earnings in the period of study, with 1854 and 1855 being the highest. It is important to note that 1853 and 1856 do not fit perfectly with this pattern; accounting for how many days hewers *actually* worked of those available is necessary, and is considered below. Nonetheless, these data demonstrate that work availability had the potential to vary year-on-year, and that these variations could have a strong influence on earnings. They also reaffirm the importance of analysing working days for understanding annual income.

## 7. Reactions to the availability of work

The Townley data can also be used to investigate the relationship between pit closures and average earnings on a fortnight-to-fortnight basis. As Figures 2 and 3 demonstrate, average fortnightly earnings in 1852 and 1856 (the years with the

**Table 3.** Days demonstrating no production at Townley, 1852–1856

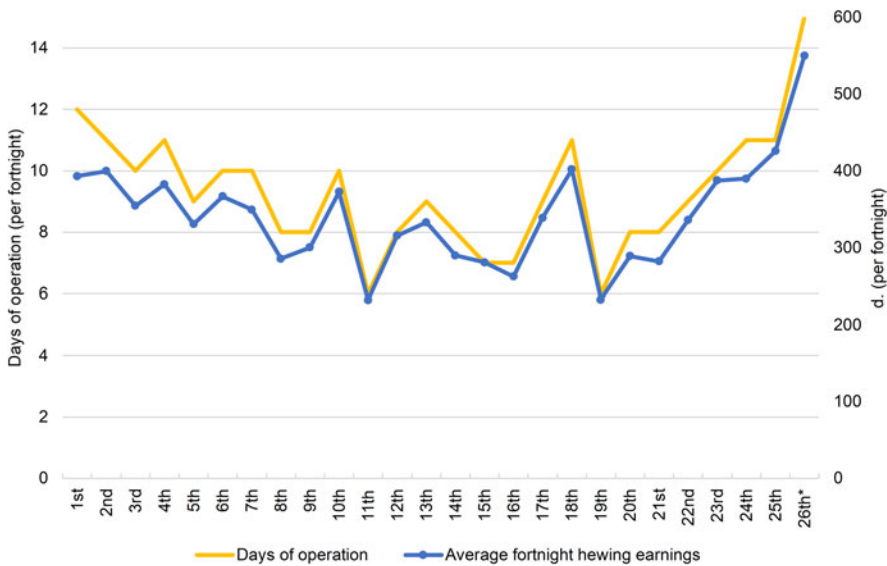
Mo1	Tu1	We1	Th1	Fr1	Sa1	Mo2	Tu2	We2	Th2	Fr2	Sa2
24	9	5	7	3	124	17	3	7	10	4	12

Source: All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

**Table 4.** Missing work days by year at Townley, by year (1852–1856)

Year	Days registering no production (excluding first Saturdays and Sundays)	Available work days
1852	50	242
1853	8	278
1854 <sup>a</sup>	7	259 (est. 277 to 281)
1855	7	280
1856	29	257

Notes: <sup>a</sup>There are two consecutive fortnights missing from the 1854 data. It is not known whether there were work stoppages during this period. The available work days column therefore provides the recorded days of operation in that year, but the estimated range gives the most likely scenario assuming a standard working pattern.  
 Source: All data derived from DRO, ‘Emma Pit Pay Bills, Stella Coal Company’, NCB I/SC 154–162.



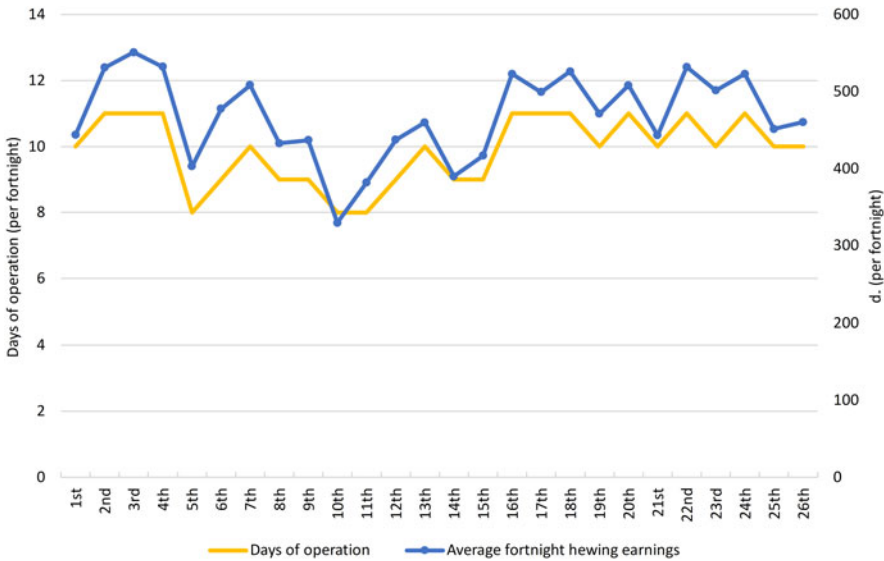
**Figure 2.** The relationship between days of operation and average fortnightly hewing earnings at Townley in 1852.

Notes: The 26th pay ‘fortnight’ contained more days than usual due to colliery accounting. See endnote 75 for discussion.

Source: All data derived from DRO, ‘Emma Pit Pay Bills, Stella Coal Company’, NCB I/SC 154–162.

highest number of work stoppages) largely coincide with the pattern of pit closures and therefore appear to be heavily driven by the availability of work.<sup>83</sup> This suggests that when work was available in these years, hewers were generally working at maximum capacity (although the sheer number of stoppages in 1852 still led to the lowest average incomes in the dataset). Such behaviour intuitively fits with the concept of work shortages, and subsequent concern over income leading to reduced voluntary absenteeism.





**Figure 3.** The relationship between days of operation and average fortnightly hewing earnings at Townley in 1856.

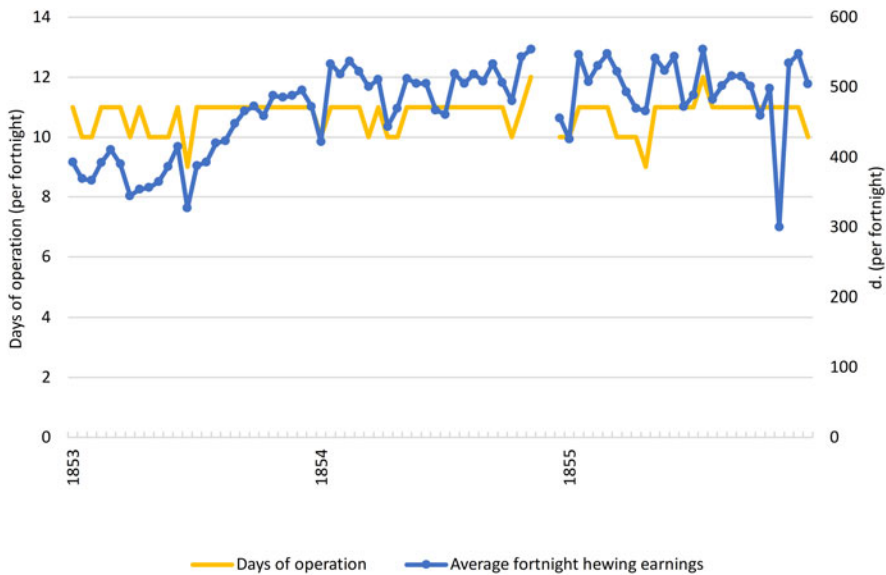
Source: All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

Conversely, in years where colliery operation neared maximum capacity and the number of available work days were largely consistent between fortnights, other factors were the main determinants of inter-fortnight variation in earnings. This is why – as [Figure 4](#) demonstrates – there appears to be no clear relationship between the days of operation and average earnings between 1853 and 1855; as productivity, uptake of available work, and piece rates were stronger differentiators in these years.

One factor which cannot be ascertained directly from these data is how long individuals actually worked during their working day. Although the shift in the north-east was usually around nine hours for a hewer, this included some underground travel time and men largely controlled the pace of their own work.<sup>84</sup> In addition, 'short-time' working was a known practice.<sup>85</sup> An indirect method of examining this type of factor is by considering the relationship between average daily output and days of operation of the colliery. If men did look to maximise their production when work was scarce, then output would be expected to rise when the number of days on which the colliery operated in a fortnight were low.

In actuality, there is little evidence that this was the case. Comparing days of operation and average daily output per hewer, [Figure 5](#) shows no clear evidence that hewers adapted their daily production in light of the number of days the colliery operated in the fortnight. While there were changes in average daily output per hewer – for example, this was particularly high at the end of 1853, and especially low in the second half of 1855 – these were prolonged periods of above or below average productivity, and therefore a consequence of longer-term factors.

It is therefore evident that there was a strong relationship between the availability of work and the level of earnings at Townley in this period. However, this relationship



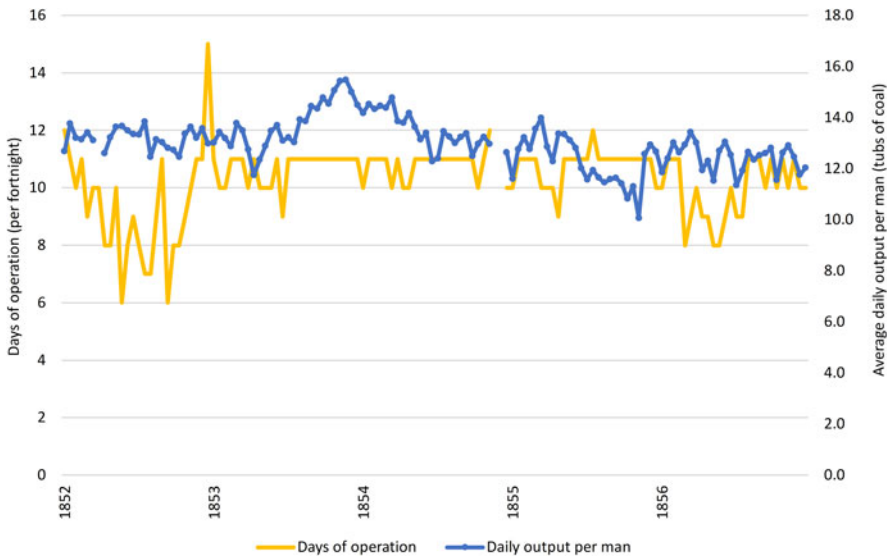
**Figure 4.** The relationship between days of operation and average fortnightly hewing earnings at Townley between 1853 and 1855.

Source: All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

was more important in years where work was in short supply than when it was plentiful. In the latter scenario, other influences on productivity and the rates at which tubs were paid were the determining factors in inter-year variations.

## 8. Worker participation

The previous sections demonstrated that the availability of work (the number of days in a fortnight that the colliery was open) had an important relationship with earnings. However, this is just one part of understanding work in this period; just because the colliery was operating did not mean that all workers were in attendance. The coal industry was still heavily manually intensive (even into the early-twentieth century, the use of coal cutting machines was limited in the region), and – although gunpowder was used in the north-east from around 1813 – this brought obvious risks, with the boost it provided to productivity variable.<sup>86</sup> A hewer therefore generally resorted to 'picks and wedges of various sorts, hammers, and shovels or forks' to carry out his task – although compressed air was also gaining popularity in this period.<sup>87</sup> Conditions in the mine could be challenging – due to wetness, ventilation, and heat – and the trip to and from the face could also be arduous. Herbert Stanley Jevons describes this as a 'trudge through pools of black slush' with 'water percolating from the roof'.<sup>88</sup> Kirby argues that the physicality of this work combined with the expected level of output forced days off for recovery by the mid-nineteenth century, but there were also other factors at play – such as voluntary absences for leisure.<sup>89</sup> Measuring the frequency of these absences is therefore important for understanding working practices in the period.



**Figure 5.** The relationship between days of operation and average daily output per hewer at Townley, 1852 to 1856.

*Notes:* The 26th pay ‘fortnight’ of 1852 contained more days than usual due to colliery accounting. See endnote 75 for discussion

*Source:* All data derived from DRO, ‘Emma Pit Pay Bills, Stella Coal Company’, NCB I/SC 154–162.

Table 5 shows two values; one which only counts days where the individual worked as a hewer, whereas the other accounts for all work.<sup>90</sup> Analysing both values largely avoids the problem of a hewer being missing from the records because he was working in a different capacity in the colliery. As might be expected, the number of individuals who worked over 90 per cent of the days available to them is higher when all instances of work are considered, compared to just hewing. This supports the theory that even those employed as a full-time hewer could, in some instances, be working in other occupations (often, this was younger men being required to act as putters – transport workers who moved the coal underground).<sup>91</sup> However, both measures lead to similar conclusions.

For the years between 1852 and 1855, the number of individuals recorded as working (in any occupation) on 90 per cent or more of the available days stands at around 77 per cent (the lowest being 74 per cent and the highest 80 per cent). The data contain relatively few instances of men working 100 per cent of the available days during their period at the colliery, even when all types of work are included. Only 6 of 117 men met this criterion in 1852 (5 per cent), 5 of 107 in 1853 (5 per cent), 4 of 99 in 1854 (4 per cent), and 3 of 126 in 1855 (2 per cent). Even amongst those who exceeded 90 per cent attendance when the colliery was open, the mean days worked for each year ranged between 95 and 97 per cent.<sup>92</sup> It was therefore uncommon for men to undertake all the work available to them, even in full employment.

1856 stands out as an extreme year. The proportion of those working 90 per cent (or more) of available days (in any capacity) was particularly high; at 86 per cent.

**Table 5.** Work undertaken by hewers at Townley, by year (1852–1856)

Percentages	Days registering hewing work: number of men (percentage of sample)					Days registering any work: number of men (percentage of sample)				
	1852	1853	1854	1855	1856	1852	1853	1854	1855	1856
≥90	88 (75)	84 (79)	77 (78)	90 (71)	105 (85)	90 (77)	86 (80)	77 (78)	93 (74)	107 (86)
80–89	25 (21)	18 (17)	14 (14)	27 (21)	15 (12)	23 (20)	16 (15)	14 (14)	24 (19)	14 (11)
70–79	3 (3)	5 (5)	7 (7)	8 (6)	3 (2)	3 (3)	5 (5)	7 (7)	8 (6)	2 (2)
<70	1 (1)	0 (0)	1 (1)	1 (1)	1 (1)	1 (1)	0 (0)	1 (1)	1 (1)	1 (1)

*Notes:* The sample consists of the same individuals outlined in [Table 1](#), and the accompanying discussion. Percentages may not sum, due to rounding.

*Source:* All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

This higher rate of participation seems to have raised average fortnightly earnings to levels comparable with 1854 and 1855 (rather than changes in rates or output), despite the colliery operating for fewer days in 1856.

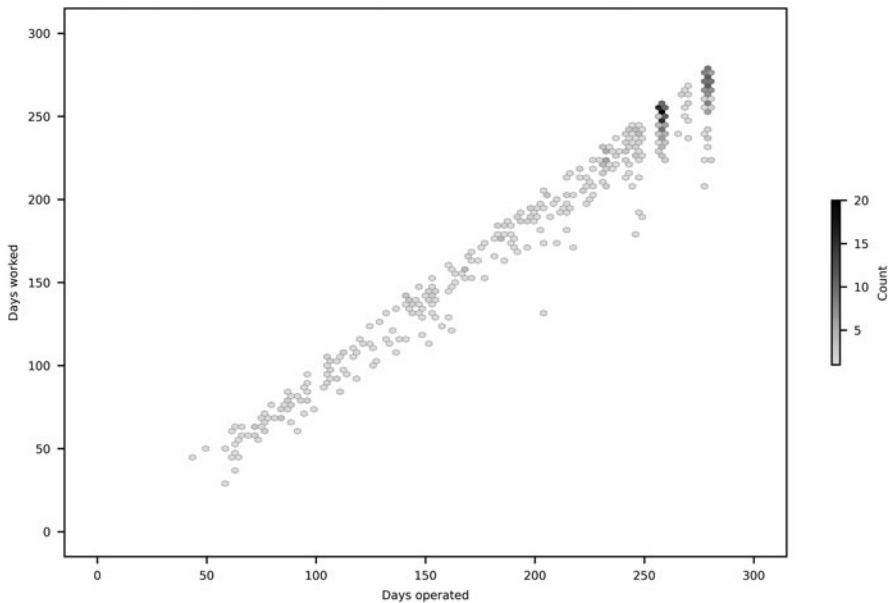
In the more typical years, a notable proportion of hewers – the remaining 25 per cent – appear to have been working on less than 90 per cent of the days available. While – for reasons which have been discussed above – there may be some margin of error on this front, it seems unlikely that this can be responsible for such a large proportion and such a sizable margin. This finding is important as it demonstrates that there was a sizable proportion of workers who – although employed consistently – worked many fewer days than the colliery operated. For the most part, this group was composed of hewers who worked between 80 and 89 per cent of the available work days. These men would still be considered as working in ‘full’ employment (it is very unlikely that they had paid jobs elsewhere), but it seems that either they demonstrated a stronger leisure preference than their contemporaries, had reduced monetary obligations, or required additional recovery time to their peers.<sup>93</sup>

Figures 6 and 7 bring together data from each year to visualise the days on which an individual worked against the days on which Townley operated during their period of employment – Figure 6 features all individuals in the sample, while Figure 7 provides an in-depth look at those present at Townley for a large proportion of the working year. The overarching theme is that individuals did not take advantage of all work opportunities. The majority were certainly consistent, and worked on a high proportion of days available, but it was rare for a hewer to be at the colliery on 100 per cent of the days it operated – as Figure 7 shows, when hewers had around 260 available work days, this typically translated into approximately 245–250 days of actual work; when around 280 days were available, this figure was closer to 265–270.

This is important when it comes to estimating the number of days an individual worked per year and requires an emphasis on the individual rather than the institution. As demonstrated above, this total could be influenced by the availability of work, but it was also subject to the willingness – or capability – of each individual to undertake this labour. There were noticeable differences between individuals working in the same occupation (in this case hewing) – most of whom would be considered to be in full-time employment – which again speaks to the importance of understanding individual experience when exploring historical earnings.

## 9. Conclusions

It is not possible on the basis of the evidence presented here to truly consider how far coalminers had witnessed an ‘industrious revolution’ by the middle of the nineteenth century. Primarily, this is for want of a suitable parallel. John Hatcher’s work on the seventeenth century coal industry suggests that hewers worked around 200 days per year, but – as he highlights – given this is only on the basis of five individuals and for a single year (at Gatherick Colliery in Northumberland for 1683/1684) it would be unwise to place too heavy an emphasis on this comparison.<sup>94</sup> Nonetheless, if we were to take Hatcher’s figure as broadly indicative, then it would appear that hewers were working more consistently by the 1850s.



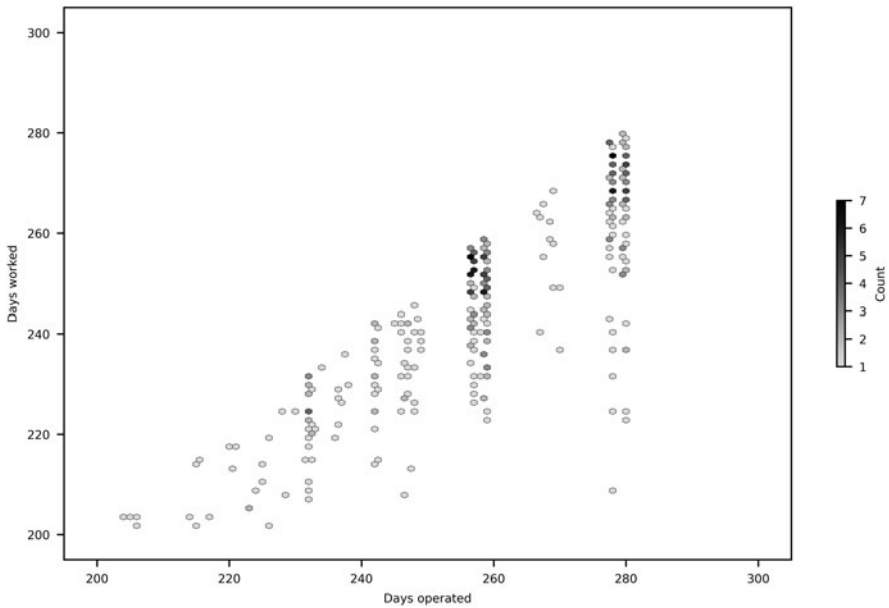
**Figure 6.** Days worked versus days operated at Townley (1852–1856).

*Notes:* The figure contains all hewer-year combinations, so the same hewer would appear more than once if they feature in the records for multiple years. Darker hexagons indicate more hewers fell within that particular days worked-days operated bin. There must be at least one individual within a bin for it to appear. Note the interpretation of the colourscale differs here to [Figure 7](#).

*Source:* All data derived from DRO, 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154–162.

Attempts to extrapolate shorter-term work to an annual basis should – for the reasons outlined above – be interpreted with caution. But by taking the average percentage at which hewers undertook work in each year and combining this with the total days on which the colliery operated, it is possible to arrive at some tentative estimates. As [Table 6](#) demonstrates, this ranged from a low of 225 days (in 1852) to a high of 267 days (in 1854). What is also evident is that these changes could occur quickly – with the length of the working year shifting rapidly between some years (for example, 1852 and 1853), but remaining consistent between others (such as between 1853 to 1854). It would therefore be a mistake to characterise the nature of this employment as predictable or consistent. Year-on-year differences in work availability could approximate a month of working days, and this has important implications for assessments of wages and standard-of-living.

The data also demonstrate varying levels of worker participation. In the simplest sense, this was related to the number of days they attended the colliery. While between 70 to 85 per cent of individuals typically undertook work on more than 90 per cent of the days available, this still leaves a notable proportion who chose not – or were unable – to do so. Work time and effort (both of which could be controlled by the hewer in this period) had an important influence on output, and this in conjunction with geology, skill, strength, and experience resulted in notable differences within the earnings of individual workers – meaning that a longer



**Figure 7.** Days worked versus days operated at Townley (1852–1856): greater than 200 days.  
*Notes:* The figure contains all hewer-year combinations, so the same hewer would appear more than once if they feature in the records for multiple years. Darker hexagons indicate more hewers fell within that particular days worked-days operated bin. There must be at least one individual within a bin for it to appear. Note the interpretation of the colour scale differs here to Figure 6.  
*Source:* All data derived from DRO, ‘Emma Pit Pay Bills, Stella Coal Company’, NCB I/SC 154–162.

**Table 6.** Predicted length of the average working year at Townley, by year (1852–1856)

Year	Mean days worked – any work (percent)	Median days worked – any work (percent)	Days in predicted working year (mean)	Days in predicted working year (median)
1852	93	95	225	229
1853	94	95	260	265
1854 <sup>a</sup>	93	96	260	267
1855	92	94	258	263
1856	95	97	244	249

*Notes:* <sup>a</sup>Available work days for 1854 are assumed to be 279, as this is the centre of the most likely range given the missing data. If it were to be assumed that the missing paybills indicate no operation of the colliery, these values would be 241 (mean) and 248 (median). Adopting the upper bound gives a working year of 262 (mean) and 269 (median).  
*Source:* All data derived from DRO, ‘Emma Pit Pay Bills, Stella Coal Company’, NCB I/SC 154–162.

working year did not always translate into higher earnings. All of this led to a highly variable employment environment, in which men employed in the same job could see very different monetary values attached to their labour.

While this article has shown that variability and volatility were both still features of work in the industry even in this period, an increase of around 25 percent of

working days (compared to two centuries prior) would certainly imply a more consistent pattern. This was – at least in part – likely a consequence of the increased demand for coal. Nationally, the industry was rapidly recruiting labour, and – whilst men in the north-east emphasised the hereditary nature of their craft – it was no exception. The threat of outside labour and the desire by colliery management to increase production likely combined in the form of more consistent work. However, this also seems to have been accompanied by a desire for a shorter work day – which became progressively more established over the course of the century.<sup>95</sup> It would therefore seem that the increased working year demonstrated here was – to an extent – progressively counterbalanced by a shortened shift.<sup>96</sup> This is consistent with Kirby's findings for north-eastern coalminers (as well as Reid's outside of the coal industry), but the net impact of this trade off on annual working hours requires further research.<sup>97</sup> The overall implication is that the data presented here seem to be consistent with some form of 'industrious revolution', but there are sufficiently plausible alternatives that it is not possible to say with certainty they were motivated by the reasons de Vries claims.

**Acknowledgements.** I would like to thank Henry French, Emily Vine, Amy Ridgway, and participants at the Economic History Society Residential Training Course 2018 for feedback on earlier versions of this article – as well as three anonymous reviewers. My thanks also go to Henry French and Alun Withey for supervising the PhD project during which much of the underlying work for this article was undertaken, and Jane Whittle and Sara Horrell for their comments on the submitted thesis. This research was enabled by an ESRC 1+3 PhD bursary (award reference: 1494247) and the Economic History Society generously provided additional funds for data collection. Due to legal concerns, the research data supporting this publication are not yet openly available.

**Competing interests.** None.

## Notes

1 For the classic optimists versus pessimists debate, see: Peter H. Lindert and Jeffrey G. Williamson, '“English workers” living standards during the industrial revolution: a new look', *Economic History Review*, 2<sup>nd</sup> ser., **36**, 1 (1983), 1–25; Charles H. Feinstein, 'Pessimism perpetuated: real wages and the standard of living in Britain during and after the industrial revolution', *Journal of Economic History* **58**, 3 (1998), 625–58; although for a recent contribution: Daniel Gallardo-Albarrán and Herman de Jong, 'Optimism or pessimism? A composite view on English living standards during the Industrial Revolution', *European Review of Economic History* **25**, 1 (2021), 1–19. For an example of energy and labour, see: Robert C. Allen, *The British industrial revolution in global perspective* (Cambridge and New York, 2009). For a recent example of the role of the family, see: Sara Horrell, Jane Humphries and Jacob Weisdorf, 'Beyond the male breadwinner: life-cycle living standards of intact and disrupted English working families, 1260–1850', *Economic History Review* **75**, 2 (2022), 530–60. The literature concerning workforce participation is discussed in-depth below.

2 'Townley' is also spelt as 'Towneley' in the same set of documents, but these relate to the same colliery. There was also a 'Towneley Colliery' in the Burnley Coalfield, so the former spelling is adopted here.

3 Robert Colls, *The pitmen of the northern coalfield: work, culture, and protest, 1790–1850* (Manchester, 1987), 8–9; James A. Jaffe, *The struggle for market power: industrial relations in the British coal industry, 1800–1840* (Cambridge, 2003), 32; M. J. Daunton, 'Down the pit: work in the Great Northern and South Wales coalfields, 1870–1914', *Economic History Review*, 2<sup>nd</sup> ser., **34**, 4 (1981), 580–2.

4 Peter Kirby, 'Attendance and work effort in the Great Northern Coalfield, 1775–1864', *Economic History Review* **65**, 3 (2012), 977–8.

5 E. P. Thompson, 'Time, work-discipline, and industrial capitalism', *Past & Present* **38**, 1 (1967), 60, 71, 73, 90–1.



- 6 For a discussion of the length of the working year in relation to real wages, see: Jane Humphries and Jacob Weisdorf, 'Unreal wages? Real income and economic growth in England, 1260–1850', *Economic Journal* **129**, 623 (2019), 2868–9.
- 7 Jan de Vries, *The industrious revolution: consumer behavior and the household economy, 1650 to the present* (Cambridge, 2008), 10; Jan de Vries, 'The industrial revolution and the industrious revolution', *Journal of Economic History* **54**, 2 (1994), 249–70.
- 8 de Vries, *Industrious revolution*, 71–2.
- 9 Alexis D. Litvine, 'The industrious revolution, the industriousness discourse, and the development of modern economies', *Historical Journal* **57**, 2 (2014), 569.
- 10 For a summary, see: Matteo Tiratelli, 'The working week in the long nineteenth century: evidence from the timings of political events in Britain', *Social Science History* **46**, 2 (2022), 298.
- 11 Douglas A. Reid, 'The decline of Saint Monday 1766–1876', *Past & Present* **71**, 1 (1976), 81–4, 86, 91.
- 12 Eric Hopkins, 'Working hours and conditions during the industrial revolution: a re-appraisal', *Economic History Review* **35**, 1 (1982), 65–6.
- 13 Douglas A. Reid, 'Weddings, weekdays, work and leisure in urban England 1791–1911: the decline of Saint Monday revisited', *Past & Present* **153**, 1 (1996), 137, 163.
- 14 Jeremy Boulton, 'Economy of time? Wedding days and the working week in the past', *Local Population Studies* **43**, 2 (1989), 42–3.
- 15 Mark Harrison, 'The ordering of the urban environment: time, work and the occurrence of crowds 1790–1835', *Past & Present* **110**, 1 (1986), 166–7.
- 16 Tiratelli, 'Working week', 308.
- 17 Hans-Joachim Voth, 'Time and work in eighteenth-century London', *Journal of Economic History* **58**, 1 (1998), 32; Hans-Joachim Voth, *Time and work in England 1750–1830* (Oxford, 2000).
- 18 Voth, 'Time', 34, 36.
- 19 Mark Hailwood, 'Time and work in rural England, 1500–1700', *Past & Present* **248**, 1 (2020), 105; Steve Hindle, 'Work, reward and labour discipline in late seventeenth-century England', in Steve Hindle, Alexandra Shepard and John Walter eds., *Remaking English society: social relations and social change in early modern England* (Woodbridge, 2013), 270.
- 20 Anne L. Murphy, 'Clock-watching: work and working time at the late eighteenth-century Bank of England', *Past & Present* **236**, 1 (2017), 123, 128–9.
- 21 For discussion of this issue and related literature, see: Kathryn E. Gary, 'The distinct seasonality of early modern casual labor and the short durations of individual working years: Sweden 1500–1800', *Lund Papers in Economic History. Education and the Labour Market* **189** (2019), 4–5.
- 22 These efforts include several working papers delivered at the XIX World Economic History Congress (2022) which are not yet published. Papers of particular relevance were found in the 'Working time in the past' and 'Timeless wages: piece rates in global economic history' sessions, including those by Joyce Burnette; Judy Stephenson, Patrick Wallis, Kathryn E. Gary, Meredith Parker, Ernesto Lopez, and Mario Garcia Zuniga; Jacob Weisdorf, Sara Horrell, and Jane Humphries; Jane Humphries and Ryah Thomas; Tim Barmby and Barbara Eberth; John Styles; and others.
- 23 R. C. Allen and J. L. Weisdorf, 'Was there an "industrious revolution" before the industrial revolution? An empirical exercise for England, c. 1300–1830', *Economic History Review* **64** (2011), 717.
- 24 Gregory Clark and Ysbrand van der Werf, 'Work in progress? The industrious revolution', *Journal of Economic History* **58**, 3 (1998), 841. But see also: John Hatcher, 'Unreal wages: long-run living standards and the "Golden Age" of the fifteenth century', in John Hatcher and Judy Z. Stephenson eds., *Seven centuries of unreal wages: the unreliable data, sources and methods that have been used for measuring standards of living in the past* (Cham, 2018), 227–66.
- 25 Humphries and Weisdorf, 'Unreal wages', 2880.
- 26 Horrell, Humphries and Weisdorf, 'Beyond', 532–4, 551, online appendix 1.
- 27 Kathryn E. Gary and Mats Olsson, 'Men at work. Wages and industriousness in southern Sweden 1500–1850', *Scandinavian Economic History Review* **68**, 2 (2020), 125–6, online appendix 1.
- 28 Humphries and Weisdorf, 'Unreal wages', 2870.
- 29 *Ibid.*, 2870. Humphries and Weisdorf do attempt to address this issue by considering systematic differences between annual and day workers, but limited information regarding the share of the labour force employed on an annual basis and the size of any premium for a particular method of hiring suggest further research is necessary to fully validate this mechanism, 2881–3.

30 Ibid., 2870.

31 This is acknowledged by Clark and van der Werf, but the implications are not fully explored: Clark and van der Werf, 'Work in progress', 831–2, note 10.

32 Judy Z. Stephenson, 'Working days in a London construction team in the eighteenth century: evidence from St Paul's Cathedral', *Economic History Review* 73, 2 (2020), 413; Judy Z. Stephenson, 'In search of the average craftsman: understanding skilled work and wages in the early modern building trades and wider economy', in Hatcher and Stephenson, *Seven centuries*, 129.

33 Stephenson, 'Working days', 428.

34 Ibid., 418.

35 Joyce Burnette, 'Seasonal patterns of agricultural day-labour at eight English farms, 1835–1844', in Hatcher and Stephenson, *Seven centuries*, 222.

36 Ibid., 211–4.

37 Joyce Burnette, 'Missing work: absenteeism at Pepperell Manufacturing Co. in 1883', *Cliometrica* 15 (2021), 757–60.

38 Burnette, 'Missing work', 784.

39 For an overview of contracting arrangements, see: Roy Church, *The history of the British coal industry, 1830–1913, Victorian pre-eminence* (Oxford, 1986), 261, 268–9.

40 M. J. Daunton, 'Miners' houses: South Wales and the Great Northern Coalfield, 1880–1914', *International Review of Social History* 25, 2 (1980), 154; For a broad indication of maximum population see: GB Historical GIS/University of Portsmouth, Ryton CP/AP through time | Population Statistics | Total Population, *A Vision of Britain through Time*. [http://www.visionofbritain.org.uk/unit/10144589/cube/TOT\\_POP](http://www.visionofbritain.org.uk/unit/10144589/cube/TOT_POP) [accessed 26 November 2022] but note that there are difficulties relating census data to places which do not correspond to a parish unit.

41 Church argues that skill 'was in effect a product of experience in the mine' and that this knowledge could vary 'from district to district, from colliery to colliery': Church, *Coal industry*, 206. For a description of the cavilling process from a slightly later period, see: Daunton, 'Down the pit', 586. Daunton highlights the variability in the scope of the cavit – the precise range at Townley is not directly recorded, but the high average number of fortnights for each individual (outlined in Table 1) suggests it did not rotate hewers outside of the colliery.

42 B. R. Mitchell, *Abstract of British historical statistics* (Cambridge, 1962), 115.

43 Church, *Coal industry*, 189.

44 Ibid., 35.

45 Ibid., 3, 85–8. Although it must be noted that any figures prior to 1872 are best estimates rather than firm output statistics, because of a lack of data.

46 Church, *Coal industry*, 37–8, 48.

47 Colls, *Northern coalfield*, 52; Jaffe, *Market power*, 26.

48 Michael W. Flinn, *The history of the British coal industry, 2, 1700–1830, the Industrial Revolution* (Oxford, 1984), 339.

49 Church, *Coal industry*, 233, 235.

50 Colls, *Northern coalfield*, 17.

51 Church, *Coal industry*, 274.

52 Ibid., 274–5. Although Daunton argues that the most fundamental change came about with mechanised longwall in the inter-war period, he does accept the manual method did bring about some changes in workplace organisation: Daunton, 'Down the pit', 583–4.

53 Church, *Coal industry*, 337. Daunton provides a good description of the differences between 'bord-and-pillar' and 'longwall' working, and why the latter resulted in more direct supervision from those in managerial roles; Daunton, 'Down the pit', 580–3.

54 The most significant of these being housing tied to the colliery (sometimes free, although this could also be charged – particularly as the century progressed): Church, *Coal industry*, 280–1. However, there were other benefits available to hewers, such as an allocation of cheap coal: G. C. Greenwell, *A glossary of terms used in the coal trade of Northumberland and Durham* (London, facsimile [n.d.], 1888), 47.

55 Church, *Coal industry*, 224–34.

56 Jaffe, *Market power*, 81–2; Colls, *Northern coalfield*, 133–6; Angela V. John, *By the sweat of their brow: women workers at Victorian coal mines* (London, 1979), 11, 70–1; Church, *Coal industry*, 632–3; Andrew Walker, "'Pleasurable homes"? Victorian model miners' wives and the family wage in a South Yorkshire

colliery district', *Women's History Review* 6, 3 (1997), 332; Amanda Milburn, 'Female Employment in Nineteenth Century Ironworking Districts: Merthyr Tydfil and the Shropshire Coalfield, 1841-1881' (unpublished PhD thesis, Swansea University, 2013), 66.

57 Colls, *Northern coalfield*, 135.

58 For example, Colls cites evidence that 'the cultivation of their Gardens' was a concern to workers in 1811, but the extent to which these activities could act as a substitute for market goods – or how far they were an option to those employed at Townley in the mid-century – is difficult to measure. Colls, *Northern coalfield*, 82.

59 Colls, *Northern coalfield*, 47. Admittedly, this is somewhat beyond the general scope of Colls' work.

60 Church, *Coal industry*, 556.

61 *Ibid.*, 556-7.

62 Church provides an in-depth discussion of the series construction, including the potential problems associated with the data employed: *Ibid.*, 559, 637-46.

63 Kirby, 'Attendance'.

64 *Ibid.*, 977. Kirby's methodology also treats individuals in each fortnightly paybill largely as separate entities, which limits assessment of work over the year.

65 Kirby, 'Attendance', 969.

66 *Ibid.*, 976.

67 The 12,000 entries figure given above refers to only hewing entries. There are approximately 24,000 entries for Townley in total, but around half refer to the work of children, supervisory capacities, and a limited amount of non-hewing adult work.

68 There were small differences between the work individuals actually undertook and their recorded number of tubs. The most important factor was the 'double shift' system, which required individuals to share workspaces with the man on the alternating shift. In the north-east, men avoided having to finish their shift on a 'full' tub by reaching semi-formalised pooling arrangements. The implications of these arrangements cannot be fully explored here as a consequence of space constraints, but they ultimately had a relatively minimal impact on productivity. Other factors which may have influenced produced-versus-recorded output include incorrect recording (as a result of both accidental and deliberate exclusions) or disqualifications because of stone content. Overall, these are relatively minor influences in the context of these data.

69 All paybill data are drawn from Durham County Records Office ('DRO'), 'Emma Pit Pay Bills, Stella Coal Company', NCB I/SC 154-62.

70 Colls, *Northern Coalfield*, 70-1.

71 Ignoring single fortnights – which cannot be matched to any other entry – leads to 12 individual histories being excluded for 1852, 17 for 1853, 12 for 1854, 16 for 1855, and 10 for 1856. A further portion of these (7 for 1852, 11 for 1852, 6 for 1854, 6 for 1855, and 4 for 1856) are only pairs or triplets of fortnights, and therefore represent an especially poor quality of data – particularly because if an individual joined and left the colliery halfway through their incoming and outgoing pay fortnight, it would heavily skew both their attendance and average fortnightly earnings. Even with five fortnights, this could result in 20 per cent of the employment history where an individual would be classified as 'absent' but could actually be working elsewhere. Lowering the requirement for a minimum of four fortnights has a limited influence on the earnings given in Table 2 – reducing the mean by 2d. in 1852, 6d. in 1853, 7d. in 1854, 10d. in 1855, and 7d. in 1856 (or -0.5 to -2.0 per cent). Lowering the threshold to two fortnights reduced this by 11d. (-3.3 per cent), 19d. (-4.7), 25d. (-5.0), 21d. (-4.1), and 16d. (-3.5) respectively, but this is to be expected given the discussion above. It also has a limited overall influence on Table 6 – including a minimum of four fortnights would alter the values in the 'Mean days worked – any work (percent)' column by 0, -1, -1, -1, and -1 respectively. Including all excluded employment histories would alter the same values by -2, -2, -2, -1, -2 respectively.

72 A small number of entries contained large single payments to groups of men – usually for 'Bargain' or 'Shift' work. If men involved were listed and identified elsewhere in the records – such as the case for four men (Thomas and William Eltringham, Christopher Whitfield and Isaac Clark – all of whom also undertook their regular hewing work in the same period) who were paid collectively for 'shooting down stone and making 39 yards rolley way' in September 1852 – then a portion of this payment was added to their other entries for that fortnight. If allocations were not specified in the entry, equal shares were assumed – although this was likely to have been at the discretion of the lead man.

73 Kirby, 'Attendance', 973.

74 Paybills were one part of a complicated recording and accounting process in the coal industry of this period, but there were other layers of documents and adjustments before pay was distributed. Paybills therefore recorded the value of a man's work, but not necessarily the precise amount he was paid. Some men were paid directly by the overman (taking home exactly what they 'earned'); others nominated a lead hewer to receive and divide what the group was owed; while further men may have worked with a single partner (known as a 'marra') and divided their wages accordingly. The reasons for this are complex and worthy of further research in their own right, but unfortunately the documents recording these arrangements are not known to have survived at Townley, and therefore the influence of such practices cannot be assessed with any reasonable certainty for these data.

75 A trick of colliery accounting means that the last fortnight in 1852 contains more than two weeks of work – it was fairly common practice to adapt record keeping around the disruption of Christmas and the New Year. When this fortnight is excluded, the average fortnightly earnings see a small fall to 333d., but as this time of year was often particularly lucrative for workers in the coal industry, the best representation of earnings is to include it despite the slightly different length.

76 Church, *Coal industry*, 561.

77 Despite the cautions in note 74, if we consider 'earnings' to be broadly representative of 'wages', the variability demonstrated here has some important potential implications. For example, Allen's 'Northern England: Craftsman' series (<https://www.nuffield.ox.ac.uk/people/sites/allen-research-pages/> [accessed 25 November 2022]) reports a nominal value of 52 pence/day in 1850 (the nearest year to the data presented here). Calculating pence/day worked (combining the data used to calculate Figure 1 with the corresponding days worked from Figure 6) for each hewer-year combination yields a comparable mean of 48 pence/day, and median of 47 pence/day. If the inter-individual variation present in this series were to also be present in Allen's, then this could provide upper and lower bounds to subsistence and respectability ratios.

78 Kirby, 'Attendance', 973; John G. Treble, 'Productivity and effort: the labor-supply decisions of late Victorian coalminers', *Journal of Economic History* 61, 2 (2001), 429.

79 There are some difficulties associated with establishing exactly which other collieries were operating in the same years, and their precise distances. The nearby (approximately, two kilometres) Stargate Colliery was also owned and operated by the Stella Coal Company in this period, but whilst it is possible that men transferred between the two, this was typically for extended periods rather than odd days – and the influence would therefore be minimised by the method of analysis employed here.

80 Church, *Coal industry*, 244; Kirby, 'Attendance', 969.

81 Jaffe, *Market power*, 155; Church, *Coal industry*, 68–9.

82 See note to Table 4.

83 The sample used in Figures 2–4 is slightly different to the one used in the rest of the article, as it only considers hewing earnings (rather than all earnings for each individual hewer, regardless of how they were earned). This series is less precise (in terms of understanding what individuals actually earned) than the earnings presented above, but it provides a better indication of the relationship between hewing and availability of work examined here. 657 entries recorded two men jointly (known as 'double working') and were split evenly to better represent earnings-per-man, resulting in 13,453 fortnightly datapoints. This is not a perfect solution to this problem, but precise shares cannot be calculated. Entries under 100d. (468 in total) and over 800d. (22 in total) were excluded from the original 13,453 to account for very limited employment or disguised gang working.

84 Colls, *Northern coalfield*, 28. Daunton discusses shift length for a slightly later period: Daunton, 'Down the pit', 587. This also broadly corresponds to Jevons' description: H. Stanley Jevons, *The British coal trade* (Newton Abbot, 1969), 608–17.

85 Church, *Coal industry*, 237.

86 Colls, *Northern coalfield*, 20, 23–4; Church, *Coal industry*, 340; Jevons, *Coal trade*, 62.

87 Church, *Coal industry*, 343–4.

88 Jevons, *Coal trade*, 615.

89 Kirby, 'Attendance', 970.

90 Excluding ad hoc shift or bargain work – where men carried out a specified task, but no particular day was recorded – although as the overall availability of this work was limited and it could often be undertaken on the same day as hewing work, this has limited influence.

91 Daunton, 'Down the pit', 589.

92 This percentage cannot be translated directly into days work of the total available in a year, because the employment histories included in the sample vary in length – although note [Table 6](#) (and the accompanying discussion). The percentage therefore refers to the proportion of work days attended whilst the individual was known to be working at the colliery.

93 The methodology used to construct these estimates omits the influence of long-term injuries; if a man were missing for an entire pay fortnight, it would not be counted in his average earnings or attendance using the methods employed above. It is highly probable that minor injuries were suffered frequently, but the degree to which they influenced worker attendance is not known, and cannot be systematically investigated using these data.

94 John Hatcher, 'Labour, leisure and economic thought before the nineteenth century', *Past & Present* 160, 1 (1998), 89.

95 Colls, *Northern coalfield*, 30–1.

96 Church, *Coal industry*, 254.

97 Kirby, 'Attendance', 969; Reid, 'Saint Monday', 101.

### French Abstract

Cet article démontre la nature variée et imprévisible de la rémunération au XIX<sup>e</sup> siècle. En utilisant comme étude de cas 12 000 entrées de paie bimensuelles de Townley Main Colliery dans le nord-est de l'Angleterre, il explore dans quelle mesure la disponibilité du travail a fluctué d'une année à l'autre et comment les ouvriers ont réagi à ce phénomène. Il examine ensuite la fréquence à laquelle ces personnes ont entrepris le travail qui était disponible et discute des implications pour notre compréhension de la durée de l'année de travail.

### German Abstract

Dieser Beitrag beleuchtet, wie unterschiedlich und unvorhersehbar sich das Einkommen im 19. Jahrhundert darstellte. Indem er rund 12.000 vierzehntägigen Zahlungsbelege der Hauptzeche Townley als Fallstudie nutzt, untersucht er, in welchem Umfang die verfügbare Arbeit über die Jahre hinweg schwankte und wie die Arbeiter darauf reagierten. Anschließend untersucht er, wie häufig diese Personen die verfügbare Arbeit tatsächlich annahmen, und was sich daraus für unser Verständnis der Länge des Arbeitsjahres ergibt.