



Analysis of the impact of employment on re-offending following release from custody, using Propensity Score Matching

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Contents

Executive Summary	i
1. Introduction	1
1.1 Background	1
1.2 Challenges to analysis	2
1.3 Analysis outline	3
1.4 Defining employment and re-offending	4
1.5 Rationale for modelling offenders with different sentence lengths separately	5
2. Data and Methodology	7
2.1 Method overview	7
2.2 Main assumptions required for Propensity Score Matching	8
2.3 Data	10
2.4 Criteria for inclusion in the sample	12
2.5 Descriptive Statistics	15
2.6 Logistic regression modelling	19
2.7 Assessing propensity scores	20
2.8 Matching process	20
2.9 Assessing match quality	22
2.10 Survival analysis	23
3. Results	24
3.1 Main findings	24
3.2 Sensitivity Analysis	28
4. Conclusions	32
4.1 Summary	32
4.2 Additional research questions	33
References	36
Technical Annex	38

Executive Summary

This report presents analysis which aims to identify the impact (if any) that employment (measured by having a PAYE employment spell notified by a P45) has on reducing re-offending.

The analysis compares the re-offending rates for offenders who get P45 employment in the year following their release from custody with a matched comparison group of offenders with no P45 employment. The rate being used for comparison is the **proven one year re-offending rate**. The matched comparison group was selected using **Propensity Score Matching**. Matching enables us to more confidently estimate the impact of P45 employment post-custody on re-offending by minimising the differences between the offenders who did and did not get P45 employment on other characteristics. A limitation here is that the data used for matching is restricted to that which is available in existing systems, and there remains a possibility that the difference after matching reflects differences in underlying characteristics which are not recorded, rather than employment.

The analysis uses linked data from the Ministry of Justice's (MoJ) data linking project which brings together data on offenders from across the Criminal Justice System. This is supplemented by data on the employment and benefit status of offenders from the MoJ / DWP / HMRC data share. This has led to a rich data set with information on offenders' criminal and labour market histories and offender attitudes and criminogenic needs (such as drug or alcohol misuse). The attitudinal variables were only available from OASys data, so only offenders with a valid OASys assessment (which tend to be the more serious offenders) were included in the analysis, due to the value of including these variables. **This means that we cannot generalise the findings to the wider offender population.**

In this analysis, **P45 employment** is used as a proxy for wider definitions of employment. The available data does not include information on self-employment, and has only partial coverage of employment where earnings are below the tax threshold, and has some further issues with data quality.

The comparison group will include offenders who got other forms of employment (non-P45 employment).

Re-offending is measured as any offence committed in the 12 months after release from custody which receives a court conviction, caution, reprimand or warning in the 12 month period or within a further six month waiting period. This means that there will be many undetected or unrecorded offences not picked up in the analysis.

This analysis shows the following statistically significant results for offenders included in our sample:

- Offenders who got P45 employment at some point in the year after being released from custody were less likely to re-offend than similar offenders who did not get P45 employment.
- For custodial sentences of less than one year, the one year proven re-offending rate was **9.4 percentage points** lower for those who found P45 employment after release than for the matched comparison group.
- For sentences lasting one year or more, the one year re-offending rate was **5.6 percentage points** lower for those who found P45 employment than for the matched comparison group.
- The time from release until first re-offence was longer for offenders who got P45 employment than for the matched comparison group, who did not get P45 employment.

Identifying the impact of employment on re-offending is a challenging undertaking, because apparent associations between employment and (re-) offending will be due in part to underlying factors influencing both employment and re-offending, rather than a direct causal link. Additionally, the influence runs in both directions, with offending affecting employment as well as the reverse and there are limitations to this analysis which are highlighted in this report. However, the magnitude of the estimates of the reduction in re-offending and their statistical significance, alongside the

results of the sensitivity analysis we have conducted, means we are confident that P45 employment has a positive impact on reducing re-offending. We would be very interested in your feedback on our methodology and any suggestions for further analysis.

Key terminology

OASys assessment - this assessment is used by prisons and probation services to measure the risks and needs of offenders under their supervision.

Proven one year re-offending rate - any offence committed in the 12 months after release from custody which receives a court conviction, caution, reprimand or warning in the 12 month period or within a further six month waiting period.

P45 employment data – employment data derived from P45 forms sent to HMRC from employers.

MoJ – Ministry of Justice

DWP – Department for Work and Pensions

HMRC – Her Majesty's Revenue and Customs

NOMS – National Offender Management Service

1. Introduction

1.1 Background

There is a large body of research suggesting employment may reduce the likelihood of re-offending, however offenders leaving custody face significant barriers to finding and staying in work. To ensure that offenders receive specialist support as soon as possible after release from custody, the Department for Work and Pensions and the Ministry of Justice are fast-tracking offenders leaving custody into the Work Programme. From early 2012, Jobcentre Plus advisers have started to take claims for Jobseeker's Allowance in prison, to start entitlement on release and to facilitate mandatory referral to the Work Programme. In addition, any prison leaver claiming Jobseeker's Allowance within 13 weeks of leaving custody will now also have a mandatory referral to the Work Programme¹. The MoJ are also committed to working with businesses to significantly increase work activity undertaken by offenders in custody, which in addition to repaying society, aims to ensure offenders are motivated to work and return to their lives outside prison, better prepared for employment².

Although it is thought that employment has a positive effect on offenders, it is difficult to make firm conclusions about the direct impact of employment on re-offending from the majority of the published literature. Many studies do not isolate the impact of employment from the other characteristics associated with increased likelihood of employment, such as criminal history and prior employment and benefit history.

Additionally, many do not consider the **timing** of employment and re-offending. If we want to look at causality, then we need to focus only on offenders who start an employment spell prior to any re-offences. There is therefore still a need to improve our understanding of the links between employment and re-offending.

¹ For more information on the Work Programme, see www.dwp.gov.uk/policy/welfare-reform/the-work-programme/

² For further details of work in prisons see: www.one3one.justice.gov.uk/

After release from custody, offenders tend to have employment levels well below the general population. Two years **after release** from custody in 2008, 15 per cent of offenders were in P45 employment, with 29 per cent of offenders starting a P45 employment spell **at some point** in the two years following their release from custody (Ministry of Justice, 2011a). Linked to this, offenders also typically have higher levels of out-of-work benefits receipt than in the general population. Two years **after release** from custody in 2008, 47 per cent of offenders were receiving a DWP out-of-work benefit³, with 75 per cent of offenders starting a new claim to an out-of-work benefit **at some point** in the two years following their release⁴. This compares to just 12 percent of the general working-age population (16-64 years) in receipt of an out-of-work benefit at any one time⁵. In addition to the direct effects of their ex-offender status (such as employer discrimination due to criminal record), studies suggest that the barriers to work for offenders include a range of other factors such as health problems; substance misuse; housing problems and homelessness; poor basic skills; low levels of qualifications, self-confidence and motivation to find work; and lack of work experience (Metcalf, Anderson and Rolfe, 2001).

1.2 Challenges to analysis

Re-offending rates are substantially higher for offenders who do not enter P45 employment after release from custody than for those who do. In the sample used in this analysis (see Section 2.4 for further details of who this includes), the re-offending rate is more than twice as high for offenders without a P45 employment spell after release compared to those who do enter P45 employment. Table 1 shows that for offenders given sentences less than one year, the re-offending rate is 69 per cent for those who do not enter P45 employment after release; compared to 32 per cent for offenders who do enter P45 employment. For custodial sentences of one year or more, the re-

³ Out-of-work benefits are defined as Employment and Support Allowance, Incapacity Benefit, Severe Disablement Allowance, Passported Incapacity Benefit, Jobseeker's Allowance and Income Support.

⁴ See Annex G for more background information on the P45 employment and benefit status of offenders.

⁵ From NOMIS query; using England and Wales data at November 2008, www.nomisweb.co.uk/

offending rate for offenders who do not enter P45 employment is 43 per cent, compared to 18 per cent for offenders who do enter P45 employment.

Table 1: Re-offending rates by P45 employment status in the year after release from custody in 2008 (based on sample used in this analysis).

Length of custodial sentence	One year proven re-offending rate	
	P45 employment spell after release	No P45 employment spell after release
Less than one year	32%	69%
1 year or more	18%	43%

Many of the factors associated with employment are also known to be associated with re-offending. For example, an alcohol misuse problem is associated with likelihood of employment, but also with the likelihood of re-offending. This makes it difficult to separate out the effect of employment on re-offending from the effects of those other associated characteristics.

When offenders who enter P45 employment do not re-offend, we cannot be sure that this was directly due to being in employment. Although we can observe whether an offender re-offends after entering employment, we cannot observe the 'counterfactual' outcome that would have occurred had they not found P45 employment. In order to understand the direct impact of P45 employment we need to estimate this counterfactual outcome; what we would expect the re-offending rate to be if these offenders had *not* found P45 employment after leaving custody.

1.3 Analysis outline

The purpose of this analysis is to evaluate the effect (if any) of P45 employment in reducing proven re-offending, and its effectiveness in increasing the time from release until first proven re-offence. This analysis only includes offenders released from custody in 2008⁶, so that we have enough data to track offenders for a full year after release. The analysis uses data from the MoJ/DWP/HMRC data share and from MoJ's internal data

⁶ i.e. before the roll-out of the Work Programme. This means that any effects of the Work Programme will not be picked up in this analysis.

linking project, which provides a rich and relatively new source of information we would like to exploit more fully.

We start with the cohort of all offenders released from custody in 2008 who had an OASys assessment, and select from this cohort the subset of offenders who enter P45 employment in the year following release from custody. We then compare them to a matched group of offenders to estimate what their re-offending rate would be if they had not entered P45 employment. Offenders released from custody for sentences less than twelve months and for sentences of twelve months or more are analysed separately. It is possible that the factors important in predicting employment, and perhaps re-offending, are very different for these two groups (or at least have different relative importance); especially as offenders with longer sentences are further away from the labour market; as their most recent employment spell will be longer ago.

1.4 Defining employment and re-offending

Employment: Employment information used in this study comes from HMRC P45 employment data which is included in the MoJ/DWP/HMRC data share. The employment data we currently have access to does not include self-employment or certain cases where earnings are below the tax threshold⁷. This means that offenders who do not have a P45 employment record are not necessarily unemployed. In this analysis, any P45 employment spell lasting more than one day is considered an employment spell⁸. Only P45 employment spells which occur prior to the first re-offence are included in the analysis, so we can isolate the impact of P45 employment on the likelihood of re-offending.

Re-offending: Measuring true re-offending levels is difficult because only a proportion of crime is detected and sanctioned. However, methods aimed at measuring true re-offending, such as self-report studies, are often unreliable

⁷ See DWP's Impacts and Costs and Benefits of the Future Jobs Fund (2012) for further information on the P45 data.

⁸ We also considered using 'stable employment', such as a P45 employment spell lasting at least six months, but a sample of that description would include very few re-offenders *through its design*.

as they rely on offenders being honest about their offences. In this analysis, we use the definition of 'proven re-offending' used in the MoJ's Re-offending National Statistics publications. 'Proven re-offending' is where an offender is convicted at court or receives a caution for an offence committed within the follow-up period (12 months) and then disposed of within either this follow-up period, or waiting period (a further 6 month period)⁹.

Only **recordable offences** (which cover all offences which may be tried in a Crown Court and also the most serious summary offences) are counted as re-offences in this analysis; consistent with MoJ's re-offending statistics.

1.5 Rationale for modelling offenders with different sentence lengths separately

This analysis looks at all offenders released from custodial sentences ending in 2008 who had an OASys assessment. This leads to a high heterogeneity of participant characteristics, as the characteristics of an offender committing an offence receiving a disposal of just a few days in prison are likely to be very different to the characteristics of an offender sentenced to many years in prison. It is likely that the factors crucial to predicting employment, and perhaps re-offending, are different for these two groups and that the relative importance of each factor will also differ.

Offences resulting in longer custodial sentences tend to be more serious. Those offenders receiving longer custodial sentences are also further removed from the labour market than those with very short custody spells, although this doesn't mean these offenders are less likely to get employment on release. Additionally, many of the offenders with sentences of one year or more are released on licence and supervised by the probation service, which may reduce the likelihood of re-offending. Therefore, offenders with custodial sentences of less than one year are only matched with other offenders with custodial sentences of less than one year and offenders with custodial sentences of one year or more are only matched with offenders with custodial sentences of one year or more.

⁹See Ministry of Justice (2011b) for further details.

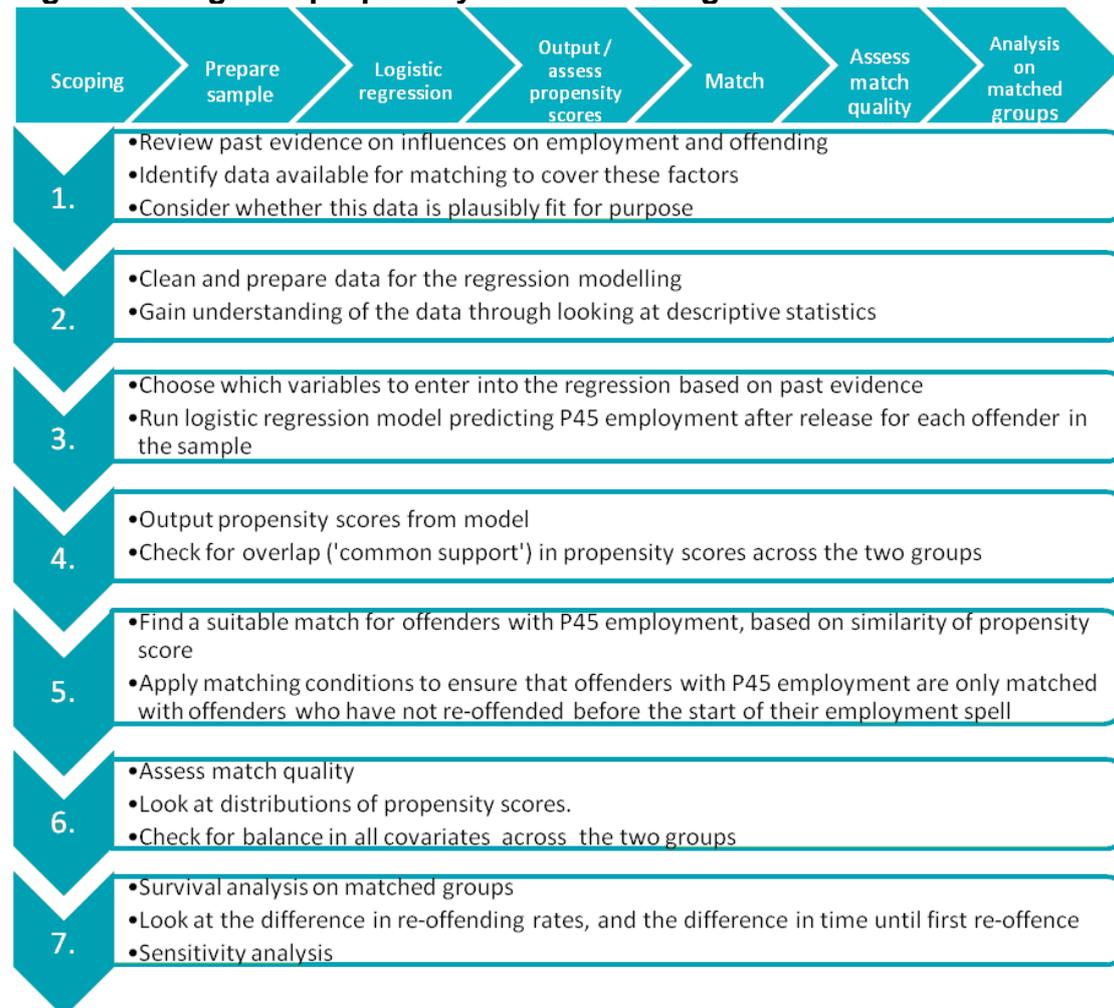
By 'hard matching' on sentence length group, we gain a more useful counterfactual; we can say things about the links between P45 employment and re-offending *for offenders receiving custody sentences of less than one year, or for offenders receiving custody sentences of one year or more.*

2. Data and Methodology

2.1 Method overview

The method used for this analysis is summarised in Figure 1 below.

Figure 1: Stages in propensity score matching



Quantifying the impact of employment on re-offending is difficult, because offenders who enter P45 employment typically have different characteristics and different likelihoods of re-offending to those who do not (see Section 2.5 of this report for descriptive statistics). Factors which predict whether an offender gains P45 employment are likely to also impact on re-offending itself. In general, when assessing the impact of an intervention, the ideal is random allocation. With a sufficient sample size, the random allocation process would enable us to assume that all the relevant characteristics, both observed and unobserved, of the two groups at the point of release from custody are

balanced. Because of this, we could then be confident that any difference in re-offending rates between the two groups would be due to the impact of P45 employment. However, assigning offenders an employment spell at random would not be feasible or ethical.

The next best option is matching. In exact matching, the aim is to create a group of similar offenders by matching on single characteristics that distinguish the two groups. For this to give us an unbiased estimate of the impact, we would need to match on every variable which influences both whether an offender will enter P45 employment and their likelihood of re-offending. This leads to what is termed the 'dimensionality problem' – it becomes unfeasible to match on every single characteristic, as we would struggle to find suitable individuals for the comparison group who are a match on every single characteristic. Since it is not possible to randomly allocate or carry out exact matching, the method we use here is called Propensity Score Matching (PSM). This works by aggregating all of the available covariates associated with employment and re-offending into one score, which we use in the matching. For more information on Propensity Score Matching, see Bryson, Dorsett and Purdon, 2002.

2.2 Main assumptions required for PSM

Sometimes, the characteristics of individuals in the P45 employment group are so different from the characteristics of those who are not that it is not possible to find a suitable individual from the comparison group for matching. We can only carry out PSM where there is a 'region of common support'; meaning that there is substantial overlap between the characteristics of employed and non-employed offenders. In practice, this means that some offenders in the treatment (P45 employment) group with very high propensity scores (i.e. very high probability of getting P45 employment after release) and some offenders in the comparison group with very low propensity scores (i.e. very low probability of getting P45 employment after release) need to be excluded from the analysis. If more than just a small proportion of the sample is excluded, findings will not be representative of the original data. This is not a problem in this analysis; we could not find a suitable match for just 3 per

cent of offenders with a P45 employment spell during the year following their release from custody.

The key assumption (the 'Conditional Independence Assumption') made in PSM is that the observable data available to us capture **all** factors influencing whether an offender enters employment as we can only match on characteristics we can observe. For this assumption to be plausible, we need to be able to control for all characteristics affecting both employment and re-offending.

There are likely to be many other unobserved variables, which to varying extents, also play a role in whether an offender enters P45 employment. For example, it would be extremely helpful if we could include a variable in the matching which looked at whether or not the offender was actively looking for work. Unfortunately this variable is not available.

It is impossible to prove that we have met the Conditional Independence Assumption, so we can never be completely certain that the estimates of the effect are unbiased. However, the advantage of having a rich data set (including the OASys variables) is that some of the variables which we have observed will indirectly capture the influence of variables we have not observed. For example, although we have not been able to observe personality type, life experience, or the actual qualifications received, we believe that by controlling for criminal history, age, attitude to employment, labour market history etc. the model will capture some of their influence by proxy. Given the richness of the dataset used, the majority of factors affecting likelihood of gaining P45 employment will be captured. Additionally, in the sensitivity analysis, we test whether there would still be an observed effect of P45 employment if there was an unmeasured variable (not captured in the data) that increased the odds of entering P45 employment after release. This was not found to affect the main findings.

2.3 Data

The MoJ Data Linking Project

This analysis uses data from the MoJ Data Linking Project, which links together data sources from across the Criminal Justice System; including from the Police, the courts, prisons and probation services. It also uses P45 employment and benefit data obtained through a data-share between MoJ, DWP and HMRC in 2010.

For a full list of available variables, see Annex B of the technical annex.

This analysis uses information from the following sources, all of which have been linked together as part of the MoJ Data Improvement Project:

The re-offending cohort (2008): This dataset is produced from MoJ's extract of the Police National Computer, which is then linked to other sources. It contains a wide range of variables relating to criminal history and previous offences, as well the re-offending outcome¹⁰.

Prison conviction and reception dates: Many offenders in the linked data have missing prison reception dates, so P45 employment and benefit histories are measured in the year prior to each offender's *conviction date*. For certain offenders, conviction date may not be that close to prison reception date (e.g. offenders remanded in custody), and therefore could not have claimed benefits or been in P45 employment during that period. This is unlikely to make much difference to the findings.

NOMS accredited interventions: This dataset holds information on which offenders have started a NOMS accredited intervention during their prison sentence, as well as whether it was completed. There are three main categories of accredited interventions in prisons; the Drug Treatment Programme (DTP), General Offending Behaviour Programme (GOBP) and the Sex Offender Treatment Programme (SOTP). Given that one of the key

¹⁰ For more information on how the reoffending cohort is produced, see Ministry of Justice (2011c).

aims of interventions is to reduce re-offending and prepare for life after release, it is important to control for any interventions carried out during an offender's sentence.

Offender Assessment System (OASys): OASys assessments are carried out by probation officers/offender managers, during a lengthy interview with the offender. They are used for identifying and classifying offending related needs and for assessing the risk of harm to self and to others, as well as to assess the likelihood of the offender being reconvicted¹¹.

The OASys assessments also include a calculation of each offender's OGRS (Offender Group Reconviction Scale) score, using risk factors such as age, gender and criminal history.

Employment and benefits data

The extract of the Police National Computer held by the MoJ has also been matched with administrative datasets from DWP and HMRC, to provide information about offenders' benefit and P45 employment history, as well as whether they have subsequent P45 employment spells in the year following release from prison. From this, we can track offenders' journeys through the employment and benefits system and through the Criminal Justice System, to improve our knowledge of how the two systems are interlinked¹².

Our employment measure, a P45 employment record starting within 360 days of release from custody, is taken from the DWP / MoJ / HMRC data share. Information from the data share on labour market history and benefit receipt were also good predictors of whether offenders enter P45 employment after their release from prison, as well as being associated with likelihood to re-offend.

The MoJ / DWP / HMRC data share contains benefit and P45 employment histories for the 3.6 million offenders who received at least one caution or

¹¹ See Risk of Harm Guidance and Training Resources: 2.2 Core Risk Assessment Tool: OASys

¹² See Ministry of Justice (2011a) for more detailed information.

conviction in England or Wales between 2000 and 2010 and who were successfully matched to DWP/HMRC data¹³.

There are some data quality issues with the P45 data. Around one third of the P45 employment spells have estimated start or end dates. Where the start or end date is unknown, a date within that tax year has been randomly allocated instead. This is a particular concern for this analysis in cases where the randomly allocated start date pushes the employment spell into the tracking period (one year after release from custody), or out of it. As part of the sensitivity analysis, we show that when all of the P45 employment spells where the start date has been estimated are dropped, the effect size is still fairly consistent with our main finding.

Out-of-work benefits: We derive variables from the DWP / MoJ / HMRC data reflecting the number of weeks in the year prior to conviction an offender received out-of-work benefits. Out-of-work benefits are defined as Employment and Support Allowance (ESA), Incapacity Benefit (IB), Severe Disablement Allowance (SDA), Passported Incapacity Benefit (PIB), Jobseeker's Allowance (JSA) and Income Support (IS).

Job density: NOMIS¹⁴ publishes data on the job density of each Local Authority. Job density is defined as the number of jobs in an area divided by the resident population aged 16-64 in that area. For example, a job density of 1.0 would mean there is one job for every resident aged 16-64. We created a variable indicating standardised¹⁵ job density for each offender, based on their Local Authority's 2008 job density score. Local Authority for each offender is taken from the latest offence information provided on the PNC, so there will be some cases where the offender is no longer living in that Local Authority.

¹³ For more information about the matching process in the data share, see Ministry of Justice (2011a).

¹⁴ NOMIS is a service provided by the ONS, which provides labour market statistics.

¹⁵ Transformed, so that scale becomes unimportant. Its mean becomes zero and its standard deviation becomes one.

2.4 Criteria for inclusion in the sample

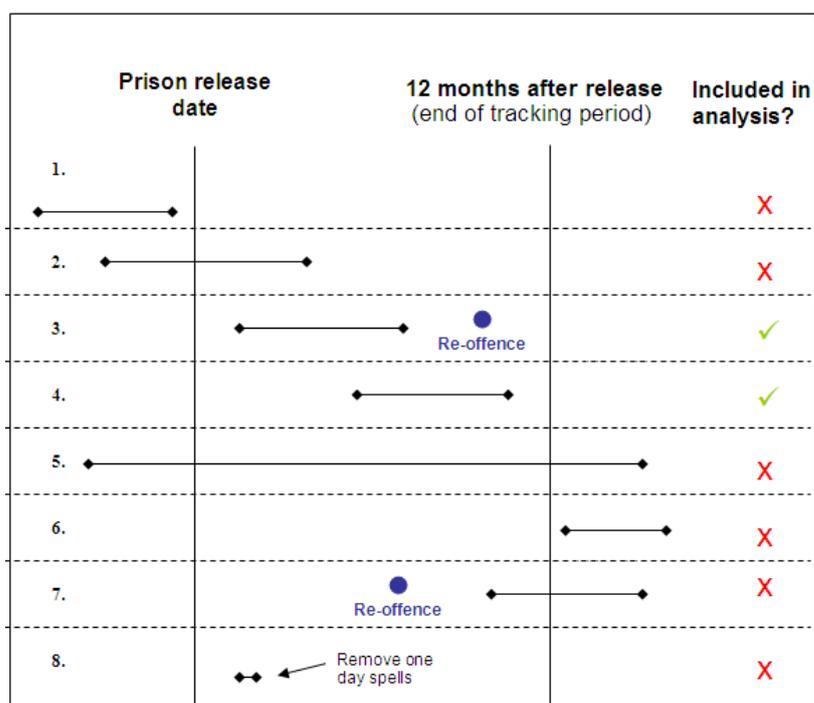
For inclusion in the sample, offenders must fit the following criteria:

- Release from a custodial sentence during 2008
- Inclusion in the MoJ/DWP/HMRC data share
- A relevant OASys record (within twenty days prior to sentencing date and one week after release from custody). Not all offenders receive an OASys assessment
- No other matching variables missing (this only reduces the sample by a small amount)
- Each offender is only included once in the sample. If an offender has multiple prison spells ending in 2008, only their first spell is included in the analysis.

See the technical annex for a flow chart showing how many offenders were in the original sample and reasons for their removal (Annex A).

Criteria for including P45 employment spells

Figure 2: Employment spells included in the analysis.



= P45 employment spell

Figure 2 shows the selection criteria for whether a P45 employment spell would be counted in the analysis. We have not included offenders in scenarios 2 and 5 in the employed group in the analysis, because although occasionally it is valid to be in P45 employment while in custody, this is rare. We consider that P45 employment spells continuing through prison and after release are more likely to represent mis-recording than to represent a job being held open throughout the sentence, which is more likely to look like a new spell starting after custody. We should investigate this assumption in more detail in further analysis.

In the matching, we only consider an offender to have a valid P45 employment spell for the analysis **if** the spell starts between their release from custody and their first re-offence. For employment to influence re-offending, changes in re-offending must occur **after** the P45 employment spell starts.

Restricting analysis to offenders with an OASys record

We only include offenders with valid OASys assessments in the analysis. Not all offenders receive an electronic OASys assessment; OASys records were only obtained for around half of the original sample. OASys assessment records were only used in the analysis if the assessment was carried out within 20 days of the conviction date and before the release date. If multiple OASys assessments were carried out within this window, then the assessment closest to the release date was used. This is to ensure that the OASys assessment reflects the characteristics of the offender as close to the point of leaving prison as possible. OASys assessments include several areas where the assessor offers a subjective rating of the scale of the offender's problems in a particular aspect of their life ('no problems', 'some problems' or 'significant problems'). This does mean it is possible for probation officers to assess offenders with similar problems differently on these scales.

The rich data surrounding motivations and attitudes provided in OASys assessments is very valuable. There is a section which asks questions about education, training and employability, which should significantly improve the

quality of our matching, as should the area relating to whether the offender received income from previous criminal activity. The larger the number of available pre-release characteristics, the greater the likelihood that we can capture all of the major factors influencing whether an offender enters P45 employment, which is why this analysis has been restricted to only include offenders with a valid OASys assessment.

Offenders receiving an OASys assessment

The characteristics of offenders with OASys assessments differ slightly from those who do not. Custodial sentences of under 12 months do not require an OASys assessment to be carried out; although it often is. Additionally, offenders under the age of 18 are not usually given OASys assessments; the Youth Justice Board has a separate tool, *Asset*, used for juveniles sentenced to Detention and Training Orders.

However, limiting the analysis to those offenders receiving an OASys assessment will affect the degree to which the findings can be generalised to the wider offender population, as those offenders with an OASys assessment tend to have more complex needs than those who do not. They are more likely to have committed violent offences, more likely to have received benefits prior to sentencing and slightly more likely to re-offend. Overall though, we think that the value gained from including OASys data overrides the reduction in generalisability.

2.5 Descriptive Statistics

In this section we show that the basic characteristics of those offenders in our sample who do have a P45 employment spell after being released from custody (either in the year after release, or before the first re-offence for those offenders who re-offended) are different from those who do not, prior to matching. All figures use the sample created for this analysis; so do not include offenders without a valid OASys assessment or with key matching variables missing.

Custodial sentences less than one year

There are differences in characteristics between the two groups, with those offenders who do not get P45 employment after release from custody having more previous convictions, greater problems with drug misuse and spending less time in P45 employment prior to custody.

Table 2: Descriptive statistics for offenders sentenced to a custodial sentence of under 12 months

	P45 employment after release	No P45 employment after release
Number of offenders in the cohort:	2,360	12,190
One year proven re-offending:	32%	69%
Male:	94%	88%
Some problems in attitude towards employment:	23%	41%
Serious problems in attitude towards employment:	5%	14%
At least some problems with alcohol misuse:	64%	62%
At least some problems with drug misuse:	39%	64%
	Mean (SD)^A:	Mean (SD):
Age at date of index offence:	28.4 (9.6)	29.8 (9.4)
Previous Court Convictions:	19.0 (26.4)	38.5 (37.8)
Weeks in P45 employment in year prior to custody:	15.4 (20.6)	4.3 (12.6)
Weeks receiving an out-of-work benefit in year prior to custody:	13.6 (18.6)	24.8 (21.9)

^AThe mean is the average, a measure of the "typical" value of a data set and the standard deviation (SD) measures how spread out the values are. A high standard deviation means that the values are widely spread.

In the sample used to create the propensity scores, 16 per cent of offenders sentenced to a custodial sentence of under 12 months started a P45 employment spell during the year following release, with 84 per cent of offenders not in P45 employment. Offenders with a P45 employment spell after release from custody have lower re-offending rates in the year following release. 32 per cent of offenders with P45 employment on release from

custody re-offended within one year of their release¹⁶; 69 per cent of offenders who did not enter P45 employment re-offended within one year. Offenders who have a P45 employment spell after release from custody spent more weeks in P45 employment in the year prior to custody and fewer weeks receiving an out-of-work benefit and tend to have a more positive attitude towards employment. Offenders with a P45 employment spell spent an average of 15.4 weeks in P45 employment and 13.6 weeks in receipt of an out-of-work benefit in the year prior to custody; compared to an average of 4.3 weeks in P45 employment and 24.8 weeks receiving an out-of-work benefit for offenders who do not have a P45 employment spell after release. 28 per cent of offenders who enter P45 employment in the year following release have at least some problems with their attitude towards employment, compared to 55 per cent of offenders who do not find P45 employment.

Those offenders who find P45 employment after release typically have fewer court convictions than those who do not. Offenders who find employment have an average of 19 previous convictions; those who do not find P45 employment have on average 39 previous convictions.

Drug misuse is much more prevalent among offenders who do not enter P45 employment. 39 per cent of offenders who do have a P45 employment spell after release admit to a drug misuse problem in their OASys assessment. 64 per cent of offenders with no P45 employment in the year following release admit to problems with drug and alcohol misuse. Alcohol misuse levels are broadly similar between the two groups.

A higher proportion of offenders who enter P45 employment after release are male (94 per cent) than those who do not (88 per cent male). The average (mean) age at 'index offence' (the offence leading to the custodial sentence) is 30 for offenders who find P45 employment; 28 for those who do not.

¹⁶ Only includes employment spells occurring prior to first re-offence.

Sentences of one year or more

Table 3 shows that there are also fairly similar differences in characteristics between offenders who get P45 employment after release and those who do not, after release from custodial sentences of one year or more.

Table 3: Descriptive statistics for custodial sentences of one year or more

	<u>P45 employment after release</u>	<u>No P45 employment after release</u>
Number of offenders in the cohort:	3,753	12,320
One year proven re-offending:	18%	43%
Male:	94%	94%
Some problems in attitude towards employment:	22%	35%
Serious problems in attitude towards employment:	4%	10%
Alcohol Misuse:	54%	54%
Drug Misuse:	46%	63%
	Mean (SD):	Mean (SD):
Age at date of index offence:	30.6 (10.8)	31.4 (10.4)
Previous Court Convictions:	19.0 (26.4)	32.1 (34.9)
Weeks in P45 employment in year prior to custody:	13.2 (19.4)	4.9 (13.4)
Weeks receiving an out-of-work benefit in year prior to custody:	12.8 (18.2)	18.7 (20.4)

23 per cent of offenders sentenced to custodial sentences of 12 months or more who are included in our sample started a P45 employment spell during the year following release. This is noticeably higher than for those with shorter custodial sentences. Before matching, the one year re-offending rate is much higher for offenders who do not enter P45 employment; 18 per cent of those with P45 employment on release from custody do re-offend compared with 43 per cent of those who do not enter P45 employment in the year following release.

Offenders sentenced to a custodial sentence of 12 months or more who have a P45 employment spell after release spent more weeks in P45 employment in the year prior to custody and fewer weeks receiving an out-of-work benefit than those offenders who did not get P45 employment. They also tend to have a more positive attitude towards employment. Offenders with a P45 employment spell spent an average of 13.2 weeks in P45 employment and 12.8 weeks in receipt of an out-of-work benefit in the year prior to custody; compared to an average of 4.9 weeks in P45 employment and 18.7 weeks receiving an out-of-work benefit for offenders who do not have a P45 employment spell after release. 26 per cent of offenders who do find P45 employment after release have at least some problems in their attitude toward employment, compared to 45 per cent of those who do not find P45 employment after release.

Offenders on longer custodial sentences who start P45 employment in the year following release from custody tend to have fewer previous convictions. Offenders who do not find P45 employment after release have an average of 32 previous convictions; whereas offenders who do find P45 employment have an average of 19 previous convictions.

There is also a strong negative association between drug misuse problems and finding P45 employment. 46 per cent of offenders who do find P45 employment have admitted to problems with drug misuse (in OASys assessment); 63 per cent of offenders who do not enter P45 employment admit to problems with drug misuse. Alcohol misuse levels are similar across the two groups.

2.6 Logistic regression modelling

We create the propensity score used to create the matched comparison group using regression modelling. We entered the variables expected to predict likelihood of starting a P45 employment spell after release into a logistic

regression model¹⁷ to obtain a single score for each offender based on their characteristics, reflecting their ‘propensity to gain P45 employment after release’. The propensity score is the **expected probability of entering P45 employment after release; given an offender’s observed characteristics**. This is the score we use in the matching. Our aim is to find a suitable comparison group where the only difference between the two groups is that offenders in the comparison group did not enter P45 employment after release. See the technical annex (Annex C) for further details of the model.

2.7 Assessing propensity scores

There is a large region of common support; where the propensity scores for the employment and no employment groups overlap. After matching, the distribution of propensity scores for the ‘treatment’ (P45 employment) group and comparison group are very similar. For histograms showing the overlap in propensity scores before matching, as well as after matching, see the technical annex (Annex D).

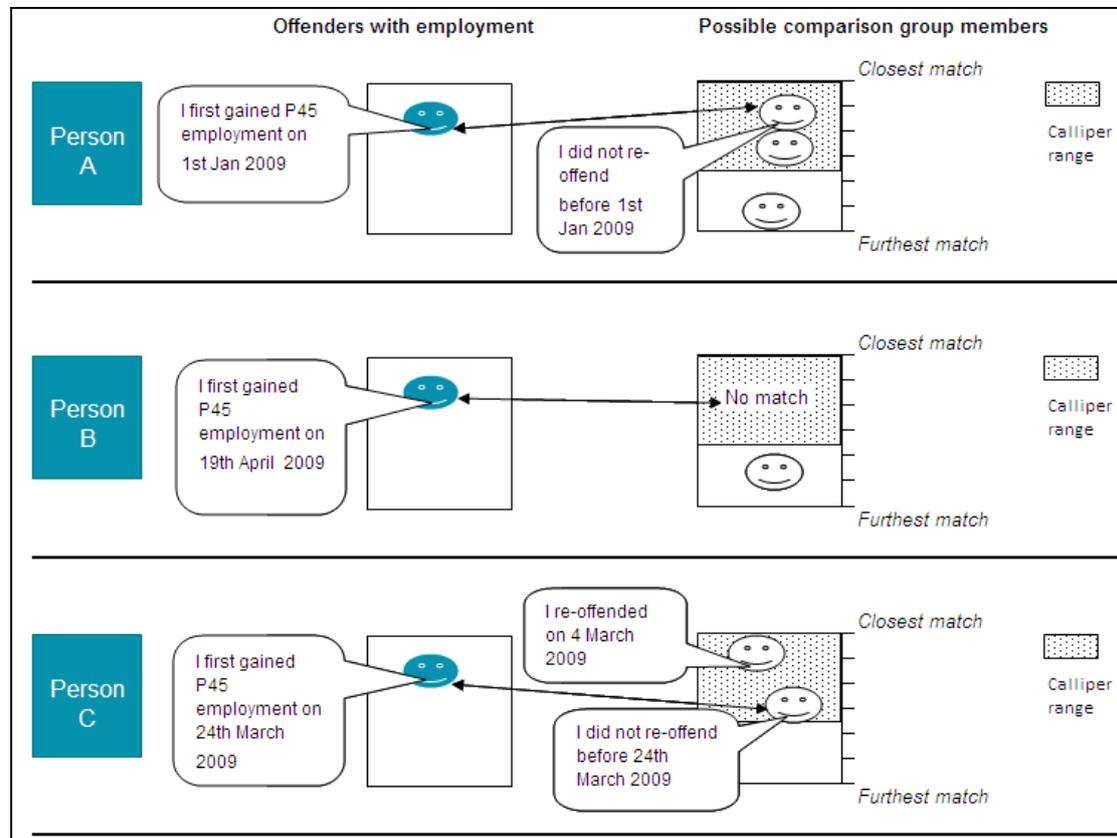
2.8 Matching process

There are a number of possible matching options available; after trying several different matching options, this study uses 1:1 Nearest Neighbour matching with a calliper of 0.2 of the standard deviation of the logit of the propensity score¹⁸, although a range of callipers were explored to test the sensitivity of the calliper size. Matching is carried out without replacement, which means that each comparison group member only appears once in the sample.

¹⁷ Logistic regression is a type of predictive model that can be used when the target variable is a categorical variable with two categories. Here, the two categories represent an offender entering P45 employment after release and not entering P45 employment after release.

¹⁸ As suggested by Austin, P.C. (2011) and Faries, Leon, Hao and Obenchain (2010).

Figure 3: The matching process



Person A – There are two potential matches in the comparison group within the calliper range. The offender with the nearest propensity score to Person A also meets the additional criteria of not having re-offended before the start of person A’s first P45 employment start, so is used as the matched comparison.

Person B – No match is found for Person B as there are no offenders in the comparison group within the calliper range.

Person C – There are 2 potential matches within the comparison group. The offender with the closest propensity score does not however meet the additional criteria, as he/she has re-offended before the start of Person C’s first P45 employment start. The next closest offender does meet this additional criteria and is therefore used for the match.

One complication in this analysis is that selection into the P45 employment group is a function of offenders **not having re-offended for long enough to search for and start work**. This means that the outcome measure (whether re-offended) indirectly affects whether someone is in the treatment group (gains P45 employment). To get around this problem, we have also added in an extra criterion to the matching process.

A match is only considered valid if the possible comparison group member **has not re-offended before the start of their matched case's first P45 employment start**. If the possible comparison member has re-offended before this point, the next best comparison member is chosen instead (next closest propensity score). This is a slightly similar approach to the pseudo start date method used in several DWP papers using PSM¹⁹.

For both groups of offenders (offenders serving short custodial sentences, and those serving longer custodial sentences), a suitable match from the comparison group was found for 97 per cent of offenders. This gives matched groups of 2,298 employed and 2,298 non-employed offenders released from custody for a sentence of less than 12 months and matched groups of 3,622 employed and 3,622 non-employed offenders released from custody for a sentence of 12 months or more.

2.9 Assessing match quality

After matching, we check that covariates at an aggregate level balance across the two groups (treatment (those who get P45 employment) and comparison). Where matching is robust, the only difference in characteristics between the two groups should be that one group enter P45 employment after release and the other does not. Whether the two groups are balanced is assessed through comparing the standardised differences for each covariate across the two

¹⁹ For example see Early Impacts of the European Social Fund 2007-13; published by the Department for Work and Pensions (2011).

groups. Smaller standardised differences reflect greater similarity between the two groups in the characteristic.

This analysis uses a cut-off point of standardised differences of less than 0.1 (or 10 per cent) when assessing balance. After the matching in this analysis, all standardised differences are below 10 per cent and vast majority are below 5 per cent, which suggests that the matched comparison groups are well balanced; see technical annex for details (Annex E).

2.10 Survival analysis

After matching, we compare the two groups. Firstly, we use McNemar's test²⁰ to compare one year re-offending rates between the two groups. After this, we produce survival curves for each of the two groups, showing time from release to first re-offence. These survival curves show the decreasing proportion of offenders who have not yet re-offended throughout the year following their release from custody. A significant difference between the two curves suggests that P45 employment has a significant impact on time to first re-offence. We also fit Cox proportional hazards models to the data to obtain a hazards ratio. The hazard ratio shows the rate at which the P45 employment group re-offend (per day) since release compared to the comparison group. For example, a hazard ratio of 1.4 would mean that the P45 employment group has a 40 per cent higher hazard of re-offending than the matched control group. A hazard ratio less than one suggests that the P45 employment group have a lower re-offending hazard of re-offending. Hazard ratios are provided in the technical annex (Annex F).

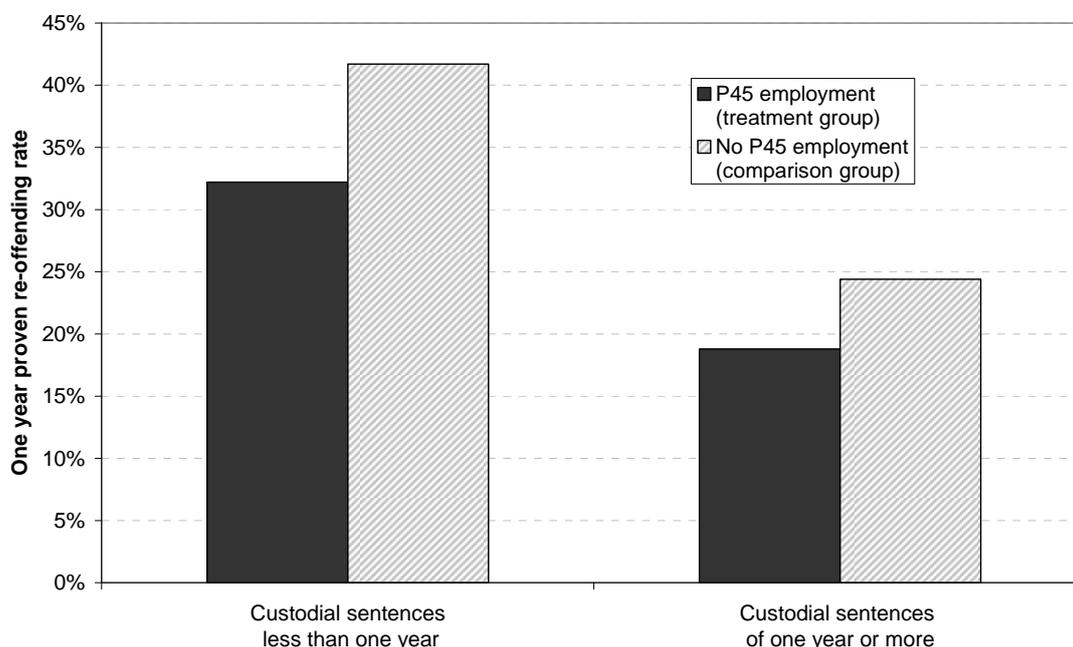
²⁰ McNemar's test is used to compare proportions (such as re-offending rates) in paired data. There is not a consensus in the literature on whether or not paired tests should be used in the matched sample, so we also apply a t-test for independent samples.

3 Results

3.1 Main findings

Offenders in our sample with a P45 employment spell within one year following their release from custody were significantly less likely to re-offend than those offenders who did not get P45 employment. For custodial sentences of less than one year, offenders with a P45 employment spell had a proven re-offending rate **9.4 percentage points lower** than the matched comparison group. For custodial sentences of one year or more, offenders entering P45 employment after release had a proven re-offending rate **5.6 percentage points lower** than the matched comparison group; see Figure 4 below.

Figure 4: One year proven re-offending rates after matching. Custodial sentences less than one year and sentences of one year or more.



These findings apply to P45 employment only. This analysis does not allow us to say anything about the impact of employment below the tax threshold or self-employment. Although we know that the comparison group members do not have a P45 employment spell within one year of their release, this

analysis does not provide any other information about their status. They may be in education or training, in low-paid/self -employment, receiving out-of-work benefits, or various other possibilities.

Sentences less than one year

32.2 per cent of offenders with a P45 employment spell after release re-offend within one year, compared to 41.7 per cent of the comparison group. This is a 9.4 percentage point decrease²¹ in the re-offending rate, which is statistically significant²². On average, the comparison group members who re-offend do so 37 days sooner than those who re-offended after getting P45 employment; 177 days (5.9 months) after release for offenders in P45 employment, 140 days (4.7 months) after release for the comparison group. As matched pairs do not necessarily have the same re-offending outcome (as they are matched on having the same likelihood of gaining P45 employment, not same likelihood of re-offending), we cannot assume that those who re-offend have the same characteristics across the employment and comparison groups.

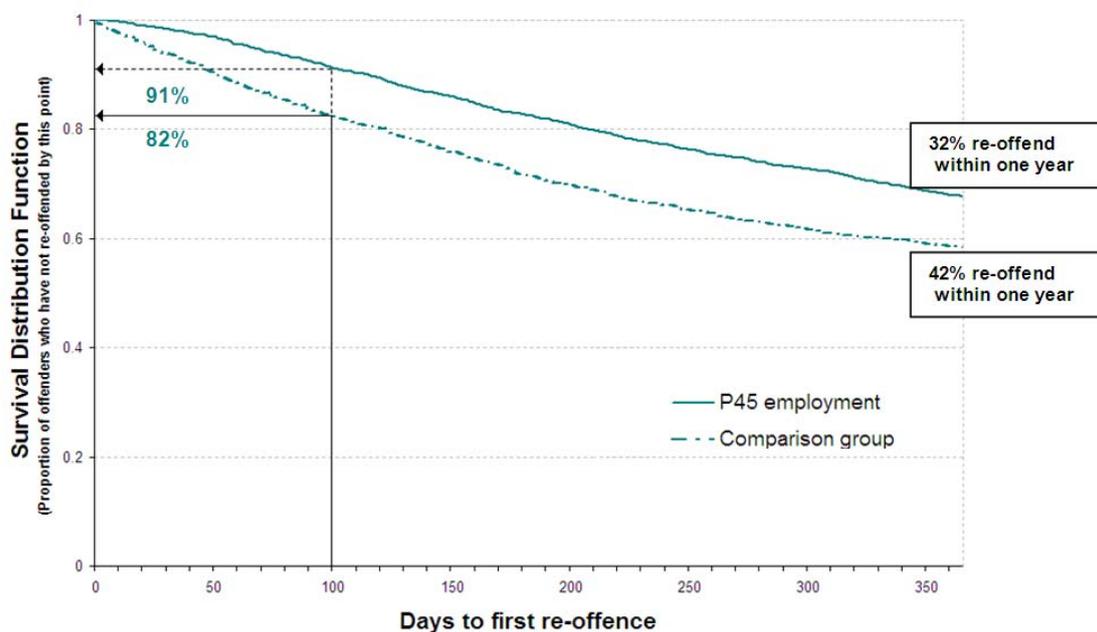
Figure 5 below shows the time to re-offend for the matched P45 employment and comparison groups. This is known as the survival curve. The difference between the survival curves is statistically significant²³, so we can be reasonably confident that P45 employment does have an effect on re-offending.

²¹ Throughout the analysis, numbers may not sum due to rounding.

²² According to McNemar's test, the one year proven re-offending rates are significantly different across the two groups ($p < 0.0001$). Additionally, an independent samples t-test also shows a significant difference ($p < 0.0001$) between the two groups.

²³ We used the test proposed by Klein and Moeschberger (1997), ($p < 0.0001$) to test for statistical significance.

Figure 5: Survival curves showing time to first re-offence for offenders released from custody after a sentence of less than one year. Offenders who enter P45 employment and matched comparison group



Interpreting the survival curve chart

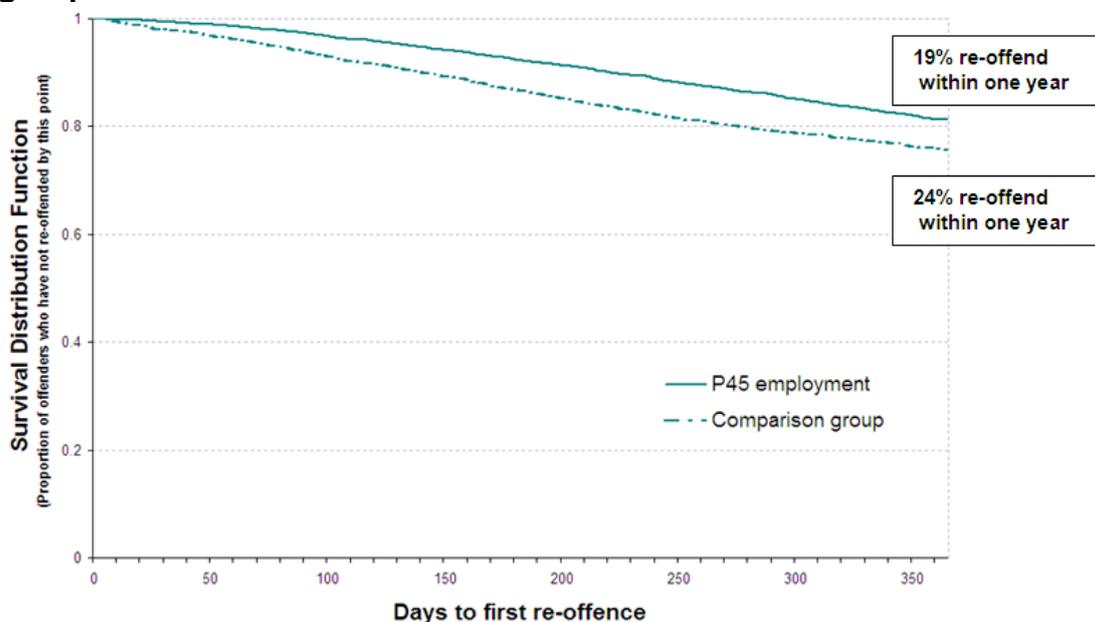
For example, 100 days after release from prison, 91 per cent of offenders who have a P45 employment spell after release have not yet committed a re-offence; compared to 82 per cent of offenders in the matched comparison group. Or conversely, 100 days after release from prison, 9 per cent of offenders who have a P45 employment spell after release have re-offended; compared to 18 per cent of the matched comparison group.

After matching, there were 380 (17 per cent of total sample after matching) matched pairs where both the treatment and control group members re-offended within one year of release, 979 (43 per cent) matched pairs where neither offender re-offended, 361 pairs (16 per cent) where the P45 employed pair member re-offended but the comparison member did not, and 578 pairs (35 per cent) where the comparison group member re-offended but the employed member did not (see table in Annex F).

Sentences of one year or more

The direction of the impact is the same as for those with sentences less than one year, but the difference is smaller. The one-year proven re-offending rates were 18.8 per cent for offenders in our sample with a P45 employment spell on release and 24.4 per cent for the comparison group; a total percentage point difference of 5.6 per cent, which is statistically significant²⁴. On average, the comparison group members who re-offended did so 34 days sooner than those in P45 employment who re-offended; 206 days (6.9 months) after release for offenders in P45 employment, 172 days (5.7 months) after release for the comparison group. Figure 6 below shows the survival curves for re-offending for the P45 employment group and the comparison group. The difference between the survival curves is statistically significant²⁵.

Figure 6: Survival curves showing time to first re-offence for offenders released from custody after a sentence of one year or more. Offenders who enter P45 employment and matched comparison group



²⁴ According to McNemar's test, the one year proven re-offending rates are significantly different across the two groups ($p < 0.0001$). Additionally, an independent samples t-test also shows a significant difference ($p < 0.0001$) between the two groups.

²⁵ We used the test proposed by Klein and Moeschberger (1997), ($p < 0.0001$) to test for statistical significance

There were 204 matched pairs (6 per cent of total matched pairs) where the offender in both the treatment and control group re-offended within one year of release, 2,262 matched pairs (62 per cent) where neither offender re-offended, 476 pairs (13 per cent) where the P45 employed pair member re-offended but the comparison member did not, and 680 pairs (19 per cent) where the comparison group member re-offended but the employed member did not.

3.2 Sensitivity Analysis

Given the limitations and caveats to this analysis it is important to conduct sensitivity analysis to check that our findings are as robust as possible. This section examines the sensitivity of the model and analysis to changes in its input.

We have carried out three separate sensitivity tests.

- **Part I** looks at whether the effect of P45 employment on re-offending would still be statistically significant if there was an unmeasured variable which increased the odds of P45 employment by up to 25 per cent.
- **Part II** shows the revised re-offending rate if all P45 employment spells with randomly allocated start dates are removed from the modelling
- **Part III** shows the impact of removing all offenders from the control group who have a P45 employment spell within one year of release, but after their first re-offence

Part I: Sensitivity to unobserved variables

Although our data is very rich, there will still be some characteristics associated with entering P45 employment which we cannot observe or measure and so are not included in the matching process. We assessed how sensitive the effect of P45 employment on re-offending is to unmeasured variables. More details on this can be found in the technical annex (Annex F).

Custodial sentences of less than one year

Even if there was an unmeasured binary variable that increased the odds of entering P45 employment after release by up to 25 per cent, and if this variable was almost perfectly associated with re-offending, the statistical significance of the observed treatment effect would still be less than 0.05 (see table in Annex F), which means that our findings would still show a statistically significant impact of P45 employment on re-offending. There is no way of testing how large the influence of unobserved variables might be, or how likely it is that there are unobserved variables, but the richness of the dataset used should minimise this as we are already controlling on a wide range of characteristics (including attitudinal characteristics).

Custodial sentences of one year or more

If there was an unmeasured binary variable that increased the odds of entering P45 employment after release by up to 25 per cent, the statistical significance of the observed treatment effect would still be less than 0.05 which means that our findings would still show a statistically significant impact of P45 employment on re-offending.

Part II: Impact of including employment spells with randomly allocated start dates

We included P45 employment spells with randomly allocated start dates in the main analysis because they still reflect genuine P45 employment spells – it is just that we are not sure when exactly these employment spells occur in the year. The majority of cases with a randomly allocated start date are unlikely to be incorrectly included / excluded from the group used in analysis, because the start date should be in the correct tax year and we know the spell end date. However, to test whether including randomly allocated start dates has a large impact on the effect size, we re-ran the matching after removing all P45 employment spells with randomly allocated start dates. From Table 4, we can see that removing randomly allocated spells does reduce the size of the effect, but not by a large amount. The effect size is still statistically significant (McNemar's test; $p < .0001$).

Table 4: Impact of removing P45 employment spells with randomly allocated start dates

Re-offending rate:	Main findings			Sensitivity test - Removing randomly allocated P45 spells		
	P45 employment (Treatment group)	Comparison group	Effect size (percentage point change in re-off rate)	P45 employment	Comparison group	Effect size
Sentences less than one year	32.2%	41.7%	9.4 ppt change ^A	31.8%	39.6%	7.8 ppt change
No. matched pairs			(2,298 pairs)			(1,869 pairs)
Sentences one year or more	18.8%	24.4%	5.6 ppt change	18.5%	22.7%	4.3 ppt change
No. matched pairs			(3,622 pairs)			(3,102 pairs)

^A ppt = percentage point

Part III: Impact of removing all offenders with P45 employment spells after first re-offence from comparison group

In the main analysis, any offender in the sample who did not have a P45 employment spell before the end of the one year tracking period **or before their first re-offence** could be used as a possible comparison group member.

We were concerned that a large number of offenders in the matched comparison group may in fact have a P45 employment spell within one year of release, but after their first re-offence. Table 5 below shows the impact of removing offenders from the comparison group who have a P45 employment spell within a year following release but after their first re-offence. The effect size is smaller, but still statistically significant (McNemar's test; $p < .0001$).

Table 5: Impact of removing offenders with a P45 employment spell after first re-offence from comparison pool

Re-offending rate:	Main findings			Removing offenders with a P45 employment spell after re-offence from comparison		
	P45 employment	Comparison group	Effect size (percentage point change in re-off rate)	P45 employment	Comparison group	Effect size
Sentences less than one year	32.2%	41.7%	9.4 ppt change	32.4%	39.1%	6.7 ppt change
No. matched pairs			(2,298 pairs)			(2,274 pairs)
Sentences one year or more	18.8%	24.4%	5.6 ppt change	18.9%	22.8%	3.9 ppt change
No. matched pairs			(3,622 pairs)			(3,609 pairs)

Further sensitivity analysis

Additional sensitivity analysis looking at the effect of removing the OASys data to see whether the effect of P45 employment on re-offending can be generalised to the wider offender population is something we could consider as further analysis.

4. Conclusions

4.1 Summary

The purpose of this analysis has been to estimate the effect P45 employment has on re-offending. It was designed to expand the evidence base on employment and what works in reducing re-offending.

Within the sample used in this analysis, the re-offending rate is lower for offenders who enter P45 employment than for the matched comparison group. The effect of P45 employment was statistically significant for offenders of either sentence length group, however P45 employment appears to have a larger impact (in terms of reducing re-offending) on offenders with custodial sentences of less than one year than custodial sentences of greater than a year. Offenders with a P45 employment spell following release who re-offended also took longer on average to re-offend. The findings of this analysis are consistent in direction with the results from previous internal Ministry of Justice research. While we can be confident in the direction of the effect (that employment reduces re-offending), the effect size cannot necessarily be generalised to the wider offender population, as we restricted analysis to offenders with an OASys assessment.

Offenders with a P45 employment spell lasting more than one day were considered 'in employment' in this analysis. We do not have data on cash-in-hand employment, self-employment or certain types of employment below the tax threshold, so these are not included here. There is a chance that some offenders in the matched comparison group may fall into one of these other employment groups. They may also be in education or training, or receiving benefits.

The impact estimates were produced using propensity score matching. Findings will only reflect the true impact of P45 employment if offenders in the P45 employment group and the matched comparison group are well-matched on all characteristics relating to P45 employment. If there are characteristics

which differ between the two groups and which impact on P45 employment, but which we haven't been able to measure, then the estimate of the effect of P45 employment on re-offending will be biased.

We cannot be sure that we have captured every important variable when calculating the propensity scores. We have minimised bias as much as possible through using a very rich data source and the sensitivity analysis is reassuring, however we are unlikely to have controlled for everything which affects whether an offender enters P45 employment or re-offends. For example, parenthood is often cited as an important factor in desistance, but whether an offender has children is not a variable we have in our data. Additionally, many ex-prisoners do not have a permanent address and therefore cannot provide these details when looking for employment. Ideally we would know more about whether those who get P45 employment soon after their release from prison are those who have secured accommodation. We also cannot capture work that prisoners do inside prison, although this information may become available in future.

4.2 Additional research questions

Impact of P45 employment on offenders without employment

This analysis focuses on offenders leaving custody who gain P45 employment and estimates their re-offending rates had they not found P45 employment. It does not estimate the inverse; the effect gaining P45 employment would have on re-offending for offenders who do not find P45 employment.

We were unable to estimate this using propensity score matching, because there was not enough overlap in the low region of propensity scores (i.e. there were not enough offenders who had a P45 employment spell after release, but who had low enough propensity scores to act as a suitable comparison group member). A greater understanding of offenders with a low propensity to enter P45 employment would be interesting however, as offenders with very low propensity scores are likely to be 'harder to help' and therefore more

persistent re-offenders. Further analysis is needed to assess the impact of P45 employment on this group.

Assessing the stability of the results over time

This analysis only includes offenders released from custody in 2008. Once we have more recent data available, it would be worthwhile to assess whether the impact is similar across years. 2008 was the start of the recession, so it may be that this has an additional effect on selection into P45 employment. In addition, more recent data would include offenders who had started the Work Programme, which may change the effect size, as it aims to give additional support to offenders claiming Jobseeker's Allowance.

Analysis of impacts of subsets of offenders

We cannot generalise our findings to the whole offender population because this analysis looks at custodial sentences only and we excluded those offenders who were not found on the MoJ/DWP/HMRC data share and those who did not have a valid OASys assessment.

We had hoped to also look at the impact of P45 employment on re-offending for offenders serving their sentence in the community. However, propensity score matching was not found to be a suitable technique, as there was not a large enough region of common support between those offenders who entered P45 employment and the possible comparison group members. We think that this is because employment history before sentence almost perfectly predicts whether an offender has a P45 employment spell after sentence. This is not the case with custodial sentences; possibly because a custodial sentence usually requires an offender to leave their current employment and seek new employment after release. Therefore there is a greater element of chance in whether an offender finds work, for offenders released from custody. Offenders who serve their sentence in the community are more likely to be able to continue in their current employment. We would welcome any comments on how we could reliably estimate the impact

employment has on re-offending for other groups of offenders – not just those serving custodial sentences.

Nature of employment spells

It would be useful to have more detail on the nature of offenders' employment spells. The P45 data does not include certain types of employment spells and some of these may never be available as, by their nature, they won't be recorded on administrative systems, but further analysis could feasibly incorporate the length of P45 spell into the analysis and other types of employment. Data on whether the offender finds their work satisfying and reasons for termination of the employment would also add value.

There is scope to improve this analysis in future as MoJ are working with DWP and HMRC to get the legal and ethical approval for a regular data share which aims to obtain more information about the employment status of offenders (potentially including information on tax credits, number of hours worked and on earnings, all of which would add value to further analysis).

Re-offending measure

This analysis focuses on the one year re-offending rate and on time from release to first re-offence. It does not include information about the severity or frequency of re-offending. If an offender has a custodial sentence for a violent assault, and is later reconvicted for another violent assault, that outcome might be considered worse than a reconviction for shoplifting. Similarly, although the re-offending rate does not take frequency of re-offending into account, this could be included in further analysis.

As this analysis is exploratory, we would welcome ideas and expert advice on how best to exploit this rich source of data in looking at the relationship between employment and re-offending. One possibility may be optimal matching; comparing offenders' life-histories and transitions between different states (employment, benefits, interventions, time in custody, offences) to look at how each of these might impact on re-offending.

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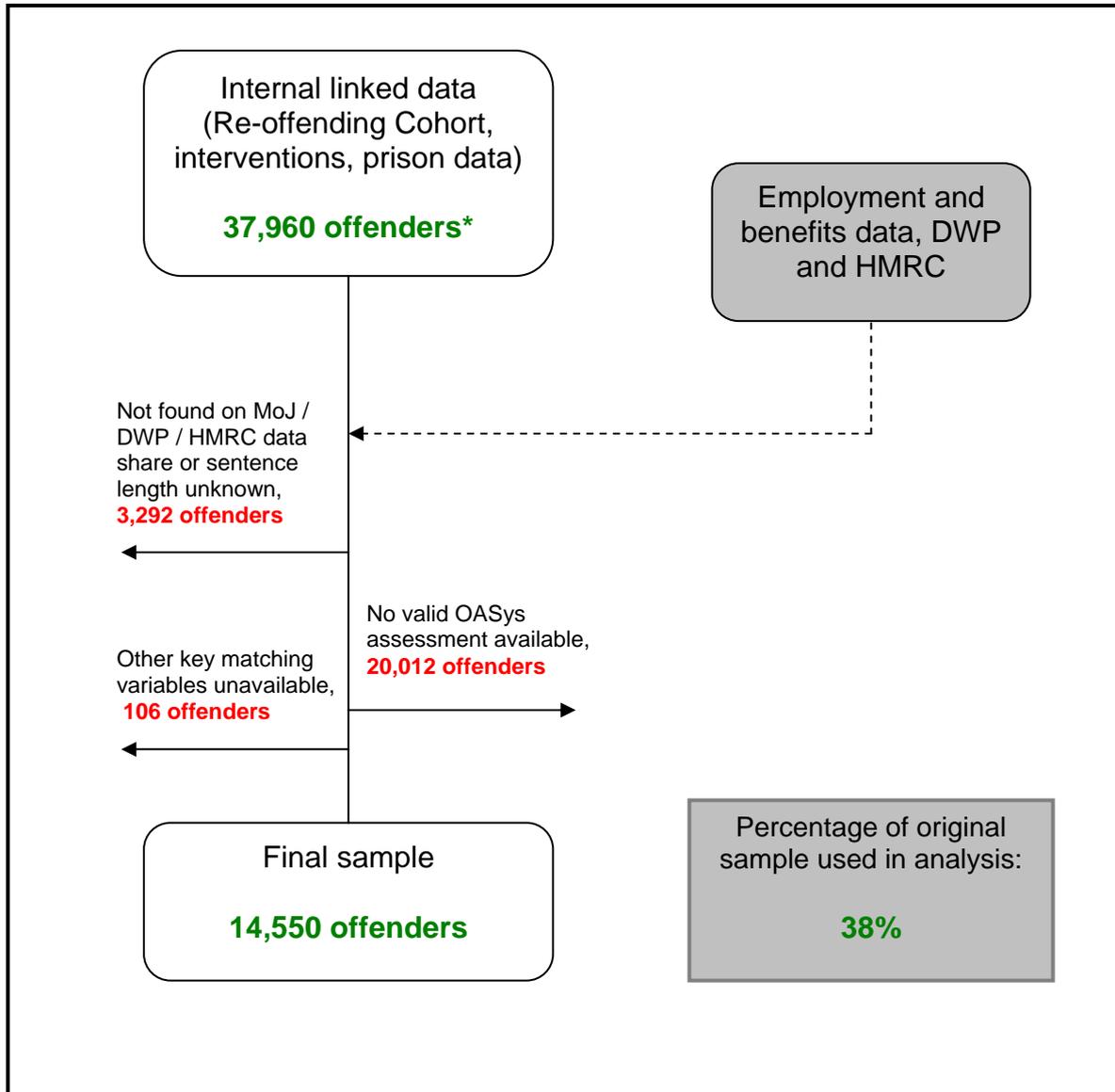
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Technical Annex

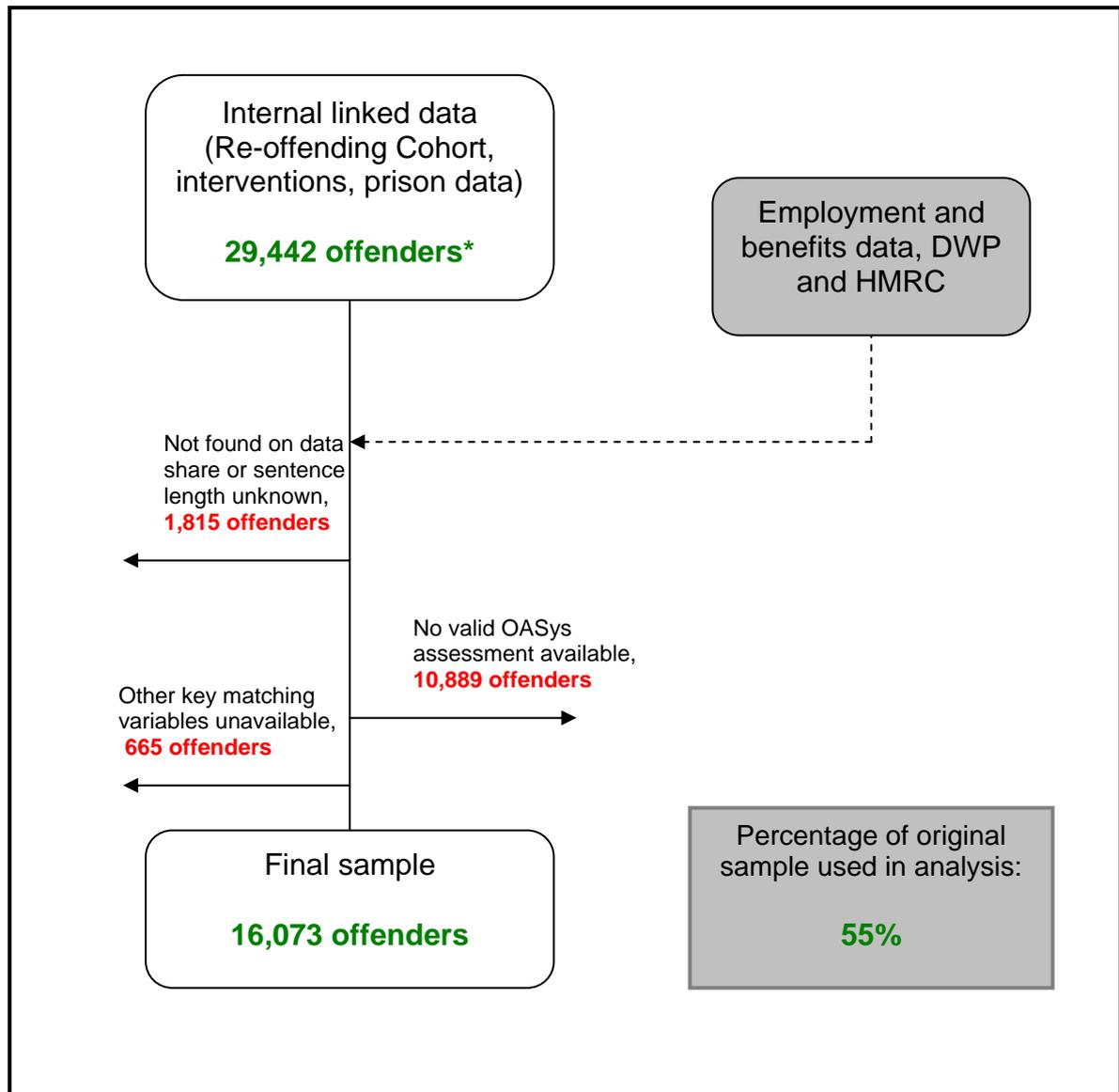
Annex A: Flow charts showing reasons for offenders' exclusions from the sample.

Custodial sentences less than one year



* These figures are in line with those in the proven re-offending publications. See 2008 figures in table 19A in the statistical tables at www.justice.gov.uk/statistics/reoffending/proven-re-offending.

Custodial sentences of one year or more



* These figures are in line with those in the proven re-offending publications. See 2008 figures in table 19A in the statistical tables at www.justice.gov.uk/statistics/reoffending/proven-re-offending.

Annex B: Available variables for creating the comparison group

The table below shows the variables available for matching and their possible values. Not all of these proved significant in the final models but all were used to assess balance in the matched sample. Index offence is the offence leading to the custodial sentence.

Variables available for matching process and possible values

Variable	Type	Values
<u>Personal/Demographic information</u>		
Gender	Categorical	<i>Male; Female</i>
Age at date of index offence (and age squared)	Numerical	Integer values
Government Office Region	Categorical	12 UK regions. Series of binary variables. (NB data only covers Prisons and Probation Services in England and Wales but some Scottish offenders included)
Ethnicity	Categorical	Series of binary variables: White, Black, Asian, Other, Unknown
<u>Criminal history and contact with CJS</u>		
Index offence	Categorical	13 broad categories, e.g. 'robbery', 'sexual offences'
Sentence length for index offence	Numerical	Continuous variable (no. days)
Offender has received an accredited intervention while in custody	Categorical	Binary variable. Values are No / Yes
Offender has undertaken the Drug Treatment Programme	Categorical	Binary variable. Values are No / Yes
Offender has undertaken the Sex Offender Treatment Programme	Categorical	Binary variable. Values are No / Yes
Offender has undertaken the General Offending Behaviour Programme	Categorical	Binary variable. Values are No / Yes
Age at first contact with CJS (and age squared)	Numerical	Integer values
Copas rate (including PNDs) ²⁶	Numerical	Continuous variable
Number of previous violent offences ²⁷	Numerical	Continuous variable
Number of previous robbery offences	Numerical	Continuous variable
Number of previous public order offences	Numerical	Continuous variable
Number of previous sexual offences	Numerical	Continuous variable
Number of previous sexual offences (child)	Numerical	Continuous variable
Number of previous burglary offences (domestic burglaries)	Numerical	Continuous variable
Number of previous burglary offences (other burglaries)	Numerical	Continuous variable
Number of theft offences	Numerical	Continuous variable
Number of handling offences	Numerical	Continuous variable
Number of previous fraud and forgery offences	Numerical	Continuous variable

²⁶ The Copas rate controls for the rate at which an offender has built up convictions throughout their criminal career. The higher the rate, the more convictions an offender has in a given amount of time, and the more likely it is that an offender will re-offend within one year. The Copas rate formula is

$$\text{copas rate} = \log_e \left(\frac{\text{Number of court appearances or cautions} + 1}{\text{Length of criminal career in years} + 10} \right)$$

²⁷ All previous offence variables exclude Penalty Notices for Disorder.

Number of previous drink driving offences	Numerical	Continuous variable
Number of previous criminal damage offences	Numerical	Continuous variable
Number of previous drug offences (import/export/production/supply)	Numerical	Continuous variable
Number of previous drug offences (possession/small scale supply)	Numerical	Continuous variable
Number of previous absconding or bail offences	Numerical	Continuous variable
Number of previous offences which resulted in a conviction	Numerical	Continuous variable
Number of previous offences which resulted in a caution	Numerical	Continuous variable
Number of previous offences committed in the year prior to index date	Numerical	Continuous variable
<u>Benefit and labour market history</u>		
Job density in offender's Local Authority	Continuous	Continuous variable (standardised)
Number of weeks in P45 employment in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving Jobseeker's Allowance in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving Employment & Support Allowance in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving Incapacity Benefit in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving Passported Incapacity Benefit in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving Severe Disablement Allowance in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving Income Support in year prior to sentence	Numerical	Values of 0-52
Number of weeks receiving a DWP out-of-work benefit in year prior to sentence	Numerical	Values of 0-52
Number of weeks on a DWP employment programme in year prior to sentence	Numerical	Values of 0-52
<u>OASys assessment variables</u>		
'Accommodation' criminogenic needs score	Numerical	Continuous variable
'Education, training and employability' criminogenic needs score	Numerical	Continuous variable
'Relationships' criminogenic needs score	Numerical	Continuous variable
'Lifestyle and associates' criminogenic needs score	Numerical	Continuous variable
'Drug misuse' criminogenic needs score	Numerical	Continuous variable
'Alcohol misuse' criminogenic needs score	Numerical	Continuous variable
'Thinking and behaviour' criminogenic needs score	Numerical	Continuous variable
'Attitude' criminogenic needs score	Numerical	Continuous variable
Work Skills	Categorical	2 binary vars, reflecting No Problems / Some Problems / Significant Problems
Attitude to Employment	Categorical	2 binary vars, reflecting No Problems / Some Problems / Significant Problems
Financial Situation	Categorical	2 binary vars, reflecting No Problems / Some Problems / Significant Problems
Financial Management	Categorical	2 binary vars, reflecting No Problems / Some Problems / Significant Problems
Illegal income from criminal activity	Categorical	2 binary vars, reflecting No Problems / Some Problems / Significant Problems
OASys re-offending predictor	Numerical	Continuous variable
OASys violence predictor	Numerical	Continuous variable

Annex C: Creating the comparison group - logistic regression model

The tables below show the variables that were used in the logistic regression model used in creating the matched control group. Many more variables were available for use (see annex B), but these are the ones that were important in predicting P45 employment after release from custody. From the model outputs we can see how different offender and offence characteristics affect whether an offender enters P45 employment on release from custody. In general, a positive coefficient means that that offender or offence characteristic increases the likelihood of entering P45 employment, and conversely, a negative coefficient means that that offender or offence characteristic decreases the likelihood of entering P45 employment. So, for example, offenders with more weeks in P45 employment in the year prior to custody are more likely to get employment after release, since ‘number of weeks in P45 employment in year prior to custody’ has a positive co-efficient. Some variables may have a more complex relationship with employment, however. Although receiving a NOMS accredited intervention while in custody appears to have a negative impact on an offender’s chances of gaining P45 employment, it is likely that this variable is actually capturing something else, i.e. the *type of offender who is given a NOMS accredited intervention*; most likely those who are ‘harder to help’²⁸.

²⁸ For help in interpreting logistic regression outputs, see www.ats.ucla.edu/stat/sas/dae/logit.htm

Logistic regression model predicting P45 employment after release for offenders with sentences of less than one year.

Parameter	Co-efficient	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	-0.0643	0.28460	0.0511	0.8212
Age at date of first contact with CJS	0.0214	0.00474	20.425	<.0001
Age at date of index offence	-0.0609	0.01550	15.4447	<.0001
Age at date of index offence, squared	0.00033	0.000215	2.3591	0.1246
Previous offences: Burglary (non-domestic)	0.0323	0.011600	7.7119	0.0055
Previous offences: Theft	-0.0104	0.00526	3.9455	0.047
Previous offences: Fraud and Forgery	0.0367	0.00907	16.3427	<.0001
Previous offences: Drink driving offences	0.0856	0.0251	11.5824	0.0007
Total number of previous convictions	-0.0051	0.0021	5.9625	0.0146
Total number of convictions in year prior to index offence	-0.0347	0.00788	19.4545	<.0001
Copas rate	-0.2729	0.0576	22.4396	<.0001
Number of weeks receiving Jobseeker's Allowance in year prior to custody	0.0248	0.0104	5.6524	0.0174
Number of weeks in P45 employment in year prior to custody	0.0221	0.00156	200.0271	<.0001
Number of weeks spent on a DWP employment programme	0.00589	0.00248	5.6243	0.0177
Number of weeks receiving Incapacity Benefit in year prior to custody	0.00725	0.0105	0.4795	0.4886
Number of weeks receiving Income Support in year prior to custody	0.00766	0.0107	0.514	0.4734
Number of weeks receiving Out Of Work benefits in year prior to custody	-0.0181	0.0104	3.0529	0.0806
Whether received an intervention while in custody	-0.3294	0.151	4.7602	0.0291
Whether attended the General Offending Behaviour Programme	-0.4429	0.3046	2.1144	0.1459
No problems with financial management	0.225	0.0697	10.409	0.0013
Serious problems with work skills	-0.1173	0.0897	1.7113	0.1908
No problems with employment history	-0.1183	0.0814	2.1132	0.146
No problems with attitude to employment	0.1606	0.0752	4.563	0.0327
Female	-0.2761	0.1049	6.9255	0.0085
Burglary	-0.2983	0.1287	5.371	0.0205
Index Offence: Other Indictable offence	-0.1386	0.0735	3.5533	0.0594
Ethnicity: Asian	-0.2118	0.1142	3.4408	0.0636
GOR: London	-0.212	0.0893	5.633	0.0176
GOR: South East	0.1507	0.076	3.9342	0.0473
GOR South West	0.2312	0.1084	4.5511	0.0329
Criminogenic Needs Score: Accommodation	-0.0146	0.00882	2.732	0.0984
Criminogenic Needs Score: Education, Training and Employability	-0.146	0.0242	36.3054	<.0001
Criminogenic Needs Score: Drug Misuse	-0.036	0.0114	9.9739	0.0016

Logistic regression model predicting P45 employment after release for offenders with sentences of one year or more.

Parameter	Co-efficient	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	0.7154	0.2335	9.389	0.0022
Age at date of first contact with CJS, squared	0.000165	0.000051	10.3973	0.0013
Age at date of index offence	-0.0427	0.0107	15.8545	<.0001
Age at date of index offence, squared	0.000231	0.000145	2.5364	0.1113
Previous offences: Sexual (child)	0.0303	0.018	2.829	0.0926
Previous offences: Fraud and Forgery	0.0131	0.0073	3.2228	0.0726
Previous offences: Drink driving offences	0.0386	0.024	2.5829	0.108
Previous offences: Criminal damage	-0.0286	0.0119	5.8049	0.016
Total number of previous cautions	0.0181	0.0138	1.7298	0.1884
Total number of previous convictions	-0.00028	0.00122	0.0527	0.8185
Total number of convictions in year prior to index offence	-0.0113	0.00697	2.6355	0.1045
Copas rate	-0.1323	0.044	9.0413	0.0026
Job density	0.0499	0.0204	5.9914	0.0144
Number of weeks receiving Jobseeker's Allowance in year prior to custody	0.00234	0.00169	1.931	0.1647
Weeks in P45 employment in year prior to custody	0.019	0.00124	233.9851	<.0001
Number of weeks spent on a DWP employment programme	0.00726	0.0022	10.8695	0.001
Number of weeks receiving Income Support in year prior to custody	-0.00862	0.00259	11.1059	0.0009
Attended Drug Treatment Programme while in custody	-0.1779	0.081	4.829	0.028
No problems with financial management	0.094	0.0578	2.6415	0.1041
No problems with work skills	-0.105	0.0634	2.7388	0.0979
Illegal income from criminal activity: Some problems	-0.1506	0.0526	8.2133	0.0042
No problems with unemployment	-0.2676	0.0672	15.855	<.0001
Index offence: Drug offences	0.1633	0.0638	6.5519	0.0105
Index offence: Fraud and Forgery	0.311	0.1290	5.8177	0.0159
Index offence: Robbery	0.218	0.0664	10.7858	0.0010
Index offence: Sexual offences	-0.1323	0.0915	2.0923	0.1480
Index offence: Violence	0.1287	0.0553	5.4245	0.0199
Ethnicity: Black	-0.1183	0.0724	2.6741	0.1020
Ethnicity: Other (Not White, Black or Asian)	0.4522	0.2300	3.8661	0.0493
GOR: London	-0.2337	0.0690	11.4799	0.0007
GOR: North East	-0.2154	0.0922	5.4603	0.0195
GOR: North West	-0.1102	0.0571	3.7269	0.0535
GOR: South West	0.1775	0.0913	3.7771	0.0520
GOR: Wales	-0.1586	0.0924	2.9472	0.0860
GOR: West Midlands	-0.1585	0.0685	5.3483	0.0207
Total criminogenic needs score	-0.0436	0.0183	5.6555	0.0174
Criminogenic Needs Score: Education, Training and Employability	-0.1953	0.0207	89.2392	<.0001
Criminogenic Needs Score: Drug Misuse	-0.0237	0.0104	5.2379	0.0221
Criminogenic Needs Score: Alcohol Misuse	0.0326	0.0107	9.3022	0.0023
Criminogenic Needs Score: Attitudes	-0.0396	0.0123	10.3005	0.0013

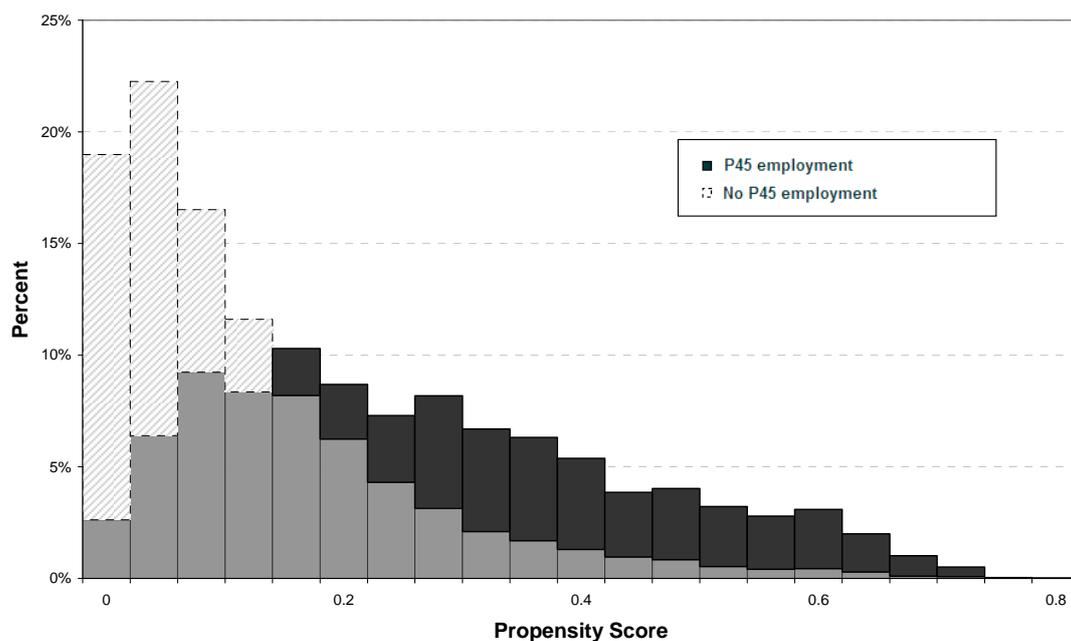
Annex D: Distributions of propensity scores before and after matching

These histograms show the distribution of propensity scores before and after matching. There was a large overlap (region of common support) in propensity scores between the two groups, which meant that we could find a match within the calliper for 97 per cent of offenders in P45 employment after release, which is very good. Offenders who do not have a P45 employment spell after release have propensity scores clustered near the bottom (left) of the distribution, as they have a lower propensity to enter P45 employment on release. The 'overlap' in propensity scores is the area shaded grey. As there are roughly three times as many offenders who do not get P45 employment, although there may not be that much overlap in the percentages, the overlap in absolute terms will be greater.

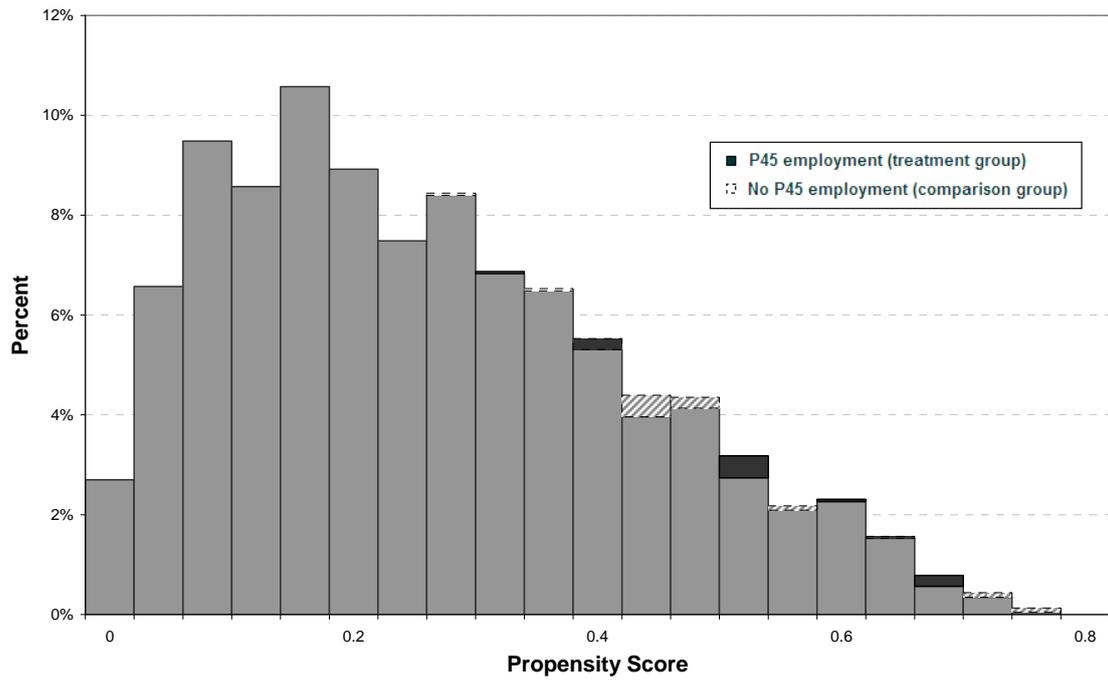
After matching, the propensity scores are much more similar across the two groups. The vast majority of the chart is grey, showing the overlap in propensity scores. The matching was successful, as only 3 per cent of the P45 employment group were off common support.

Custodial sentences of less than one year:

Distribution of propensity scores before matching

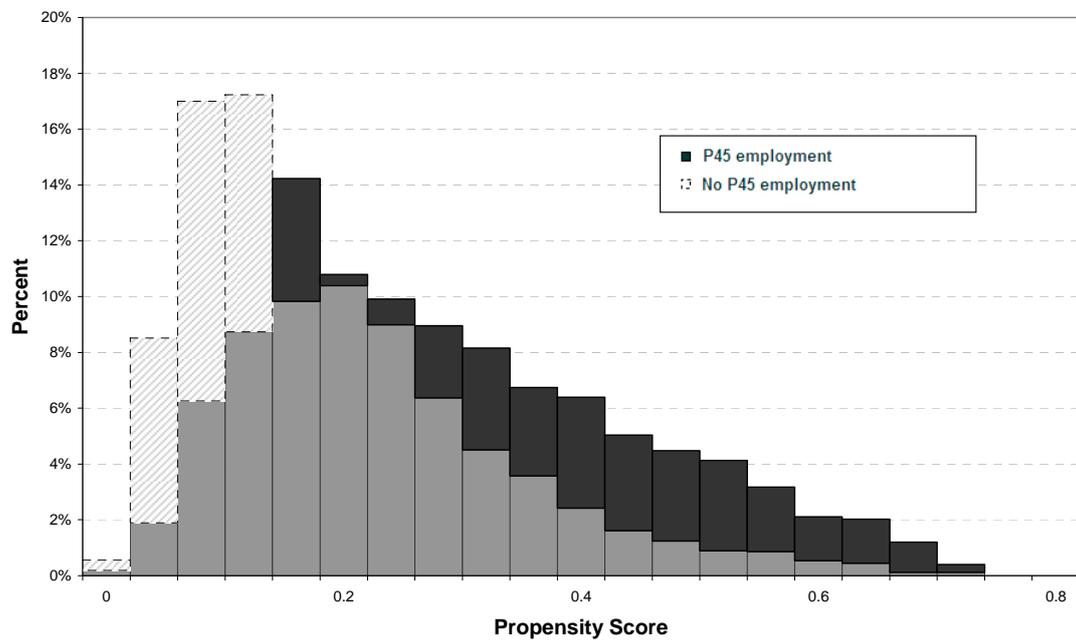


Distribution of propensity scores after matching

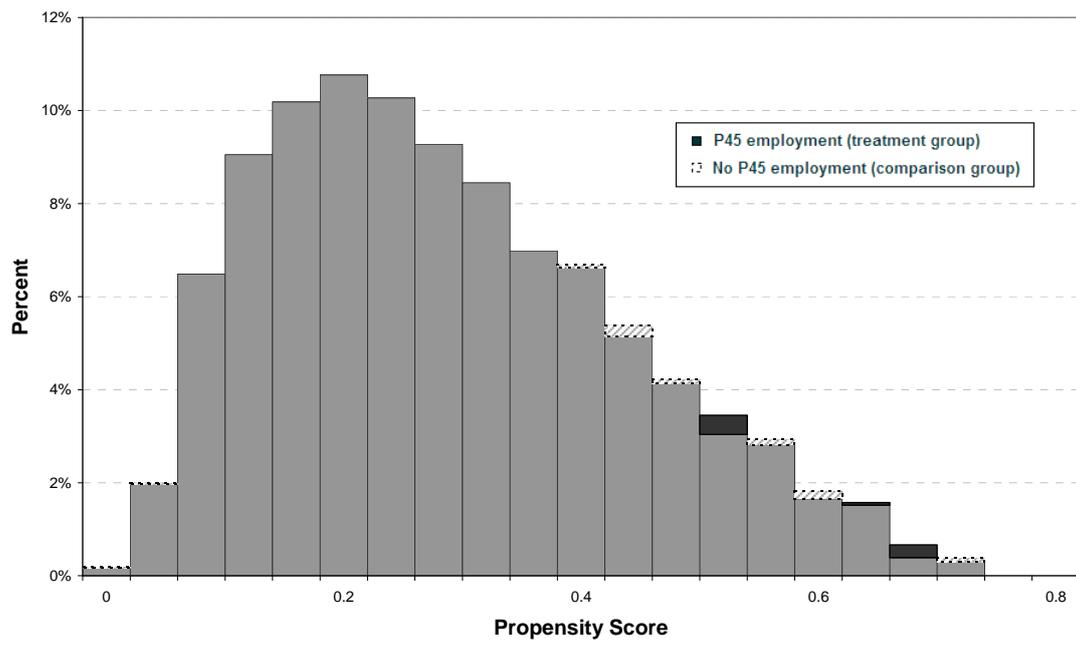


Custodial sentences of one year or more:

Distribution of propensity scores before matching



Distribution of propensity scores after matching



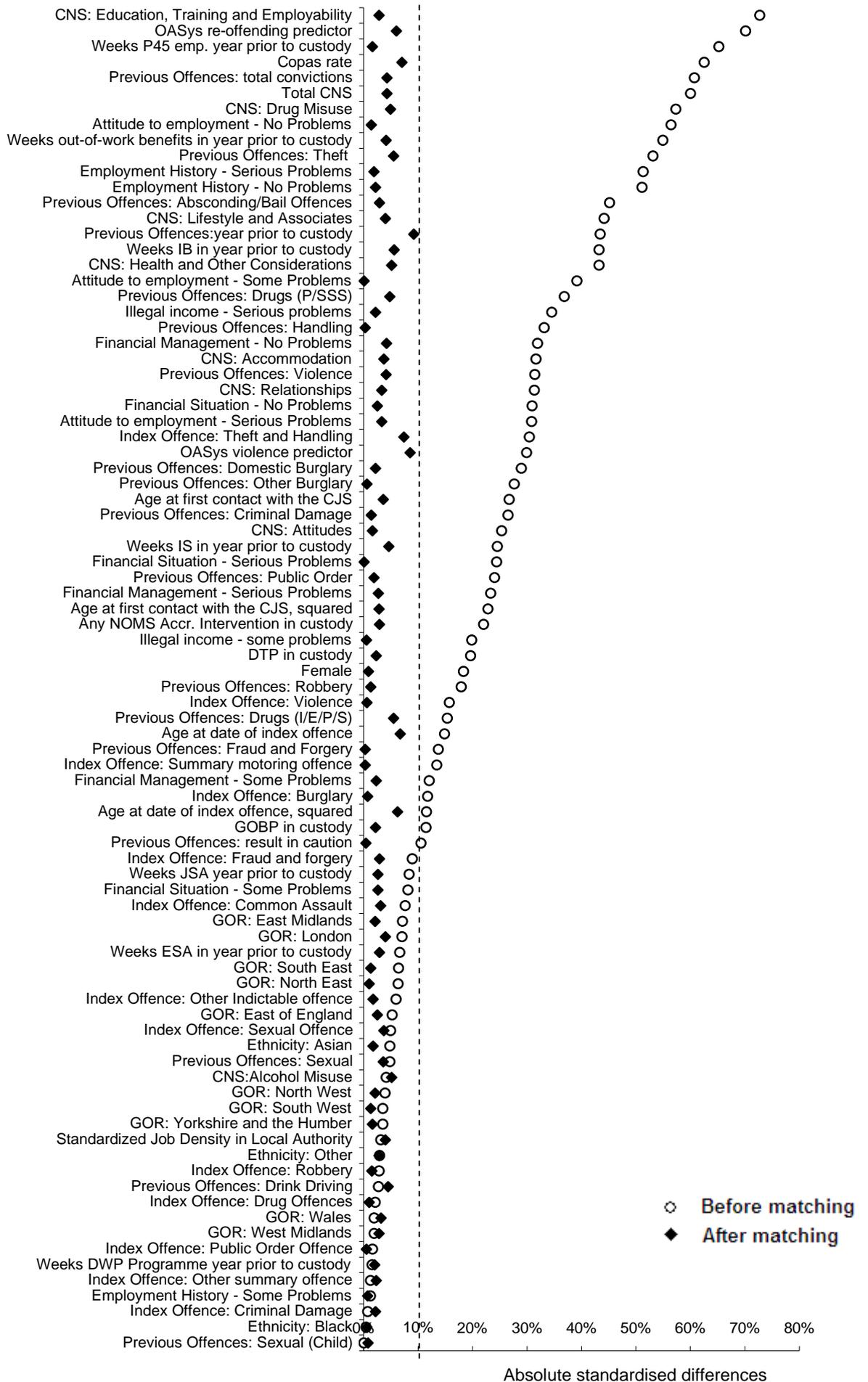
Annex E: Assessing balance after matching

After the matching, it is important to assess how similar the two groups (treatment (in P45 employment on release) and control (no P45 employment on release)) are. This helps us gauge the quality of the matching. The two groups should be identical on all characteristics except for P45 employment on release. Standardised differences between the treatment and control group of less than 10 per cent in each variable tell us that the groups are well-balanced after the matching. The chart below shows all variables and their standardised differences after matching. The tables below give variable means and standardised differences before and after matching.

Glossary for chart:

CJS	Criminal Justice System
CNS	Criminogenic Needs Score
Drugs (I/E/P/S)	Import, Export, Production, Supply
Drugs (P/SSS)	Possession, Small Scale Supply
DTP	Drug Treatment Programme
GOBP	General Offending Behaviour Programme
P45 emp.	P45 employment
SOTP	Sex Offender Treatment Programme

Characteristics before and after matching: sentences less than one year

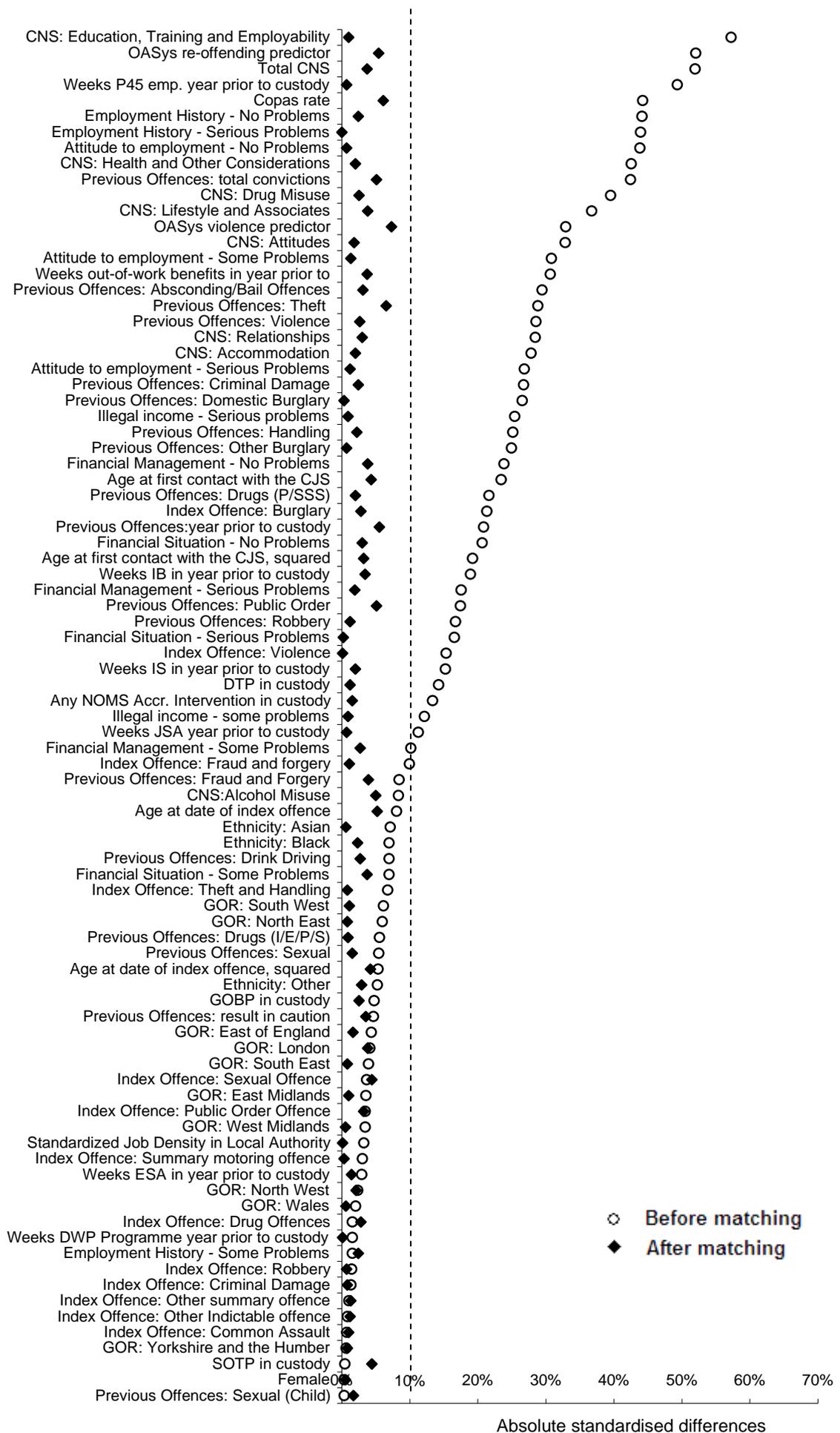


Characteristics of offenders before and after matching: sentences less than one year

	Before Matching			After Matching		
	No P45 Employment (Control group)	P45 Employment (Treatment group)	absolute standardised difference	No P45 Employment (Control group)	P45 Employment (Treatment group)	absolute standardised difference
N:	12,190	2,360		2,298	2,298	
Female	11.60%	6.40%	18%	6.60%	6.40%	1%
Black	7.70%	7.60%	0%	7.90%	7.70%	1%
Asian	4.30%	5.30%	5%	5.70%	5.40%	2%
Other	0.50%	0.80%	3%	1.00%	0.70%	3%
Criminal History:						
Age at first contact with the CJS	17.5	19.5	27%	19.7	19.4	4%
Age at first contact with the CJS, squared	348.7	454.7	23%	462.6	447.8	3%
Age at date of index offence	29.8	28.4	15%	29.1	28.5	7%
Age at date of index offence, squared	978.6	901.5	12%	945.6	902.4	6%
Index Offence: Burglary	6.3%	3.7%	12%	4.0%	3.8%	1%
Index Offence: Common Assault	11.1%	13.6%	8%	14.8%	13.7%	3%
Index Offence: Criminal Damage	2.8%	2.7%	1%	2.3%	2.7%	2%
Index Offence: Drug Offences	3.2%	3.6%	2%	3.4%	3.5%	1%
Index Offence: Fraud and forgery	1.8%	3.2%	9%	3.6%	3.1%	3%
Index Offence: Other Indictable offence	13.2%	15.2%	6%	15.6%	15.0%	2%
Index Offence: Other summary offence	6.0%	5.7%	1%	5.1%	5.7%	2%
Index Offence: Public Order Offence	2.3%	2.5%	2%	2.7%	2.6%	1%
Index Offence: Robbery	0.6%	0.8%	3%	0.7%	0.8%	2%
Index Offence: Sexual Offence	0.7%	1.1%	5%	1.6%	1.2%	4%
Index Offence: Summary motoring offence	8.4%	12.5%	13%	12.6%	12.5%	0%
Index Offence: Theft and Handling	27.3%	15.0%	30%	12.8%	15.3%	7%
Index Offence: Violence	12.0%	17.5%	16%	17.1%	17.3%	1%
<u>Mean number of previous offences:</u>						
Previous Offences: Violence	3.5	2.4	31%	2.3	2.4	4%
Previous Offences: Robbery	0.3	0.1	18%	0.1	0.1	1%
Previous Offences: Public Order	2.0	1.2	24%	1.1	1.2	2%
Previous Offences: Sexual	0.1	0.0	5%	0.1	0.0	4%
Previous Offences: Sexual (Child)	0.1	0.1	0%	0.1	0.1	1%
Previous Offences: Domestic Burglary	1.1	0.5	29%	0.5	0.5	2%
Previous Offences: Other Burglary	1.6	0.8	28%	0.8	0.8	1%
Previous Offences: Theft	8.8	2.9	53%	2.6	3.0	6%
Previous Offences: Handling	1.0	0.4	33%	0.4	0.4	0%
Previous Offences: Fraud and Forgery	1.1	0.7	14%	0.7	0.7	0%
Previous Offences: Drink Driving	0.5	0.6	3%	0.5	0.6	5%
Previous Offences: Criminal Damage	2.1	1.4	27%	1.4	1.4	1%
Previous Offences: Drugs (Import/Export/Production/Supply)	0.1	0.1	15%	0.1	0.1	6%
Previous Offences: Drugs (Possession/Small Scale Supply)	1.5	0.8	37%	0.9	0.8	5%
Previous Offences: Absconding or Bail Offences	3.5	1.9	45%	1.8	1.9	3%
Previous Offences that resulted in a caution	1.5	1.3	11%	1.3	1.3	0%
Previous Offences that resulted in a court conviction	38.5	19.4	61%	18.8	19.8	4%
Previous Offences in year prior to custody	4.9	3.0	43%	2.8	3.1	9%
Copas rate	-0.4	-0.9	63%	-0.9	-0.9	7%

Interventions:						
Received the Drug Treatment Programme in custody	6.50%	2.50%	20%	2.20%	2.50%	2%
Received the General Offending Behaviour Programme in custody	2.00%	0.70%	11%	0.50%	0.70%	2%
Received any Prison Accredited Intervention	8.00%	3.00%	22%	2.60%	3.10%	3%
Government Office Region:						
East Midlands	9%	11%	7%	10%	11%	2%
East of England	8%	10%	5%	9%	10%	3%
London	11%	9%	7%	10%	9%	4%
North East	6%	5%	6%	4%	5%	1%
North West	16%	14%	4%	15%	14%	2%
South East	11%	13%	6%	13%	13%	1%
South West	7%	8%	4%	7%	7%	1%
Wales	6%	6%	2%	7%	6%	3%
West Midlands	12%	11%	2%	12%	11%	3%
Yorkshire and the Humber	11%	10%	4%	9%	10%	2%
Labour Market:						
Standardised Job Density in Local Authority	0.0	0.0	3%	0.0	0.0	4%
Weeks in P45 employment in year prior to custody	4.3	15.4	65%	14.2	14.6	2%
Weeks receiving Jobseeker's Allowance in year prior to custody	9.7	8.5	8%	8.4	8.7	3%
Weeks in DWP Programme in year prior to custody	2.6	2.7	2%	2.6	2.8	2%
Weeks receiving Incapacity Benefit in year prior to custody	10.5	3.5	43%	4.3	3.6	6%
Weeks receiving Employment and Support Allowance in year prior to custody	0.2	0	7%	0.1	0	3%
Weeks receiving Income Support in year prior to custody	4.2	1.6	25%	2	1.6	5%
Weeks receiving out-of-work benefits in year prior to custody	24.8	13.6	55%	14.8	14	4%
OASys Assessment:						
OASys re-offending predictor	60.9	44.9	70%	44.2	45.5	6%
OASys violence predictor	39.9	34.5	30%	33.3	34.8	9%
Illegal income - some problems	21%	14%	20%	14%	14%	1%
Illegal income - Serious problems	24%	11%	35%	11%	11%	2%
Financial Management - No Problems	32%	47%	32%	49%	47%	4%
Financial Management - Some Problems	41%	35%	12%	35%	36%	2%
Financial Management - Serious Problems	27%	17%	23%	17%	18%	3%
Employment History - No Problems	15%	37%	51%	37%	36%	2%
Employment History – Some Problems	46%	46%	1%	47%	47%	1%
Employment History - Serious Problems	39%	17%	51%	16%	17%	2%
Attitude to employment – No Problems	45%	72%	56%	72%	71%	1%
Attitude to employment - Some Problems	41%	23%	39%	24%	24%	0%
Attitude to employment - Serious Problems	14%	5%	31%	4%	5%	3%
Financial Situation - No Problems	27%	41%	31%	42%	41%	3%
Financial Situation - Some Problems	42%	38%	8%	37%	39%	3%
Financial Situation – Serious Problems	31%	20%	24%	21%	20%	0%
Accommodation Criminogenic Score	3.1	2.1	32%	2.1	2.2	4%
Education, Training and Employability Criminogenic Needs Score	4.5	2.8	73%	2.8	2.9	3%
Relationships Criminogenic Needs Score	2.6	2.0	31%	2.0	2.1	3%
Lifestyle and Associates Criminogenic Needs Score	3	2.3	44%	2.2	2.3	4%
Drug Misuse Criminogenic Needs Score	3.3	1.7	57%	1.6	1.7	5%
Alcohol Misuse Criminogenic Needs Score	3	2.8	4%	2.7	2.9	5%
Attitudes Criminogenic Needs Score	4.6	4.1	25%	4.1	4.1	2%
Health and Other Considerations Criminogenic Needs Score	3.1	2.2	43%	2.2	2.3	5%
Total Criminogenic Needs Score	5.3	4.1	60%	4	4.1	4%

Characteristics before and after matching: sentences of one year or more



Characteristics of offenders before and after matching: sentences of one year or more

	Before Matching			After Matching		
	No P45 employment (Control group)	P45 employment (Treatment group)	absolute standardised difference	No P45 employment (Control group)	P45 employment (Treatment group)	absolute standardised difference
N:	12,320	3,753		3,622	3,622	
Female	6%	6%	0%	6%	6%	1%
Black	11%	9%	7%	10%	9%	2%
Asian	5%	6%	7%	6%	6%	1%
Other	0%	1%	5%	1%	1%	3%
Criminal History:						
Age at first contact with the CJS	17.9	20	23%	20.3	19.9	4%
Age at first contact with the CJS, squared	385.1	500.1	19%	516.7	494.8	3%
Age at date of index offence	31.4	30.6	8%	31.2	30.7	5%
Age at date of index offence, squared	1097.3	1053.9	5%	1093.9	1059	4%
Index Offence: Burglary	19%	12%	21%	11%	12%	3%
Index Offence: Common Assault	1%	1%	1%	1%	1%	1%
Index Offence: Criminal Damage	2%	2%	1%	2%	2%	1%
Index Offence: Drug Offences	15%	16%	2%	17%	16%	3%
Index Offence: Fraud and forgery	2%	3%	10%	3%	3%	1%
Index Offence: Other Indictable offence	11%	11%	1%	11%	11%	1%
Index Offence: Other summary offence	1%	0%	1%	0%	0%	1%
Index Offence: Public Order Offence	0%	0%	3%	0%	0%	3%
Index Offence: Robbery	12%	13%	1%	13%	13%	1%
Index Offence: Sexual Offence	7%	8%	4%	9%	8%	4%
Index Offence: Summary motoring offence	1%	1%	3%	1%	1%	0%
Index Offence: Theft and Handling	6%	5%	7%	5%	5%	1%
Index Offence: Violence	20%	27%	15%	26%	26%	0%
<u>Mean number of previous offences:</u>						
Previous Offences: Violence	2.9	2.0	29%	2.0	2.0	3%
Previous Offences: Robbery	0.4	0.2	17%	0.2	0.2	1%
Previous Offences: Public Order	1.3	0.9	17%	0.9	0.9	5%
Previous Offences: Sexual	0.1	0.1	5%	0.1	0.1	2%
Previous Offences: Sexual (Child)	0.1	0.1	0%	0.1	0.1	2%
Previous Offences: Domestic Burglary	1.9	1.0	27%	1.0	1.0	0%
Previous Offences: Other Burglary	1.9	1.0	25%	1.0	1.0	1%
Previous Offences: Theft	5.3	2.9	29%	2.6	3.0	7%
Previous Offences: Handling	1.1	0.6	25%	0.6	0.6	2%
Previous Offences: Fraud and Forgery	1.0	0.7	8%	0.6	0.7	4%
Previous Offences: Drink Driving	0.4	0.3	7%	0.3	0.3	3%
Previous Offences: Criminal Damage	1.7	1.1	27%	1.1	1.1	2%
Previous Offences: Drugs (Import/Export/Production/Supply)	0.2	0.1	6%	0.1	0.1	1%
Previous Offences: Drugs (Possession/Small Scale Supply)	1.4	0.9	22%	0.9	1.0	2%
Previous Offences: Absconding or Bail Offences	2.1	1.3	29%	1.3	1.4	3%
Previous Offences that resulted in a caution	1.1	1.0	5%	1.0	1.1	4%
Previous Offences that resulted in a court conviction	32.1	19.0	42%	18.3	19.6	5%

Previous Offences in year prior to custody	2.4	1.7	21%	1.5	1.7	6%
Copas rate	-0.8	-1.2	44%	-1.2	-1.2	6%
Interventions:						
Received the Drug Treatment Programme in custody	10%	6%	14%	6%	6%	1%
Received the General Offending Behaviour Programme in custody	6%	5%	5%	4%	5%	3%
Received the Sex Offender Treatment Programme	0%	0%	0%	1%	0%	4%
Received any Prison Accredited Intervention	14%	10%	13%	10%	10%	2%
Government Office Region:						
East Midlands	8%	9%	4%	9%	9%	1%
East of England	7%	8%	4%	8%	8%	2%
London	13%	11%	4%	13%	12%	4%
North East	6%	5%	6%	5%	5%	1%
North West	18%	17%	2%	16%	17%	2%
South East	10%	12%	4%	11%	12%	1%
South West	4%	6%	6%	6%	6%	1%
Wales	6%	5%	2%	5%	5%	1%
West Midlands	11%	10%	3%	10%	10%	1%
Yorkshire and the Humber	11%	12%	1%	11%	11%	1%
Labour Market:						
Standardised Job Density in Local Authority	0	0	3%	0	0	0%
Weeks in P45 employment in year prior to custody	4.9	13.2	49%	12.2	12.1	1%
Weeks receiving Jobseeker's Allowance in year prior to custody	7.8	6.4	11%	6.5	6.6	1%
Weeks in DWP Programme in year prior to custody	1.9	2	2%	2	2.1	0%
Weeks receiving Incapacity Benefit in year prior to custody	7.9	5	19%	5.6	5.1	3%
Weeks receiving Employment and Support Allowance in year prior to custody	0.1	0.1	3%	0.1	0.1	1%
Weeks receiving Income Support in year prior to custody	2.6	1.3	15%	1.5	1.4	2%
Weeks receiving out-of-work benefits in year prior to custody	18.7	12.8	31%	13.9	13.2	4%
OASys Assessment:						
OASys re-offending predictor	52.2	39.5	52%	39	40	5%
OASys violence predictor	34.8	29	33%	28	29	7%
Illegal income - some problems	22%	17%	12%	17%	18%	1%
Illegal income - Serious problems	31%	20%	25%	21%	20%	1%
Financial Management - No Problems	38%	50%	24%	51%	49%	4%
Financial Management - Some Problems	40%	35%	10%	34%	35%	3%
Financial Management - Serious Problems	22%	15%	18%	15%	15%	2%
Employment History - No Problems	20%	40%	44%	40%	38%	2%
Employment History - Some Problems	43%	42%	2%	42%	43%	2%
Employment History - Serious Problems	37%	18%	44%	18%	18%	0%
Attitude to employment - No Problems	54%	75%	44%	74%	74%	1%
Attitude to employment - Some Problems	35%	22%	31%	22%	22%	1%
Attitude to employment - Serious Problems	10%	4%	27%	4%	4%	1%
Financial Situation - No Problems	36%	46%	21%	47%	45%	3%
Financial Situation - Some Problems	40%	36%	7%	35%	37%	4%
Financial Situation - Serious Problems	24%	18%	17%	18%	18%	1%
Accommodation Criminogenic Score	3.0	2.1	28%	2.1	2.2	2%
Education, Training and Employability Criminogenic Needs Score	4.2	2.9	57%	3.0	3.0	1%
Relationships Criminogenic Needs Score	2.4	1.9	28%	1.9	1.9	3%
Lifestyle and Associates Criminogenic Needs Score	3.1	2.5	37%	2.5	2.5	4%

Drug Misuse Criminogenic Needs Score	2.9	1.8	40%	1.8	1.9	3%
Alcohol Misuse Criminogenic Needs Score	2.1	1.9	8%	1.8	1.9	5%
Attitudes Criminogenic Needs Score	4.3	3.6	33%	3.6	3.7	2%
Health and Other Considerations Criminogenic Needs Score	2.8	2.0	43%	2.0	2.1	2%
Total Criminogenic Needs Score	4.9	3.8	52%	3.8	3.9	4%

Annex F: Testing the difference in re-offending rates

The tables below show whether matched pairs are concordant (both offenders within the pair do re-offend, or both do not re-offend) or discordant, and the direction of the effect of P45 employment. Where the pairs are discordant, there are more pairs where comparison group member re-offends but the offender with a P45 employment spell does not, than the reverse. This suggests that P45 employment reduces the likelihood of re-offending.

A: Custodial sentences less than one year

Comparison Group	P45 Employment group	
	No proven re-offence within one year	Proven re-offence within one year
No proven re-offence within one year	979	361
Proven e-offence within one year	578	380

McNemar's Test	
Statistic (S)	50.1480
DF	1
Asymptotic Pr > S	<0.0001
Exact	1.4×10^{-12}

There is not a clear consensus in the literature about whether or not paired tests should be used to test for differences between the matched groups in PSM; therefore we also used independent samples t-tests to test for significance. The t-test also showed that re-offending was significantly lower in the P45 employment group than in the matched comparison group; $t(4581) = 6.67, p < 0.0001$.

Sensitivity testing for difference in re-offending rates (using McNemar’s test²⁹) – testing for effect of unobserved variable: Sensitivity Analysis I

The upper bound of the p value can tell us whether the effect of P45 employment on release would be significant, even if there was an unobserved variable which increased the odds of P45 employment on release by 5 per cent, 10 per cent, 15 per cent etc. In our analysis, even if there was an unobserved variable which increased the odds of employment on release by 25 per cent, P45 employment would still have a significant effect on reducing re-offending.

Gamma	P +	p -	p (lower bound)	p (upper bound)
1.00	0.50000	0.50000	8.9×10^{-13}	8.9×10^{-13}
1.05	0.51220	0.48780	3.1×10^{-15}	8.9×10^{-13}
1.10	0.52381	0.47619	0	0.000000012
1.15	0.53488	0.46512	0	0.000000523
1.20	0.54545	0.45455	0	0.000012337
1.25	0.55556	0.44444	0	0.000174846

The upper bound reflects the highest possible value of p when we introduce an unobserved binary variable which increases the odds of P45 employment on release. If p becomes greater than 0.05 we can no longer conclude that P45 employment has a statistically statistical effect on re-offending.

B: Custodial sentences of one year or more

Comparison Group	P45 Employment group	
	No proven re-offence within one year	Proven re-offence within one year
No proven re-offence within one year	2,262	476
Proven re-offence within one year	680	204

McNemar’s Test	
Statistic (S)	36.0000
DF	1
Asymptotic Pr > S	<.0001
Exact	2.2×10^{-9}

²⁹ McNemar’s test is used to compare proportions (such as re-offending rates) in paired data.

An independent samples t-test also showed that re-offending was significantly lower in the P45 employment group than in the matched comparison group; $t(7,177) = 5.84, p < 0.0001$.

Sensitivity testing for difference in re-offending rates

Even if there was an unobserved variable which increased the odds of employment on release by 25 per cent, P45 employment on release would still have a significant effect on reducing re-offending.

Gamma	P +	p -	p (lower bound)	p (upper bound)
1.00	0.50000	0.50000	1.5×10^{-9}	0.000000
1.05	0.51220	0.48780	6.3×10^{-9}	0.000000
1.10	0.52381	0.47619	1.8×10^{-14}	0.000009
1.15	0.53488	0.46512	0	0.000235
1.20	0.54545	0.45455	0	0.003083
1.25	0.55556	0.44444	0	0.023152

Hazard ratios

Cox proportional hazard models were fitted to the matched samples, so that we could obtain hazard ratios for re-offending.

As the propensity score matched sample does not consist of independent observations, we used a Cox proportional hazards model that stratified on the matched pairs (Cummings, McKnight, & Greenland, 2003). This approach accounts for the within-pair homogeneity by allowing the baseline hazard function to vary across matched sets. We also fit a Cox proportional hazard model with robust standard errors (Lin & Wei, 1989) to ensure that the hazard ratio was fairly similar when using either choice of suitable model.

The hazard ratio is an expression of the hazard or chance of re-offending for offenders who entered P45 employment after release as a ratio of the hazard of re-offending occurring in the matched comparison group. For us to be able to say with confidence that re-offending occurs earlier in the absence of a P45 employment spell after release, the hazard ratio must be less than one and the upper limit of the 95% confidence interval of the hazard ratio must also be less than 1, which is the case for both samples in this analysis. The hazard

ratio also allows us to calculate the probability that an offender with a P45 employment spell after release will re-offend before an offender from the matched comparison group³⁰.

Sentences less than one year

The only predictor variable in the Cox proportional hazard model was P45 employment on release, stratified on the matched pairs. The hazard ratio for P45 employment compared to no P45 employment was 0.62 (95% CI=[0.56, 0.70], $p < 0.0001$). This corresponds to a 38 per cent chance of an offender in P45 employment re-offending before an offender from the matched comparison group.

When the alternative univariate Cox proportional hazards model was fit and a robust variance estimate was obtained, the associated hazards ratio was 0.69 (95% CI=[0.63,0.76], $p < 0.0001$). This corresponds to a 41 per cent chance of an offender in P45 employment re-offending before an offender in the matched comparison group.

This shows that offenders with P45 employment have a lower hazard of re-offending than the matched comparison group and that the hazards ratio is fairly similar in both models.

Sentences of one year or more

When we fitted a Cox proportional hazard model which was stratified on the matched pairs, the hazard ratio for P45 employment compared to no P45 employment was 0.70 (95% CI=[0.62, 0.78], $p < 0.0001$). This corresponds to a 41 per cent chance of an offender in P45 employment re-offending before an offender from the matched comparison group.

When we fitted a univariate Cox proportional hazards model with a robust variance estimate, the associated hazards ratio was 0.72 (95% CI=[0.66,0.80], $p < 0.0001$). This corresponds to a 42 per cent chance of an

³⁰ This can be calculated by **Probability = (hazard ratio) / (1 + hazard ratio)**

offender in P45 employment re-offending before an offender from the matched comparison group.

For custodial sentences of greater than one year, offenders with P45 employment have a lower hazard of re-offending than the matched comparison group and the hazards ratio is very similar in both models.

Annex G: Benefit and P45 employment status of all offenders released from custody and offenders serving sentences in the community in 2008

The analysis in the main body of this publication presents findings on the impact P45 employment has on re-offending for a sample of offenders released from prison in 2008.

To improve the quality of the matching and analysis, only offenders who had an OASys assessment were included in the analysis -these tend to be the more serious offenders with higher needs³¹. However, the key limitation of restricting the analysis to offenders with OASys assessments is that it means that the findings can not be generalised to all prisoners.

In addition, the analysis focused on offenders released from custody. The methodology used was not found to be appropriate to extend the analysis to see the impact employment has on re-offending for offenders serving sentences in the community.

Therefore, the following descriptive statistics are included to provide contextual information on the benefit and P45 employment status of **all** offenders released from prison in 2008 (i.e. not just those with an OASys assessment) and those sentenced to serving sentences in the community in 2008.

The descriptive statistics show the benefit and P45 employment status of offenders up to two years before and after their sentence.

Key findings

Offenders serving custodial sentences

Benefit status:

- Around half of all offenders released from custody in 2008 claimed benefits on release – 51 per cent of all offenders released from custody in 2008 were claiming benefits one week after release, with 50 per cent claiming benefits two years after release

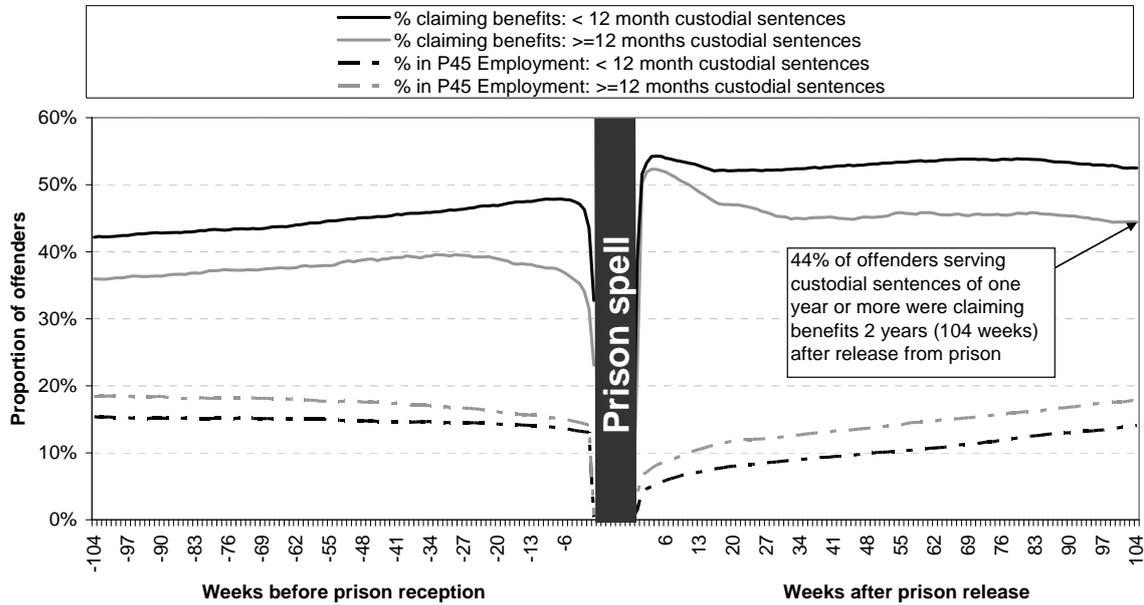
³¹ See Chapter 2 of publication for further information on the difference between offenders given an OASys assessment and those offenders who are not.

- During the two year period after release from custody in 2008, 82 per cent of offenders made a new benefit claim **at some point** in those two years.
- Offenders serving custodial sentences of under twelve months are slightly more likely to be claiming benefits than those offenders serving custodial sentences of twelve or more months - particularly a few years after release from prison:
 - 52 per cent of offenders serving custodial sentences of under twelve months were claiming benefits one week after release in 2008, with 53 per cent of these offenders claiming benefits two years after release.
 - 50 per cent of offenders serving custodial sentences of twelve months or more were claiming benefits one week after release in 2008, falling to 44 per cent of offenders claiming benefits two years after release.

P45 employment status:

- Around 5 per cent of offenders released from custody in 2008 are in some form of P45 employment a few weeks after release from prison. The proportion in P45 employment increases to 15 per cent of offenders in P45 employment two years following release from custody.
- During the two year period following release from custody overall, 29 per cent of offenders started P45 employment **at some point**.
- Offenders serving custodial sentences of twelve months or more are slightly more likely to be in P45 employment than offenders serving shorter sentences. 14 per cent of offenders serving custodial sentences of under twelve months were in P45 employment two years after release, compared to 18 per cent of offenders serving longer custodial sentences.

P45 employment and benefit status of offenders released from custody in 2008 – by sentence length: Under one year sentences (<12 month), one year or more sentences (>=12 months)



Note: This chart tracks offenders’ benefit and P45 employment status for two years prior to prison reception date, and two years after release from prison. The “prison spell” bar in the chart indicates the time offenders spent in prison but is for illustration purposes only to show that it is not a continuous period.

Offenders serving sentences in the community

	Proportion of offenders	
	Claimed Benefits	In P45 employment
4 weeks before sentence date	42%	26%
Sentence Date	44%	25%
2 weeks after sentence date	46%	25%
2 years after sentence date	51%	30%

Benefit status:

- 44 per cent of offenders sentenced to a community sentence or suspended sentence order (SSO) in 2008 were claiming benefits at the time of sentence, with 51 per cent claiming benefits two years after the sentence date.

- During the two year period following their sentence date, 77 per cent of offenders serving sentences in the community made a new benefit claim **at some point**.

P45 employment status:

- Offenders serving sentences in the community (Community sentences and SSOs) in 2008 were more likely to be in P45 employment than offenders released from custodial sentences. A quarter of offenders sentenced to sentences in the community were in P45 employment at the time of sentence, compared to 30 per cent in P45 employment two years after their sentence date.
- During the two year period following their sentence date, 51 per cent of offenders serving sentences in the community were in P45 employment **at some point**.

The table below provides a cumulative measure of benefit and P45 employment status over the two year period for offenders released from prison in 2008, or sentenced to a community sentence/SSO in 2008. This does not mean that the offender was claiming benefits, or in P45 employment at the two year point following release from prison / sentence date – just that they had one (or more) of those statuses **at some point** in the two years following release / sentence date.

Proportion of offenders released from custody or starting community sentences in 2008 who claimed benefits or were in P45 employment at some point in the two years following release / sentence date

	Proportion of offenders who either claimed benefits or were in P45 employment <u>at some point</u> in the two years after release from custody, or sentence date	
	Claimed benefits	In P45 Employment
Offenders released from custody in 2008:		
Under 12 month custodial sentences	83%	30%
Twelve month or more custodial sentences	79%	34%
All offenders released from custody	82%	31%
Offenders starting community sentences in 2008 (Community Sentences /Suspended Sentence Orders)	77%	51%

These descriptive statistics relate to offenders released from custody or who started a community sentence (including an SSO) in 2008 to allow enough time to track the benefit and P45 employment status up to two years after release / sentence date. However, we know that the actual proportion of offenders claiming benefits has increased since 2008³², which we think is due to the recession – in line with the increase in the proportion of the general population who claim benefits.

Please contact us if you would like further information on the benefit and P45 employment status of offenders. We will be extending this analysis in future with the new ongoing data share between MoJ, DWP and HMRC. We would be grateful for any feedback or suggestions for further analysis using our linked data.

³² See Chapter 2 of “Offending, employment and benefits – emerging findings from the data linkage project”

Contact points for further information

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