



Distribution of cocaine on banknotes in general circulation in England and Wales



C.G.G. Aitken^{a,*}, A. Wilson^b, R. Sleeman^c, B.E.M. Morgan^c, J. Huish^c

^a University of Edinburgh, School of Mathematics and Maxwell Institute, Peter Guthrie Tait Road, Edinburgh EH9 3FD, UK

^b University of Durham, Department of Mathematical Sciences, Lower Mountjoy, Stockton Road, Durham DH1 3LE, UK

^c Mass Spec Analytical Ltd., Golf Course Lane, Filton, Bristol BS34 7RP, UK

ARTICLE INFO

Article history:

Received 19 July 2016

Accepted 18 October 2016

Available online 24 October 2016

Keywords:

Cocaine

Banknotes

Regional variation

Mixed effects models

ABSTRACT

A study of the quantities of cocaine on banknotes in general circulation was conducted to investigate regional variations across England and Wales. No meaningful support was found for the proposition that there is regional variation in the quantities of cocaine in banknotes in general circulation in England and Wales.

© 2016 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

A study of the quantities of cocaine on banknotes in general circulation was conducted to investigate regional variations across England and Wales. The study was conducted in response to a 2014 court ruling [*R. v. Rashid and others*, [T20147216] (19th January 2015)] and to review the findings of a similar study reported on in 2007 [6]. In the 2007 study, tests were carried out which did not find evidence that the region from which the banknotes in general circulation came has an effect on the quantities of drug found [6].

The study reported in [6] is a very good investigation of the factors influencing the contamination of UK banknotes with drugs of abuse. Seven possible factors were studied, one of which was a dummy variable. The work of Mass Spec Analytical Ltd. (MSA) received support in a court ruling in 2007 *Director of the Assets Recovery Agency v Jackson and others* [2007] All ER (D) 149 (Nov): ‘Nor is it now in dispute that the MSA database is representative of banknotes taken from banks located in the United Kingdom’ (para. 185); and ‘references to data from the Association of Payment Clearing Services show[ing] “weekly cash payments within the UK account for approximately 20% of the total cash in circulation

which represents significant mixing over time. In addition, cash entering the banking system and other major organisations such as supermarkets, is collected on a daily basis and sent to sorting centres” ’ (para. 188).

It will always be possible to argue that a particular level of a particular factor specific to a particular case has not been studied. Thus, not every city in the UK has had notes sampled from it for the study in [6]. This may be seen as a failing when applying the data to a particular city. A possible rebuttal of a suggestion of failure would be to take a sample (in some way) from a population deemed relevant to a particular case at the time of the police investigation. Such a procedure is open to other criticisms of irrelevance:

- Area: the area from which the sample was taken may be too large or may be too small; there is no criterion to determine the correct area. However, it is noted in [6] that ‘notes originating in one area may rapidly end up in another part of the country, and the banknotes handled by drug dealers will mix in the system, precluding a stable geographical population of banknotes’ (p. 169).
- Relevance of type: the relevance of the type of source of the banknotes to a particular case is difficult to determine and hence it is easy to argue irrelevance. For example, suppose the seizure was made in a casino, therefore it could be said the training set should be from a casino (or the same casino). Alternatively, suppose the seizure was made in an area of dockland, therefore it

* Corresponding author at: School of Mathematics, The University of Edinburgh, UK.

E-mail address: cgga@ed.ac.uk (C.G.G. Aitken).

could be said the training set should be from an area (the same area) of dockland. Many of the banknotes in MSA's training sets are taken from banks, for which they have been criticised. In the same paragraph of [6] quoted in the immediate point above, it is also noted that "[f]ew businesses, especially in areas where there are high crime rates, carry large quantities of cash on their premises for lengthy periods of time; banknotes will pass into the banking system, from where they are sent to regional sorting centres" (p. 169). This statement provides a strong argument that banks are the best place from which to take samples.

Notwithstanding the above explanations of the good quality of the database used by MSA, the database came under severe criticism in *R. v. Rashid and others*. For example, '[i]t is a database of pure convenience' (page 31C) or '[t]he assertion that notes from banks are typical is not supported by any evidence and is illogical' (page 31G). The court also wanted to 'have seen a much, much, more recent paper, much more objectively scrutinised, dealing very closely with the database ...' It is as an answer to that last comment that the study, to which the results reported here refer, was conducted.

The timeliness of the data in [6] was criticised in the ruling. The study [6] was published in 2007 and refers to data collected from 2004 onwards. Such data may be thought out of date in the context of a case reported on in 2015 (and assumed to be of crime committed in 2014). However, in a report written in response to the Sheffield ruling MSA note that

"MSA's database is unquestionably the largest such database in the world, comprising the examination of over one hundred thousand individual notes (at the time of writing, 118,951 sterling banknotes have been examined), with a value of over one and a half million pounds (at the time of writing £ 1,710,315). Together with the Bristol data, today's database is massive when compared to the database which was deemed '... sufficient for comparisons safely to be based on it ...' (para. 27) in the Court of Appeal Case of *Compton and Compton* [2002] EWCA Crim 2835 (and supported in *Benn and Benn* [2004] EWCA Crim 2100, paras. 44 and 45). The *Compton* ruling also stated 'we apply our own common sense to conclude that the range and weight of MSA's database is sufficient for comparisons safely to be based on it.' (para.27 of *Compton and Compton*). Interestingly, in *Compton*, the argument was put forward that '... no samples had been taken from London, or from any of the larger northern cities' (para. 26), and that there was a concentration on Lloyds Bank, precisely the argument being put forward today against a database which is now ten times larger than at the end of 2002, and includes many more locations. Whilst it is true to say that this is a small proportion of notes in general circulation, it is unfair and inaccurate to say that it has no statistical significance, without deferring to statistical experts to offer an opinion."

Thus, the database has been kept up to date and has grown considerably in size since the time to which [6] refers.

The court in *R. v. Rashid and others* was also concerned about the semi-quantitative nature of the data. The method of thermal desorption combined with tandem mass spectrometry is considered to be semi-quantitative because no method has yet been published to extrapolate the intensities of the ion transitions detected to the absolute quantity of drug present on the banknote [2]. Despite this, it is still possible to use the data obtained in a statistical analysis because comparisons can be made between the intensity of ion transitions detected on different samples of banknotes. These transitions provide a proxy for the amount of cocaine, sufficient for a meaningful statistical analysis. Two examples of such a statistical analysis which seek to determine the evidential value of cocaine on banknotes are described in [7,8].

Table 1

Experimental design for the analysis of banknotes in general circulation taken from eight distribution centres, identified as 1, ... 8 with two samples *a* and *b* from each centre. There are two analysts A1 and A2. There are two instruments *F* and *C*. The end at which a note is analysed is denoted 1 or 2.

Location	Sample	End	Analyst	Machine	No. notes
12924	<i>a</i>	1	A1	<i>C</i>	120
12924	<i>a</i>	2	A2	<i>F</i>	120
12924	<i>b</i>	1	A2	<i>C</i>	120
12924	<i>b</i>	2	A1	<i>F</i>	120
12925	<i>a</i>	1	A1	<i>C</i>	120
12925	<i>a</i>	2	A2	<i>F</i>	120
12925	<i>b</i>	1	A2	<i>C</i>	120
12925	<i>b</i>	2	A1	<i>F</i>	120
12926	<i>a</i>	1	A1	<i>C</i>	120
12926	<i>a</i>	2	A2	<i>F</i>	120
12926	<i>b</i>	1	A2	<i>C</i>	120
12926	<i>b</i>	2	A1	<i>F</i>	120
12927	<i>a</i>	1	A1	<i>C</i>	125
12927	<i>a</i>	2	A2	<i>F</i>	125
12927	<i>b</i>	1	A2	<i>C</i>	125
12927	<i>b</i>	2	A1	<i>F</i>	125
12928	<i>a</i>	1	A1	<i>C</i>	125
12928	<i>a</i>	2	A2	<i>F</i>	125
12928	<i>b</i>	1	A2	<i>C</i>	125
12928	<i>b</i>	2	A1	<i>F</i>	125
12929	<i>a</i>	1	A1	<i>C</i>	120
12929	<i>a</i>	2	A2	<i>F</i>	120
12929	<i>b</i>	1	A2	<i>C</i>	120
12929	<i>b</i>	2	A1	<i>F</i>	120
12930	<i>a</i>	1	A1	<i>C</i>	125
12930	<i>a</i>	2	A2	<i>F</i>	125
12930	<i>b</i>	1	A2	<i>C</i>	125
12930	<i>b</i>	2	A1	<i>F</i>	125
12931	<i>a</i>	1	A1	<i>C</i>	120
12931	<i>a</i>	2	A2	<i>F</i>	120
12931	<i>b</i>	1	A2	<i>C</i>	120
12931	<i>b</i>	2	A1	<i>F</i>	120

The training data for these two studies were obtained from samples of English and Scottish currency obtained from a variety of police force areas and locations around the UK; see Tables 1 and 2 in [7]. A large number of the samples were taken from the Bristol area.

2. Data collection

2.1. Sampling procedure

The purpose of the study reported here is to consider the variation in the quantity of cocaine contamination on banknotes in general circulation in England and Wales. This will help answer a question often raised in court. To perform this study, samples of banknotes from different regions in England and Wales were required. This section discusses the procedure used to select these samples.

Table 2

Two measures of goodness-of-fit, Akaike's information criterion (AIC) and Bayes' information criterion (BIC) for nine models of quantity of cocaine on banknotes in general circulation. Small values are good.

Model	BIC	AIC
1. Analyst, Location, Machine, Sample, Note	7279.110	7197.616
2. Analyst, Location, Machine, Note	7270.846	7195.622
3. Analyst, Location, Machine	8974.887	8905.931
4. Location, Machine, Sample, Note	8785.021	8709.796
5. Analyst, Machine, Sample, Note	7237.253	7199.641
6. Analyst, Location, Sample, Note	7521.012	7445.787
7. Machine, Sample, Note	8743.164	8711.820
8. Analyst, Sample, Note	7479.155	7447.812
9. Location, Sample, Note	8895.831	8826.875

Download English Version:

<https://daneshyari.com/en/article/6462571>

Download Persian Version:

<https://daneshyari.com/article/6462571>

[Daneshyari.com](https://daneshyari.com)