DNA RETENTION POLICY: RESULTS OF ANALYSIS RELATING TO THE PROTECTIONS OF 'THE SCOTTISH MODEL'

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1. Introduction

The Coalition Agreement[1] contains a commitment to introduce a policy framework for managing the DNA database which affords 'the protections of the Scottish model of DNA retention'. This paper presents the results of analyses undertaken by the Home Office Economics and Resource Analysis Group (ERAG) on the salient aspects of the Scottish retention model. These analyses are based on data on arrests and convictions obtained from the Police National Computer (PNC). They consider the offending behaviour of individuals in the time period following different types of criminal justice system (CJS) event (e.g. arrest with no further action, caution or conviction) and for different types of individual and offence.

2. Conceptual approach adopted in the ERAG analysis

The broad conceptual approach to examining the issues relevant to DNA retention policy was to consider how the behaviour of individuals who might be subject to a particular policy compares with individuals who would not be subject to the policy but who are otherwise similar. For instance, the behaviour of individuals with no previous convictions, who are arrested for an offence but not convicted, might be compared with that of other individuals who have not previously been arrested or received a conviction.

A significant difference in behaviour between groups of individuals could be said to provide a *prima facie* case for having differential policy treatment of them. Where behaviour is different but changes over time, differential treatment could be said to be *prima facie* justified for as long as behaviour is significantly different. This might be specifically relevant to the question of whether DNA retention should be temporary, and if so, for how long. However, this approach would be considering only offending risk as a possible basis for the case for differential treatment. There might, of course, be other justifications for differential treatment.

Individuals' behaviour can be measured in terms of the risk of subsequent contact with the CJS – whether in terms of arrest, caution, conviction or some other outcome. Measuring behaviour in terms of the risk of future CJS disposal[2] has the advantage of a direct link with the harm associated with offending, and hence supports the assessment of policies with public protection objectives. That link is closer for some disposals than others; for example, convictions have a proven link with an offence, and hence harm, whereas an arrest need not necessarily imply any actual offending. No

[1] http://www.cabinetoffice.gov.uk/media/409088/pfg_coalition.pdf
[2] 'Disposal' is a general term to refer to proven convictions for an offence, cautions, warnings, fixed penalty notices and other outcomes imposed on an offender following an offence.

disposal measures the full extent of offending, however, since not all offences are reported to the police or brought to justice.

Evidence that offending risk is significantly higher in one group than in another is insufficient on its own to justify a differential DNA retention policy. Costs and benefits should be taken into account, and some of these are not easily quantified. If such a policy is to be justified on cost-benefit grounds, three conditions would need to hold:

1. There are benefits to be gained from retaining DNA profiles, in terms of the likely impact on detection rates, crime and, ultimately, harm, or some other form of social value (e.g. justice) – otherwise, no retention is justified in the first place;
2. The benefits of retaining the profiles of one group of individuals are higher than of retaining those of the general population (however defined) – otherwise, there is no case for singling out any particular group, just because they come into contact with the CJS. This is the relative risk issue already mentioned;
3. The benefits of retaining DNA profiles outweigh the costs, in terms of, for example, database maintenance but also factors such as individual privacy.

Assuming condition 1 holds, if offending risks in one group of individuals and the general population are equal, the incremental benefits of DNA retention for that group are zero. If retention costs are positive, then a cost-benefit approach will tend to set a retention period at a point where there is a positive increment in offending risk between the retained group and the general population.

Therefore, the length of time for which the offending risk of one group of individuals is above the level observed in the general population only gives an indication of the *maximum* retention period which might be justified, that is, the retention period which might be justified if retention costs are zero.

An 'optimal' retention period would be based on the full costs and benefits of DNA retention. However, the evidence currently does not exist in a form which would permit the estimation of the marginal value of retaining the DNA profiles of different individuals, in terms of the impact on crime or (e.g.) justice.[3] There is also no available evidence of the cost of retention in terms of its impact on individual privacy. Therefore, this analysis was not able to estimate optimal retention periods for DNA retention.

[3] The ACPO Criminal Records Office (ACRO) has undertaken research which demonstrates that retained DNA profiles can contribute to the resolution of criminal cases (ACRO, 2009). However, it was not able to quantify the additional contribution that profiles can make, or to say for how long retention is justified. Further, strong evidence is currently lacking of the impact case resolution has on crime, or of the benefit case resolution has in terms of justice or other social values.

3. Aspects of DNA retention policy considered in the ERAG analysis

For the purposes of this analysis, the Scottish model of DNA retention[4] can be characterised as follows:

- Indefinite retention of DNA profiles of adults and juveniles on conviction for any offence;
- Temporary retention of DNA profiles of adults and juveniles on charge (but not conviction) for qualifying violent and sexual offences for three years (extendable by two years on application).

In addition, the European Court of Human Rights, in its S and Marper judgement[5], found a case in favour of treating juveniles more leniently than adults in terms of their contact with the CJS and any subsequent retention of their DNA.

Accordingly, the issues identified for consideration in the current analysis were as follows:

- Retention periods for those arrested for or charged with an offence, but not sanctioned;[6]
- Retention periods for those receiving different CJS disposals, for instance, cautions;
- Comparison of behaviour of juveniles and adults;
- The definition of qualifying offences.

Further details of the methodologies to explore these issues are given below.

4. Methodological approach

Hazard rates

The basic approach adopted in this work was to describe the behaviour over time of a given sub-population of interest in terms of a 'hazard rate'. This approach has been used previously in the academic literature concerning offending behaviour over time (e.g. Kurlycheck *et al*, 2006; Blumstein and Nakamura, 2009; Soothill and Francis, 2009). The hazard rate for conviction can be estimated as follows:

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[4] Police, Public Order and Criminal Justice (Scotland) Act 2006. Details of the Scottish framework were provided as part of the 2008 consultation on DNA and fingerprint evidence (http://www.scotland.gov.uk/Publications/2008/09/22154244/15).

[5] S and Marper v United Kingdom 30562/04 [2008] ECHR 1581 (4 December 2008)

[6] The more general term 'sanction' is used rather than 'conviction' to reflect the fact that some CJS disposals do not require proof of guilt (e.g. cautions) or acceptance of guilt (e.g. fixed penalty notices).

$$h(t|G) = \frac{\text{Number of individuals in group } G \text{ convicted at time } t}{\text{Number of individuals in group } G \text{ not convicted up to time } t} \qquad (1)$$

where $h(t|G)$ is the hazard rate for any given group, G, at any time, t. The hazard rate is therefore the probability that an event (in this case, conviction) occurs in the proportion of the group for whom the event has not occurred up to that point. As the event occurs to more and more individuals over time, those individuals are no longer relevant to the calculation of future risk and they are removed from the denominator in (1). This measure is therefore particularly suited to the analysis of policies which are designed to manage risks over time.

A policy of temporary DNA retention on (e.g.) arrest might be applied to an initial arrest with no sanction or to any arrest with no sanction. The former would imply that DNA would be retained on arrest for a maximum length of time equal to the retention period, unless there was an intervening conviction which precipitated indefinite retention. The latter would mean that the retention 'clock' would be 'reset' on every subsequent arrest. 'Clock-resetting' is relevant to the assessment of the appropriate retention period for any particular policy scenario. Therefore, hazard rates are correctly estimated taking account of the effects of resetting. In practice this means that the time between an initial arrest with no sanction and the first subsequent arrest which does result in a sanction is excluded from the hazard rate calculations. However, the effects of resetting on estimated hazard rates depend on factors which might be the subject of policy scenarios, such as the definition of a qualifying offence (which affects how frequently an individual might be (re-)arrested). This would make it difficult to assess appropriate relative treatments between scenarios. For this reason, hazard rates were calculated with and without the effects of clock-resetting, depending on the question being considered (see below).

In some cases, individuals in the initial arrestee cohort considered in this analysis had been re-arrested subsequently, but the outcome of that re-arrest was still pending. Therefore, different hazard rates were also calculated assuming the outcomes of these cases were either sanctions ('guilty') or no sanction ('innocent').

Comparative measures of general population risk

To provide an indication of the period of time that estimated hazard rates in group *G* might diverge, implying a possible (*prima facie*) argument for differential retention of DNA profiles, the annual probability that the same event occurs in a comparable, general population was calculated. A comparable population was defined primarily in terms of the age and gender composition of the cohort under consideration. Because the evidence suggests that age is a key driver of offending risk (and, in particular, that offending risk rises steeply to a peak at around 18 years of age before then declining (Soothill *et al*, 2002)), the hazard rate for the comparable population is also likely to change over time.

It is to be expected that conviction rates for individuals with no prior convictions will be lower than for individuals who are proven offenders, at least on average.[7] It might be argued that the comparative general population group should have the same convictions profile as the group of individuals who are the subject of the specific policy scenario in question. For instance, the behaviour of individuals with no prior convictions who are arrested for a qualifying offence should arguably be compared only with the behaviour of individuals in the general population who also have not been convicted previously, or even arrested. If this is the case,[8] a comparative risk estimate which does not exclude individuals with prior convictions is likely to be too high, because it will be inflated by the effects of the previously-convicted group, and the relative seriousness of the behaviour of the policy scenario group will be under-estimated. Due to data limitations, however, the proportion of the general population with prior convictions can only be estimated with some difficulty, and it is generally not currently possible to identify individuals with no prior arrests. The implications of this are considered below.

Power curves

The data available for the current analysis to estimate hazard curves were limited in terms of the period of time they covered (see below). In particular, suitable data on arrests were only available for a period of approximately four years (see Section 6). Hazard rates beyond four years were therefore estimated by fitting a power curve to the observed data and extending the curve to later years. This extrapolation can only be done with error and hence introduces some uncertainty into results outside of the four-year data period. Analysis of reconviction rates, for which more data are available, suggests the power curve is likely to remain a reasonable approximation for at least seven years. Extrapolating beyond seven years introduces increasing amounts of uncertainty, since the point at which the power and hazard curves diverge is not known.

Results reported below relating to a time within the four-year data period are also those obtained from the fitted power curves. Using calculated hazard rates rather than observed hazard rates in this way has the advantage of increasing the accuracy of results within the four-year period by reducing the impacts of both random noise and distortions caused by seasonal or one-off

[7] This might be expected, but it does not have to be the case: for instance, if a subset of proven offenders who had already permanently ‘desisted’ was compared with a subset of individuals with no previous convictions who were ‘late onset’ offenders, then the future conviction risk of the former might be lower than that of the latter.

[8] There is no single ‘correct’ definition of the population against which the behaviour of any particular sub-group should be compared for this analysis. It would seem appropriate that a policy of DNA profile retention should target those people who represent a higher risk of future offending. Elevated risk is by implication taken to be indicated by a CJS event such as arrest, since it is at this point that DNA retention is proposed. However, future offending risks vary across the population in ways which are not necessarily related to prior CJS contact. Selecting individuals on the basis of a comparison only with their own cohort could therefore result in a group of policy-affected individuals with different levels of risk, some of whom have lower risks than other individuals from different cohorts who are not selected because they have not had contact with the CJS.

events. The residual impacts of these factors were calculated using a statistical technique called boot-strapping. This involved generating 1,000 alternative data sets from the observed data[9], fitting a power curve to each data set and calculating the 95 per cent confidence interval of these power curves. This approach avoids many of the assumptions of simpler techniques and enables the impact of sampling error on the extrapolated results to be estimated.

Real relative risks
A second approach to dealing with the potential uncertainty introduced by the limited availability of data was to evaluate proposals by comparing risks, for the policy group and the general population, estimated at a point four years after the initial event relevant to each scenario.

If the ratio between the two risks is 1:1, then this indicates that they are (or are close to) equal. The extent to which the ratio is higher than this gives a measure of the divergence between the two risks (and hence a continuing *prima facie* case for differential treatment).

This approach was adopted because it ensured that all results were being compared on the basis of real, rather than forecast or extrapolated, data, since four years was the minimum amount of real data available for any policy scenario under consideration. The disadvantage was that it did not take account of the trajectory of offending risk, and whether or not risks were likely to approach equalisation near to the four-year point.

However, two points can be made in relation to this weakness. First, the uncertainties in estimating the hazard curves and comparator population risks were such that the time period taken for risks to be equalised was not likely to be estimated robustly enough, at least in some cases, for it to be regarded as a reliable *point estimate* of the maximum retention period. Second, even if it were, this would only be an estimate of the maximum retention period, and as suggested above, the information does not currently exist to estimate optimal retention periods. In that respect, therefore, risk ratios could be seen as an indicator of what differential treatments (in terms of relative retention periods) might be appropriate based on this evidence. However, the exact relativities adopted in practice would need to be a matter of judgement.

5. Data

The previous discussion indicates that data requirements for the current analysis included data relating to the offending behaviour of individuals following arrest and following sanction. Data were also needed for the estimation of conviction risks in the general population. Data on offending behaviour following arrest and sanction were obtained from the PNC. Two versions of the PNC database were accessed.

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[9] Each alternative data set is the same size as the original but the random selection is done with replacement, so some individuals might appear multiple times whilst others do not appear at all.

Arrest-to-sanction data

The operational version of the PNC is a hierarchical database, maintained by the National Policing Improvement Agency, and used by the police to share information on people, vehicles, crime and property. This version was used to identify all individuals arrested between April and July 2006. Before April 2006, PNC arrest data were heavily weeded, which made the remaining arrest data incomplete in ways it was not possible to specify. April 2006 is therefore the earliest date available for consistent PNC arrest information. July 2006 was set as the end of the sample selection period to account for the time taken for arrests to be resolved in a definite outcome (i.e. as no further action, charged but not guilty, caution or conviction). Statistics on the time from 'offence to completion' for cases passing only through magistrates' courts suggest a mean duration of over three months, with a significant 'tail' extending beyond 12 months (Ministry of Justice, 2009). Time taken in crown courts, where more serious offences are tried, is likely to be even longer. An end date of July 2006 would allow a follow up period of at least four years, which was considered sufficient to limit the impact that pending cases might have on the analysis. As described above, pending cases were dealt with by constructing different hazard curves on the assumption that they were resolved either as no further action or disposal.

The arrest data obtained covered all 84,256 people with no previous sanctions who were arrested without sanction during the period April to July 2006. Variables in the dataset were age, gender, the date of each arrest from April 2006 to June 2010, the associated offence codes and any CJS outcomes.[10] 73 per cent of the sample were male, with a mean age of 29 (mode around 18). Each individual averaged 2.0 arrest dates over the period and 1.3 offence codes per arrest date, giving a total sample of almost 170,000 arrest events and over 220,000 individual 'cases' (arrest-offence combinations). Less than 15,000 of these were 'pending' at the end of the sampling period. Effective sample sizes varied according to the scenario under consideration; for instance, a restricted list of qualifying offences limited the relevance of some arrest events. This produced a maximum sample size of just fewer than 65,000 arrest events for the scenario which considered the sanction behaviour of individuals arrested for offences which were not on the 'CSA+'[11] list, with some individuals appearing more than once because they had multiple eligible arrests within the selection period. The scenario which considered individuals who were arrested for offences on the 'CSA+' produced a sample of size of just over 23,000, with the 'Scottish list at arrest'

[10] It is important to recognise the restricted scope of the variables recorded in the PNC research database relating to individuals. These are limited to age, gender, perceived ethnicity, CJS contact type, offence type and sentence type. No other information is provided which might potentially be useful in explaining variations in offending behaviour, such as educational attainment, psychological profile, parental background and so on. This significantly limits the type of analysis that can be done, and explains why it was not considered appropriate to adopt (for instance) multivariate and similar analytical approaches for either the arrest- or sanction-based work.

[11] This and other scenarios discussed here are described in more detail in Section 6 and footnote 15.

scenario generating just over 26,000. The smallest arrest sample was obtained for the scenario considering behaviour following retention on charge, with 7,794 eligible adult arrests. A sample of 1,323 juveniles for the same scenario was considered too small to permit reliable comparisons.

Sanction-to-sanction data

The research version of the PNC is an anonymous relational database, maintained by the Ministry of Justice, and used to support research across the CJS into offending behaviour. This version was used to identify 346,620 individuals (71 per cent male, mean age 26, mode 14) who received their first conviction, caution or equivalent during 2005, and 136,914 (80 per cent male, mean age 24, mode age 15) who received their second.[12] Each individual in the first group averaged 1.9 conviction-, caution- (or equivalent) dates up to the end of 2009, and each date was associated with an average 1.3 offence codes. Each individual in the second group averaged 3.0 dates and 1.4 offence codes per date during the same period. As for arrests, effective sample sizes varied according to the scenario under consideration. For the arrest-to-sanction analysis, a maximum sample size of 191,248 was obtained for the analysis of adult behaviour following a proven offence; the smallest sample size was 3,816 for the analysis of behaviour of juveniles following their second conviction.

General population comparator data

General population comparator hazard rates were based on a combination of data from the PNC research database and population statistics from the Office for National Statistics (ONS). Dividing the number of people in each age-gender group who received a caution, conviction or equivalent in 2008 (PNC) by the mid-year population estimate for the same group (ONS) produced annual sanction likelihoods. These were then weighted according to the gender and age profile of the portion of the sample who did not receive a proven offence during the follow-up period. The age profile used was that pertaining either at initial arrest or at a point four years later – the limit of the data used in the analysis. Using the four-year profile was particularly relevant to cases relating to juvenile samples whose rates of offending change much more significantly with age than adults'. 2008 was chosen as the reference year because it was the mid-point of the four-year data period.

The approach described above was based on statistics including individuals with previous convictions, who, as argued above, are likely to have conviction rates which are higher than individuals with no previous convictions. Therefore, comparator rates were also generated for the subset of the population with no prior cautions or convictions. Historical information on this issue is not readily available, so figures were estimated as follows. First, the research version of the PNC database stretches back far enough that it could be used to calculate the number of individuals under the age of 19 who had committed a prior proven offence by the end of 2008. This, combined with ONS population statistics, permitted the calculation of the size of the 'innocent' population of each age to 18. The size of the innocent population in

[12] The research PNC does not currently include data on arrests.

each age older than 18 was then assumed to be equal to the estimate of the previous age's size, less the number of first-time proven offenders for that age group in 2008 (from the research PNC), and adjusted by the relative total population sizes of the two age groups, as follows:

$$N_a^I = (N_{a-1}^I - FTE_{a-1}) \times (N_a^T / N_{a-1}^T) \quad (2)$$

where, for ages greater than 18, and at the start of any given year, $N_a^{I,T}$ is the size of the total (*T*) and innocent (*I*) populations of age *a*, and FTE_a is the number of 'first-time entrants to the CJS' (individuals receiving their first conviction or caution) of age *a* in that year.

The approach therefore assumed that rates of first-time offending in the 19-plus age groups were similar, historically, to first-time offending rates in the same age groups in 2008. Clearly, to the extent that offending rates have changed over time, this would be expected to generate some error in the resulting estimates. This error might not be significant for younger age groups, whose estimates were based on years relatively recent to 2008, giving little scope for changes to have occurred. The error might be more significant for older age groups whose peak age of offending was some time in the past. However, the overall effect on the general population comparator is likely to be minor, given the relatively small proportion of first-time entrants from older age groups.[13] If the current estimates of first-time offending rates for the 35 to 60 age groups were to be doubled, the overall, general population first-time offending rate estimate would rise from an initial 1.75 per cent per annum (see Figure 2) to an initial 1.9 per cent per annum, or by less than nine per cent, suggesting this estimate is not sensitive to possible errors generated by this aspect of the methodology.

6. Results

How does the risk of sanction following arrest compare with sanction risk in the general population?

The first piece of analysis considered individuals with no prior sanctions who were arrested for a qualifying offence, between April and July 2006, but not sanctioned for it.[14] A qualifying offence was defined as the existing Crime and Security Act (2009) (CSA) list with the addition of robbery.[15] Hazard curves

[13] For instance, in 2008, there were nearly four-times as many first-time entrants to the CJS aged between seven and 25 as aged between 35 and 60.

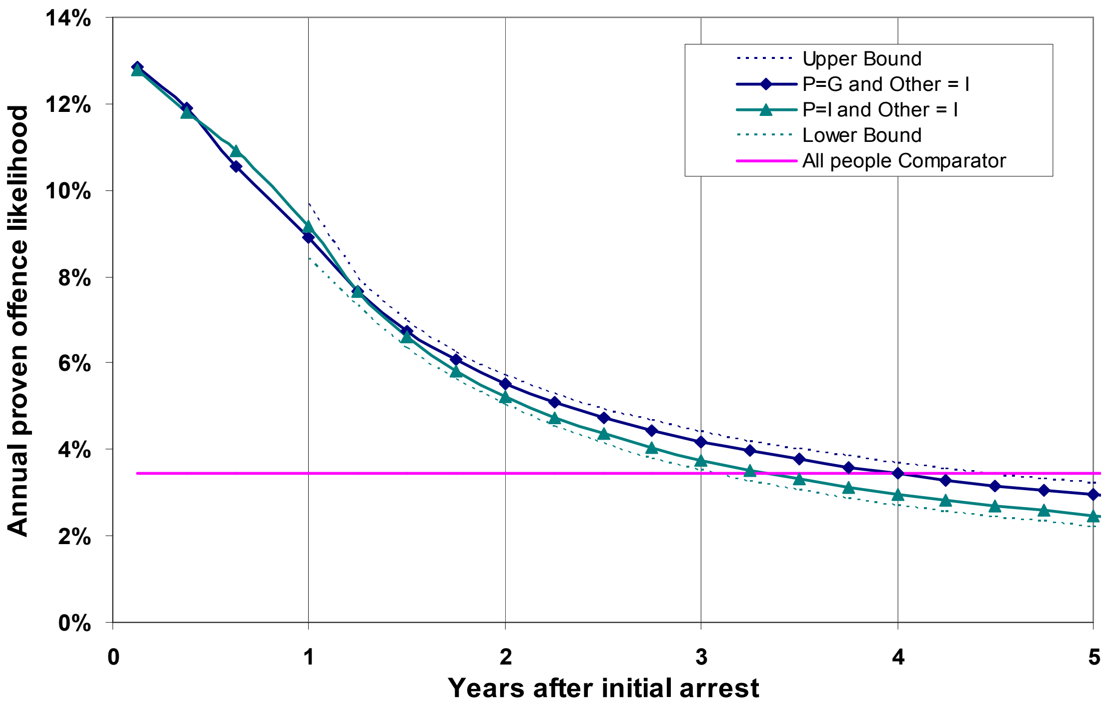
[14] The definition of a sanction here, and in the estimation of hazard rates, includes a conviction, a caution, and a reprimand or warning (for juveniles), which involve proof or acceptance of guilt, but excludes FPNs, which do not. This arrest definition includes both those arrested with NFA and those charged but found not guilty. The difference in behaviour between these two subgroups is considered below.

[15] The list of qualifying offences in the CSA was in turn based on the qualifying offence list in the Criminal Evidence (Amendment) Act (1997). This did not include robbery. However, robbery is an offence which is likely to involve significant levels of violence and attracts a maximum penalty of life imprisonment. Both of these factors (as well as evidence presented by Dubourg *et al*. (2005) on social costs) suggest it is at least as serious as burglary and actual bodily harm, both of which do appear on the 1997 and 2009 lists. Robbery was

were constructed assuming that pending cases were either innocent or guilty. Cases classed as 'other' in the dataset were treated as innocent. The resulting hazard rate estimates, including the effects of 'clock-resetting', were compared first against the estimate of the annual risk of sanction for the general population, adjusted to have the same age and gender profile as the arrestee cohort.

These results are presented in Figure 1, which presents two hazard curves. The first (with diamond markers) is estimated assuming that pending cases are guilty and 'other' cases are innocent ('P=G and Other=I' in the legend). The other (with triangular markers) is estimated assuming that pending and 'other' cases are both innocent ('P=I and Other=I' in the legend). The dotted lines marked 'Upper Bound' and 'Lower Bound' are the 95 per cent confidence limits of the power curves obtained from the bootstrapping exercise described above. The curves are estimated assuming a policy of 'clock-resetting', so describe how sanction risk changes over the five years following the initial or latest arrest with no sanction. The hazard rates at particular time points can then be compared against the estimate of sanction risk in the equivalent general population, which in this case is assumed not to vary over time.

Figure 1 Arrest-to-sanction hazard rates and general population sanction risk for 'CSA+' offence list



The main hazard curves in Figure 1 show that the point at which the rate of proven offending (i.e. convictions and cautions) reaches the national average for the same age and gender profile occurs between three and four years after the initial arrest. The upper and lower bounds show that the actual

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therefore included in the list of qualifying offences as a likely candidate for inclusion following the Coalition's current review of the DNA retention provisions. This scenario is termed 'CSA+' at various points in this paper.

intersection point may be as high as four years nine months or as low as three years. Further, the average risk over the fourth year is not significantly different from the average annual risk in the general population.

The analysis above and presented in Figure 1 compares the arrestee group's sanction risk against a risk which would be expected in the general population, after adjustment to make the gender and initial age profile of the two groups similar. This means that the risk measure has two important features:

- It is based on a population measure which includes individuals who have been previously sanctioned for an offence. These individuals are likely to have a higher risk of sanction than individuals who have never had been sanctioned previously, meaning that the population average measure will also be higher than for the group of innocent individuals alone;
- It is constant, and does not reflect the fact that sanction risks change over time. As mentioned above, evidence indicates that risks tend to rise at early ages and reach a peak at around 18, before falling again in later life.

Figure 2 Arrest-to-sanction hazard rate and general population sanction risk (ageing, no previous sanction basis) for 'CSA+' offence list

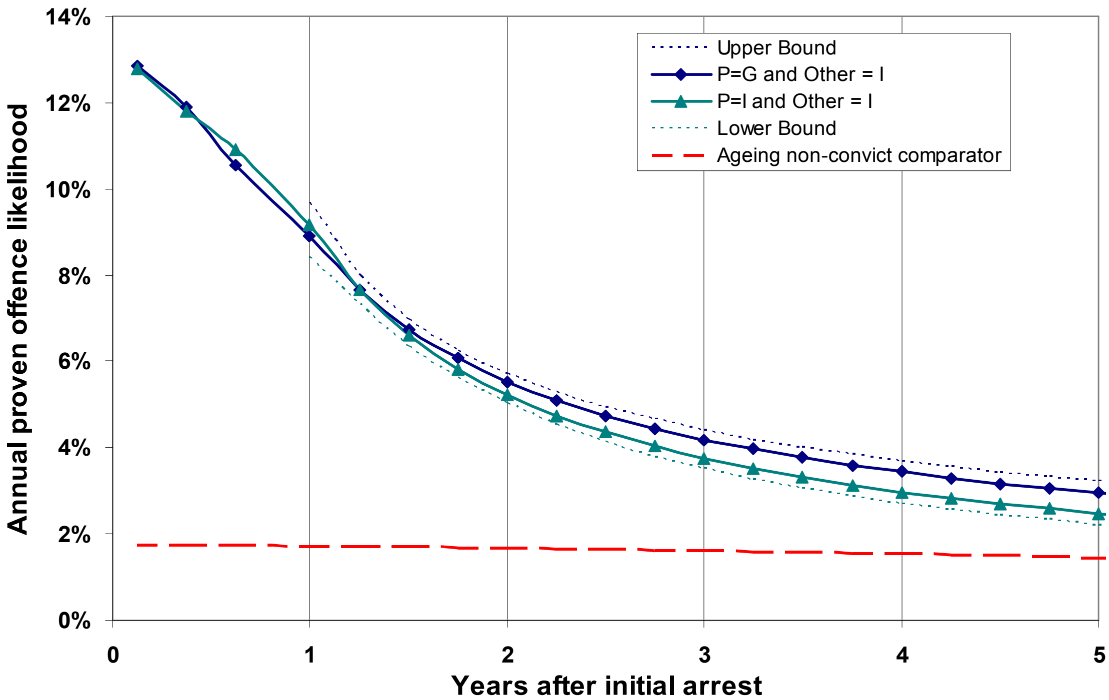

Figure 2 presents the same hazard curves as before but with a comparator line which attempts to remove individuals with prior sanctions and to incorporate the effects of ageing. Due to the difficulties in estimating the total number of individuals in the population who have prior sanctions, the comparator line can only be estimated with some uncertainty, and is provided here for illustrative purposes. However, for the purposes of discussion, two remarks can be made about this comparator line:

- The estimated general population risk is lower, at around two per cent per year, compared with almost four per cent per year in Figure 1, reflecting the fact that individuals with prior sanctions are likely to have a higher risk of future sanction than those without;
- The line slopes very slightly downwards, reflecting the downward effect of ageing on sanction risk.[16]

The effect of using this comparator line would be that risks between the arrestee group and the general population, although becoming closer over time, would appear to remain significantly different from each other five years after the initial arrest event. It is difficult to forecast the future profile of arrestee sanction risk with confidence. However, the shape of the hazard curve at the five-year point would then suggest that convergence might only occur a long time into the future, and in fact might never happen.[17] This would then imply that the risk of subsequent sanction of the arrestee group would always be higher than that of the comparable general population. Although, because of significant uncertainties in estimating general population conviction risks which exclude individuals with previous convictions, this example is provided only for illustration, it does serve to demonstrate the potential effect of the choice of comparator group on the results and any subsequent inferences that are drawn.

How does the risk of sanction following arrest for serious offences compare with the risk of sanction following arrest for non-serious offences?

Table 1 presents sanction risks for the arrestee group and the comparator general population ('baseline' in the table), and the ratio of the two, evaluated at the four-year point following an initial arrest with no sanction.[18] It does this for three possible definitions of 'serious' (three different lists of qualifying offences), and the implied 'non-serious' ('other offences' in Table 1) group. These definitions are the Scottish qualifying list, the CSA list plus robbery, and a hypothetical list based on all indictable offences.

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[16] The effect of ageing on the general population comparator risk estimate can be seen more clearly in Figure 3.

[17] Blumstein and Nakamura (2009) and Kurlycheck *et al* (2006) considered the risk of re-arrest following an initial arrest event, rather than the risk of sanction. Soothill and Francis (2009) considered the risk of court conviction following an initial such event. Therefore, none of these studies is directly comparable with the analysis presented here. However, all three studies found that hazard rates converged only after considerable lengths of time. Blumstein and Nakamura (2009) found no convergence after twenty years for some analysis scenarios, although did not report whether the differences at this point were statistically significant. Soothill and Francis (2009) concluded that, 'if persons remain crime-free for a period of, say, ten years after the age of 20 years, then those with an offence record in their youth and/or early adulthood have similar but not quite equal likelihoods of a further conviction compared with the on offending population of their age' (p387).

[18] 'Sanction' here covers convictions and cautions (and the juvenile equivalents) and excludes FPNs. Estimated sanction risks exclude the impact of 'clock-resetting', which would vary depending on the assumed scope of the qualifying list. Baseline risk estimates include individuals with previous sanctions, and the same applies for subsequent comparative results in this section. Comments made above in relation to the choice of comparative general population group therefore apply.

Table 1 Sanction risks and risk ratios by definition of qualifying offence

Definition of qualifying offences	Qualifying offences			Other offences		
	Hazard	Baseline	Ratio	Hazard	Baseline	Ratio
Scottish list at arrest	3.0%	2.7%	1.1	3.4%	3.3%	1.0
CSA list plus robbery at arrest	3.5%	3.2%	1.1	3.2%	3.1%	1.0
Indictable offences at arrest	3.3%	3.1%	1.1	3.3%	3.2%	1.0

There was a total of just over 93,000 offences for which individuals were initially arrested in the full sample, covering over 600 offence types. The top 50 known offence types covered over 80 per cent of these offences, and spanned a wide severity range, from being drunk and disorderly, at the lower end, to rape, towards the top.

Individuals were arrested for just over 23,000 qualifying offences under the 'CSA+' scenario, of which almost 90 per cent were for 13 of the top 50 offence types. Inspection suggests that all of these would be clearly at the upper end of the range of severity for the top 50 offences, including burglary, robbery, rape and serious violent assault. Just over 26,000 offences resulted in arrests under the 'Scottish list' scenario, with over 91 per cent being for 11 of the top 50 offences. Major differences between the Scottish list and the 'CSA+' list reflect the former's concentration on sexual and violent offences: common assault (the second most important offence by volume) is included on the Scottish list, while burglary and robbery (both in the top 15) are excluded.[19] Just over 47,000 offences occurred under the 'indictable offences' scenario, with just over 82 per cent of offences accounted for by 30 of the top 50 offence types. Many of these, however, were offences at the 'lower end' of the severity spectrum, including shoplifting, other theft and receiving stolen goods (but excluding common assault, a summary offence). The remaining almost 40 per cent of the top 50 offences were diverse in nature (for instance, harassment, criminal damage, illegal entry to the country, uninsured driving), but would mostly be classed as lower severity, although the scope for significant variation within offence types (e.g. conspiracy to defraud) makes it difficult to generalise.

Nevertheless, the data and discussion suggest that the 'CSA+' scenario is likely to be a relatively 'sharp' test of the impact of defining qualifying offences by reference to increased severity, with at least 90 per cent of qualifying offences classifiable as 'more severe'. Around two-thirds of qualifying offences might be classified as such under the 'Scottish list' scenario, while less than half of qualifying offences under the 'all indictable' scenario might be called 'more severe'. Together, the three scenarios represent a reasonable test of the impact of varying the severity of the arrest offence list on observed offending behaviour following arrest.

[19] Robbery is excluded apparently despite the evidence which suggests that this offence can involve significant levels of violence, and harm, on average (Dubourg *et al.*, 2005).

Table 1 shows that the risk ratios at four years are very similar between those arrested for qualifying and non-qualifying offences, and that this similarity is robust to variations in the definition of ‘serious’.

How do sanction risks compare following different CJS outcomes?

Table 2 considers the risk of sanction following, arrest with no further action; arrest and charge with no guilty verdict; a FPN; and, a proven offence. The risks presented in Table 2 are not calculated on the basis of a restricted set of qualifying offences. A comparison of adult sanction risks and relative risks at the four year point suggests no substantial difference between those arrested with no further action and those charged but not found guilty. The baseline risk estimate is slightly higher for the ‘arrest with no further action’ group, possibly reflecting the younger age profile compared with the ‘charged not guilty’ group (average age of 33 in the former case and 35 in the latter). There is less difference in hazard rates at the four-year point, however, resulting in a very slightly higher risk ratio for ‘charged not guilty’, but still not one which suggests the presence of ‘excess’ risk. This suggests that the behaviour of adults following an arrest with no further action is very similar to the behaviour of adults who are charged but not found guilty. Insufficient data exist to make any similar assessment for juveniles.

Table 2 Sanction risks and risk ratios following different CJS outcomes

Initial outcome	Juveniles			Adults		
	Hazard	Baseline	Ratio	Hazard	Baseline	Ratio
Arrest with no further action	7.4%	5.7%	1.3	2.6%	2.8%	0.9
Charged not guilty	Insufficient Data			2.4%	2.4%	1.0
Fixed Penalty Notice	7.1%	5.7%	1.2	3.6%	3.5%	1.0
Proven offence	9.5%	5.2%	1.8	3.4%	2.7%	1.3

Table 2 provides the same information, for both adults and juveniles, following a proven offence (conviction, caution or equivalent). Risk ratios for juveniles are 1.3 for the ‘arrest with no further action’ group and 1.8 for the ‘proven offence’ group. For adults, the ratios are 0.9 and 1.3 respectively, suggesting that relative risks are higher for the proven offence groups compared with those arrested with no further action, although not by a great amount. A comparison with the results for groups given a FPN suggests their relative risks are more similar to the arrestee groups’ than the conviction groups’ (ratios of 1.2 and 1.0 for juveniles and adults respectively). It should be noted, however, that these comparisons are not based on formal tests of statistical significance.

How do conviction risks compare following different proven offences?

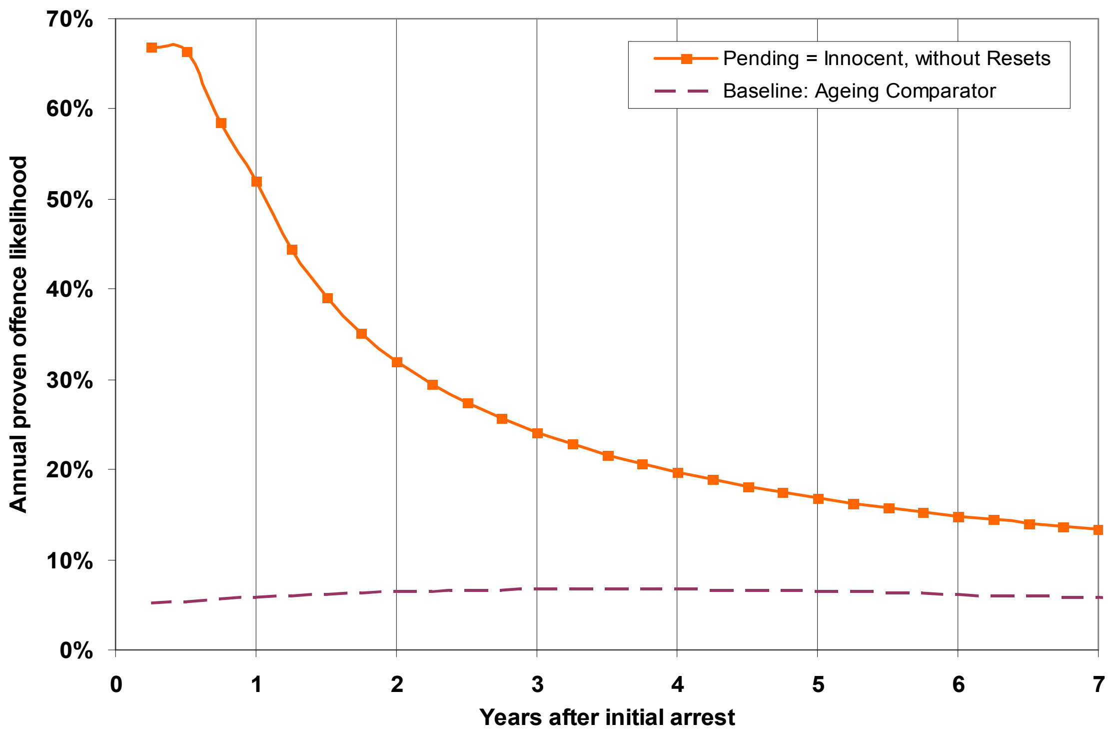
Table 3 presents sanction risks and risk ratios, measured at the four year point, for adults and juveniles following cautions (or the youth equivalent) and non-custodial convictions for any offence. For both groups, results for first caution and first conviction are similar to each other. The results for a second caution and a first caution-first conviction combination are also similar to each other. For both groups, risks and ratios are higher for second caution, first caution-first conviction and second conviction than they are for a simple first caution or conviction. Risk ratios are highest for the second non-custodial conviction groups.

Table 3 Sanction risks and risk ratios following proven offences

Proven offence groups	Juveniles			Adults		
	Hazard	Baseline	Ratio	Hazard	Baseline	Ratio
First caution (or equivalent)	9.5%	5.2%	1.8	3.6%	2.8%	1.3
First non-custodial (NC) conviction	10.1%	5.9%	1.7	3.2%	2.6%	1.2
Second caution (or equivalent)	15.4%	5.6%	2.8	8.0%	3.8%	2.1
Caution then NC conviction	15.8%	5.9%	2.7	7.8%	3.7%	2.1
Second NC conviction	18.7%	5.9%	3.2	6.0%	2.7%	2.3

Comparing the results in Table 2, risks and ratios are higher in all cases following a proven offence (first or second) than they are following an arrest with no conviction. For adults, hazard rates and baseline risks are under three per cent at the four-year point following arrest, with ratios around 1.0. Hazard rates following a first or second proven offence range from just over three per cent to eight per cent at the same point, with ratios from 1.2 to 2.3.

Figure 3 Second-conviction hazard rate and ageing general population conviction risk for juveniles



Further analysis suggests that sanction risks following a second proven offence might not converge with sanction risks observed in the general population, at least over relevant timescales. This is demonstrated in Figure 3 for the case of juveniles, which compares the risk of a second non-custodial conviction following a first non-custodial conviction against an ageing comparator line. Thus it can be seen that, by seven years after the first conviction, there is still a substantive difference in risks between the conviction and general population groups, and the curves appear almost parallel at this point, suggesting no obvious convergence in the 'near' future.

How do the sanction risks of juveniles and adults compare?

Tables 2 and 3 provide risk estimates and ratios for adults and juveniles separately. It can be seen from these results that, in all cases where estimates could be made, baseline risks and hazard rates at the four-year point following each initial CJS event are substantively higher for juveniles than for adults, as are the corresponding risk ratios. This is in line with a considerable body of academic literature which has found that early contact with the CJS is a strong predictor of more persistent and prolific offending careers (e.g. Farrington, 1992).

Likely effect on these comparisons of excluding convicts

It should be remembered that the preceding comparisons are in most cases made against general population definitions which include individuals with prior convictions. Excluding such individuals is likely to lower the comparator risk in all cases, and could mean that risks do not converge. It would also be expected to increase all of the risk ratios presented in Tables 1-3. It is possible (although by no means guaranteed) that the relativities between these ratios, on which the current comparative analysis has been based, might change, because the age and conviction profiles for different offence types also differ. However, it is not currently possible to estimate conviction risks which exclude the effects of prior convictions, with sufficient confidence or over reasonable timescales, for them to be the general basis for the analysis. Therefore, the current comparisons are likely to be the fairest possible at this point, but their limitations should be recognised.

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