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MINIMUM WAGE UNDERPAYMENT IN THE INFORMAL ECONOMY

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Executive Summary

The minimum wage is an important part of the Government's goal of reducing low pay in employment. All employers are obliged to pay the National Minimum Wage (NMW) to workers within its scope at the rate that is set by the legislation. Beginning in April 1999, the NMW has been set annually following advice from the Low Pay Commission. Since 1 April 2016, the National Living Wage (NLW), applying to workers aged 25 and over, has complemented the NMW.

Estimating the numbers of jobs that pay at rates below the minimum wage is difficult. There are difficulties in both collecting data and in finding methods of measurement. Further, the jobs that pay below the minimum wage could be informal, avoiding easy detection. This study has reviewed a number of methods used in recent research to overcome these challenges of measuring underpayment in the informal economy.

There are two challenges in measuring non-compliance in the informal economy. Firstly, there are difficulties in measuring the scale of informal economic activity and the employment associated with it. At its extreme, informality can be associated with multiple and co-ordinated breaches of law and then employers, businesses and individuals may systematically hide economic activity from the authorities, surveys and researchers. Secondly, when the economic activity is informal and so hidden from government surveys or oversight, it is hard to establish whether employment is at wages compliant with the minimum wage.

The report recommends four approaches that address the challenges to a different degree. Their feasibility varies and the report then focuses on challenges in applying the methods for quantifying the extent of underpayment.

Two approaches are drawn from recent research in tax compliance. To explore the feasibility of these approaches with regard to minimum wage compliance, the study has particularly benefited from interviews and discussions with those enforcing NMW compliance, tax compliance as well as enforcing other aspects of employment obligations. Two further methods are already being used in low pay research and so being relatively straightforward to progress. The methods usually focus on the drivers and context of underpayment in the informal economy, rather than quantifying the extent, and the report explores whether the approaches can be used in measuring how many jobs in the informal economy may be non-compliant.

The first approach – drawn from the tax compliance literature – is to use **top-down accounts of the informal economy**. The accounts identify hidden economic activity based on tax compliance estimates. Such work is used for official, national accounts, measures of the economy. The report finds these give an overall quantum of the informal sector and associated employment but its ability to measure noncompliance then depends on the availability of other indicators around pay levels to complement the top down estimates of the hidden economy. This would be the recommended focus of further work.

Recommendations about the second approach – **qualitative and quantitative surveys of employers targeting the informal economy** – centre on some particular limitations. The

approach provides a richer picture of the context and processes around underpayment, but usually only at the informal/formal margin. Employers in the extremes of informality necessarily will be reluctant however to be open about their activity. Generally, even with reassurances about confidentiality of responses and careful selection of respondents, the approaches have low response rates and there appears to be a bias away from those likely to be informal. This suggests difficulties in using this approach to measure the extent of underpayment in the informal economy.

The potential to use **household surveys where the households are employers and surveys of vulnerable groups** is likely to be higher. Government oversight is low when households directly employ individuals meaning there is a concern about any associated employment being informal. Further, there are vulnerable groups that may also avoid interaction with government. Studies to enumerate, in a representative manner, such individuals and households provide a part of the underpayment picture.

The study recommends exploring whether using **audits as government investigates underpayment** is feasible for measuring the extent of underpayment. Audits of employers that find underpayment then provide a wider set of information, allowing some determination about whether the business' activity is informal. Audit data can be derived from NMW enforcement, from tax compliance work as well as from targeted investigations by HMRC and other departments. Whether the administrative data can be compiled in a manner allowing analysis and whether statistical methods can then estimate the extent of underpayment remains to be tested.

1. Introduction

All employers are obliged to pay the National Minimum Wage (NMW) to workers within its scope at the rate that is set by the legislation. Beginning in April 1999, the NMW has been set annually, revised following advice from the Low Pay Commission. Since 1 April 2016, the National Living Wage (NLW), applying to workers aged 25 and over, has complemented the NMW.

HM Revenues and Customs (HMRC) enforce both forms of minimum wage and there is evidence of non-compliance. When 2,667 employers were subject to a completed investigation by HMRC's minimum wage compliance teams in 2015/16, just over nine hundred and fifty employers were paying below the NMW affecting fifty-eight thousand workers (HC Deb, 4 May 2016, question 36477). Government is taking a tougher approach on employers that break national minimum wage law. For example, the maximum penalty has increased from £5,000 to £20,000.

There is also work to improve the detection of non-compliance, often beginning with identification of where underpayment occurs and so directing where investigative activity might be focused. When employers are asked about what they pay, about 0.8% of jobs have wages that pay below full adult minimum wage. However, this in itself does not measure underpayment. The estimate includes jobs with exemptions from the adult rate implying that some of these jobs are likely to comply with minimum wage obligations, while paying below minimum wage.

This indicates the difficulties quantifying the extent of underpayment even in well-measured parts of the economy. In the formal economy, evidence on the behaviours associated with non-compliance is difficult to collect, primarily as non-compliance is illegal. Careful studies find businesses often surprised to find they are not compliant (Patel, 2012). A particular problem occurs when economic activity is informal, occurring in those parts of the economy that are hidden from Government.

Both employers and employees may hide their employment. Employers want to hide the underpayment or other illegal aspects of their activity. Employees may benefit from hiding their employment: it may allow gaining access to benefits that would be removed were their status known. Further, there has been Government recognition of a change in the nature of non-compliance with labour market regulation, with a particular concern about abuses alongside organised crime in the hidden and informal economy (BIS & HO, 2015).

This study focuses on the approaches to measure the extent of underpayment that occurs in the informal economy. The findings are summarised in the next chapter, [chapter 2](#). In the [third chapter](#), the informal economy is defined as that part of economic activity that is hidden from government oversight.

[Chapter 4](#) focuses on “top down” approaches to estimating minimum wage underpayment in the informal economy. These start from official measures of the size of the informal economy produced by HMRC to understand tax gaps and in ONS work to measure GDP “exhaustively” including activity that is hidden. Such top down sources have not so far been used in NMW underpayment research and the chapter describes indicators that

could be combined with estimates of informal employment to estimate jobs being paid below minimum wage.

[Chapter 5](#) focuses on two “bottom up” approaches that use data collected about underpayment in the informal economy. The approaches focus on survey evidence, one surveying employers and the second focusing on particular groups that are involved in informal employment. Both approaches have been used in previous studies so the feasibility issues can be discussed using the experience of past research.

[Chapter 6](#) then turns to bottom up approaches using administrative data collected as HMRC enforces minimum wage compliance. Such data has not been used in quantifying underpayment and so some feasibility issues remain to be explored and the chapter discusses these.

The report also includes some [annexes](#) exploring studies where the focus has been underpayment in the formal economy. In producing this report, these studies were reviewed to consider whether they provide evidence on the informal economy and whether the methods used could be applied to the informal. Many of the studies use the Office for National Statistics (ONS) employer and labour force surveys, primarily the Annual Survey of Hours and Earnings (ASHE) and surveys of employees, such as the Labour Force Survey (LFS).

2. Findings

For this study, two broad types of methods are defined: top-down and bottom-up. Top-down approaches differ from the bottom up methods by not seeking to measure the phenomenon directly. Rather, measures derive from a high level estimate of informal employment and then identify what proportion or part of this can be identified as likely to involve minimum wage underpayment. Chapter 4 describes how such an approach might be implemented for minimum wage compliance in the informal economy.

An example of a top-down approach is estimations of the amount of VAT and duties that are avoided because transactions are hidden. It is possible to estimate the total expenditure on a VAT-able product using macro measures of expenditure. Then, the total potential tax on this product can be determined “top-down”. There is then detailed and authoritative information about what taxes have been collected and HMRC calculate the tax gap of uncollected taxes. The estimates are essentially the difference between top-down estimates of overall activity and the (high quality) measures of those activities that are not hidden.

In looking at underpayment in the informal economy, a top-down approach would start from high level estimates of informal activity or informal employment. It is estimated that around 12% of economic activity takes place in the shadow economy (Williams and Schneider, 2014). The analysis might then account for how much employment is associated with of this activity and whether any employment involves minimum wage underpayment, drawing on assumptions and modelling about underpayment. Coherence is maintained by always working within the overall understanding about informal employment that has been provided “top-down”.

This report looks at approaches to estimating the number of jobs in the informal economy. Table 2.1 indicates the findings from this study for a top-down approach, about the methods. The overall objective would be to undertake **top-down accounts of the informal economy**, which identify economic activity that is hidden. These approaches are increasingly being implemented in national accounts and so suggesting the quality, in terms of coverage, is considered adequate for official statistics.

The table indicates – in the fourth column – the key stages to implementing a top-down approach. The first two stages seek to build on the estimates of the size of the hidden economy in the national accounts. Later stages then add more data to estimate minimum wage underpayment. A problem for this, however, is there are relatively few underlying (bottom-up) data sources to estimate how much of the informal work done is undertake at pay rates below the minimum wage. The availability of other indicators around pay levels to complement the top down estimates of the hidden economy may help on this, but some bottom-up work would be needed.

Bottom-up methods collect data directly from participants in what is being investigated. As much social research is bottom up, the bottom-up/top-down distinction places a considerable body of evidence in the bottom-up category. For this study, bottom-up evidence focusing on underpayment in the formal setting was reviewed. These are presented in the annex. The most common methods have started by using ASHE and then

improving the estimates from this source using additional data about possible underpayment. These studies however do not cover the informal sector specifically.

An alternative set of bottom-up methods collect data, often qualitative, about the low paid but targeting those hidden from government oversight. Chapter 5 present these approaches. The methods focus on “surveying the hard-to-reach” and the first stages of such approaches typically identify businesses, employers or employees that can provide evidence about informality and underpayment. Questionnaires are then both designed and conducted in a manner that ensures respondents provide appropriate evidence in an area where there may be reluctance to be candid.

Because these approaches are already being used, their feasibility is well understood. Further, there continue to be investments in such studies – such as recently announced plans for HMRC sponsored work mapping the hidden economy – which may focus on providing or indirectly provide evidence about minimum wage noncompliance in informal settings.

Chapter 6 looks at approaches that do not use surveys but rather use the data collected as audits for minimum wage compliance are conducted. This data has been used in monitoring the performance of compliance systems. HMRC reports the number of complaints about underpayment, the cases investigated and the outcomes. For example, employees can report employers through the ACAS Helpline (previously the Pay and Worker Rights Helpline) for minimum wage and other employment issues, providing insight into employee concerns on compliance with minimum wage. The underlying dataset is similar to those used in compliance over tax or immigration. Those other data systems, especially in the US, have been analysed to explore what they may say about the wider picture of non-compliance and the report reviews such work.

Table 2.1 indicates the findings of this report with regard to bottom up evidence describing how the three approaches might be implemented:

- **Qualitative and quantitative surveys of employers and their workers targeting the informal**, which addresses the challenge of measuring the extent of underpayment particularly in hidden activities. While already used to explore compliance in specific groups and sectors, these methods can only claim to be representative of the wider picture under special circumstances. They would be of limited use in estimating the extent of underpayment in the informal economy, but would provide a qualitative understanding of the context and drivers for underpayment.
- **Household as employer surveys and surveys of vulnerable groups.** Government oversight is low when households directly employ individuals meaning there is a concern about any associated employment being informal. Further, there are vulnerable groups – such as migrants – that may also avoid interaction with government. Studies to enumerate, in a representative manner, such individuals and households provide a key part of the underpayment picture.
- **Quantitative studies of compliance audits** using the evidence collected as Government investigates compliance. This approach is used in tax compliance and

ought to be feasible. NMW enforcement activity involves collecting data in a similar manner to tax compliance, as a by-product of investigative and audit work. Analysis of this data would provide high quality estimates of the number of jobs found to be non-compliant, which in itself is useful. Whether the results can then be generalised would depend on issues detailed below.

There are two issues that limit these bottom-up approaches. A first is how representative the studied group is of the wider population. This is important if evidence is to be used to provide a holistic picture about underpayment needed for policy making. This issue is most stark when surveying the hard-to-reach, where there are likely to be strong reasons for not generalising results much beyond the studied group. In the case of employer surveys, past studies have found sample sizes to be both small and potentially quite biased. Those targeted for interview often refuse to participate, even when surveyors indicate the confidentiality of any results and take specific measures to make respondents feel at ease. Further, survey respondents are not representative of the wider targeted employers and those involved with informal activity are less likely to be open. Research then focuses on qualitative aspects of underpayment or informality.

Such problems are present, but less pronounced, when workers are surveyed or studies are conducted targeting households that employ domestic staff. Sampling strategies – including ones specifically designed to survey the hard-to-reach – provide a better set of respondents: sample sizes are large and there is sufficient complementary evidence to indicate how representative results are of the wider phenomenon. The sampling can be assisted with local, area-specific workshops of experts in the area, to test and develop the sampling strategy.

The final bottom-up approach seeks to generalise from administrative data derived as minimum wage rules are enforced. This combines the data with (complex) statistical estimation techniques. The estimation requires the researcher to understand how the enforcement activity was targeted, as such actions are rarely randomly targeted. This can then be used to generalise to the wider population from any non-compliance that is found in those inspected. For this approach, the main constraint is the extent to which investigation work can be accessed and analysed. Analysis will require a complex, qualitative administrative data to be structured appropriately and this is resource intensive.

A second issue is the extent to which the data collection can guarantee high quality data about the underpaid, especially in the informal economy. There has been considerable research on this issues and it indicates how any extrapolation will result in a high level of uncertainty. This is because underlying datasets are often weak at the lower end of the pay distribution. Further, identifying underpayment is complicated – needing evidence about pay, hours, other benefits and costs – with various interactions between different aspects magnifying any inaccuracies due to collection. Table 2.1 therefore suggests a first stage should explore the feasibility of this approach.

Table 2.1: Approaches for Estimating the Extent of NMW Underpayment

Approach	Method	Example studies	Stages of approach	Issues and scope
1. Top-down	Use ONS/HMRC estimates of hidden employee remuneration and integrate evidence on underpayment.	ONS annual estimates of hidden economy compensation of employment using HMRC work	<ol style="list-style-type: none"> 1. Top-down estimates of hidden employment using HMRC/ONS work 2. Account for measured and unmeasured employment 3. Identify/analyse indicators of underpayment and low pay 4. Identify/analyse hiddenness indicators 5. Modelling/estimation as appropriate 	Provides bounds on the informal economy and a framework to integrate evidence about low pay. Some assumptions needed, derived from other approaches. Quality of assumptions underpinning estimates.
2. Surveys of employers in informal sector	Surveying employers likely to be underpaying and establishing extent of non-compliance	Qualitative studies include IPSOS-Mori (2012)	<ol style="list-style-type: none"> 1. Identifying a sample frame for “hard to measure”, e.g. enforcement 2. Local workshops to bring in context 3. Augmenting approaches to sampling 4. Survey design to understand underpayment 5. Qual/quant analysis for estimation 	Provides targeted evidence about underpayment in businesses somewhat informal but qualitative. Representative research difficult/costly. Issues around who does the survey, links to enforcement, overcoming hiddenness.

Approach	Method	Example studies	Stages of approach	Issues and scope
3. Surveys key groups participating in informal employment	Surveying households about informal employment, groups employed informally	Williams (2004); Anderson et al. (2006); trades unions surveys	<ol style="list-style-type: none"> 1. Identifying a sample frame for “hard to measure”, e.g. enforcement 2. Local workshops to bring in context 3. Survey design to understand underpayment 4. Qual/quant analysis for estimation 	Groups, such as migrants, need specialised surveys. Surveys about employment by households successfully undertaken though now dated.
4. Case data from HMRC compliance	Estimate non-compliance using statistical analysis of investigations evidence	50k/year jobs noncompliant, no formal/informal split	<ol style="list-style-type: none"> 1. Compile and code case level data 2. Initial scoping analysis to test feasibility 3. Appropriate econometric method, controlling for selection issues 	Novel data and approach. Data from enforcement needs to be carefully structured such as identifying whether employment is hidden.

3. Defining the Informal Economy

This chapter explores definitions of the informal economy. The discussion is structured around a particular definition of the informal or hidden economy: the paid production and sale of goods and services that are unregistered by, or hidden from the state for tax and/or welfare purpose but which are legal in all other respects (Williams, 2004). The chapter explores the issues as such a definition is applied to employment and low pay in employment.

Ram, Edwards and Jones (2004) describe how definitions of the ‘informal economy’ are characterised by considerable ambiguity. A key challenge is that the informal becomes a residual, what remains once one understands the formal. This chapter begins with a common definition, and then considers how this might be applied when quantifying the extent of minimum wage non-compliance. A key problem for measurement is the extent to which employers and employees hide underpayment, making measurement difficult.

Defining informality when activity is hidden

A useful definition of the informal economy is a space that “comprises all currently unregistered economic activities that would contribute to the officially calculated gross national product if the activities were recorded.”¹ A definition of formality then follows from this: the formal economy is where a government has oversight and the power to monitor, tax, and regulate the exchange of goods and services.

This definition of the formal/informal supports aggregate economic measurement, particularly estimating GDP. It can be used to define formality and informality in employment, centring on whether economic activity is undeclared. The activity itself may be legal, but if undeclared it would fall in the scope of the informal. For example, it defines as informal a household employing staff on a cash-in-hand basis, which may then be unregistered to avoid both expenditure and income taxes as well as the legal obligations associated with employment. This definition also includes illegal exchange as being part of the informal economy, that is, where the activity itself is illegal. An example would be the sale of drugs. There has been recent work to measure such activity to meet international national accounts requirement (Abramsky and Drew, 2014).

This study’s preferred definition of the informal economy is “the paid production and sale of goods and services that are unregistered by, or hidden from the state for tax and/or welfare purposes but which are legal in all other respects.”² This definition remains grounded in measuring the economy, but has the advantage of focusing on those parts of economic activity where the activities are legal but done in an illegal way. It then avoids activities that are illegal and so hidden for that reason.

¹ Schneider and Williams (2013) p.24

² Williams (2004) p.188

This study then focuses on applying this definition, but particularly with regard to how hiding activity might affect measuring employment. The focus of this study is the spectrum of behaviours between two extreme categories:

- Employer does not declare economic activity to gain some economic advantage but little systematic hiding of activity beyond this: “Hidden”; and
- Multiple, co-ordinated or collusive hiding of wage rate, employment and related economic activity perhaps involving employers and employee: “Very Hidden”.

In the first category, the activity is undeclared, usually to avoid tax. As the employment is not declared, such behaviours mean that the jobs are unlikely to be identified in key labour market datasets and administrative systems. These are akin to the HMRC “moonlighters”, economic actors that hide some of their activity (HMRC, 2015).

HMRC also consider there to be “ghosts” when collecting taxes, economic agents that conceal activity much more completely. Not declaring an activity and so employment may only be one of a range of unreported aspects of the activity. An employer may be breaking employment law and also avoiding taxes; an employee may be in receipt of benefits they would be ineligible for given their employment. In such circumstances, the behaviours to hide employment would be within a wider set of hiding actions. These actions would combine to obstruct research that estimates underpayment.

Looking at underpayment on the other side of the formal/informal split can test the understanding of the informal in the previous paragraph. The pay can be below the minimum wage in the formal economy. Here, too, behaviours could be segmented in terms of their hiding. In formal economic activities, employment could be declared and the pay rate is disclosed but there is known underpayment either because of “Error” or “Avoidance”. Equally, employment may be declared, but the wage rate does not comply with minimum wage obligations but this is miss-represented: “Evasion”. Research to measure minimum wage underpayment in the formal sector is reviewed in the annex of this report. It is found that the underpayment will appear in surveys or the payroll returns in the first case. In the second category, an employer misrepresents the details of the employment contract intentionally to hide the rate of pay from the authorities (or researchers). The fact of the employment is declared. But, the exact wage rate is inaccurately provided. To find this, additional data has to be collected.

Issues in defining the informal

The definitions of the informal economy are helpful but, in measuring the extent of underpayment, some specific issues may arise.

A first is that the hiding of economic activity may be by the employer or the employee or both. However, in the definition outlined above, it is the behaviour of the employer that is the starting point in identifying informality. This is because definitions start with whether the economic activity of the business is outside the formal economy. When, identifying underpayment, studies often do use evidence from employees, such as labour force surveys. A challenge then is in deciding whether the employment is located in the informal economy.

A related issue, at the interface between the formal and informal, is an employer's intent. Employers caught underpaying will claim that they were unaware of their obligations, citing complexities with regard to particular aspects, or that they have failed through some mistake rather than actively sought to avoid meeting the NMW (Patel, 2011). An employer may declare an employment at an hourly wage rate at or above NMW but there are unpaid hours worked, or leave is not adequately compensated for. This is not reported, evading minimum wage obligations. Whether this underpayment is in the informal sector then needs evidence about wider compliance issues. An indicator of their overall compliance may then be used, such as the extent to which they comply with different aspects of employment laws. Arguably, any assessment of intent has to be in the context of the measures taken by the enforcement of the NMW legislation by HMRC.

A similar challenge arises from the employee perspective in that employees may actively conceal their employment, sometimes alongside other illegal behaviours. Research by Katungi et al (2006) found evidence that the informal economy is not only composed of those who work within it to survive, but also involved people who saw economic gain in undertaking their work in the informal economy. Drivers for these individuals include being able to 'top up' earnings made in either the formal economy or through benefits. Findings suggest that due to restrictions on working hours, benefits would be lost if additional work was undertaken formally. There were also cases of individuals who are opposed to claiming benefits (e.g. because of pride) and therefore turn to the informal economy for work. Flexibility is also seen as a key benefit of informal working. Obtaining a job through social networks rather than the more formal processes of applications and interviews of the formal economy, along with the flexibility of being able to fit employment around childcare needs are key to keeping the informal sector thriving.

Underpayment and concepts of employment

There is definitional complexity when defining employment as opposed to other forms of work. In an informal setting, where government oversight is low, there is a risk that employment has been miss-classified as self-employment. Where this is the case reflecting the work's informality, employment rights including minimum wage obligations may not be met. The informality of the underlying activity can then mask both the underpayment and the fact that the work contract would ordinarily be considered employment.

One particular recent trend has been a significant growth in self-employment and movements from employment to self-employment. Resolution Foundation work has shown that such workers tend to be lower paid than employees and experienced sharper pay falls over the course of the economic downturn (D'Arcy and Gardiner, 2014). This has attracted interest around whether low pay employment is disguised as self-employment. But drawing conclusions about whether the low pay is entirely driven by the change in employment status is difficult, as surveys indicate there are multiple reasons for the movement towards self-employment. Studies impart to self-employment benefits justifying a lower remuneration, such as improvements in the nature of work.

For defining employment in this study, these examples highlight a particular research challenge. Generally, the status of a worker as an employee, conferring employment rights, is quite clearly defined. However, this may not be the case in an informal setting. This will have particular consequences. A key part of any collection of data would be to

determine whether the hiding of the economic activity has also hidden the exact employment status. If so, then there may be work that – were the cloak of informality removed – would fall within the scope of minimum wage obligations and may be at wages below minimum wage.

Studies have generally been able to make a judgement when using survey data. For example, the studies reviewed later that used data from surveys of households that supply or purchase labour informally (such as Williams, 2006) do then collect information about the work and implicitly a determination is made that this could be employment. However, there will be measurement issues in this.

Concluding remarks

There has been considerable discussion about what constitutes the informal economy. For a study measuring underpayment in the informal economy, this discussion suggests a focus should be employment that is associated with economic activity not declared to government. Further, a focus is on economic activity that, in itself, is not illegal but merely undertaken in an illegal manner. This would exclude activities such as the selling of illegal drugs. Where employment occurs in an otherwise legal economic activity that is hidden from tax collection in particular, this separates informal from formal in a manner consistent with other official efforts to measure the informal economy.

There are two extremes of behaviours in hiding any underpayment occurring in an informal economic activity. Firstly, an employer does not declare the economic activity associated with employment to gain some economic advantage but there is little systematic hiding of activity beyond this, hereafter “hidden” non-compliance. A further category is where non-compliance is “very hidden”, meaning that there is multiple, co-ordinated or collusive hiding of economic activity to escape a range of employment and non-employment obligations.

4. Top-down Measures of the Informal Economy

This chapter considers whether recent work measuring the informal economy can provide a top-down context to estimating minimum wage underpayment. There have been two recent strands of work to measure the value of the hidden economy: the measurement of GDP for official statistics and the estimating of the tax gap arising because taxable activities are hidden. The chapter explores whether these estimates of the informal economy can be integrated with evidence about low pay to provide top-down estimates of the jobs at risk of being below minimum wage. In particular, a range of indicators can link the incidence of minimum wage noncompliance to the estimates of informal employment to derive estimates of underpayment.

There is a large literature on the estimation of the hidden economy. Schneider (2014) observed that there are so many studies, which use different methods in order to estimate the size and development of the shadow economy, that it is quite difficult to judge the reliability of various methods. This is unsurprising given the challenges of measuring activities where avoiding detection is a key aim.

The quality of the top-down approach is dependent on the underlying data and assumptions. Schneider (2014) reviews the different methods used in estimating hidden economic activity, often tailored to the particular characteristics of the data available about the phenomenon being measured. Williams and Schneider (2013) then provide estimates for a number of countries using the multiple-indicator, multiple-impact approach demonstrating feasibility for the UK. They estimate the UK shadow economy to be about 10% of measured GDP in 2012. This would mean as much as three million jobs, if the shadow economy generated employment in proportion to its activity.

This chapter reviews two particular strands of work, both providing official estimates for the UK informal economy. One measures the tax gap, using various methods to account for tax losses as economic activity is hidden. The tax gap estimates are then used by ONS in improving the national accounts so that they cover the hidden economy. The chapter then turns to how such overall measures of the informal economy can be complemented by evidence on where NMW underpayment may be found. The use of top-down estimates of the informal economy with evidence of noncompliance from statistical and administrative data is however unlikely to allow estimates to be derived about how many of the jobs in the informal economy may involve pay below the minimum wage.

Measuring the UK informal economy

Each year HMRC estimate the taxes that have been lost as economic activity is hidden or miss-reported (HMRC, 2015a). The tax gap that emerges reflects the hiding of transactions that are liable to expenditure taxes such as VAT and duties. There is also lost tax revenues in undeclared profits, capital gains or other income. However, a significant part of the tax gap is due to the miss-reporting or hiding of employment earnings, reducing the levels of income tax and national insurance contributions collected.

HMRC estimate the lost employment taxes because employment is not registered. Tax gap estimates are made for individuals who do not declare any earnings of any form to HMRC, known as ‘ghosts’, and for ‘moonlighters’ who have two or more sources of income but only declare one for tax purposes. The tax gap estimate for ghosts uses information on Jobseeker’s Allowance claimants, income reported to HMRC by known individuals and estimates of illegal immigration flows. HMRC’s moonlighters’ tax gap estimates are based on work by Statistics Denmark looking at the shadow economy in Germany, Great Britain and Scandinavia (HMRC, 2015a, Pedersen, 2003).

HMRC estimates are then used by ONS to adjust the UK national accounts for the missed economic activities associated with the tax gaps (Abramsky and Wild, 2015). In the first stage of the adjustment, the missing tax is split between taxes related to production and the generation of income (including employment income) and those that are not (such as inheritance taxes). This is important because the former is contributing to GDP while the latter is taxes on transfers and so not contributing. ONS national accounting rules place the entire employment tax gap as related to missed income relevant to GDP estimation.

ONS is most interested in the income and economic activity missed associated with any tax receipts missed. For every pound of missed employment tax, the underlying income is estimated by using the relevant tax rate to scale the missing tax into estimates of concealed income. Data are not available on the characteristics of tax evaders (e.g. income) relative to the whole population, so it is assumed that evaders face the same effective income tax rate as the population paying that tax. This means that the ONS measure – while it may be suitable for overall economic activity estimation – could be unsuitable when used on sub-populations such as those on the low paid. These estimates could provide a starting point, as the shortcomings may be ameliorated by adapting the methods employed, integrating any evidence on the populations of interest.

The concealed employment income derived relates to the national accounts aggregate “compensation of employee” in GDP. This gives an estimate of several billions of hidden income. The ONS then allocates this estimate of hidden employment income to an industry breakdown, recognising that different industries are more or less likely to be affected by hidden employment. ONS places more concealed employment income in industries dominated by small and medium enterprises, where employers directly supply households and where government regulation is not very high. In this modelling work, ONS is acknowledging that certain sectors, such as restaurants and takeaway food, are more likely to employ informally.

Accounting for the hidden economy’s employment

ONS estimate the undeclared remuneration of informal employment at industry level. The coverage of these estimates is designed to be comprehensive. In particular, HMRC integrate into the tax gap analysis a range of sources about employment that might be hidden to avoid tax. A few issues about coverage remain, such as missing (hidden/informal) employment that involves very few hours and is at wages near the minimum wage so that no tax would be expected.

Table 4.1 indicates the stages that would be needed to derive an estimate of the number of jobs paid below the minimum wage from the ONS estimate. A first stage is to use average wage rates to estimate the number of jobs that the ONS income estimates imply.

These are the jobs in the informal economy, potentially both hidden and very hidden. ONS estimates are disaggregated by industry, but it may be appropriate to integrate any regional analysis as this would allow for the possibility of regional differences in wage rates. Modelling may also consider whether there is evidence about wage rates in the informal economy to improve the estimates for jobs.

The number of these jobs that would be paid below the minimum wage relies on some modelling of the distribution of the wages in these hidden jobs. This is the focus of the next section.

Table 4.1: Coverage of HMRC/ONS estimates of hidden employment

Estimation stage	Coverage	Issues
ONS estimates of undeclared compensation of employees	Includes “ghosts” and “moonlighters”; adjustments made for illegal migrants	Underpinned by averages for whole population and may need to disaggregate estimates, such as by income groups, region, as well as by industry to be more robust
Estimation of jobs associated with hidden pay	Jobs estimated by dividing total compensation by appropriate wage rate by industry; some sources may provide jobs directly not requiring backing out	May miss those jobs where employee earns below the basic tax allowance and NI minimum thresholds and so not liable to tax
Modelling distribution of wage rates and numbers of underpaid	Depends crucially on underlying evidence and data	See below

The first two rows of the table indicate analysis that centres on the ONS/HMRC work, unpacking it to focus firstly on hidden remuneration and then on related informal employment. However, the estimation must then integrate data beyond that used in the hidden economy estimates to look at underpayment. The issues around modelling the distributions of wage rates and then the number underpaid in the informal economy are primarily around modelling and estimating how wages are distributed in these jobs and what the likelihood is that those employed in businesses in the informal economy are underpaid.

To some extent, the distribution of pay could be imputed from estimates relating to the formal, such as the results of ASHE and LFS. However, this will miss key aspects of informality and is likely to have a high level of uncertainty and imprecision. There may be complex pay structures in informal employment, e.g. piece rates; there may be non-pay parts in the remuneration. Further, the sources may miss the underpaid systematically

because the economic activity is being hidden. This means the next stage of the top-down analysis needs additional data. The next section provides some of the potential sources.

Evidence to improve estimates of the underpaid

There are areas of the labour market where the number and pay of employees is hidden. The last section indicates how work to include these in official measures of economic activity may be used to provide a top-down estimate of the overall level of informal employment. However, such top-down evidence may only provide indicative estimates of the hidden underpaid.

The value of top-down analysis is then improved by integrating more evidence into the top-down estimates. A focus is to improve the indicators of underpayment incidence and, where researchers have sought to measure the extent of underpayment at a whole economy level, a first step has often been to identify where underpayment is likely because of a concentration of low paid jobs (such as Ipsos MORI, 2012).

Because there are readily available datasets on the distribution of wages, a good starting point is to use these to identify which parts of the economy have substantial numbers of jobs at or near the NMW. Table 4.2 suggests that the ASHE dataset might be analysed by geography and sector for this and Box 4.1 indicates findings when this is undertaken. ASHE has a number of drawbacks to give exact measures of the extent of underpayment and indicators based on the Labour Force Survey can augment the ASHE indicator.

Table 4.2: Indicators of underpayment likelihood

Indicator	Definition	Sources	Analysis
Paid at or near NMW	Jobs with an hourly wage at or near NMW, measured in number and share	ASHE	Analyse by geography; analysis by sector; analysis by occupation
Employees not in ASHE	Jobs not on PAYE because below the LUL	LFS, sector specific data such as NMDS-SC	Analyse by group and sector the jobs that have few hours and are low paid
Non-pay remuneration	For identified occupations, understand the remuneration package and unpaid travel time or additional non-pay benefits	LFS, sector specific data such as NMDS-SC	Analyse a restricted set of occupations

Indicator	Definition	Sources	Analysis
Apprentices	Employees that are registered apprentices	Apprentice Register/Individual Learner Records, Apprentice Pay Survey	Analysis by sector; analysis by region
Complaints about underpayment and other employment practices	Complaints pursued for tax, immigration, agency conditions	HMRC, Home Office, BIS Employment Agencies Inspectorate	Analysis by sector/group and enforcement action
Investigative programmes	Inspections by regulatory bodies in enforcement of employment law in a cross-industry or area-based operation	HMRC, Home Office, BIS Employment Agencies Inspectorate	Drivers for NMW targeted programme; Drivers for other agencies' programmes
Registers in and beyond central government	Employers and/or purchasers are overseen by central, local government and by (online) trading platforms	Innovative and varied and potential of each being explored by (different parts of) government	Customised
Characteristics of informal employment pay and conditions	Surveys of groups with high levels of informal employment	Bespoke surveys of groups involved in informal employment as employers or employees	Bespoke analyses

Table 4.2 also gives indicators that could be used to add to the ASHE evidence but on specific sectors and groups. Surveys can be used to indicate whether pay at or near to the minimum wage is associated with non-pay remuneration or unpaid hours of work. Information on whether a job is filled by an apprentice can indicate whether ASHE may be reporting employees as underpaid who are actually being paid correctly, but at the lower NMW for apprentices. Such information is improving, such as ASHE recently including an apprentice flag, but its quality has yet to be tested. There is also results from the Apprentice Pay Survey, analysed in Drew et al. (2015). A further source is the Individual Learner Record data source, which integrates the register of apprentices. Drew et al (2015) observe that – because many apprentices receive pay at rates that mean they are not declared to HMRC for National Insurance – this may identify more individuals in the apprentice workforce than is found in ASHE.

The number of complaints made to the ACAS Helpline can be used to corroborate the ASHE analyses. Some issues will arise to make the two source consistent, such as the point-in-time nature of ASHE's measure of jobs paying below NMW versus ACAS evidence being around spells of potential non-compliance. However, any analysis could even link the two sources at firm level (though analyse the linked data in an anonymised form).

Complaints that are related to the minimum wage are investigated by HMRC and two sets of data are associated with a case. The first is the record of the complaint detailing the complainant and the nature of the problem. A second comprises of evidence brought together from other sources. On receipt of a case referral, a compliance officer will normally carry out an investigation into the employer's business. This will usually include a review of the employer's payroll and associated records so beginning to establish how hidden the business's activity is. Most importantly, the investigative work will sometimes determine an infringement of minimum wage has occurred. This indicator therefore can definitively measure both where noncompliance has occurred and how hidden it is.

HMRC NMW enforcement works alongside other enforcement activities, such as HMRC tax compliance, Gangmasters Licensing Authority (GLA), Home Office immigration and visas. The ACAS helpline routes complaints to the appropriate organisation and the case related evidence is then compiled. The administration of enforcement will vary across the different organisations, but there are similarities to that used in enforcing minimum wage. Each organisation uses some form of risk-based targeted enforcement and initial processing of a complaint will compile case evidence to assess the risk of a significant infringement. Where the investigation uncovers minimum wage noncompliance, these will be reported to the HMRC teams enforcing minimum wage obligations.

Some of the enforcement bodies operate within a licensing framework or powers that necessitate a register of employers. Gangmasters have to be licensed and the GLA then oversees the licensing process and maintaining a register of licensees. The Home Office also register sponsors for two types of immigrant: skilled migrants and students. Registers of employers also underpin the tax system, with the PAYE system in particular being key to managing employment for most businesses. The duty to register is useful in understanding hiddenness. As an employer that falls within the scope of the particular requirement has to register, not registering is a clear case of hiding.

The lower portion of table 4.2 look at coverage in government administrative registers. The main register for employment is the PAYE system, which has all UK employers registered that use PAYE. There is considerable linking across such registers, especially as an investigative work is progressed. So an employer that is being investigated with regard to failure to meet employment obligations is likely to be checked in terms of registration and compliance on VAT registration and – if involved in managing gangs – checked with the Gangmasters register. Such checks provide evidence on the hiddenness of the economic activity, being highest where a business is hiding from a number of government bodies.

Box 4.1: Using the Annual Survey of Hours and Earnings to identify Low Pay Sectors

The government estimates the number of workers paid below the NMW through the Annual Survey of Hours and Earnings (ASHE) dataset. ASHE is a survey of employees completed by employers. It is a one per cent sample of employees using information provided by employers. It (and its predecessor, the New Earnings Survey or NES) has been the main source of information on earnings in the UK since the 1970s. ASHE is used to generate the official estimates of the low paid, the percentage of jobs paid below the NMW. However, ASHE is not the only source for official low pay statistics.

In general, the dataset is seen as reliable, accurate and representative of formal employment (Milton, 2004; Fry and Ritchie, 2013). Around 175,000 employees are sampled annually, and the data are linked to employer characteristics. Detailed pay and hours data is available, but age and gender are the only personal characteristics.

The main pay variable is derived by dividing actual pay by actual hours; employers provide a stated hourly wage if the employee receives one. There are some limitations for understanding compliance issues: ASHE does not ask about possible reasons a pay level may be lower than NMW but still be compliant with minimum wage obligations. So, the focus of ASHE analysis is pay rates below NMW, rather than whether the rates are compliant or not with minimum wage obligations.

Corlett and Whittaker (2014) use ASHE to locate where low pay is most common. They look at the number of jobs and businesses that are paying below particular wage rates – such as half median hourly pay – by occupation, industry, region. Results indicate the prevalence of low pay in “hotels and restaurants” and in “wholesale and retail” both in number of jobs and in terms of the share of jobs in these industries.

Innovations are being made with HMRC matching to non-government registers. HMRC are consulting on extending their data-gathering powers to obtain data from business intermediaries who facilitate transactions, particularly online, and electronic payment service providers who operate digital wallets (HMRC, 2015b). Businesses register to such service providers and – where they otherwise hide their activity from government – using this data could potentially help identify parts of the hidden economy. The approaches to do this will be developed over time, but the potential to both validate the returns that businesses make to government using the data from intermediaries, alone, would at give some insight into what is missing. If data collected is of a suitable form, there may also be the possibility to estimate what is missed as by government as it collects taxes, or regulates a business.

The final row in Table 4.2 is the focus of the next chapter. This is surveys of those informed in informal economic activity, either as an employer or as an employee. Surveys can be conducted tailored for these groups to explore the extent and drivers for informal

employment, the pay and conditions of the employment as well as the wider context of the activity. There are a diversity of approaches, often customised to the group being surveyed. A key issue in such data collection is overcoming the hiddenness of the informal activity.

Modelling methods to estimate underpayment

The previous sections give some of the possible datasets that could be used to estimate underpayment in the informal economy, given some top-down estimate of hidden employment is estimated from the HMRC/ONS work. There have been a number of indirect methods designed to measure the characteristics of the informal economy. Each have sought to tackle the fact that aspects of the informal, such as the extent of underpayment, will be hidden. The methods have usually started by using additional data that would act as a proxy for the otherwise unobserved activity. A key question is whether robust estimation using the sources in Table 4.2 is possible.

The first sources of data have provided a number of analyses of the numbers of jobs at or near the minimum wage, especially using ASHE. The annex to this report reviews these studies and there is a considerable evidence base around the formal employment where the pay rate is below minimum wage. This has then been further improved by using the data on specific employee groups, such as apprentices or workers in the care sector. The studies often uncover the formality or informality of the activity and then, given top-down estimates of the informal employment patterns, some underpayment estimations could be made.

However, the robustness of such estimations will necessarily be questionable. They will be built on multiple assumptions about the indicators. Each indicator will have strengths and weaknesses and while approaches have been developed (reviewed in Schneider, 2014) to draw these out in an estimation approach, the overall strength of any estimate is unlikely to be high without some evidence confirming the assumptions made. The lower half of Table 4.2 list some of the sources for such evidence. The use of administrative data associated with minimum wage compliance offers a high quality data source for the occurrence of non-compliance. A key problem with this source is whether it can be generalised beyond those that are investigated. Equally, surveys of those involved in informal employment – either as employers and employees – are very difficult. The later chapters outline how these bottom-up sources of evidence may be used.

Concluding comments

This chapter describes a top-down approach to research on the extent of minimum wage underpayment in the informal economy. The first stage involves determining the employment associated with hidden economic activity, derived using the official measures of economic activity.

These top-down estimates form the basis for an account of the employment in the informal economy and the second part of this chapter details indicators that can be used to locate where employment may be low paid or even underpaid. Some of the indicators actually do identify underpayment and – to the extent that such underpayment is in employers that hide the employment – this provides evidence of underpayment in the informal economy.

The key about the top-down approach is that – where the indicators are statistically robust – it can allow such evidence to be generalised. However, the strength of the top-down approach is dependent on the underlying assumptions used to uncover the hidden aspects of the economy. This requires bottom-up, quantitative analysis and the next two chapters consider such approaches.

5. Bottom-up approaches using surveys about undeclared work

Investigating underpayment of the NMW/ NLW is tricky, because it is illegal and therefore hidden from authorities and researchers. Some data sources about the labour market can suffer from systematic coverage issues, biasing statistics about NMW underpayment. The bias can arise at various levels and at different degrees. This chapter synthesises across two approaches to reveal hidden non-compliance. A first approach has researchers investigating the nature of any non-compliance, surveying employers and their workers. The second surveys individuals and households that act as employers or employees from groups that are likely to be party to employment below the minimum wage.

This chapter focuses on studies of employers and employees not complying with NMW obligations and hiding this. This is likely to be a feature of underpayment in the informal economy. The problem with hidden activity is two-fold. Firstly, a population of those involved in such activity is not available to sample from so that any survey undertaken cannot easily be generalised. A second issue is that any evidence from those hiding their underpayment or the informality of their activity is then likely to miss-inform or be left out of surveys or other data collected about the employment. These two problems mean that estimates of underpayment are hard to make. As such, the literature has tended to be qualitative, exploring the drivers and context for informality or non-compliance.

Despite these issues, approaches have been developed to investigate phenomenon in areas of the economy that are hidden. This chapter splits these into two approaches. Both start with evidence about hidden activity usually derived from compliance systems, but the first then has researchers investigate what is occurring and whether the findings can be generalised to the hidden population. The second approach surveys groups that – through profiling – are likely to be participating in employment that does not comply with NMW.

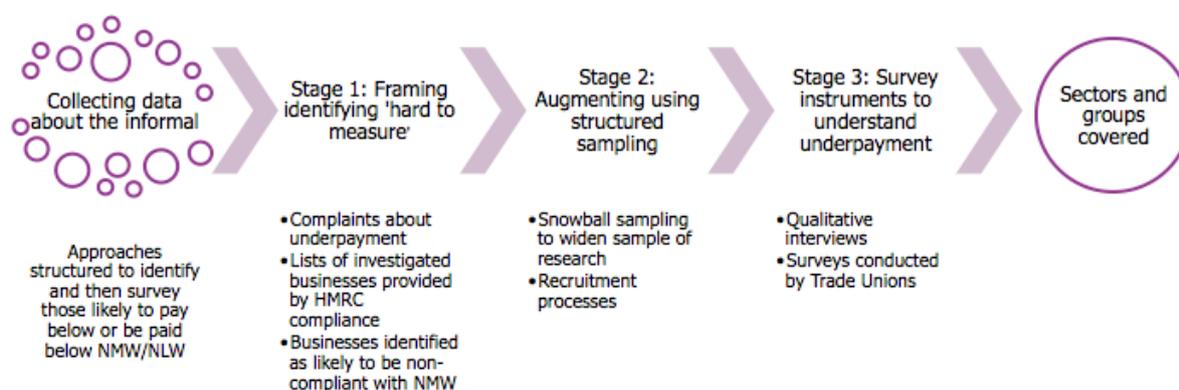
Approach 1: Surveying the hard to reach

A difficulty for methods that use official surveys or administrative data is that they do not incorporate the ‘grey’, cash-in-hand or illegal economy. Studies around the National Minimum Wage have involved data collection seeking out and then enumerating those in these forms of employment. The collections vary by the steps taken to identify the population to study, the way respondents in the target group or sector are selected and the data collection method. Some then focus on understanding of underlying reasons, opinions, and motivations of non-compliance to National Minimum Wage legislation, offering insight into the drivers of non-compliance.

This research is investigative in nature, extending beyond measuring the extent of underpayment. It aims to “explore” or “uncover” potential relationships and variables that could be relevant to understanding non-compliance. The conclusions often assert parameters or potential correlations to be tested by in-depth quantitative research and modelling. This work usually involves interviews of individuals, designed specifically to uncover behaviours which are generally covert. Regarding non-compliance, this research

surveys employers and employees about minimum wage compliance, draws on labour representative bodies targeting their membership; and questions households as employers of the low paid.

Figure 1: The stage processes behind the first approach



Rather than considering these separately, the next sections are structured according to the process of research. The stages are usually first about defining the frame from which a study selects the hard-to-measure, then the manner in which sampling is improved, with a survey instrument then being deployed and results analysed.

Stage 1: Identifying a sample frame for the hard to measure

This stage focuses on finding a first sample of employers, targeting those likely to be hidden and paying below the minimum wage. Two sources are used.

Underpayment Enforcement Data as an Initial Sample

In work on NMW underpayment, the initial sample is often drawn from the investigations about NMW infringement. Workers and employers can make allegations of underpayment of wages below NMW via the ACAS Helpline and HMRC follows up each of these. Employers are also investigated in targeted enforcement, informed by HMRC analysis around risk of non-compliance.

This has often provided a frame from which surveys draw. This sampling frame is used in BIS (2014) to examine employers' attitudes and behaviour toward non-compliance of NMW legislation. A total of 39 interviews were conducted with workers currently working below the National Minimum Wage. Croucher and White (2007) interview workers whom they could identify through this administrative source.

There are issues with this dataset. Croucher and White find that the records omit significant information (ethnic identities were not recorded) and are sometimes incomplete. For example, only one worker is identified as the contact in collective cases and contact details for that worker are not always complete. Cases are sometimes only identified by employer name. Further, the sample includes only individuals who are comfortable reporting to an official body. This may mean individuals working in the 'very hidden', where relatively high levels of infringement are probable, are not represented. The authors also suggest that there may be sample bias in that respondents with grievances with employers

may be over-represented. However, they conclude compliance data is the only source to yield a reasonable sample “even for indicative research”.³

Whereas Croucher and White focus on enforcement in general, HMRC (2013) focuses on enforcement in the social care sector. The study was primarily an operational review, following up on concerns raised about low pay in the sector. Its findings drew out results relevant for operations and the methods employed benefitted from the access HMRC has to its administrative data. HMRC selected for investigation on the basis of complaints from care workers received via the ACAS Helpline regardless of location and size of employer. However, the data is augmented using other evidence collected as enforcement activity is progressed. The study focuses on a selection of 80 care providers (40 residential care and 40 domiciliary care providers) who according to HMRC records employed more than 75 workers and met criteria for investigations.

Researchers have sought to understand the context of employers selected for investigative and enforcement action, usually interviewing those involved in the enforcement process alongside drawing from the lists of businesses investigated. Patel (2012) used a sample of non-compliant employers that was constructed from cases closed by HMRC between September and November 2010. Employers had previously stated that they were non-compliant due to mistakes rather than deliberate non-compliance. Patel then interviewed officers involved in the investigative work. Ipsos MORI (2014) also interviewed NMW enforcement officers in February 2011.

Purposive sampling of employers and employees

Employers are sometimes identified from a database of employers, such as Dun & Bradstreet. Low wage sectors are selected on key characteristics (size, location, sector), often mirroring those targeted by enforcement activity. The drawing of businesses in this manner has the advantage of – potentially – reaching businesses and employers before they have been targeted by enforcement. However, the sample size needed for this to find evidence around underpayment has to be large. A strand of the Ipsos MORI (2014) uses this approach, but it complements other sampling frames rather than providing the only evidence.

Gilman and Ram (2003) is a study that relaxes aiming for a representative sample, purposively interviewing on the basis of possible circumstances of employers. The focus is on sectors where low pay is significant and targeting small firms, which other studies have found are more likely to hide activity from authorities. The businesses were identified using networks of business and trade associations, local councils, trade unions, banks and low pay organisations. Such a sampling strategy restricts generalising results beyond the particular case studies analysed, but the study involves two surveys, one before and one after the implementation of the NMW in 1999 so assessing the change in employer and employee behaviours. This may be less affected by the sampling issues.

Stage 2: Augmenting the Sample to be Representative

A key question after stage 1 is how representative the initial, so-called “convenience” sample of employers is. The researcher will have selected the sample through information

³ Ibid (2007) p. 149

about businesses at risk of underpayment and likely to be in the informal economy. This research is then followed by work considering whether the results from an initial list of cases can be generalised.

Integrating local expertise

Studies often involve a stage selecting a locality to conduct surveying. This involves compiling a set of data for the selection, such as the demographic characteristics, the types of businesses and evidence on pay and the distribution of pay. The sampling of the area in this way can mean results can be generalised to some extent, but then selecting the businesses or individuals to surveys needs also to be undertaken in an analytical manner. Often local expertise can be used for this.

Surveyors often conduct workshops involving local experts with knowledge of the scale and location of informal activity. This would involve compliance offices from central and local government bodies, those involved with supporting employment more generally. Business organisations familiar with the area would also be involved. The workshops provide a chance to improve both the sampling strategy and to identify sources from which to sample. Croucher and White (2007) and Ipsos MORI (2012) describe the important role such input had.

Using a screening questionnaire

In Ipsos MORI (2012), a survey phase may involve calling selected employers in order to determine their eligibility and willingness to take part in the research. A screening questionnaire is used at recruitment to ensure the right employers take part and minimum quotas were met. Such questionnaires allow the researcher to stratify the sample with the aim to substantiate that the views of the interviewees are reflective of the sample of interest. Stratification is followed along region, sector, and outcome of inspection. A key part of the survey is steps to encourage participation: interviews were conducted at a time and place most convenient to employers and incentives of £40 per interview were offered as compensation for employers' time.

However, it is noted that this strategy has some drawbacks. The sample may not be reliably stratified because any flexibility provided to recruiters to account for the unknown elements of the sample profile may result in bias. For example, if recruitment focuses on businesses identified as non-compliant using administrative sources, studies have then found the employers prepared to answer surveys are ones that dispute their arrears. It then proves difficult for the survey to authoritatively categorise which side of compliance the businesses fall.

Snowballing recruitment and iterative recruitment

A third sampling method to enumerate hidden populations is snowball sampling or other forms of chain referral samples. Goodman (1961) established snowball as the best known, with recent statistical grounding to this being provided by Heckathorn (1997). An initial convenience sample or a random sample of contacts is approached and the researcher asks them to participate. Each participant is then asked to provide a fixed number of additional names and this is repeated a number of times.

Snowballing is particularly popular when trying to survey illegal or hidden activity, such as the drug market or sex work (e.g. Lupton et al, 2002, for drug market in a UK area). By the

nature of these activities, investigations into them are unwelcome and barriers to investigation are likely to be erected. By using the initial interviewee as the entry point for further interviews, snowballing aims to get round barriers through personal introductions which engender confidence that any information supplied will not get back to the 'authorities'. Ipsos MORI (2012) employ the approach in investigating minimum wage non-compliance.

The statistical properties of snowballing have been elaborated by Heckathorn (1997) who demonstrates how successive rounds of the approach might result in estimates that are representative of the underlying hidden population. The key to the approach is that referrals eventually return to cases that have already been surveyed or are in known networks. This confirms the extent of the hiddenness and the method potentially provides an efficient way to recruit enough respondents to both provide evidence about the phenomenon and confirm the extent of the informal activity.⁴

Box 5.1: Snowballing assumptions and getting a representative sample

There has been considerable use of the snowballing method outside of minimum wage noncompliance and labour market research. The assumptions underlying the approach have been tested.

Gile and Handcock (2011) elaborate on three. Firstly, there is no bias induced by the initial sample, usually a convenience sample, in our case, provided by minimum wage compliance officers. A third assumption is that the behaviours of the contacts in referring further contacts does not systematically avoid some members of the hidden activity. This then ties to what is assumed about returning to the same contact found through different referrals.

In looking at minimum wage compliance, such issues are complex and careful studies are indicating problems in referral processes and in non-response of contacts being biased. To some extent, that is to be expected given the phenomenon being measured but there have been some areas where these approaches are more successful – recent work in surveying populations suffering some hidden health problem – and drawing on what works may provide some direction to any future studies.

Box 5.1 outlines some of the assumptions behind snowballing. Patel (2011) highlights the issues researchers have found, focusing on the initial phase of interviewing even before referrals. It is found that “coupled with different refusal rates by selection criteria such as region and past compliance and several cancelled interviews, target quotas were not always achieved”⁵ and that “the sample of non-compliant inspected employers included only those who consented to be interviewed, which may mean that the response from the employers that took part may be biased.”⁶

⁴ Ibid (2012) p.9

⁵ Ibid p.17

⁶ Ibid p.1

That this may be a problem is indicated in BIS (2014). A “free-find”⁷ approach was taken. This relies on specialist qualitative researchers using a screening questionnaire to identify workers working below the NMW. The specialist recruiters visited places where people tend to socialise and get together, targeting relatively deprived communities⁸. It was felt inadvisable to visit respondents’ places of work given that their employers were breaking the law. In the study, there was also an element of controlled snowballing.⁹

Stage 3: Surveying the hard-to-reach

Surveying those not complying with minimum wage requires careful design of the survey instrument. The nature of the research means that participants may hold reservations about taking part, since in agreeing to an interview, they may be admitting to breaking the law. Ipsos MORI (2012) note that participants are offered reassurances that they would not be identified, exposed or reported to any authority as a result of their participation in the research. The success for this will often depend on the credibility of the researcher in making such statements. For example, where researchers badge themselves as “academic” or independent in some way, this will assist in response rates. Where targeted groups are some minority with specific cultural norms or languages, then the extent to which researchers can identify with these norms may also be significant.

Some interviewers structure any questionnaire to build trust and then probe. To identify households employing undeclared workers, Williams (2004) used household interviews that first asked whether a task had been undertaken in the household during the previous five years/year/ month/week (depending on the activity). If not, they were asked why not. If it had been undertaken, they were asked who had conducted the task, whether the person had been unpaid or paid, and if paid, whether or not it was ‘cash-in-hand’ as well as how much they had been given. Moreover, for each task completed, respondents were asked in an open-ended manner why they had decided to get the work done using that source of labour (so as to enable their motives to be understood) and how they would have completed the task if they had not employed this labour.

Surveying businesses about their informality uncovers a range of challenges, most importantly around response rates. Croucher and White (2007) conclude that “data of any sort in the area are therefore very much at a premium.”¹⁰ In their study, a total of 1,163 letters were sent to potential respondents selected by compliance officers across Britain and Northern Ireland. Of these 832 were employers and 331 were workers. The researchers successfully interviewed 70 individuals (43 employers and 27 workers), conducting 82 interviews with them.

Where sample sizes are likely to be small, a mix of in-depth interviews with as many telephone interviews as possible, has allowed researchers to explore qualitatively the context and drivers for non-compliance and then use the telephone interviews to discuss how general results are. In all cases, contextual questions are asked about work social relations. Further questions reflect the enforcement process: how cases arose, proceeded,

⁷ BIS (2014) p.i

⁸ Ibid (2014) p.i

⁹ BIS (2014) p.i

¹⁰ Croucher and White (2007) p.149

and were resolved. Open questions are asked about people's reactions at every stage to the enforcement process.

In Ipsos MORI (2012), 18 face-to-face Interviews were conducted and used discussion guides, designed in collaboration with the LPC. During the recruitment process, attrition proved quite significant and there were concerns that those declining to participate were biased towards those "hiding" their employment practices. This prompted a change in qualitative methodology to target "face-to-face in depth interviews with employers who were deliberately evading paying the NMW."¹¹

The study then explores the behaviours that define informality and hiddenness. One finding was that employers that were not compliant with minimum wage obligations were not necessarily failing to comply in relation to other areas of their business, such as registering for VAT. This behaviour ties with an important driver to comply: the chance of being caught and the penalties associated with hiding activity from government. With NMW underpayment, the current penalty¹² is to pay arrears and a financial penalty of 200% of the unpaid wages, with a maximum penalty of £20,000 per worker. In recent years, employers have perceived that the highest penalties would be for failing to comply with tax legislation and immigration rules. Some were prepared to accept the risk of being caught paying less than NMW, but felt other obligations were more likely to be enforced and penalties more severe for non-compliance (IPSOS Mori, 2012, p.50).

For Patel's study, two separate discussion guides were used in the interviews; one for the NMW officers and one for the employers. Stimulus materials were also used in the interview. Interviews lasted for approximately one hour and were recorded for transcription purposes. Where possible interviewers spoke to interviewees face-to-face. All face-to-face interviews with employers were conducted in their place of work. Interviews with NMW officers were conducted over the telephone. In presenting the findings of this report the authors stress that "all of the non-compliant employers taking part in this research said their noncompliance was a result of error rather than being deliberate and in most cases errors were made because of a misunderstanding of a specific detail of the legislation."¹³

BIS (2014), in conducting the interviews, interviewers adopted a case study approach, "allowing participants the freedom to recount their experiences chronologically so that researchers were apprised of their employment journey."¹⁴ However, although all of the interviews were interactive in form they also used and were based on topic guides. Most of the interviews were conducted face to face and lasted up to an hour in length. In a small number of instances interviews were carried out by telephone so as to meet the availability of the respondent.

These studies provide important qualitative evidence about the context of non-compliance and the drivers for underpayment, but they do not provide measures of the extent of the phenomenon. While the in-depth face-to-face interviews essentially validates the telephone interviews, there is very limited evidence of the extent of the phenomenon. This

¹¹ Ipsos Mori (2012) p.9

¹² BIS (2016) Policy on HM Revenue & Customs enforcement, prosecutions and naming employers who break National Minimum Wage and National Living Wage law

¹³ Patel p. 2

¹⁴ Ibid (2014) p.7

is likely to be because the businesses surveyed have strong incentives to hide their that are revealed.

Approach 2: Surveying household employers and vulnerable groups

Approach 1 focuses on businesses, surveying both employers and their employees identifying those that are in informal employment relationships. There has been a history of targeted surveys of individuals and households that are vulnerable to working informally. This has taken two directions. Firstly, an important class of employers is households that directly employ workers. Secondly, there are individuals that are particularly vulnerable to informal employment, sometimes due to the status of the group or occupation that they are employed in.

Households as employers

There is a very high chance that households that directly employ will do this informally. There is very little government oversight as households purchase services. That has meant that payment may be in cash and unrecorded both by the employer household and the employee. Further, such employment can often be at low pay rates.

Measures of the informal economy – such as the HMRC tax gap analysis reviewed in the last chapter – make specific adjustments for this employment. The estimates use a study by the Danish statistics office that surveyed households in four countries about their employment for domestic services (Pedersen, 2003). Williams (2004) examines the spatial distribution of undeclared work, especially the ‘cash-in-hand work’, focusing on “household work practices”¹⁵. The eventual surveys were held between 1998 and 2001 in eleven English localities.

A maximum variation sampling method was used to select localities for investigation. This purposive strategy selected affluent and deprived, rural and urban localities in different regions of England using the Index of Multiple Deprivation to rank all wards in England and Wales according to the level of their multiple deprivation. The second stage of the sampling was to ensure randomisation but complete coverage. The research team called at every nth dwelling in each street, depending on the size of the neighbourhood and the number of interviews sought and there was careful replacement where there was no response. This provided a spatially stratified sample of each locality.

These studies of households directly employing employees are now quite old. They then can be criticised for their relevance to current employment practices and HMRC are currently considering options in updating the evidence available, particularly focusing on mapping the hidden economy. Any study may then provide up-to-date evidence about employment at or near the minimum wage.

Employment in vulnerable groups

Research can also target particular social groups, surveying working practices because the group is deemed to be vulnerable to being paid below the minimum wage. The

¹⁵ Ibid (2004) p.190

sampling can be assisted with local, area-specific workshops of experts in the area, to test and develop the sampling strategy.

Anderson et al. (2006) study experiences of migrants from East and Central Europe working in low-wage occupations in selected sectors of the UK economy. The authors selected four sectors of employment in 2004: Agriculture, construction, hospitality and the au pair sector. Regarding agriculture, the authors did not aim to study the whole agriculture sector, but focused on the labour-intensive sub-sectors of fresh fruit, vegetable and salad production, where migrant workers are employed in large numbers in fields and co-located pack-houses. Four accession nationalities were chosen on the basis of their prominence in the Seasonal Agricultural Workers Scheme (SAWS), Au Pair and Sector-based Scheme (SBS). These were Czech, Slovak, Lithuanian and Polish. These schemes were subsequently ended but did – for this study – also provide sampling frames, though the authors recognise statistical representativeness could not be guaranteed. As a comparison group of people whose immigration status would not change with EU enlargement, they selected two further nationalities: Ukrainian and Bulgarian.

Both survey and in-depth interviews were conducted face to face and in the migrant's first language. Surveys were designed to be completed by an interviewer and to take approximately one hour. In-depth interviews were semi-structured and designed to be tape-recorded, with the possibility of detailed notes if interviewees did not consent to being taped. After some time, re-interviews took place, and new respondents were asked retrospective questions about their experiences both before and after EU enlargement. To understand employer behaviour, Anderson et al (2006) use a postal survey. In addition to the postal survey, they also conducted in-depth interviews with around thirty employers, including some agencies. A different methodology was employed for the au pair sector. The authors conducted a postal survey of 800 host families that drew a total of 268 responses. They also carried out an additional ten in depth interviews with six different host families (four of whom were interviewed before and after EU enlargement).

Evans et al (2006) review evidence on the drivers for employees participating in informal working. Poverty (and in particular absolute poverty) is often cited as the key reason why certain employees work within the informal economy. Having large debts, being unable to find work within the formal economy (such as those with criminal records and those awaiting outcomes of asylum applications), and lacking the means to ensure even a basic standard of living were all identified as drivers behind the decision to seek work within the informal economy.

Table A1.1 in the annex considers research undertaken by trade unions, surveying their members about pay and conditions. These studies are usually provided to the Low Commission as evidence for setting the minimum wage.

Equity – as the trade union for professional performers and creative practitioners – surveys actors and performers. The membership is made up of around 40,000¹⁶, professionally creative people. There are a further five thousand student members. A recent survey found that 11% earned nothing from their work in the entertainment industry and 67% earned either nothing or under £10k per year. Nearly half of the respondents (46%) had

¹⁶ www.equity.org.uk/about-us/our-members/

worked in the entertainment industry for no pay in the past twelve months and, of those, 51% received no expenses. BECTU, a media and entertainment trade union with membership from trades behind the camera, also find low pay in this sector. It has approximately 25,000 members and its survey results prove similar to Equity work.

BECTU also carried out research into web-based advertisements of unpaid jobs in film/TV. A detailed “snapshot analysis”¹⁷ was carried out of jobs advertised on [mandy.com](http://www.mandy.com)¹⁸. Of 110 job adverts analysed, 51 (46%) specified a rate of pay at or above the NMW, 13 (12%) were unclear, and 46 (42%) were explicit that the work was unpaid or below the NMW.

These methods to measure non-compliance, surveying union membership and the analysis of job adverts, can be criticised for their statistical representivity. The sample size of the surveys are unknown in the submissions of both unions, and BECTU chose [mandy.com](http://www.mandy.com) because it was “a website well-known for its policy of posting ads for both paid and unpaid/illegal jobs, mostly in the micro-budget area of film/TV production.”¹⁹ Further, some particular improvements to the surveys may be needed to tease out whether the employment is formal or informal.

Concluding comments

This chapter presents bottom-up approaches used by researchers to understand underpayment in informal or hidden economic activity. Bottom-up methods collect data directly from participants in what is being investigated. As much social research is bottom up, the bottom-up/top-down distinction places a considerable body of evidence in the bottom-up category.

The methods can collect data, often qualitative, about the low paid but targeting those hidden from government oversight. The methods focus on “surveying the hard-to-reach” and the first stages of such approaches typically identify businesses, employers or employees that can provide evidence about informality and underpayment. Questionnaires are then both designed and conducted in a manner that ensures respondents provide appropriate evidence in an area where there may be reluctance to be candid.

Because these approaches are already being used, their feasibility is well understood. One of the key aspects of the approaches in measuring the extent of underpayment is how representative the results are to the wider, usually unknown, population. In employer surveys the evidence has been mixed for this, with a systemic bias in businesses that do not respond. When the informal activity is viewed from the perspective of the household, either as the employer in a non-compliant arrangement or as an employee, then careful surveys are less susceptible to such biases.

There continue to be investments in such studies – such as recently announced plans for HMRC sponsored work mapping the hidden economy – which may focus on providing or indirectly provide evidence about minimum wage noncompliance in informal settings.

¹⁷ BECTU (2012) p.6

¹⁸ www.mandy.com/index.php?country=GB

¹⁹ BECTU (2012) p.6

6. Compliance management data

This chapter briefly describes a third approach, using the administrative data as compliance with various employer obligations is enforced. The chapter describes methods to analyse such data, which have focused on statistical methods to understand how audit activity has been targeted. A second focus has been on organising data. Records of audit are not ordinarily used in measuring behaviours so a considerable investment has to be made to the underlying data.

Audits are common in tax collection. They act both to identify non-compliance and to give incentives to tax payers to comply with tax rules, fearing that an audit may reveal any non-compliance and the taxpayer then facing a stiff penalty. Audits are also a feature of minimum wage enforcement. Often, they are initiated responding to an employee's complaint. Also, based on an employer's at risk of non-compliance, HMRC would target investigative work and then reveal whether employment is occurring at wage rates below minimum wage. The audits involve detailed look at records and then decisions over the extent of underpayment. This means these assessments could form the basis for understanding overall underpayment. As with methods reviewed in previous chapter, a key problem is to generalise the results from these audits to the wider labour market.

Approach 3: Hidden underpayment in investigated employers

This section looks at approaches that use audit data to estimate the propensity of activity to be associated with non-compliant practises. There is a literature on tax compliance, reviewed by Erard and Feinstein (1998), and the recent focus on econometric models to analyse multi-stage audit processes may be applicable to the data being collected as minimum wage compliance is investigated.

Such methods fall within a wider literature on tax compliance focusing on analysis of administrative data around compliance in tax systems. To some extent, because compliance processes are similar in different areas of enforcement, the methods may be transferable. However, there are differences between tax compliance and minimum wage compliance, perhaps the most significant being that tax noncompliance does not have an adversely affected party beyond the government. With minimum wage underpayment, employees are incentivised to report non-compliant employers. The complaints made by employees, which are then investigated, provide a particular sampling issue and the selection bias this causes would have to be modelled.

However, there are similarities also. In minimum wage compliance, there are audits to evaluate whether and to what extent policies and requirements are being met. A feature of the audits is that they focus on reasonable assurance and, due to the practical constraint, cannot examine every detail and so may understate the extent of non-compliance.

Stage 1: Structuring investigative data

A key part of the econometric work undertaken using audit data has been to structure the datasets. The aim has been to provide variables about the decisions that drive forward an audit. Then a second set of classifications characterise the level of compliance that is

revealed through the audit. The problem for the analyst is that the case level data compiled as enforcement is progressed is unlikely readily to be useable for statistical analysis. The case load information will mix various forms of evidence, some qualitative, some quantitative and most primarily designed to make the case for compliance.

Erard and Feinstein (2009) particularly structure the data around US tax audit processes, suggesting a first decision is around what to audit and the type of audit conducted. Then, they model the outcome of the audit in terms of two parts: the fact of any identified non-compliance and the extent of any non-compliance. To achieve this, the nature of non-compliance has to be structured. In the case of income taxes, this is in terms of different categories of incomes.

HMRC investigative data with regard to minimum wage enforcement will need to be categorised and structured around the investigative process. This would have to cover a number of aspects. Firstly, the evidence used to target businesses to be investigated would have to be summarised into variables that might be used to model the businesses investigated. In targeted enforcement activity, the variables used include region, industry, size and past enforcement evidence.

There is then also the complaints data, which causes investigative work either directly or indirectly as complaints to other enforcement bodies are routed to HMRC because minimum wage concerns are raised. Croucher and White (2006) reported some of the problems they found in the audit data. As noted earlier, where a group of employees had reported an infringement, the investigative work only gave one contact point. Further, important characteristics of the complainant – such as gender and ethnicity – were unavailable.

A second set of data is around the outcome of the investigations. These are already standardised, as they form part of HMRC monitoring systems. The number of jobs and amount of underpayment is routinely reported for the companies that are found not to comply with minimum wage rules. The structuring of such data would also need to be considered. One issue would be what evidence is available about whether the economic activity of the employer is informal. The determinants for this would be whether the activity was hidden from government. Secondly, the fact of employment would need to be assessed, as opposed to some sub-contracting of work. Ideally, capturing such data would reflect the investigation process where a first stage is to understand the nature of the non-compliance.

Stage 2: Initial analysis of case data

The structuring of the investigative data is key to using it for analysis about non-compliance. The second stage is needed to explore whether analysis is feasible and to feedback improvements to the first stage. This stage may only be necessary in a first study of the compliance case data. Further, the extent to which enforcement teams can be encouraged to use formats as they investigate cases that allow for the case data to be analysed may be explored.

Initial analysis could focus on the variables that HMRC use to assess compliance risk. Audits normally rely on selecting and then investigating areas deemed to be of greatest risk for substantial non-compliance with reporting, procedural, or other requirements. A

first set of analyses might focus on the drivers for the investigative work. A case is initiated by HMRC either because a complaint is made through ACAS or because another enforcement agency alerts HMRC to minimum wage compliance issues. These are demand-led investigations and there is no comparable driver for investigative work in tax compliance as minimum wage noncompliance can be flagged by the employee independently of HMRC investigative work.

HMRC also conducts investigations targeting groups of businesses based on intelligence and profiling, identifying businesses likely not to comply with minimum wage obligations and then initiating investigative work to identify any non-compliance. This is more like tax compliance programmes. Where non-compliance on minimum wage is identified, the extent to which it has been hidden (poor record keeping, inaccurate returns to authorities) is also established during the investigation.

For HMRC NMW investigations, in 2015/16 there were almost 2,700 NMW investigations. 1,600 originated from complaints and 1,100 were targeted investigations. Given that HMRC has to follow up all complaints made, the former, demand-led investigative activities have to be resourced first and this then determines the level of resources available for targeted actions. However, the numbers of cases means there will be a large dataset, far larger than those available through surveys covered in the last chapter. This provides some opportunity for different cuts of the data, with these having enough observations to provide robust estimates.

Box 5.2: Accessing HMRC compliance evidence

Researchers can access HMRC datasets securely in the HMRC data lab. The facility is a secure setting where research can be undertaken if researchers are suitably accredited and the research is in an area allowable – such as tax policy related research.

The results of work have to be non-disclosive and there are checks made before results are released to ensure this. Within the lab, the records accessed are generally anonymised so that casual identification of cases is not possible. While the facility has been used for research using tax records, the data on enforcement activity has not so far been made available through the lab. Analysis of enforcement data, to date, has been undertaken by HMRC officials in their operational systems and little research work has used the data. So, some exploratory work will be needed to assess what access is feasible.

Stage 3: Econometric analysis of case data

The aim of the econometric analysis is to use the audit evidence but correct for two problems. A first is that an audit is targeted, which itself is related to the chance of non-compliance. There is then circularity in this, which – in econometric terms – leads to an identification problem.

For targeting enforcement, HMRC follows a risk-based approach. Potential areas to target are identified, informed by other government bodies (BIS) and relevant institutions (Low

Pay Commission, Trade Unions). The discussions identify types of businesses that need pro-active action. HMRC also refines the scale and scope of the investigative action, analysing a sector by geography and past enforcement history with the HMRC. HMRC will undertake test visits of local employers to further build a risk picture and then refine the targeting, or commence enforcement. During the visits, employers will be investigated and their records checked for any infringements. Discrepancies are categorised by “reasons for error”, a classification system that notes the type or nature of any problem, e.g. inadequate recording of hours.

A second econometric issue is the acceptance that audits will at best capture all non-compliant behaviour and so there is a bias down in any averages of non-compliance. When an issue or process is evaluated, there is often potential for imperfect detection of non-compliance. For example, in tax audits, examiners are not always successful in uncovering certain forms of income that have been understated. Erard and Feinstein (2009) introduce econometric methods for controlling audit findings that are subject not only to the sampling errors, but also errors in detection.

In UK compliance work, the evidence matures as the case is investigated. Investigative work is risk-based, with HMRC compliance teams prioritising activity where the highest risk of significant non-compliance. If, for example, a case is deemed not to be risky then a call or letter will be sent to remind the employer of obligations. More substantial resources are allocated to any investigation where the non-compliance risk is high. Compliance officers might check records from the employer and begin to compile evidence about the nature of underpayment; evidence will also be compiled to inform the value of any underpayment.

Concluding comments

Chapter 6 looks at approaches that do not use surveys but rather use the data collected as audits for compliance are conducted. This data has been relatively little used in minimum wage analysis. The minimum wage compliance management information system is one of a set of similar sources, such as those used in compliance over tax or immigration. The report looks at these sources. Further, employees can report employers through the Pay and Worker Rights Helpline for minimum wage and other employment issues, providing a key resource about concerns raised by employees.

Because any single study is likely to be incomplete, there is value in seeing individual research adding to the body of what is known. There is also then value in joining up work with other work being undertaken. A particular current investment that may be relevant is HMRC’s intention to conduct a large-scale quantitative piece of research which aims to map the hidden economy, in terms of the different types of individuals and businesses that are involved (HMRC, 2015c).

Annex 1: Underpayment in the formal economy

There is a large literature about low pay in the UK and the way that policies have sought to tackle the problem. Much of the research is commissioned to support the setting of the National Minimum Wage. Within this research, there has been a growing interest in compliance with minimum wage rules. This literature has expanded in several directions, but one particular area has been quantifying the extent of non-compliance. In this chapter, the findings and results of recent studies on underpayment are summarised. Results are also presented in tables 3.1 and 3.2.

This review has focused on the literature looking at the extent that underpayment can be measured. Some of the results emerging from recent work:

- Estimates of the extent of underpayment, using the Annual Survey of Hours and Earnings, are now routinely released. These do not distinguish between employment that is formal from that which is informal;
- There are differences in the results from ASHE and the other main source, the Labour Force Survey, around the extent of underpayment and work has been undertaken to explain these in terms of the differences in the data sources; and
- There is a growing set of studies on informal employment and compliance with the minimum wage. These involve additional collection of data, with that collection targeting the parts of NMW underpayment hidden from official sources.

A further strand of research is looking at underlying drivers for underpayment, such as working practices expecting a high degree of flexibility in employees sometimes effectively reducing pay rates. Finding correlations between observable employment practices and a risk that employees are paid below the minimum wage is useful in targeting compliance interventions.

Quantitative Findings

Submissions to the Low Pay Commission (LPC) form the starting point on evidence about NMW underpayment. BIS (2016) use the Annual Survey on Hours and Earnings (ASHE) and find that the number of employee jobs paid below the NMW has decreased from 222,000 in April 2014 to 209,000 jobs in April 2015. Moreover, the proportion of jobs paid below the NMW remains at 0.8% of all 16+ employee jobs. The trend in such figures, the report argues, is “broadly stable over time”.²⁰ These estimates relate to employment that is formal, in that the jobs covered by ASHE can be identified on HMRC’s pay-as-you-earn (PAYE) system. They are then declared to government.

²⁰ BIS (2016) p.46

The estimates can be disaggregated into specific age groups. The report finds that 2.2% of total jobs held by those aged 18-20 were paid below the NMW compared to 0.7% of those aged 21 and over. Data for those aged 16-17 are based on a sample size “too small to be considered reliable.”²¹

Regarding the level of NMW underpayment, the ASHE data presented suggests that “the magnitude of pay below the NMW hourly rate was small for all age-groups and previous research indicates that underpayment is due to error rather than deliberate non-compliance.”²² Of those non-compliant with the 18-20 rate, 50% were within 20p of the NMW and of those non-compliant with the 21+ rate, 48% were within 20p of the NMW. Reminding the reader that 16-17 data is based on a small sample, the report states that approximately 40% of underpaid jobs were within 20p of the NMW.

ASHE remains a key data source, but it has some shortcomings. BIS (2015) discusses three of these. The first is that there are legitimate reasons for a job to be paid below the NMW, for example where accommodation is provided by the employer. Such non-pay benefits are not included in ASHE. Secondly, ASHE draws records from PAYE systems. Low paid workers earning below the lower earnings limit for national insurance contributions (primarily part-time women workers) can be excluded from this (Fredman, 2003: 304). This is generally regarded as one of the explanations for the relatively higher levels of underpayment observed in estimates based on household and sector specific employee surveys. The third reason is that, while ASHE is considered an accurate measure of pay information in the formal economy, its coverage will be low for earnings data in the grey, informal economy. Therefore, “estimates of non-compliance based on ASHE need to be treated with caution and are not necessarily evidence of wrongdoing.”²³

Hicks et al (2009) compare estimates based on ASHE with results from the Labour Force Survey (LFS) to see where discrepancies arise. A finding is that ASHE understates the number of employees paid below the minimum wage (Ritchie et al, 2016). Hicks et al (2009) also find methodological reasons why the LFS may overestimate the extent of low pay. A particular issue for the LFS is that it relies on recall by the respondent about overall pay, hours and hourly pay and relating this to the surveyor in a manner that is required for pay analysis.

Generally, ASHE is the preferred measure of low pay in the UK, as it has a much larger sample and the earnings information obtained from employers is more accurate than the self-reported information in the LFS. However, for underpayment analysis, some of the behavioural aspects need to be integrated and ASHE only has limited information regarding employees’ characteristics and variables about the nature of a particular job. LFS is better for this, though even with LFS it is not always possible to accurately estimate how many of the employees in jobs below the NMW are legitimately paid below the NMW because of exemptions in the legislation. Therefore, estimates of jobs paying below the minimum wage using the LFS may not measure non-compliance.

²¹ Ibid (2016) p.46

²² Ibid (2016) p.47

²³ BIS (2016) p.45

Le Roux et al (2013) proposes methods to improve analysis on the LFS and ASHE datasets. The study tackles measurement issues in the two surveys, such as the so-called “rounding problem” and correctly identifying legal reasons for employers paying below-NMW pay rates. The results show that noncompliance increased over time according to LFS estimates, but was broadly stable according to ASHE estimates. Non-compliance was generally higher for younger workers than adult workers. Adjusting non-compliance estimates for the possible reporting of earnings at rounded rates can have a large impact on noncompliance estimates, as can adjustments relating to eligibility for the Youth Development Rate, applying to 18-20 year olds, and the 16-17-year-old rate.

This line of research has been pursued using the new Apprentice Pay Survey, first conducted in 2012. A key issue in low pay studies is being able to identify apprentices, as their pay may be lower than the apprentice rate for the NMW because of built-in complexity and also because of well-established difficulties in apprentices’ ability to insist on pay rates. A methodology has been developed using the APS to take into account those who are apprentices and, if so, whether they are in their first year. This has had considerable impact on the estimate of underpaid workers based on ASHE. For those aged 16-17, underpayment fell from 9% to just over 1% of the workforce. Underpayment, for those aged 18-20, fell from just over 7% to around 1.5%. For those over 21, the impact was more muted, falling from 0.8% to just over 0.75% of the workforce.

Bewley et al (2014) calculate the number of people earning less than the minimum wage, by using the ASHE dataset. They estimate the relationship between flexible employment and the bite of the minimum wage. Their analysis indicated that 4.4 per cent of employees were paid the NMW or less in 2004. However, these employees were widely distributed across workplaces, with 25.9 per cent of workplaces employing some staff that received the NMW or less. Furthermore, there is some evidence that compliance with the NMW varied with the use of flexible employment practices. Non-compliance was more likely where there was some use of shift working or employees worked part-time and it was lower where some employees worked compressed hours, worked at home, or where agency workers were used.

The findings suggest that there may be value in targeting the monitoring of compliance at workplaces with the types of flexible employment practices associated with a greater likelihood of noncompliance i.e. those with shift-workers and a greater proportion of part-time workers. Workplaces with agency workers or employees working compressed hours or at home may be less of a cause for concern, unless there are other reasons to suspect individual workplaces of failing to comply with the NMW.

Recent research, especially following the move to a National Living Wage, has looked at what minimum wage rises might mean were it applied to the self-employed. Broughton and Richards (2016) use the Family Resources Survey and the HMRC Survey of Personal Incomes. They find that 1.73 million workers will continue to be paid below the NLW when it comes into force in April 2016 because it does not cover the self-employed. The authors state that effectively, with the National Living Wage acting as a floor for employees, there is a risk that low pay continues to exist, but largely invisible, through self-employment.

Findings about underpayment are emerging from datasets outside the large public surveys. Table A1.1 considers research undertaken by trade unions, surveying their members about pay and conditions. Such surveys provide evidence about underpayment

more as a by-product of the wider issues tackled by such studies. They fall within a wider set of work that seeks to identify sectors and groups in the economy that are particularly vulnerable to low pay or pay below the minimum wage in the context of the working practices. These studies are usually provided to the Low Commission as evidence for setting the minimum wage.

Equity – as the trade union for professional performers and creative practitioners – surveys actors and performers. It is made up of ca. 40,000²⁴, professionally creative people. There are a further 5,000+ student members. A recent survey found that 11% earned nothing from their work in the entertainment industry and 67% earned either nothing or under £10k per year. Nearly half of the respondents (46%) had worked in the entertainment industry for no pay in the past twelve months and, of those, 51% received no expenses. BECTU, a media and entertainment trade union with membership from trades behind the camera, also find low pay in this sector. It has approximately 25,000 members and its survey results prove similar to Equity work.

BECTU also carried out research into web-based advertisements of unpaid jobs in film/TV. A detailed “snapshot analysis”²⁵ was carried out of jobs advertised on mandy.com²⁶. Of 110 job adverts analysed, 51 (46%) specified a rate of pay at or above the NMW, 13 (12%) were unclear, and 46 (42%) were explicit that the work was unpaid or below the NMW.

The above shows two novel methods to measure non-compliance, surveying union membership and the analysis of job adverts. However, both methods as carried out above can be criticised for their statistical representivity. The sample size of the surveys are unknown in the submissions of both unions, and BECTU chose mandy.com because it was “a website well-known for its policy of posting ads for both paid and unpaid/illegal jobs, mostly in the micro-budget area of film/TV production.”²⁷

A particular source for analysis, described later, has been the data from the Pay and Work Rights Helpline (ACAS). Individuals concerned about employment practices can contact regulatory bodies through a “hotline”. According to the ACAS, the last published figures are from 2013, and suggest that around 4,000 complaints were received and over 20,000 enquiries. A later section describes some of the limitations of this data, but also explores some of the ways researchers use it as an entry point into measuring underpayment. In particular, IPSOS Mori (2012) uses the data to identify sectors of focus as: Hospitality, Market service, Retail, Hairdressing, Production/Construction, Security/Cleaning and Social care. The next section turns to the range of studies that focus on underpayment in the last of these, social care.

Findings relating to the care sector

Table A1.2 summarises findings from literature on the social care sector. The social care sector has seen a flurry of specific literature that crosses classifications by methodology or data source. Hussein (2011) specifically examines underpayment in the sector. The paper

²⁴ www.equity.org.uk/about-us/our-members/

²⁵ BECTU (2012) p.6

²⁶ www.mandy.com/index.php?country=GB

²⁷ BECTU (2012) p.6

combines the National Minimum Dataset – Social Care (NMDS-SC) with data from ASHE and LFS to estimate the fraction of care workers paid below the minimum wage. Hussein uses a hierarchical Bayesian model approach. She concludes that there are 1.7m direct care jobs in the UK, and approximately 10% of these are likely to be paid under the NMW.

These estimates focus on those employers that declare their employment in various registers and datasets. The focus therefore is the formal employees in the sector. Hussein argues that such estimates are likely to provide an under-representation of the true numbers of workers paid under the NMW, mainly due to the exclusion of those working in the grey or casual labour market. Further, the pay distributions are derived from the NMDS-SC data that is collected from employers, but the returns are not supported by supplementary pay documentation needed to estimate hourly pay consistent with minimum wage guidance.

Reflecting the concerns raised by Hussein, HMRC carried out an evaluation of National Minimum Wage enforcement in the social care sector over the period 1st April 2011 to 31st March 2013. HMRC (2013) selects a sample of care sector employers for investigation, investigating all complaints from care workers received via the Pay and Works Helpline regardless of location and size of employer.

The research involved over 183 investigations. HMRC (2013) found non-compliance in 88 (48%) of these, identifying £338,835 arrears of pay for 2443 workers. The average arrears for an underpaid employee were £138. The total value of penalties charged was £112,786. The highest value arrears in a single enquiry (£36,026) and the highest value of arrears owed to a single worker (£11,223) were both attributable to errors by the employer related to the operation of the accommodation offset rules and the provision of accommodation to workers. The report notes “The incidence of non-compliance in this sector was higher in 2011/12 and 2012/13 than any year since 1st April 2008.”²⁸

HMRC (2013) expresses concerns that many employers had failed to keep sufficient records of working time to demonstrate that workers were being paid at least the national minimum wage. This has been observed in earlier research also (Croucher and White a decade ago). A particular area of recent concern is the non-payment of travel time for workers in domiciliary. The lack of working time records served to inhibit employers’ ability to self-check compliance with NMW and extended the time required by employers to provide evidence to HMRC that workers were receiving the appropriate NMW rate of pay.

Using the NMDS-SC dataset Bessa et al. (2013) distinguishes between different grades of care workers (junior and senior care workers, managers). The NMDS-SC dataset shows that whilst average pay is around 15 per cent above the minimum wage, a proportion of domiciliary care workers are paid below the minimum wage (1.1% of workers, taking the period October 2008-April 2012 as a whole). This figure rose sharply in 2011/12: the proportion of domiciliary care workers paid at or below the NMW (6.1% at or below and 2.5% below the NMW) in 2012 is slightly lower than the LPC figure of 7.9 per cent for the proportion of jobs in the wider category of social care paid at or below the April 2011 NMW (LPC, 2012). This is below Hussein’s for all care workers recorded in the NMDS-SC (2011). However, they suggest that calculations are likely to be a conservative estimate of

²⁸ HMRC (2013) p.4

those paid under the minimum wage, because it is unclear whether hourly rates in the NMDS-SC data set recognise travel time. Also this research work is not directly comparable to the work of Hussein because the researchers focus is on domiciliary care rather than the wider social care sector.

Gardiner (2015) uses Hussein's estimates and updates numbers of the proportion of care jobs being underpaid to estimate total lost pay across the economy. The author finds that taking the midpoint of the range for the prevalence suggests a total of 160,000 direct care jobs paying below the minimum wage in 2013-14. Note that this is at the lower end of Hussein's range for the number of care jobs paying below NMW (155,000 – 220,000) due to improvements in methodology for estimating the number of jobs in the sector.

On this basis the authors estimate that each non-compliant frontline care job underpaid by an average of £815 over the course of 2013-14. Putting these two figures together, our estimate is that frontline care workers across the UK lost out on £130 million in wages during 2013-14 due to NMW non-compliance and at least £4 million is missing from these workers' pension pots each year.

Concluding remarks

Recent research has been able to estimate the number of jobs receiving hourly rates below minimum wage. The approaches generally focus on formal employment, estimating the degree to which surveys point to evidence of underpayment usually based on payroll information. By drawing on data that is likely to be reported to the authorities, the underpayment reflects employment that is not being hidden. It therefore may miss underpayment where it is in the informal economy.

Table A1.1: Studies Estimating the Extent of NMW Underpayment

Reference	Method	Data	Estimates/Findings
Bewley et al. (2014)	Flexible employment practice and the 'bite' of the NMW	WERS, LFS, ASHE	4.4% of employees paid NMW or less in 2004
Le Roux et al. (2013).	Creates models of non-compliance	LFS and ASHE	Baseline non-compliance rate: 0.5% between 2000 and 2004, increased to 2.1% in 2012
Broughton and Richards (2016).	Descriptive statistics	FRS and SPI	1.73 million workers will continue to be paid below the NLW when it comes into force in April 2016
Hicks et al. (2009).	Tabulate underpayment with demographic variables	LFS and ASHE	ASHE 2008: 288,000 jobs paying less than the NMW (1.1% of all UK employee jobs) LFS, Apr-Jun 2008: 445,000 jobs paying below the NMW (1.7 per cent of all UK employee jobs).
RAND Europe (2008)	Interviews and Literature Reviews	Interviews of experts	Size of UK hidden economy 12.5% in 2002
BECTU (2012)	Monitoring job advertisements	Member Survey; Advertisements from mandy.com	33% of young members had >10 unpaid positions; 46 of jobs (42%) were explicit that the work was unpaid or below the NMW

Reference	Method	Data	Estimates/Findings
Equity (2015)	Survey Results	38,500 members	11% earned nothing from their work and 67% earned either nothing or <£10k per year. 46% of respondents had worked for no pay in the past twelve months and of those who had 51% received no expenses.
BIS (Jan 2016)	Descriptive Statistics	ACAS and ASHE	Around 4,000 complaints made to the ACAS in 2013; The number of employee jobs paid below the NMW is 209,000 jobs in April 2015; 0.8% of 16+ employee jobs

Advisory, Conciliation and Arbitration Service Helpline (ACAS), Annual Survey of Hours and Earnings (ASHE) Labour Force Survey (LFS), Family Resources Survey (FRS) and Survey of Personal Incomes (SPI) National Minimum Data Set for Social Care (NMDS-SC) Longitudinal Care Study (LoCS)

Table A1.2: Studies of National Minimum Wage in the Care Sector

Reference	Method	Data	Estimates/Findings
Hussein (2011)	Hierarchical Bayesian estimation estimating the number of under-paid	NMDS-SC and LoCS	Care workers paid less than NMW estimated to be between 9.2 and 12.9%; between 156,673 to 2192,41 underpaid workers
Gardiner (2015)	Adds to Hussein (2011) Explains the monetary loss to the under-paid	NMDS-SC and LoCS	Total loss in wages of £130 million At least £4 million missing from underpaid workers' pension pots
HMRC (2013)	Interviews with employer	183 employers selected from complaints, third part intelligence, and risk profiling	Non-compliance in 48% of enquires
Bessa et al. (2013).	Panel analysis	NMDS-SC	Total: 3.4 per cent were paid at or below the NMW, with 1.1 per cent paid below Care workers only: 3.4 per cent paid at or below the NMW and 1.0 per cent below Senior Care workers: zero to 0.3 per cent, but this rose substantially to 10.1 per cent The proportion of the domiciliary care workforce at or below the NMW was statistically significantly higher in October 2011-April 2012 than in both previous periods

Advisory, Conciliation and Arbitration Service Helpline (ACAS), Annual Survey of Hours and Earnings (ASHE) Labour Force Survey (LFS), Family Resources Survey (FRS) and Survey of Personal Incomes (SPI) National Minimum Data Set for Social Care (NMDS-SC) Longitudinal Care Study (LoCS)

Annex 2: Measuring Underpayment where Employment is not Hidden

Investigating underpayment of the NMW/ NLW is tricky, but there are a set of analyses that build on large-scale public surveys. They focus on tackling coverage and measurement issues in the surveys and are grounded in well-used data sources. They tend to tackle underpayment in the formal setting and this annex reviews the approaches used.

To understand underpayment, analysis starts with people paid at or near the minimum wage using 'standard' sources, typically the ONS surveys ASHE and LFS. The standard assumption is that employer data (e.g. ASHE) is high quality as it is derived from pay records. Both sources indicate payment below the minimum wage and provide detailed information about drivers for pay, such as industry, occupation and mode of employment.

But there are problems in using these sources in measuring NMW underpayment. These are broadly around "easy to measure" issues, such as adjusting findings from these sources for possible justifiable underpayment or making evidence-based adjustments to findings from the two sources that are correlated with illegal underpayment. The approaches detailed in this section do not adjust for the "hard to measure", covered in the past section. However, the approaches used are similar.

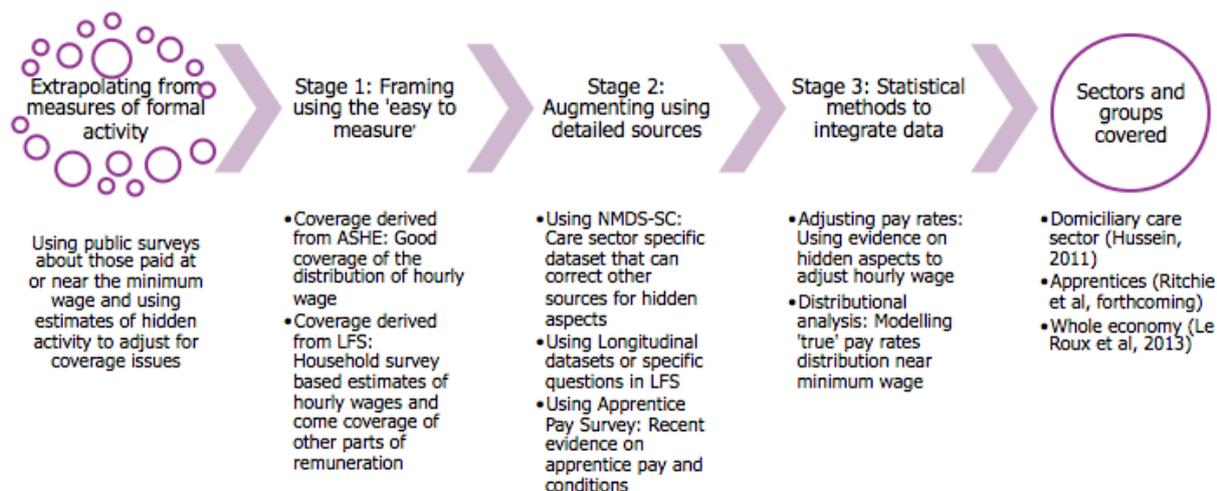
Extrapolating from measures of the formal economy

The approaches described in this section are the most feasible but perhaps the least likely to pick up underpayment in hidden, informal economic activity. The three stages typically used as analysts interpolate from public data sources however do provide considerable insight into the drivers for accidental or intentional but declared underpayment.

Stage 1: Framing using the 'easy to measure'

Ritchie et al. (forthcoming) describe the measurement problems around using ASHE or LFS to identify the amount of non-compliance. The surveys enumerate the hours and earnings of workers gathered from that subset of those worker-employer interactions sampled. As a frame from which to measure the extent of underpayment, there is then a need to understand the scope for error between employer/employee actions surveyed and the statistical conclusions about whether pay does not meet NMW obligations.

Figure 2: Extrapolating from measures of formal activity



There is evidence to suggest (see Ritchie et al, 2014, for a review) that some of the lowest paid are non-randomly missing from both of the major data sources. ASHE is a 1% sample of employees, drawn from PAYE data. Completion of the ASHE survey is compulsory for employers, and so response rates are high at around 75%-80%. The missing responses are largely the result of workers who are not traced at the time of survey. However, it is likely that those who are not traced have a higher turnover of jobs, which is also associated with low pay.

The LFS does not suffer from this problem, as it is a random sample of households. However, as the survey is voluntary, response rates are low and have been falling for many years. It is widely thought that response rates to the LFS are lowest amongst the highest and lowest earners.

There is also a question of timing. The NMW changes in October each year (except 1998 and 2016). Not all wages change immediately, which causes problems, with a particular problem potentially arising in observations made around October. Employees may be observed in the weeks before a new NMW, so that compliance would be with regard to the September rate. Even after the new NMW is in force, employees are allowed to and often do backdate pay should non-compliant rates be used in the period when a new NMW has begun.

Ormerod and Ritchie (2007), Fry and Ritchie (2013) and Ritchie et al (2014) demonstrated that rounding of wage data by respondents is well-established in the LFS, and has an impact on measured non-compliance levels. Fry and Ritchie (2013) went further, predicting distributions for the LFS and ASHE based entirely on where the minimum wage was set relative to a 'focus point'. They observe how few 18-21 year-olds on the 'development' rate reported earning the NMW. Instead, they all reported £5.00, despite ASHE data showing that roughly half were being paid the NMW of £4.98.

Rounding occurs at the level of data collection: hourly-paid works round hourly wages, weekly paid round weekly wages, and salaried workers round salaries; and checking documentation when responding to the survey reduces the chance of rounding (Ritchie et al, 2014).

Low Pay from LFS

The Labour Force Survey (LFS) is a quarterly survey of roughly 60,000 individuals, of whom three quarters are employed. It has very detailed personal characteristics, such as ethnicity. Pay and hours are reported by the employee to generate a derived wage rate, but concerns over the accuracy of the data means that the preferred pay measure is the hourly rate stated by the employee (Fry and Ritchie, 2013). Respondents are asked to provide pay information by referring to documentation, but only a small proportion do so, and this seems to affect the accuracy of estimates (Ormerod and Ritchie, 2007a; Ritchie et al, 2014).

The LFS asks survey participants about hours and earnings in both their first and second jobs. Specifically, the question is phrased as “What was your gross pay, that is your pay before any deductions, the last time you were paid?”. The participant is then prompted to specify what period was covered by this payment (e.g. pay for a week, a month, etc.). The participant is also asked whether this pay included any overtime payments, payments for unsocial hours, bonuses, etc. Participants are also asked whether they are paid at a basic hourly rate, and whether they receive an hourly rate for overtime work.

Studies differ in whether they only use the stated hourly rate or also derived rates. For example, Le Roux et al. (2013) prefer to impute hourly rates for workers who did not state one based on other characteristics.

Although this rounding effect is pervasive, it is consistent over time and scale of the NMW, and hence is predictable. Fry and Ritchie (2013) suggests ways to adapt measures if NMWs were just above or below a ‘focus point’, and Le Roux et al (2013) applied this method in their analysis of non-compliance showing that this can have a considerable impact on the compliance rate.

Notwithstanding the problems of dishonest or rounded responses, respondents may simply fail to provide accurate information. Griffiths et al (2007) show that a number of ASHE respondents fail to understand the different wage measures; however, in that case it is possible to improve compliance estimates by manual adjustment of the data.

Both ASHE and the LFS have weights to produce population estimates. ASHE has an additional set of weights calculated specifically for low pay work to address the expected non-response discussed above. However, ASHE weights are derived from the LFS – as that it not limited to selection from PAYE employment – whose weights are in turn derived from the decennial Census, with some inter-census adjustment. Hence, while these weights are the ‘best available estimate’, it is not possible to use the contrast results to draw inferences about non-covered samples; therefore, the weighted estimates can be taken, at best, as a lower estimate of non-compliance for the general workforce.

A problem in the LFS is that only a subset of workers reported the preferred stated wage measure. One option is to adjust the weights (which reflect the overall sample size) to deal only with reported observations. The alternative is to impute the missing wages and apply the standard weights. A multiple imputation method was devised by ONS for the LPC in 2002 and has been in use since then. Although the imputation is only used for LPC figures and not external researchers, those who have reviewed the LPC statistics have been highly critical. Dickens and Manning (2004) criticised the fundamental assumptions "...the tests we have done indicated that it fails." (p6). Ritchie et al (2014) were more concerned that the resulting estimates were very sensitive to the methods, particularly as the MI at this time was being used to generate estimates based on very few observations.

One regular failure of understanding in employee data is the issue of working hours and breaks. Employees sometimes (erroneously) include lunch breaks in their working hours, leading to underestimate of hourly pay. This is one of the reasons why the LFS prefers to use the stated wage rate rather than one derived from the earnings/hours calculation.

Some workers are paid piecework rates, others are eligible for time spent travelling to work, and all are eligible for an accommodation offset. In general, this information is not available in either of the major datasets, and so this is not assessed.

Aware of these shortcomings, authors have devised methods to correct for them. Le Roux et al. (2013) take legitimate reasons for underpayment into account, as well as the results of Ormerod and Ritchie (2007) and Fry and Ritchie (2012). They improve the data available from LFS and ASHE in several steps. First, they impute missing values on hourly pay rates in the LFS, using a method devised by Skinner, Stuttard, Beissel-Durrant and Jenkins (2002) based on personal characteristics of individual workers. This reduces measured underpayment, as the imputed values tend to be above the minimum wage.

Second, they accommodate the findings of Ritchie et al. by rounding minimum wage rates down to the nearest 10p, and only counting those falling under this revised rate as being underpaid. To a certain extent it is also possible to adjust LFS data for exemptions to the NMW/ NLW. The authors do not count those as being underpaid who report that they are provided with accommodation by their employer, receive bonuses, tips or commissions, and those who complete a recognised apprenticeship.

Most researchers are familiar with the statistical problem noted above. However, few consider the processing of the data which can add either error or spurious accuracy.

Consider the calculation of hourly pay in ASHE, which is calculated by dividing weekly basic earnings by weekly basic hours. However, these weekly figures might have been calculated from others – for example, monthly salary. It is also possible that the two do not have coincident periods: hours are often specified on weekly basis, even if salaries are monthly, in which case respondents are asked to multiply weekly hours by 4.348 to get a monthly total. Respondents are also required to convert decimal times (eg 37.5 hours) into hours and minutes (37 hours, 30 minutes). Clearly, there is much scope for error, particularly as the ASHE questionnaire boxes only have space for two decimal places.

These errors should be small but because non-compliance is a yes-no question errors can be significant. Although this appears to be an intractable problem, the solution in terms of non-compliance is straightforward. LPC treat wages round to 1p below the NMW as being

at the NMW; this has, historically, seemed to address these processing issues. Note that the small adjustment is made because the data are generally assumed to be accurate; in contrast, Kampelmann et al (2015) treated wages 25% below the minimum as 'complaint' to allow for measurement error.

Stage 2: Augmenting using surveys/sources on detail of employment

Once the sampling frame has been analysed, researchers turn to augmenting data with sources that fill the gaps when using ASHE and LFS. Two recent studies adjust for compliance in two directions. In the care sector, the concern is that underpayment is understated, as employers and employees may pay the correct hourly rate but then fail to adequately remunerate other aspects, such as travel. For apprentices, the concern is that underpayment is incorrectly identified in ASHE or LFS because apprentices are only entitled to below NMW wage.

Using care sector data

Hussein (2011), and Gardiner (2015) following in her footsteps, cleverly combine the NMDS-SC with data from ASHE and LFS to estimate the fraction of care workers paid below the minimum wage. Hussein uses a hierarchical Bayesian model approach. This appreciates that any sample will have bias, and that biases are not necessarily independent across samples. The method treats previous estimates as arising from a random process governed by parameters to account for such dependencies.

National Minimum Data Set for Social Care

This data is a specialised dataset that has been used extensively is the National Minimum Data Set for Social Care (NMDS-SC). The NMDS-SC is a rich national data set providing information on the pay and conditions of care workers. A key benefit of this dataset is that it contains establishment level data, along with detailed individual-level data on workers within these establishments, thus offering the potential to control for a range of factors which might determine pay outcomes and the relationship between pay, hours and income (Bessa et al., 2013). Furthermore, it is very specific in the kind of work it covers. Even 5-digit SIC codes can comprise vastly different activities, especially in the social sector (Hussein, 2011).

The Longitudinal Care Workforce Study is used to estimate adjustment factors that account for additional time worked not included in hourly pay rates. Separate factors are used for unpaid working time and travel time. This produces an adjusted distribution of direct care workers hourly pay based on a subset of the NMDS-SC. Hussein notes that results are sensitive to the adjustment parameters chosen, as the distribution of pay rates is very narrow, tightly clustered around the level of the NMW/ NLW. However, even using conservative assumptions, she is able to produce powerful results.

Gardiner (2015) uses Hussein's estimates of the proportion of care jobs being underpaid to estimate total lost pay across the economy. Using updated numbers, she first arrives at the total number of jobs affected. Then, she estimates the number of hours paid at less than the minimum wage, and the gap to the legal minimum. Going a step further, she also

estimates the knock-on effect of reduced retirement savings, reduced tax receipts and national insurance contributions.

Using the Apprentice Pay Survey to adjust underpayment estimates

The NMW Apprentice Rate (NMWAR) was introduced in 2010; prior to that, apprentices were exempt from the regulations (which may in itself have led to overestimates of non-compliance). The NMWAR is payable to all apprentices in their first year of the apprenticeship; after that, those aged under 19 stay on the NMWAR whereas older apprentices revert to their age-specific NMW. The NMWAR is therefore more complicated, as it requires knowledge of both age and length of training. Measuring hours for apprentices is also more complicated: they should have a minimum number of on- and off-site training which should all be included in their paid hours, but there is evidence that this is badly understood.

Ritchie et al use the Apprentice Pay Survey (APS) to explore how this affects NMW underpayment focusing on measurement issues. They consider some of the issues through experience with LFS and ASHE. For APS, the researchers note a problem in timing. The 2011 and 2014 surveys took place in the middle of the year when minimum wage adjustments tend to have settled down. The 2012 APS went into the field in October 2012, just after the minimum wage had changed. It was therefore impossible to identify whether wages being paid at the previous year's rate were legitimate or not.

Apprentice Pay Survey

In 2011 the UK Department for Business Industry and Skill (BIS) commissioned an Apprentice Pay Survey specifically to monitor the impact of the new NMWAR. Earlier apprentice pay surveys indicated the benefits. Neither ASHE nor LFS had sufficient information on apprentices as numbers were small, no training data was gathered and questions needed to calculate the appropriate rate was missing.

The APS was sent to a random sample of all those registered for an apprenticeship in the UK. Apprentices can be identified with certainty through administrative systems: only those registered with BIS count as apprentices. This provides the sample frame. The APS is voluntary, and response rates are relatively low. Nevertheless, there is confidence that the responses are representative of the apprentice population.

The APS was run in 2011 and 2012. There were a number of problems with the survey (summarised in LPC, 2015 and Drew et al 2015a), and it was completely redesigned for 2014. The revised survey is believed to be more reliable (Drew et al, 2016).

The 2011 and 2012 APS asked for wage data at the payment level: for hourly-paid workers, an hourly wage was recorded, for weekly paid a weekly wage, and so on. Standard hours were also recorded, so that a wage could be derived for the non-hourly paid. As with the LFS, wages are rounded at the pay period, which may account for some of the disparity in responses.

However, the main cause for the difference seems to be a mismatch between hours and earnings: the APS derived wage has a much wider distribution than that in the hourly rate. This resulted from steps taken in the 2014 APS to get information sourced from reliable information. APS 2014 calculated a derived rate, taking account of accommodation offsets. However, as a result of this the number of apprentices giving an hourly rate declines and this, in turn, leads to the lowest rates of non-compliance. Asking about hourly rates, rather than dividing total pay by hours worked gives different rates. This is somewhat different to ASHE results for the wider economy, where the survey simply asks the employer to record total paid-for hours. However, the question could be misinterpreted, and it could be that ASHE respondents are omitting training hours to keep pay above the minimum. Drew et al (2015b) investigate this by comparing hours of apprentices and other employees, and concluded that there was no systematic difference; if firms are under-reporting hours, it does not seem to be significant.

Drawing inferences from the apprentice pay data is also somewhat easier. For example, the much lower non-compliance rate in the first year is found in all breakdowns of the data, whether univariate or multivariate, and whether ASHE or APS is used (Drew et al 2015b, 2016).

Stage 3: Statistical methods to integrate data

After compiling datasets to measure the extent of underpayment, the focus of research turns to analysis, often integrating evidence on the causes of underpayment or characterising the population of the underpaid. Research differs in the degree of sophistication of methods used, ranging from descriptive statistics to regression methods.

A decision has to be made about what form of underpayment is modelled. Some seek to explain the binary variable of compliance/non-compliance. Others take the distance of earnings to the minimum wage (the so-called Kaitz index) as the dependent variable to gauge the “bite” of the NMW/ NLW. Because estimating actual earnings is not straight forward, research has to accommodate different definitions of wages.

Drivers of underpayment

Authors with data available at individual worker level tend to focus on descriptive statistics. On the one hand, these datasets provide interesting demographic variables that can be used to take different cuts at the datasets. On the other hand, these datasets are seldom longitudinal and do not go beyond basic information, prohibiting more advanced analysis.

An example of this approach is Broughton and Richards (2016), who make their point mainly through charts and graphics. They emphasise divergences among regions and industries in the extent to which self-employed individuals earn less than the NMW/NLW. They also consider demographics such as age and gender in characterising the problem. Hicks et al. (2015), studying the differences between estimates based on the LFS and ASHE also produce summary statistics by age, gender and full-time/ part-time to show how estimates change along these lines.

Le Roux et al. (2014) and Bewley et al. (2013) run panel regressions on wage data aggregated by local area and industry. Le Roux et al. model non-compliance with the minimum wage as a function of local area fixed effects (their specification 1) and GDP growth, unemployment rates and local area fixed effects (specification 2). Other factors

included in both specifications are time trends and the impact of the recent recession. Also the researchers include the share of the low-paying sector in the local area and averages of worker characteristics (gender, ethnicity, qualifications). The dependent variable in each case is the Kaitz index at the local area level. The authors estimate various model specifications, also experimenting with the definition of local areas to assure the robustness of their results.

Bewley et al. (2013) take a different angle to the issue of low pay and focus on the connection between the bite of the NMW/NLW and the use of modes of flexible employment. To do so, they exploit variations in the bite of the minimum wage across areas. They form a comparison group of workplaces where some employees received hourly pay within 20 per cent of the wage distribution of the NMW, but no employees received the NMW or less. Using panel regressions, they estimate the proportion of workers under different modes of flexible employment as a function of the Kaitz index, year and area fixed effects and a range of other control variables.

Bessa et al. (2013) study the domiciliary care sector where they benefit from the availability of a large micro dataset. Distinguishing between different grades of care workers (junior and senior care workers, managers), they run multivariate logistic regressions. They use four different dependent variables: a binary variable of being paid at or below the minimum wage, the distance from the minimum wage, weekly pay and a binary variable indicating whether a worker is on a zero-hours contract. As control variables they employ organizational as well as individual characteristics.

Estimating Underpayment: Approaches Focusing on the Tails of Income Distributions

The goal of Hussein (2011) is to estimate the proportion of direct social care workers paid below the NMW. This is accomplished in two steps: First, Hussein adjusts hourly wage rates for unpaid work, and second, she estimates the proportion of those paid below the NMW using hierarchical Bayesian modelling.

Hourly pay rates are adjusted for unpaid time using an adjustment factor (measured in unpaid minutes per week). This is used to produce an adjusted distribution of direct care workers hourly pay. Estimates for unpaid times were taken from another survey, the Longitudinal Care Survey. The conservative adjustment used produced a decrease in hourly pay rates of 1%.

Using this adjusted distribution of pay rates, Hussein proceeds to estimate the proportion of those falling below the NMW. Most authors do this by simply taking a cut-off value at the current NMW rate, and stating the proportion of workers falling below this rate as the underpaid proportion. Hussein recognises that every sample is biased. Therefore, rather than just taking a point estimate, she uses hierarchical Bayesian modelling to estimate the distribution around this point estimate.

Bayesian inference requires the estimation of the probability of model parameters. These can be estimated using Markov chain Monte Carlo simulation. Bayesian analysis does provide a point estimate like traditional methods, but also simulates the whole distribution. This “posterior” distribution can be used to make comparisons across groups.

The classical Bayesian approach is augmented by a hierarchical procedure. This means that newly available information (the dataset at hand) are not seen in isolation, but as an update on previous knowledge. Previous estimates of underpayment are therefore used as a starting point to the new estimates. The estimation procedure treats previous estimates as arising from a random process governed by hyper-parameters. The new estimates are treated as part of this random process, so that the estimated distribution benefits from information available from previous point estimates.

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