Are Estimates of Non-Standard Employment Wage Penalties Robust to Different Wage Measures? The Case of Zero-hour Contracts in the UK

EGIDIO FARINA, COLIN GREEN and DUNCAN MCVICAR*

Evidence suggests that non-standard jobs are associated with wage penalties. Yet, these jobs possess a range of undesirable characteristics that should generate compensating wage differentials. This evidence relies on derived wage variables, prone to measurement error likely to be correlated with employment contract. Stated-rate hourly wage questions are not subjected to the *same* measurement issues. Using zero-hour contracts in the UK, we show that there is no conditional average ZHC wage penalty once stated-rate hourly wage measures are used. We discuss implications for policy.

Introduction

Across a range of developed economies, there have been substantial increases in the share of workers in what can be described as non-standard employment arrangements (Katz and Krueger 2019).[1] The specific form of these contractual arrangements is heavily dependent on country-specific institutional and legal frameworks, but a common feature is a reduction in job security often combined with greater hour variability.

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*The authors' affiliations are, respectively, Queen's University, Belfast, UK. e.farina@qub.ac.uk. Norwegian University of Science and Technology, Trondheim, Norway and IZA, Bonn, Germany. colin.green@ntnu.no. Queen's Management School, Queen's University Belfast, Riddel Hall, 185 Stranmillis Road, Belfast BT9 5EE, UK. and IZA, Bonn, Germany. d.mcvicar@qub.ac.uk. This research was funded by Leverhulme Trust Research Project Grant RPG-2017-314, which we gratefully acknowledge. We also gratefully acknowledge the Office for National Statistics and the UK Data Archive for access to unit record data from multiple waves of the UK Quarterly Labour Force Survey and from multiple cohorts of the UK Longitudinal Labour Force Survey used in this paper. The findings and views reported in this paper are those of the authors and should not be attributed to the Leverhulme Trust or any of the organizations listed above.

[1] A number of other terms are also used including contingent employment, flexible employment, flexible working arrangements, and alternative work arrangements.

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This has given rise to a range of concerns regarding potential negative effects on worker outcomes, with the effect on wages being a focus of both researchers and policymakers (e.g., Lass and Wooden 2019; OECD 2015; Taylor, Marsh, and Nicole 2017). This is a critical point. If the characteristics of non-standard employment contracts are broadly undesirable, then they should generate compensating wage differentials or other offsetting desirable characteristics (Rosen 1986). For example, workers for whom short-term variability in hours and even earnings generate disutility should receive higher wages in compensation. Similar arguments follow in terms of the expectation of greater job insecurity on wages (Abowd and Ashenfelter 1981). A lack of wage compensation, or even the existence of wage penalties, would make it more likely that these changes in contractual arrangements reflect a decline in worker welfare, suggesting a role for policy intervention. A complication is that jobs that vary in contractual arrangements likely vary in other key aspects, while workers sort across these contracts, and both are known to affect our ability to observe compensating differentials (Duncan and Holmlund 1983; Hwang and Reed 1992). In practice, a typical finding in the international literature is that non-standard jobs, including fixed-term and other temporary jobs such as casual jobs, appear to pay lower wages than permanent jobs, even after controlling for differences in observable (and in some cases time-invariant unobservable) worker and job characteristics (e.g., Booth and Francesconi 2002; Forde and Slater 2005; Hagen 2002; Jahn and Pozzoli 2013; Mertens and Gash 2007).

Recently, the UK has witnessed a rise in a specific form of non-standard employment, zero-hour contracts (ZHCs), that exhibit both job insecurity and short-term hour variability (Datta and Giupponi 2019; Farina, Green and McVicar 2020). ZHCs have been defined as employment contracts where the employer does not guarantee the individual any work and where the individual is not obliged to accept any work offered (e.g., DBIS 2013). While, as we demonstrate later, these jobs are not constrained to particular sectors or occupations, there are known to be high concentrations of ZHC work within the care sector, and among hospitality workers.

As with other forms of non-standard employment, this has led to concerns about worker outcomes including wages. At first glance, the evidence with respect to wages appears strong. Several recent studies have shown that wages are lower in ZHC jobs than in other types of jobs in the UK, with estimated unconditional hourly wage penalties typically between 30% and 50%, which remain large (in the order of 5% to 9%) even after conditioning on observable job and worker characteristics (Adams and Prassl 2018; Clarke and Cominetti 2019; Datta et al. 2019; Gardiner 2016; Koumenta and Williams 2019; TUC

2014). No studies report a ZHC wage premium or the absence of a ZHC wage penalty.

This wage penalty literature, including that for ZHCs, typically relies upon wage information that is derived from survey responses to questions on earnings and hour data, and these are particularly prone to measurement error (for examples of such studies, see Booth et al. 2002; Forde and Slater 2005; Hagen 2002; Lass and Wooden 2019; Mertens et al. 2007; for a discussion of measurement error in derived hourly wages, and its econometric consequences, see Bound, Brown, and Duncan 1994).[2] If this measurement error is uncorrelated with employment contract then, although it may lead to imprecise estimates of contractual wage penalties, it will not bias estimates. This seems probable for some sources of measurement error in derived wages but not others. For example, rounding in reported hours and earnings is likely uncorrelated with employment contract. However, there are other sources of measurement error that may be correlated with contractual status. One concern is if reported periods for earnings and hours do not match. A symptom of this is that wage distributions using derived measures have been found to be wider than those using alternative wage measures, for example, as reported by employers, and with many implausible values (Ormerod and Ritchie 2007). This may be more problematic for workers, such as those in non-standard employment, whose hours and earnings may vary considerably from week to week. Another potential concern with reported hours in this context is the scope for differential inclusion of unpaid hours by survey respondents under different contracts. Previous research suggests that unpaid hours are widespread among ZHC workers (Datta et al. 2019). Importantly, and as we argue further, both could lead to consequential bias in estimates of contractual wage penalties.

An alternative to this kind of derived hourly wage measure exists in many of the surveys used to date in the wage penalty literature.[3] These surveys all include stated-rate hourly wage questions for workers paid an hourly rate. Naturally, these stated-rate measures are also susceptible to measurement error, for example, related to rounding, but arguably do not suffer from the same potential mismatch between hour and earning periods, or inclusion of unpaid hours. Furthermore, these two wage measures capture slightly different things, both of which are potentially interesting. The stated rate measures the on-paper hourly wage rate (as would be reported by the employer), whereas the derived

[2] Jahn and Pozzoli (2013), which uses administrative data for Germany, is an exception, although the wage variable is still derived and refers to the daily wage rather than the hourly wage.

[3] Including, for the UK, the Labour Force Survey (LFS), the British Household Panel Survey, and Understanding Society, and internationally, the German Socio-Economic Panel, and the US Current Population Survey.

hourly wage may measure something closer to the in practice hourly wage, accounting for any unpaid hours worked that survey respondents include in their total hour responses. If workers on non-standard contracts disproportionately include unpaid hours in their hour responses—consider, for example, domiciliary care workers on ZHCs paid for appointment time but not travel time in between appointments—then there are measurement differences between the two wage variables that are correlated with contract type, suggesting potential for sensitivity in wage penalty estimates depending on the wage measure used. The two measures may diverge in another respect, too; whereas a stated-rate measure will typically capture only the basic rate, a derived wage measure will capture any above-basic earnings due to overtime or shift premiums. If such premiums are more likely (or larger) for standard, permanent workers than for those on non-standard contracts—and ZHC workers, in particular, seem unlikely to work overtime that attracts a wage premium given the lack of contracted hours—then there is further scope for sensitivity in non-standard employment wage penalty estimates according to the wage measure used.

At first glance, then, it seems surprising that stated-rate measures have not been used alongside derived wage measures in the non-standard employment wage penalty literature, including the ZHC wage penalty literature. This leads to questions about the robustness of this literature's conclusions. One likely contributing factor is the trade-off in terms of reduced sample coverage; stated-rate wage measures tend to cover far fewer survey respondents than derived wage measures because not all workers are paid an (or know their) hourly rate. This likely reduces their usefulness for estimating the wage differential experienced by fixed-term workers, for example, some of whom might be paid on a monthly/annual salary basis. But for ZHCs, and potentially other variable-hour contract types such as casual and short-hour contracts, this may be a moot point because almost all such workers will be paid on an hourly basis and will likely be familiar with their hourly rate. Furthermore, because non-ZHC hourly paid jobs (and the workers who hold them) are likely to be closer to ZHC jobs in terms of observable and unobservable job and worker characteristics than non-ZHC jobs paid an annual salary, estimation on a sample restricted to hourly paid workers may have advantages in terms of the internal validity of ZHC wage penalty estimates. A complicating factor is that if ZHC hourly paid workers work more unpaid hours than comparable hourly paid workers (including on other forms of non-standard employment), then stated-rate hourly measures may underestimate any wage penalties attached to ZHC work.

Using UK LFS data, this paper estimates ZHC wage differentials using both derived and, for the first time, stated-rate hourly wage measures. Using derived

wages, we replicate the ballpark conditional ZHC wage penalty typical of existing studies. We then show, in contrast, that there is no conditional ZHC wage penalty, on average, when using the stated-rate hourly wage measure. In an extension, we exploit the longitudinal structure of the LFS to show this is also the case in individual fixed-effects models which provide additional control for time-invariant unobserved heterogeneity of workers. The takeaway message is that the size, nature, and even existence of any ZHC (and other non-standard employment) wage penalty in the UK appears highly sensitive to how wages are measured. The implied conjecture is that this might also be the case for some other estimates of non-standard employment wage penalties in the wider literature.

Data

In the UK, ZHCs have been defined as employment contracts where the employer does not guarantee the individual any work and the individual is not obliged to accept any work offered (e.g., DBIS 2013). This makes them comparable to a range of employment arrangements in other countries, including ZHCs in Finland, "If and When" contracts in Ireland, some causal work in Australia, and others (see Datta et al. 2019; O'Sullivan 2019). In practice, not all ZHCs appear to offer the right to turn down work without penalty—so-called "one-sided flexibility" (CIPD 2015; Low Pay Commission 2018). Recent (but pre-COVID-19) estimates suggest that three percent of those in employment, or 974,000 workers, were employed under a ZHC in their main job in the UK in October–December 2019 (ONS 2020).

Our main data source is the UK LFS (Office for National Statistics 2019, Office for National Statistics 2017). We restrict our attention to those aged 16+, in employment (excluding the self-employed), and we pool over the period from 2015 to 2018.[4] The LFS collects data from households for five consecutive quarters, with a fifth of the sample replaced each quarter. The LFS is used primarily as a cross-sectional data set in applied research (the Quarterly Labour Force Survey, or QLFS). Because it has a rotating panel structure, however, it can also be used as a longitudinal data set (the Longitudinal Labour Force Survey, or LLFS). For most of the analysis here, we use the QLFS as it offers a larger sample and includes a wider selection of relevant variables (especially on other non-standard employment contracts). Unlike existing studies of the ZHC wage penalty, however, we complement our

[4] We include proxy responses throughout but our key conclusions are robust to their omission.

analysis of the QLFS with analysis of LLFS which provides an opportunity to difference out individual time-invariant unobservables. Given that questions on earnings, wages, and contract type are not asked in every wave and every quarter, as we discuss below, when using the LLFS we are limited to quarter 2 (Q2) and quarter 4 (Q4) entry cohorts from 2015–2017, with just two observations (wave 1 and wave 5) for each individual in the relevant balanced panels. The resulting sample size is small, covering just 1540 individuals drawn from four cohorts.[5] Because this is pushing at the limits of the data, conclusions from the LLFS analysis are treated as tentative.

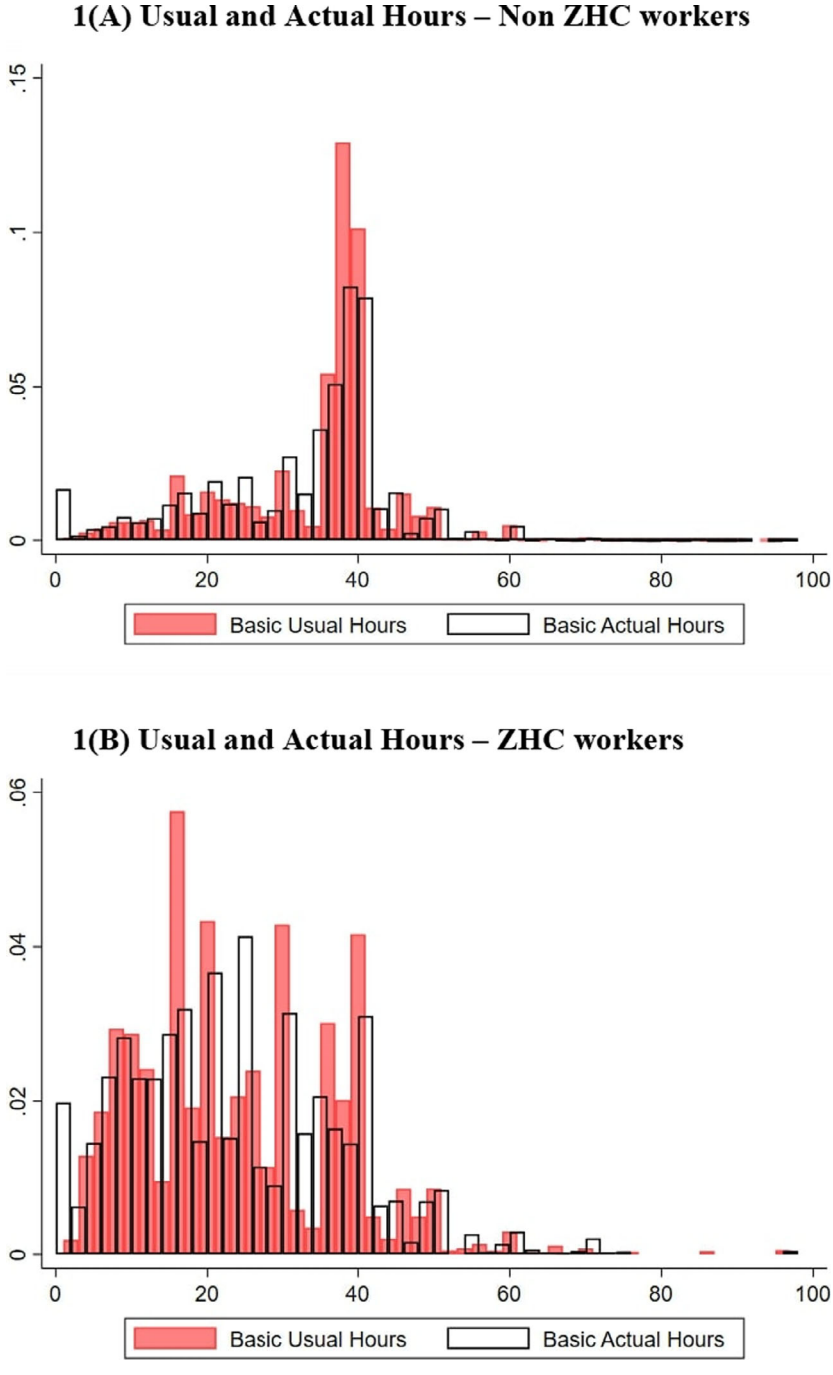
The UK LFS contains two hourly wage measures (for a discussion, see Ormerod and Ritchie 2007). The first is an hourly pay variable (HOURPAY) derived from gross weekly earnings in the respondent's main job (in the last pay period) divided by the total number of (usual) weekly hours of work, including (usual) hours of paid overtime (but not unpaid overtime), in the main job.[6] Note that weekly earnings in the last period are itself a derived variable, as respondents are asked how much they were paid the last time and, subsequently, what period the payment covered (If the pay period is monthly, for example, this must be converted into a weekly equivalent). Also note the scope for mismatch between the pay period (linked to the most recent occasion the respondent was paid) and the hours (their usual hours). This is addressed by a contingency; for respondents who say their pay varies from one period to the next—highly likely for many ZHC and some other non-standard contract workers—HOURPAY uses usual pay (converted to weekly) in place of pay in the last period. But even the concept of usual pay, let alone its accurate reporting, seems problematical for many ZHC and other variable-hour workers. As a result, this is likely to be a noisy measure of wages, and particularly so for ZHC workers. It is unclear, however, whether this form of measurement error (rather than simply its variance) is correlated with ZHC (or any other contract) status. Also potentially concerning in the context of estimating the ZHC wage penalty is inclusion of unpaid hours in total usual hours by survey respondents in a manner that could be correlated with contract type. While it seems possible that workers in standard, permanent jobs disproportionately include unpaid hours, it seems more likely that workers in non-standard jobs do so, in which case estimated non-standard employment wage penalties may be exaggerated.

[5] No data are provided for the 2015Q4 entry cohort or for wave 5 of the 2016Q2 cohort.

[6] Respondents are also asked their actual hours in the past (reference) week. This is often less than usual hours, and if so respondents are further asked why this is the case? For ZHC workers, the modal response is "hours usually vary." Figure 1 displays hours worked by contract status and demonstrates that ZHC workers are more likely to work part-time hours and also have more variation between actual and usual hours, with some ZHC workers reporting no hours in the previous week.

FIGURE 1

Distribution of Hours Worked (Usual and Actual in Last Week) by Contract Status [Color figure can be viewed at wileyonlinelibrary.com]



Unpaid hours appear to be common among ZHC workers in the UK, with Datta et al. (2019) citing survey evidence that 30% of ZHC workers regularly work unpaid hours, on average eight hours per week. Note that earning information is only collected in wave 1 and wave 5 for each respondent. That aside, however, the measure has good coverage, given that earning and hour data are observed for almost all those in employment in the relevant waves. As a result, HOURPAY is available for roughly two fifths of the QLFS employed sample in any one quarter.

The alternative measure (HRRATE) is a directly reported hourly wage rate.[7] Ormerod and Ritchie (2007) compare the merits of the two LFS wage measures, and although HRRATE is also subject to some forms of measurement error (e.g., rounding), omits any above-basic pay premiums, and is only returned for those workers who previously answer yes to the question whether they are paid on an hourly basis, it is the preferred LFS-based wage measure of the ONS when estimating the extent of low pay. A key argument for this is that reduced coverage relative to HOURPAY is not as salient an issue toward the bottom of the wage distribution because most low-pay workers are paid on an hourly basis. The same is true for workers on ZHCs (along with their most similar counterparts in standard, permanent employment); for our QLFS sample, 83% of those who report being on a ZHC also report their hourly wage rate. Crucially for our purposes, the scope for hours and earnings mismatch and for inconsistent inclusion of unpaid hours in HOURPAY is absent for HRRATE. We view HOURPAY and HRRATE as complementary measures—one that seeks to measure the on-paper hourly wage and one that seeks to measure hourly pay—which may lead to different conclusions about the ZHC wage penalty (and those for other forms of non-standard employment). In the following discussion for the sake of clarity, we refer to these two sources of wage data as hourly pay and the hourly wage rate, respectively.[8] Note that, like HOURPAY, the relevant questions for HRRATE are only asked to LFS respondents in employment in waves 1 and 5. Throughout the paper, both wage variables are measured in real rather than nominal terms (£2017Q2).

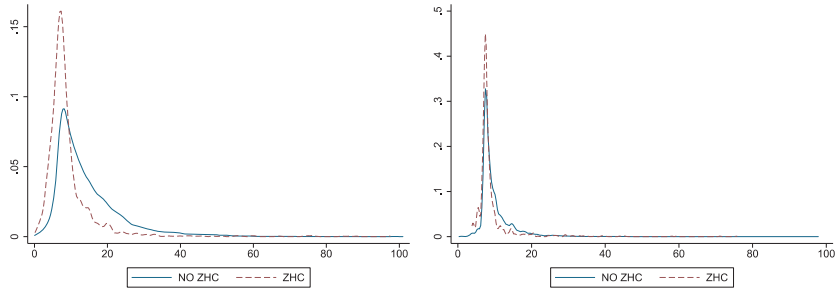
Information on ZHCs is collected in the LFS via a question (FLEX10) which asks respondents if they are employed on a flexible hour contract in their main job. Respondents are able to choose up to three options, with ZHCs

[7] The question is as follows: *What is your (basic) hourly rate?*

[8] Following the LFS documentation and, specifically, the Labour Force Survey User Guide—volume 3: Details of LFS variables relative to the years 2015-2018, observations with hourly pay >£100 (HOURPAY) are treated as missing.

FIGURE 2

Distribution of Earnings by ZHC Status.



Derived Hourly Wage **Reported Hourly Wage Rate**

Note: The figures give the distribution of hourly pay for people in employment, excluding self-employed, for workers on ZHCs (red/dotted line) and those not on ZHCs (blue/solid line). The figures are obtained using QLFS Q2 and Q4 data over the period 2015-2018. Hourly wages > £100 are treated as missing. Nobs = 81,284 (derived hourly wage) and 26,790 (hourly wage rate) [Color figure can be viewed at wileyonlinelibrary.com]

one of these.[9] We treat an individual as being employed on a ZHC if they choose ZHC for any of the three options. Note that until January 2020, FLEX10 was only asked every other quarter, specifically in April–June (Q2) and October–December (Q4), so our QLFS and LLFS samples are restricted to these quarters only. A second question (JOBTYP) collects information on whether the main job was permanent or temporary. We define a "temporary job" dummy equal to 1 if respondents report being in a temporary job, and 0 otherwise. Those answering "temporary" are asked a follow-up question (JBTP10).[10] We use this to disaggregate temporary employment into its component types, constructing one dummy for each of the five types.[11] Finally, those who report being in permanent employment are asked whether they are employed through an employment agency, from which we define an additional

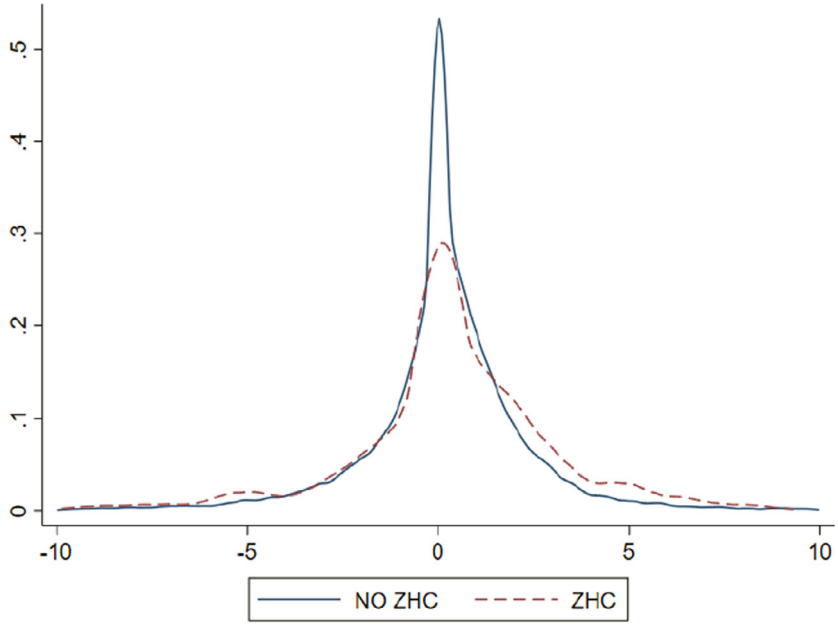
[9] The question is worded as follows: *Some people have special working hour arrangements that vary daily or weekly. In your (main) job is your agreed working arrangement any of the following…1 flexitime (flexible working hours), 2 an annualized hour contract, 3 term-time working, 4 job sharing, 5 a nine-day fortnight, 6 a four-and-a-half day week, 7 zero-hour contract, 8 on-call working, or 9 none of these?*

[10] The first question is worded as follows: *Leaving aside your own personal intentions and circumstances, was your job…1 a permanent job, 2 or was there some way that it was not permanent?* The follow-up question is: *In what way was the job not permanent, was it… 1 working for an employment agency, 2 casual type of work, 3 seasonal work, 4 done under contract for a fixed period or for a fixed task, 5 or was there some other way that it was not permanent?*

[11] Note that respondents can choose more than one option (up to five), so these dummies overlap.

FIGURE 3

DIFFERENCES BETWEEN THE STATED-RATE HOURLY WAGE AND THE DERIVED HOURLY WAGE, ZHC, AND NON-ZHC WORKERS.



NOTE: OBTAINED USING QLFS Q2 AND Q4 DATA OVER THE PERIOD 2015-2018. HOURLY WAGES > £100 ARE TREATED AS MISSING. NOBS = 26,790 [COLOR FIGURE CAN BE VIEWED AT WILEYONLINELIBRARY.COM]

dummy for "permanent agency" employment. Note that ZHC is not an option in JBTP10. Although ZHCs can effectively be severed at any time as the employer is not obliged to offer the individual any work, they are not treated as a form of temporary employment by the ONS. Indeed, most ZHC workers (65% in our QLFS sample) report being in permanent employment in the LFS.

Naturally, measurement error in ZHC status is an additional concern for estimating ZHC wage effects. Farina et al. (2020) discuss a range of measurement issues. These include a shift-work check in the LFS questionnaire in Q2 from 2004 to 2013 where respondents who say they were on shift work are not asked FLEX10, suggesting the possibility of under-reporting of ZHC status prior to 2013. The most important ZHC measurement issue, however, concerns the likely lack of respondent awareness of ZHCs prior to intense media coverage in 2013. Farina et al. (2020) show that growing public awareness of ZHCs can account for between one quarter and two thirds of the very rapid growth in reported ZHC numbers in the LFS over 2013/14, but suggest that there is

no clear association beyond 2014. Both random noise and systematic underreporting of the ZHC dummy variable will lead to attenuation bias in the estimated ZHC pay penalty, with the magnitude of the bias depending on the extent of misclassification. Further, if unreported ZHCs are drawn disproportionately from lower-wage (higher-wage) ZHCs, there may be an additional positive (negative) bias on the estimated ZHC coefficient in the wage regression. Together, this motivates our choice to focus on the period of 2015–2018, that is, *after* the public awareness induced growth in reported ZHC prevalence over 2013/14 and after the shift-work check is removed.[12]

As a starting point for investigating these issues, Figure 2 presents kernel density plots of the distributions of each wage variable for our QLFS sample, separately for ZHC and non-ZHC workers. Focusing first on the derived hourly wage, the distribution for ZHC workers clearly sits to the left of the distribution for non-ZHC workers, with a range of higher-wage rates with little support for ZHC workers. The gap between the ZHC and non-ZHC mean wage (the unconditional ZHC pay penalty) is £5.40 (see also Table A1 in the Appendix), consistent with the estimate from Datta et al. (2019). Given the coverage of the derived measure, this comparison is made over almost all workers in the relevant quarters and waves. In contrast, the wage distributions for ZHC and non-ZHC workers appear more similar when stated-rate hourly wages are used, with the difference in means (the unconditional ZHC wage penalty) just £1.30. The sample for this comparison is much smaller because many non-ZHC workers (and a minority of ZHC workers) do not report an hourly wage rate. Whether from differences in sample or differences in measurement, however, it is immediately apparent that the choice of wage measure is likely to be consequential for estimating the ZHC wage penalty.

Figure 3 provides the difference between the two wage measures for ZHC and non-ZHC workers respectively, using the common sample for which both measures are reported. The pattern of difference for non-ZHC workers looks broadly normally distributed. However, this is not the case for ZHC workers who have much lower mass at zero, and where it seems that there is also more mass to the right suggesting that the derived hourly wage understates pay relative to the hourly rate. This suggests systematic differences and not, that for instance, ZHC workers simply have more (mean zero) measurement error in their derived hourly wage measure. Again, the suggestion is that the choice of wage measure will be consequential for estimates of ZHC wage penalties.

Appendix Table A1 provides descriptive statistics by ZHC status for our baseline QLFS sample on wages (both measures), the prevalence of other

[12] Our key conclusions are also robust to narrowing this time window.

atypical contractual forms, and a long list of socio-demographic and job characteristics used as controls in our regression analysis. ZHC workers tend to have characteristics that are associated with lower wages, for example, they are disproportionately concentrated among younger age groups, women, black and other minority ethnic groups, and non-graduates. Also note the higher reported prevalence of other atypical contract forms among ZHC workers: ZHC workers disproportionately describe themselves as being in temporary employment (although this is still a minority), in particular temporary agency, casual, or temporary other employment.

Estimation

Our benchmark regression model is the following which estimates, by OLS, the ZHC wage differential conditioned on a wide range of observable worker and job characteristics:

$$\ln(wage)_i = \beta_0 + \beta_1 ZHC_i + \boldsymbol{X}'_{1i}\boldsymbol{\beta}_2 + \boldsymbol{X}'_{2i}\boldsymbol{\beta}_3 + \beta_4 TEMP_i + \boldsymbol{X}'_{3i}\boldsymbol{\beta}_5 + \varepsilon_i \quad (1)$$

where the dependent variable is the log of hourly pay or the hourly wage for individual *i*. ZHC is a binary indicator taking value 1 if workers report to be on a ZHC in their main job, and 0 otherwise. $\boldsymbol{X}_{1i}$ denotes the set of individual characteristics observed for worker *i*, as listed in Table A1, and including dummy variables for quarter/year. $\boldsymbol{X}_{2i}$ denotes the set of job characteristics for worker *i* (excluding dummies for contract form), as listed in Table A1. $TEMP_i$ is a binary dummy for being employed on any form of temporary contract. $\boldsymbol{X}_{3i}$ is a set of other atypical working arrangement dummies including casual, seasonal, fixed-term, temporary agency, permanent agency, and other temporary. We start by estimating (1) excluding $\boldsymbol{X}_{1i}$, $\boldsymbol{X}_{2i}$, $TEMP_{i,}$ and $\boldsymbol{X}_{3i}$ and then introduce the controls step by step. (When $\boldsymbol{X}_{3i}$ is included we drop $TEMP_i$.) In each case, the parameter β_1 gives the estimated wage differential between ZHC and non-ZHC workers. Initially, we allow the estimation samples to vary according to wage measure used. We then impose a common sample.

We then extend the estimation in two directions. First, to explore whether ZHC wage penalties are heterogeneous, and whether any such heterogeneity is sensitive to the particular wage measure employed, we repeat estimation of (1), including all controls but excluding $TEMP_i$, for a wide range of subsamples including by age group, gender, education, occupation, and industry. No existing studies of the ZHC wage penalty have examined how wage effects vary across these different groups.

Second, we exploit the LLFS over the same period to estimate an individual fixed-effects version of (1) for each wage variable. Even when conditioning on

the extensive set of observable controls included in (1), non-random sorting of workers into employment contracts, which may bias our OLS estimates of β_1, remains possible. If less productive workers sort into ZHCs, for example, ZHC wage penalties will be overestimated. To the extent that any such unobserved differences in productivity are time-invariant, however, fixed-effects estimation will difference them out. Despite this advantage, no existing study of the ZHC wage penalty takes this approach although it is quite common in the wider non-standard employment wage penalty literature (e.g., Booth et al. 2002; Lass and Wooden 2019). Note that in our case there are disadvantages to the fixed-effects approach, including possible exacerbation of any attenuation bias due to measurement error in the ZHC dummy, the smaller sample size in the LLFS compared to the QLFS,[13] and the reduced set of observed job characteristics available in the LLFS compared to the QLFS. In the latter respect, the most notable omission from the LLFS is the set of variables denoting temporary job type; we observe only whether the respondent is on a ZHC, and in a temporary or permanent job, so the fixed-effects regressions include $TEMP_i$ but exclude $\boldsymbol{X}_{3i}$.

Results

Baseline OLS estimates and their sensitivity. Table 1 presents OLS estimates of (1), estimated on our QLFS sample pooling over 2015–2018, using the hourly pay measure. The first column excludes controls from (1), so provides the estimated unconditional ZHC pay penalty, averaged over this period, in percentage terms. This unconditional estimate is very large, at 46%, but similar to estimates reported using earlier QLFS data (Adams and Prassl 2018; Gardiner 2016).

Including standard demographic characteristics as controls, along with regional and year/quarter dummies (column 2), reduces this penalty by a half. Column (3) adds a range of controls for job characteristics which again has a sizeable impact on the ZHC pay penalty, reducing it to 4.5%. For comparison, the temporary employment wage penalty is 7%. This model and estimated wage penalty are similar to that reported by Gardiner (2016) and Clarke and Cominetti (2019), who estimate ZHC wage penalties of 6.6% (for 2011–2016)

[13] Table A2 in the Appendix shows that the QLFS and LLFS samples are similar in many respects (e.g., mean wages according to both measures) but differ in some others, with the LLFS sample more concentrated in the middle of the age distribution, more frequently reporting children in the household, and with some minor differences in ethnic composition, education levels, job tenure, sectoral, occupational, and regional distribution.

TABLE 1

OLS Wage Regression, QLFS 2015–2018, Log Hourly Pay

	(1)	(2)	(3)	(4)
ZHC	−0.460***	−0.232***	−0.045***	−0.045***
	(0.013)	(0.013)	(0.012)	(0.013)
Temporary Job			−0.074***	
			(0.009)	
Permanent Agency Work				0.009
				(0.013)
Temporary Contract: Agency Work				−0.027*
				(0.015)
Temporary Contract: Casual				−0.055**
				(0.022)
Temporary Contract: Seasonal				−0.139***
				(0.039)
Temporary Contract: Fixed Term				−0.054***
				(0.012)
Temporary Contract: Other				−0.117***
				(0.023)
Demographic Characteristics	No	Yes	Yes	Yes
Job Characteristics	No	No	Yes	Yes
Regional Dummies	No	Yes	Yes	Yes
Quarter Dummies	No	Yes	Yes	Yes
N	81,284	81,284	81,284	81,284
R-squared	0.014	0.322	0.459	0.459

Notes: Significance at the 10% level is represented by ∗, at the 5% level by ∗∗ and at the 1% level by ∗∗∗. The dependent variable is (log) hourly pay expressed in £2017Q2. Demographic characteristics are age, gender, marital status, binary indicators for the presence of children in the household, non-UK/British Citizenship, ethnic group, full-time student status, and highest qualification achieved. Job characteristics (column 3) are temporary job, part-time job, public employment, tenure, occupation, and industry indicators. Robust standard errors in parentheses.

and 5% (for 2018), respectively, and temporary employment wage penalties of 5.5% and 6%, respectively. One implication is that ZHCs are not out of line with other non-standard employment contracts in terms of wages, at least once observable job and worker characteristics are conditioned upon. We further explore the ZHC wage penalty compared to those for other atypical employment types in column (4), which splits temporary jobs into the different contract types and includes a permanent agency work dummy. Note that adding these other contract types makes no difference to the estimated ZHC wage penalty.

Table 2 repeats this exercise using the directly reported hourly wage measure. Note the smaller sample in this case given the lower coverage of this measure.[14] Column (1) shows the unconditional wage penalty is much smaller when comparing ZHC workers to those in other hourly paid jobs, at 12.5%. These other hourly paid jobs (and the workers who hold them) are likely to be more similar to ZHC jobs in terms of both observable and unobservable characteristics, which although advantageous for estimating the ZHC wage penalty other things being equal, makes the estimated ZHC wage penalty in column (1) more difficult to interpret as an unconditional wage penalty because, in

TABLE 2

OLS Wage Regression, QLFS 2015–2018, Log Hourly Wage Rate

	(1)	(2)	(3)	(4)
ZHC	−0.125***	−0.071***	−0.012*	−0.009
	(0.009)	(0.008)	(0.007)	(0.007)
Temporary Job			0.022***	
			(0.007)	
Permanent Agency Work				0.038***
				(0.011)
Temporary Contract: Agency Work				0.059***
				(0.012)
Temporary Contract: Casual				0.000
				(0.011)
Temporary Contract: Seasonal				−0.013
				(0.017)
Temporary Contract: Fixed Term				0.053***
				(0.015)
Temporary Contract: Other				−0.027
				(0.017)
Demographic Characteristics	No	Yes	Yes	Yes
Job Characteristics	No	No	Yes	Yes
Regional Dummies	No	Yes	Yes	Yes
Quarter Dummies	No	Yes	Yes	Yes
N	26,790	26,790	26,790	26,790
R-squared	0.007	0.282	0.494	0.495

Notes: Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The dependent variable is (log) hourly wage rate expressed in £2017Q2. Demographic characteristics are age groups, gender, marital status, binary indicators for the presence of children in the household, non-UK/British Citizenship, ethnic group, full-time student status, and highest qualification achieved. Job characteristics (column 3) are temporary job, part-time job, public employment, tenure, occupation, and industry indicators. The estimation sample consists of LFS respondents in our pooled sample who reported information on both HOURPAY and HRRATE. Robust standard errors in parentheses.

[14] Rather than estimating on all available observations in our sample, to facilitate comparison of estimates using the different wage measures on a common sample (in Table 3), we restrict the sample for Table 2 to those observations for which both HRRATE and HOURPAY are specified. This reduces the sample for Table 2 by approximately 5%, with estimates highly robust to this step.

effect, the sample selection already conditions on worker and job characteristics to the extent that they are correlated with hourly paid status.

Again, the estimated wage penalty falls once controls are included for worker (column 2) and job (column 3) characteristics, in the latter case to 1.2%, and on the borderline of statistical significance at conventional levels. This is considerably smaller than all existing estimates from the nearest-equivalent models in the studies cited above. Also, note the contrast in the estimated wage penalty for temporary employment when comparing hourly pay (a wage penalty of 7.5%) with the hourly wage rate (a wage premium of 2.2%). Adding other contract types to the model in column (4) slightly reduces the estimated ZHC wage penalty to 0.9%. Similarly, there is no statistically significant wage penalty or premium for casual, seasonal, or other temporary work. We estimate wage premiums for permanent agency, temporary agency, and fixed-term jobs, however, of 3.8%, 5.9%, and 5.3%, respectively. The bottom line, when using this alternative wage measure, is that there is no ZHC wage penalty at the mean—nor is there a wage penalty for fixed-term, casual or seasonal work—when we condition on worker and job characteristics and other atypical contractual forms which overlap with ZHC status.

There are two potential explanations for the difference in the conditional ZHC wage penalty estimates when comparing the two wage measures. First, the wage rate regressions are estimated on a selected sample compared to the hourly pay sample. Almost all (95%) of those who report their hourly wage rate also report earning and hour information from which the hourly pay measure is derived. But only a third of those for whom we observe hourly pay also report their hourly wage rate. We test whether this explains the difference in estimated ZHC wage penalties by re-estimating equation (1) on the hourly wage rate sample but using hourly pay as the dependent variable. Table 3 presents the results. Although the unconditional ZHC wage penalty is smaller than in Table 1—we are now comparing ZHC jobs with more similar non-ZHC jobs than in Table 1—once we condition on observable worker and job characteristics, there is only a small difference between Tables 1 and 3 estimates of the ZHC wage penalty (4.5% compared to 3.9%). The implication is that the contrast in the estimated ZHC wage penalties across the two measures of wages does not reflect sample selection.

The second potential explanation for the contrast is differences in what is measured by the two wage measures, including but not limited to measurement error in hourly pay from mismatch between hours and earnings and from heterogeneous inclusion of unpaid hours. Figure 4a shows the distributions for the common sample, again by ZHC status. The patterns fit with what was shown in Figure 3. Clearly, the hourly pay distribution is more dispersed than the hourly wage rate distribution, in particular with a heavier left tail. The mode, median, and mean wage are also lower for this measure once we restrict to the common

TABLE 3

OLS Wage Regression, QLFS 2015–2018, Log Hourly Pay, Hourly Wage Rate Sample

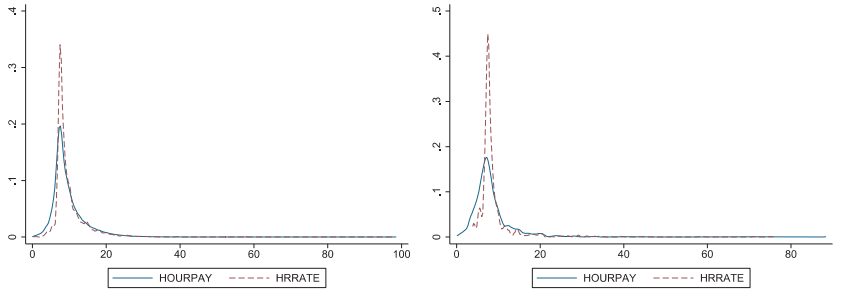
	(1)	(2)	(3)	(4)
ZHC	−0.178***	−0.112***	−0.040***	−0.039***
	(0.014)	(0.014)	(0.013)	(0.013)
Temporary Job			−0.019*	
			(0.011)	
Permanent Agency Work				0.015
				(0.018)
Temporary Contract: Agency Work				0.048***
				(0.017)
Temporary Contract: Casual				−0.034
				(0.024)
Temporary Contract: Seasonal				−0.075**
				(0.038)
Temporary Contract: Fixed Term				0.007
				(0.020)
Temporary Contract: Other				−0.073***
				(0.023)
Demographic Characteristics	No	Yes	Yes	Yes
Job Characteristics	No	No	Yes	Yes
Regional Dummies	No	Yes	Yes	Yes
Quarter Dummies	No	Yes	Yes	Yes
N	26,790	26,790	26,790	26,790
R-squared	0.009	0.197	0.333	0.334

Notes: Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The dependent variable is (log) hourly pay expressed in £2017Q2. Demographic characteristics are age groups, gender, marital status, binary indicators for the presence of children in the household, non-UK/British Citizenship, ethnic group, full-time student status, and highest qualification achieved. Job characteristics (column 3) are temporary job, part-time job, public employment, tenure, occupation, and industry indicators. The estimation sample consists of LFS respondents in our pooled sample who reported information on both HOURPAY and HRRATE. Robust standard errors in parentheses.

sample. If this left shift in the wage distribution is uncorrelated with ZHC status, it may reduce the precision of our estimates but will not impart bias. Figure 4b, however, shows that the left shift in the wage distribution when comparing the two measures is particularly pronounced among ZHC workers. In other words, there are disproportionately more low-paid ZHC workers than non-ZHC workers using hourly pay when compared to hourly rate. Our conjecture is that this most likely reflects disproportionate inclusion of unpaid hours in paid hour responses by ZHC workers, that is, that ZHC workers disproportionately overestimate their hours of (paid) work compared to those employed under other contractual forms. For example, ZHCs are highly prevalent among domiciliary care workers, often paid only for time scheduled with clients and not for time traveling between appointments (Bessa, Forde, and Moore 2013). Differences between pay and basic wage relating to overtime and shift premiums, with ZHC workers less able than other workers to access such premiums, or their premiums being smaller, would suggest a right shift in the hourly pay distribution compared to the hourly

FIGURE 4

DERIVED HOURLY WAGE VS REPORTED HOURLY WAGE RATE DISTRIBUTIONS, BY ZHC STATUS.



a: All in Employment **b: ZHC Only**

NOTE: THE FIGURES GIVE THE DISTRIBUTION OF HOURLY PAY FOR ALL WORKERS (A) AND FOR ZHC WORKERS ONLY (B). THE BLUE/SOLID LINE USES THE DERIVED HOURLY WAGE (HOURPAY) MEASURE, AND THE RED/DOTTED LINE USES THE STATED-RATE HOURLY WAGE (HRRATE) MEASURE. THE FIGURES ARE OBTAINED USING QLFS Q2 AND Q4 DATA OVER THE PERIOD 2015-2018. HOURLY WAGES > £100 ARE TREATED AS MISSING. NOBS = 26,790 (A) AND 1531 (B) [COLOR FIGURE CAN BE VIEWED AT WILEYONLINELIBRARY.COM]

wage distribution (and particularly for non-ZHC workers), rather than the left shift that we observe in the data.

The bottom line is that the sensitivity in ZHC wage penalty estimates demonstrated here is driven by measurement differences not by sample differences. The implication of this sensitivity is that earlier estimates of the ZHC wage penalty appear to have exaggerated the extent to which wages in ZHC jobs are lower, at least on paper, than those in observationally similar non-ZHC jobs for observationally similar workers. This is to the extent that we question whether there is any conditional ZHC wage penalty at all. There is an important caveat to this argument, however, which is that by better measuring hourly wages *on paper*, the stated-rate hourly wage measure may *overestimate* the hourly wage rate of ZHC workers *in practice*. From this perspective, the two sets of estimates are perhaps best interpretable as a range, with hourly pay potentially overestimating the ZHC wage penalty and the hourly wage rate potentially underestimating the ZHC wage penalty. Either way there are sufficient grounds to question the existence, and certainly the magnitude, of the estimated ZHC wage penalty presented in the existing literature, and by implication, the robustness of existing non-standard employment wage penalty estimates in the wider literature.

Heterogeneous effects and fixed-effects extensions. Although we find no statistically significant ZHC wage penalty on average when using the hourly wage

rate measure, this may hide wage penalties for particular demographic groups or job types when using this measure. Furthermore, the nature of any heterogeneity in ZHC wage effects may differ according to the two wage measures. To assess these questions, we re-estimate (1) on the QLFS common sample split by demographic and job characteristics. Results are presented in Appendix Tables A3 and A4, for hourly pay and the hourly wage rate, respectively. Table A3 suggests larger wage penalties, using the hourly pay measure, for 16–24 s and 35–49 s, for men than for women (for whom the ZHC wage penalty is not statistically significant), for middling levels of education compared to either extreme, for UK/British citizens compared to non-UK/British citizens, for jobs in the private sector compared to the public sector (for which there is no ZHC wage penalty), and concentrated in particular industries (notably restaurants/hotels where ZHC jobs are particularly prevalent, and transport) and occupations (notably managers, sales and customer service, process, plant and machine operatives, and elementary occupations). These occupational and industry differences, and the uneven gender and ZHC composition across them, raise the possibility that this generates the marked differences in male and female ZHC penalties. To explore this, we re-estimated these gender ZHC penalties including highly disaggregated 4 digit industry and occupational codes. The resultant estimates were essentially unchanged from those reported in Table A3.

Although estimated coefficients are typically smaller, this pattern of heterogeneous effects is also evident when using the hourly wage rate measure. The main exception to this conclusion of robust patterns of heterogeneity is that when using the hourly wage rate measure, non-UK citizens experience a wage penalty and UK/British citizens do not.

Another key difference among ZHC workers is whether they consider themselves temporary or permanent contracted workers. This might influence wages if, for instance, temporary and permanent ZHC workers differ in bargaining power. To investigate this in Table 4, we report estimates, across our three approaches, where we allow the ZHC wage effect to differ between temporary and permanent contracted workers. These reveal two points. First, the wage penalty/premium attached to temporary work in general is highly sensitive to wage measure, and unlike ZHCs in general, sample choice. Second, while there is no difference between temporary and permanent ZHC penalties for hourly pay, the overall zero effect of ZHC workers on hourly wage rates hides marked differences across temporary and permanent ZHC workers. These estimates suggest a small wage premium attached to ZHC work for temporary contracted workers which hints at compensating differentials for this group.

The national minimum wage represents one institutional feature that has the potential to impact upon wage penalties associated with ZHC work. Many, although as demonstrated by Figures 1 and 3 not all, ZHC jobs are minimum

TABLE 4

OLS Wage Regression, QLFS 2015–2018, Permanent and Temporary ZHC workers

	(1) ln(HOURPAY)	(2) ln(HRRATE)	(3) ln(HOURPAY)
Temporary Job * NO ZHC	−0.085***	0.015*	−0.035***
	(0.009)	(0.008)	(0.012)
Permanent Job * ZHC	−0.075***	−0.023***	−0.064***
	(0.014)	(0.007)	(0.016)
Temporary Job * ZHC	−0.065***	0.031**	−0.019
	(0.022)	(0.012)	(0.022)
Demographic Characteristics	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes
Regional Dummies	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes
N	81,284	26,790	26,790
R-squared	0.459	0.494	0.333
$\beta_{PermJob*ZHC} = \beta_{Temp.\ Job*ZHC}$: *p*-value	[0.690]	[0.000]***	[0.089]*

Notes: Significance at the 10% level is represented by ∗, at the 5% level by ∗∗, and at the 1% level by ∗∗∗. The dependent variable is (log) hourly pay (columns 1 and 3) and (log) hourly wage rate (column 2) expressed in £2017Q2. Demographic characteristics are age groups, gender, marital status, binary indicators for the presence of children in the household, non-UK/British Citizenship, ethnic groups, full-time student status, and highest qualification achieved. Job characteristics are part-time job, public employment, tenure, occupation, and industry indicators. The estimation sample in columns (2) and (3) consists of LFS respondents in our pooled sample who reported information on both HOURPAY and HRRATE. Robust standard errors in parentheses.

wage jobs. This may limit the ability of employers to pay hourly rates that are different across employment contracts. We examine this by re-estimating our models from Table 2 but where we exclude the 2832 workers who report hourly wages at or below the minimum wage at the time they were surveyed. Doing so increases the absolute magnitude of the ZHC wage effect slightly. For instance, the coefficients for column (3) move from −0.012 to −0.016, and for column (4) from −0.009 to −0.014 and become statistically significant at the 10% level.

Finally, Table 5 presents individual fixed-effects estimates of the ZHC wage penalty using the LLFS sample common to both hourly pay and hourly wage rate measures. While one has to be careful with interpreting these estimates as they are identified by relatively few movers (approximately 150 dependent on specification and sample), the key point is that including individual fixed effects makes very little difference to estimated ZHC coefficients. For comparison, the OLS equivalent estimates with the same sample (and reduced LLFS set of controls) are also presented. The OLS estimates in columns 1 and 3 are consistent with those in Tables 2 and 3, despite the difference in sample and changes in the composition of the covariates, again showing sensitivity in the estimated ZHC wage penalty according to the wage measure employed (although in this case both estimates are smaller in magnitude and imprecisely estimated). For hourly pay, the fixed-effects estimate of the ZHC wage penalty

TABLE 5

OLS and Fixed-effects Wage Regressions, LLFS 2015–2018, Log Hourly Pay & Log Hourly Wage Rate

	Derived hourly wage		Hourly wage rate	
	OLS (LLFS)	Fixed effects (LLFS)	OLS (LLFS)	Fixed effects (LLFS)
ZHC	−0.032	−0.054	−0.000	−0.002
	(0.043)	(0.054)	(0.025)	(0.017)
Temporary Job	−0.001	−0.052	0.067***	−0.019
	(0.038)	(0.065)	(0.024)	(0.019)
Demographic Characteristics	Yes	Yes	Yes	Yes
Job Characteristics	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	Yes	Yes	Yes
Observations	3080	3080	3080	3080
R^2	0.317	-	0.517	-
R^2 - within	-	0.038	-	0.058
Number of identifiers	-	1540	-	1540

Notes: Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The dependent variable for the first two columns is (log) derived hourly wage and for the second two columns is (log) reported hourly wage (HRRATE), both expressed in £2017Q2. Demographic characteristics are age groups, gender, marital status, binary indicators for the presence of children in the household, ethnic groups (columns 1 and 3), regional dummies (columns 1 and 3), and highest qualification achieved. Job characteristics are temporary job, part-time job, public employment, tenure, occupation, and industry indicators. The estimates were obtained using the LLFS for all people observed in employment in both waves 1 and 5, excluding self-employed, for whom ZHC status and HOURPAY and HRRATE were non-missing, entering the LFS sample between 2015Q2 and 2017Q4. Robust standard errors in parentheses.

is (an imprecisely estimated) 5.4%; for the hourly wage rate, it is 0.2%. We draw two conclusions from this. First, ZHC wage penalty estimates are sensitive to the wage measure employed in both OLS and fixed-effects models. Second, once we condition on our long list of observable worker and job characteristics, and once we restrict to hourly paid jobs for which hourly rates are returned, selection into ZHC jobs on worker time-invariant unobservable characteristics does not appear to be driving the estimated ZHC wage penalty (or its absence in the case of hourly wage rate estimates). Note, however, that estimated wage differentials for temporary employment appear more sensitive to the inclusion of individual fixed effects, to the extent that a small overall wage premium according to OLS hourly rate estimates becomes a small but non-significant wage penalty according to the fixed effect hourly rate estimates. Naturally, this fixed-effects approach leaves open the possibility of time-varying unobservables that may influence wages and vary with job contract.

Discussion and Conclusion

Existing studies of the ZHC wage differential in the UK consistently show large unconditional and conditional ZHC wage penalties. This suggests that ZHC

contracts are associated with lower worker welfare. In this paper, we show that this conclusion is highly sensitive to issues of wage measurement, to the extent that we question whether there is any conditional ZHC wage penalty at all. As we discuss, a further complicating factor is the reporting of hours worked by ZHC workers and/or that ZHC workers may work more unpaid hours than comparable workers. We demonstrate that the nature, magnitude, and even existence of wage penalty estimates for other forms of non-standard employment in the UK are also shown to be sensitive to the wage measure used. An implication is that the typical finding of non-standard employment wage penalties in the wider international literature, which also tends to use similar derived hourly wage measures, may also be similarly sensitive.

How do we interpret the possible absence of a ZHC wage differential, on average, from a theoretical perspective? Given the insecure and variable-hour nature of ZHCs one might expect a wage *premium*—a compensating wage differential—in a competitive labor market. Mas and Pallais (2017), for example, find that workers tend to require a substantial wage premium to accept a schedule set by an employer at short notice. Our estimates showing wage premiums for other contingent forms of employment including fixed-term and agency jobs are consistent with compensating differentials for insecurity. On the other hand, because (at least some) ZHCs offer workers flexibility about when they work, one might expect a wage *penalty* if ZHC workers are prepared to pay for such flexibility by accepting lower wages (and Mas and Pallais (2017) suggest that some workers are indeed willing to pay for flexibility). One possible explanation for the zero ZHC wage penalty or premium is that these offsetting non-wage characteristics (and indeed any other ZHC-related non-wage characteristics) balance out in terms of the attractiveness of ZHC jobs overall.[15] Alternatively, labor market frictions and/or a lack of alternative work for these workers may limit the extent to which ZHC workers, but not necessarily other contingent contract workers, are able to command a positive compensating wage differential; ZHC jobs are disproportionately concentrated among women, young workers, and migrant workers, for example. It is also difficult to square ZHC wage penalties that exist only for men and not women (using either wage measure) with compensating wage differentials; we would need to argue that male ZHC workers are prepared to pay more for flexible

[15] A further complicating factor is that there exist two forms of employment in the UK, employees and workers, where a key difference is the lack of benefit entitlement for the latter. If individuals on ZHCs are more likely to be classified as workers, then this is a further compensation penalty not picked up by looking at wages. Likewise shorter hour workers are less likely to be covered by pension legislation or receive compulsory employer pension contributions. Information on these benefits and entitlements is not available in the LFS. This, combined with a focus on wages, likely understates any *compensation* penalties associated with ZHC work.

hours than female ZHC workers on average, which seems unlikely. Perhaps more likely is that employers disproportionately use ZHCs to screen male workers (see Faccini 2014) or that some employers view ZHC employment among men but not necessarily women as a negative productivity signal.

Efforts to improve our understanding of ZHCs are particularly timely given the range of policy interventions, from banning ZHCs to imposing a wage premium on non-guaranteed hours to imposing a right-to-convert for workers, currently being proposed in the mainstream of the UK debate (e.g., DBEIS 2019; Labour Party 2019; Taylor et al. 2017). While we do not directly address these policy proposals here, the lack of any clear conditional wage penalty, where one had previously been widely reported, weakens one of the arguments for such intervention; ZHCs may be inferior jobs in numerous respects, but lower hourly wages may not be one of them. With this said, even the lack of an overall wage penalty for ZHC workers does not suggest that low wages in these jobs are not a source of concern. The absence of a premium could still be interpreted as problematic if one expects compensating differentials to workers for their loss of job security and increased burden of working-hour volatility.

Of course, the sensitivity of the estimated ZHC wage penalty (and, indeed, other non-standard employment wage penalties) demonstrated here to the wage measure used makes drawing any conclusions about labor market behavior, or implications for policy, more difficult. ZHC wage penalties may appear less consistent with compensating wage differentials, and more deserving of policy intervention, than the absence of any such penalty, but we cannot be confident whether such a penalty exists or not. Again, because this sensitivity may also affect the wider non-standard employment wage penalty literature to some extent, some of what we think we know about labor markets in this respect, and some of what we advise policymakers regarding intervention, may also require reconsideration.

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APPENDIX A

TABLE A1

Descriptive Statistics by ZHC Status

	Employed not on a ZHC Mean (St. Dev.)	Employed on a ZHC Mean (St. Dev.)	*t*-test for mean difference
HOURPAY (2017£)	14.60 (9.62)	9.17 (7.42)	−662.81***
HRRATE (2017£)	10.03 (8.95)	8.76 (4.95)	−151.25***
Usual Work Hours	34.07 (10.83)	23.99 (13.32)	−1079.85***
Perm Agency Contr.	0.015	0.053	355.98***
Temp.: Agency	0.008	0.085	903.56***
Temp.: Casual	0.007	0.134	1559.76***
Temp.: Seasonal	0.003	0.024	460.93***
Temp.: Fixed Period	0.024	0.051	204.71***
Temp.: Other	0.006	0.081	976.54***
Age Group (16–24)	0.109	0.348	881.55***
Age Group (25–34)	0.238	0.190	−131.57***
Age Group (35–49)	0.352	0.205	−359.37***
Age Group (50–64)	0.275	0.208	−175.28***
Age Group (65+)	0.027	0.049	160.67***
Female	0.501	0.581	186.68***
Mar. Stat.: Divorced	0.075	0.063	−54.23***
Mar. Stat.: Married	0.511	0.314	−462.37***
Mar. Stat.: Other	0.016	0.018	13.64***
Mar. Stat.: Separated	0.025	0.031	38.22***
Mar. Stat.: Single	0.372	0.575	490.72***
Children (0–4)	0.159	0.122	−119.90***
Children (5–15)	0.282	0.265	−43.24***
Non-UK/Brit. Citizen	0.128	0.178	174.04***
Ethnic: Asian	0.050	0.049	−4.77***
Ethnic: Black	0.027	0.060	235.07***
Ethnic: Chinese	0.005	0.004	−24.17***
Ethnic: Other	0.025	0.033	63.96***
Ethnic: White	0.893	0.854	−148.11***
Full-time Student	0.031	0.190	1020.02***
Educ.: Degree/Equiv.	0.356	0.213	−350.69***
Educ.: Higher Educ.	0.098	0.100	9.57***
Educ.: GCE A level	0.224	0.298	205.82***
Educ.: GCSE A-C	0.196	0.235	115.10***
Educ.: Other	0.073	0.092	85.75***
Educ.: No Qualif.	0.053	0.062	46.29***
Part-Time	0.249	0.653	1085.60***
Temporary Job	0.046	0.348	1613.59***

TABLE A1 (CONTINUED)

	Employed not on a ZHC Mean (St. Dev.)	Employed on a ZHC Mean (St. Dev.)	*t*-test for mean difference
Public Employment	0.273	0.160	−297.64***
Tenure: (0–11) months	0.162	0.382	691.42***
Tenure: (12–23) months	0.115	0.193	283.89***
Tenure: (24–35) months	0.089	0.103	59.76***
Tenure: (36–47) months	0.069	0.076	29.07***
Tenure: (48–59) months	0.055	0.054	−7.21***
Tenure: 60+ months	0.509	0.192	−745.40***
Occ.: Manager/Senior Off.	0.100	0.020	−313.10***
Occ.: Professional	0.224	0.072	−428.29***
Occ.: Associate Prof. & Tech.	0.144	0.058	−289.42***
Occ.: Admin. & Secretarial	0.122	0.061	−218.92***
Occ.: Skilled Trades	0.075	0.043	−140.20***
Occ.: Personal Service	0.092	0.254	642.28***
Occ.: Sales & Customer Serv.	0.084	0.081	−12.97***
Occ.: Process, Plant, Mach. Op.	0.058	0.076	86.64***
Occ.: Elementary	0.100	0.335	898.95***
Industry: Agri & Fish	0.006	0.004	−37.59***
Industry: Bank, Fin. & Insur.	0.163	0.106	−180.16***
Industry: Construction	0.049	0.018	−169.33***
Industry: Distrib., Hotels & Rest.	0.187	0.339	452.23***
Industry: Energy & Water	0.019	0.004	−125.83***
Industry: Manufacturing	0.104	0.048	−215.99***
Industry: Other Services	0.043	0.094	289.21***
Industry: Publ. Ad., Educ, Health	0.341	0.337	−11.13***
Industry: Transport & Comm.	0.088	0.051	−154.45***
Region: East Midlands	0.075	0.089	61.62***
Region: Eastern	0.097	0.079	−71.83***
Region: London	0.131	0.125	−22.93***
Region: North East	0.042	0.044	12.77***
Region: North West	0.112	0.105	−27.83***
Region: Northern Ireland	0.021	0.010	−91.50***
Region: Scotland	0.08	0.069	−45.50***
Region: South East	0.142	0.134	−27.84***
Region: South West	0.087	0.115	117.65***
Region: Wales	0.045	0.053	42.43***
Region: West Midlands	0.081	0.084	12.05***
Region: Yorkshire-Humber	0.086	0.094	30.64***
Observations	79,423	1861	

Notes: Each entry reports the weighted mean/proportion and standard deviation (in parentheses) for the demographic and job characteristics, obtained by pooling the QLFS April–June and October–December surveys over to the period 2015–2018, for respondents reporting information on HOURPAY interviewed in Wave 1 and Wave 5. Column (1) refers to all individuals in employment, excluding self-employed, not on ZHCs. Column (2) refers to individuals in employment, excluding self-employed, on ZHCs. Column 3 reports the two-sample *t*-test on the equality of means. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The number of observations for HRRATE is 25,259 (Column 1) and 1531 (Column 2).

TABLE A2

Descriptive Statistics—QLFS sample vs LLFS

	(1) QLFS Mean (St. Dev.)	(2) LLFS Mean (St. Dev.)	(3) *t*-test for equality of means
HOURPAY (2017£)	9.71	9.63	0.809
	(5.22)	(5.02)	
HRRATE (2017£)	9.96	9.68	1.748*
	(8.77)	(4.25)	
Working Hours	28.98	28.71	1.176
	(12.10)	(11.74)	
ZHC	0.060	0.062	−0.443
Perm Agency Contr.	0.023	-	
Temp.: Agency	0.021	-	
Temp.: Casual	0.022	-	
Temp.: Seasonal	0.007	-	
Temp.: Fixed Period	0.024	-	
Temp.: Other	0.015	-	
Age Group (16–24)	0.182	0.166	2.193**
Age Group (25–34)	0.210	0.217	−0.903
Age Group (35–49)	0.293	0.317	−2.768***
Age Group (50–64)	0.278	0.280	−0.235
Age Group (65+)	0.038	0.021	4.818***
Female	0.573	0.579	−0.638
Marital Status: Divorced	0.090	0.097	−1.280
Marital Status: Married	0.424	0.426	−0.213
Marital Status: Other	0.024	0.024	0.000
Marital Status: Separated	0.031	0.025	1.827*
Marital Status: Single	0.431	0.428	0.319
Children (0–4)	0.141	0.307	−24.158***
Children (5–15)	0.286	0.453	−19.236***
Non-UK/British Citizenship	0.150	.	
Ethnic Group: Asian	0.048	0.063	−3.651***
Ethnic Group: Black	0.032	0.019	3.937***
Ethnic Group: Chinese	0.002	0.000	2.200**
Ethnic Group: Other	0.024	0.020	1.378
Ethnic Group: White	0.893	0.898	−0.853
Full-time Student	0.073	.	
Education: Degree or equiv.	0.158	0.154	0.577
Education: Higher Education	0.097	0.101	−0.711
Education: GCE A level	0.281	0.318	−4.301***
Education: GCSE A-C	0.269	0.265	0.474
Education: Other	0.113	0.105	1.329
Education: No Qualification	0.081	0.057	4.675***
Part-Time	0.449	0.469	−2.114**
Temporary Job	0.084	0.076	1.527
Public Employment	0.197	0.183	1.853*
Tenure: (0–11) months	0.222	0.167	7.025***

TABLE A2 (CONTINUED)

	(1) QLFS Mean (St. Dev.)	(2) LLFS Mean (St. Dev.)	(3) *t*-test for equality of means
Tenure: (12–23) months	0.139	0.150	−1.664*
Tenure: (24–35) months	0.092	0.111	−3.429***
Tenure: (36–47) months	0.071	0.093	−4.437***
Tenure: (48–59) months	0.053	0.059	−1.392
Tenure: 60+ months	0.423	0.420	0.319
Occup: Managers & Senior Off.	0.032	0.032	0.000
Occup: Professional	0.081	0.070	2.136**
Occup.: Associate Prof. & Tech.	0.064	0.054	2.167**
Occup: Admin. & Secretarial	0.098	0.109	−1.932*
Occup: Skilled Trades	0.094	0.094	0.000
Occup: Personal Service	0.161	0.168	−0.999
Occup: Sales & Customer Serv.	0.154	0.166	−1.743*
Occup: Process, Plant, Mach. Op.	0.096	0.112	−2.825***
Occup: Elementary	0.220	0.194	3.312***
Industry: Agri & Fish	0.007	0.008	−0.634
Industry: Bank, Fin. & Insur.	0.090	0.090	0.000
Industry: Construction	0.037	0.035	0.556
Industry: Distrib., Hotels & Rest.	0.322	0.313	1.015
Industry: Energy & Water	0.014	0.015	−0.441
Industry: Manufacturing	0.107	0.102	0.853
Industry: Other Services	0.051	0.053	−0.480
Industry: Publ. Ad., Educ, Health	0.307	0.324	−1.934*
Industry: Transport & Comm.	0.065	0.060	1.067
Region: East Midlands	0.086	0.084	0.375
Region: Eastern	0.089	0.073	2.977***
Region: London	0.081	0.077	0.771
Region: North East	0.050	0.056	−1.444
Region: North West	0.117	0.114	0.491
Region: Northern Ireland	0.025	0.020	1.692*
Region: Scotland	0.090	0.090	0.000
Region: South East	0.114	0.137	−3.774***
Region: South West	0.106	0.118	−2.045
Region: Wales	0.054	0.048	1.411
Region: West Midlands	0.085	0.079	1.138
Region: Yorksh.-Humber	0.105	0.104	0.171
Observations	26,790	3080	

Notes: Each entry reports the weighted mean and standard deviation (in parentheses) for the demographic and job characteristics, obtained using the QLFS (Column 1) and LLFS (Column 2) estimation samples from Table 3 and Table 5, respectively. Column 3 reports the two-sample *t*-test statistic on the equality of means. Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The estimates refer to all individuals in employment, excluding self-employed.

TABLE A3

OLS Wage Regressions by Worker/Job Characteristics, QLFS 2015–2018, Log Hourly Pay, Hourly Wage Rate Sample

	(1) β	(2) *SE*	(3) *N*
Panel 1: Age			
16–24	−0.061***	0.023	4109
25–34	−0.029	0.024	5.138
35–49	−0.058**	0.027	8332
50–64	−0.041	0.031	8164
65+	0.103	0.082	1047
Panel 2: Gender			
Male	−0.082**	0.024	10,788
Female	−0.014	0.016	16,002
Panel 3: Education			
Degree	−0.021	0.040	4122
Higher Education	−0.060	0.043	2640
Secondary Education	−0.040**	0.016	14,699
Other Education	−0.061	0.050	3055
No Education	0.036	0.042	2274
Panel 4: Industry			
Agri/Fish	−0.286**	0.115	174
Banking	−0.057	0.039	2371
Construction	−0.017	0.080	964
Restaurants/Hotel	−0.093***	0.021	8325
Energy	0.041	0.107	384
Manufacturing	0.012	0.065	2861
Other Services	−0.001	0.045	1356
Public Admin., Education, and Health	0.011	0.024	8629
Transport	−0.117*	0.068	1726
Panel 5: Occupation			
Managers & Senior Off.	−0.170***	0.063	856
Professional	0.036	0.054	2259
Associate Professions & Tech.	−0.030	0.084	1683
Admin. & Secretarial	0.005	0.074	2739
Skilled Trades	−0.069	0.066	2459
Personal Service	0.015	0.023	4426
Sales & Costumer Service	−0.081*	0.048	4025
Process, Plant, and Machine Op.	−0.130***	0.050	2596
Elementary	−0.073***	0.020	5747
Panel 6: Citizenship			
UK/British	−0.039***	0.015	22,922
Non-UK/British	−0.029	0.028	3868
Panel 7: Sector			
Private Sector	−0.052***	0.014	21,213
Public Sector	0.037	0.044	5577

Notes: Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The dependent variable is (log) hourly pay expressed in £2017Q2. Controls and sample (from which each subsample is drawn) are as in Table 3 Column 4. Robust standard errors in parentheses.

TABLE A4

OLS Wage Regressions by Worker/Job Characteristics, QLFS 2015–2018, Log Hourly Wage Rate

	(1) β	(2) *SE*	(3) *N*
Panel 1: Age			
16–24	−0.007	0.010	4109
25–34	−0.025**	0.012	5.138
35–49	−0.043***	0.013	8332
50–64	−0.021	0.015	8164
65+	0.090**	0.044	1047
Panel 2: Gender			
Male	−0.021*	0.012	10,788
Female	−0.005	0.008	16,002
Panel 3: Education			
Degree	0.008	0.021	4122
Higher Education	−0.026	0.024	2640
Secondary Education	−0.013*	0.007	14,699
Other Education	−0.017	0.014	3055
No Education	−0.004	0.015	2274
Panel 4: Industry			
Agri/Fish	−0.062	0.065	174
Banking	−0.009	0.024	2371
Construction	0.034	0.080	964
Restaurants/Hotel	−0.048***	0.007	8325
Energy	−0.053	0.122	384
Manufacturing	−0.002	0.051	2861
Other Services	0.017	0.020	1356
Public Admin., Education, and Health	0.014	0.012	8629
Transport	−0.050	0.032	1726
Panel 5: Occupation			
Managers & Senior Off.	−0.138***	0.045	856
Professional	0.089**	0.044	2259
Associate Professions & Tech.	0.028	0.051	1683
Admin. & Secretarial	0.015	0.026	2739
Skilled Trades	−0.023	0.037	2459
Personal Service	0.004	0.009	4426
Sales & Costumer Service	−0.035**	0.016	4025
Process, Plant and Machine Op.	−0.058**	0.025	2596
Elementary	−0.030***	0.008	5747
Panel 6: Citizenship			
UK/British	−0.005	0.008	22,922
Non-UK/British	−0.026**	0.013	3868
Panel 7: Sector			
Private Sector	−0.017***	0.007	21,213
Public Sector	0.034	0.021	5577

Notes:: Significance at the 10% level is represented by *, at the 5% level by **, and at the 1% level by ***. The dependent variable is the (log) hourly wage rate expressed in £2017Q2. Controls and sample (from which each subsample is drawn) are as in Table 3 Column 4. Robust standard errors in parentheses.