Confidence in Australian Banknotes

Kim Nguyen and Anny Francis

RESERVE BANK
OF AUSTRALIA

Figures in this publication were generated using Mathematica.

Confidence in Australian Banknotes

Kim Nguyen and Anny Francis

Authors: nguyenk and francisa at domain rba.gov.au

Media Office: rbainfo@rba.gov.au

Abstract

We investigate various factors that might influence the general public's confidence in the security of Australian banknotes, using a unique series of online banknotes surveys conducted by the Reserve Bank of Australia since 2010. We find that past encounters with counterfeits, and past experience of problems using banknotes, significantly worsen an individual's perceived counterfeit risk. Females, younger adults, and people with low income are also found to assess the counterfeit risk more negatively. Conversely, and with the exception of being a younger adult or having had serious problems using banknotes, confidence in the system to remove counterfeits is largely unaffected by demographic factors or past exposure to counterfeits. Awareness of a banknote upgrade program does not seem to have much effect on confidence, while knowing more security features of banknotes is associated with higher confidence. To assess the relationship between media coverage and public confidence in banknotes we use monthly data on media reports on counterfeiting, genuine banknotes mistakenly submitted as counterfeits, and actual counterfeit detections. As more unique counterfeit incidents are reported in the media, more genuine banknotes are mistakenly submitted as counterfeits, which we interpret as media coverage heightening the sense of counterfeit risk.

Table of Contents

1.   Introduction

The Reserve Bank of Australia is responsible for the production and issuance of Australian banknotes, and works to ensure that the public has confidence in banknotes as a means of payment and a secure store of wealth. Understanding which factors influence the public's confidence in banknotes may help the Bank in achieving this aspect of its mandate. For instance, should the Bank's banknote education programs be more targeted towards certain demographic groups? Should the Bank focus on increasing the level of security features or on improving banknotes' usability? Should the Bank engage more actively with the media around reporting on counterfeits?

To answer these questions, this paper first explores how an individual's demographic characteristics, knowledge, and personal experiences shape their perception of counterfeit risk regarding Australian banknotes, and their confidence that counterfeits will be removed from circulation. The data come from a unique series of online banknotes surveys conducted for the Bank since 2010.

One interesting finding is that past experience of serious problems using banknotes significantly worsens both counterfeit risk perception and confidence in the system for removing counterfeits, regardless of personal experiences with counterfeits. This suggests that ensuring circulating banknotes are of high quality and are easy to use may be important in maintaining the public's confidence in our banknotes.

Unsurprisingly, we also find that past encounters with counterfeits increase an individual's perceived likelihood of being a counterfeit victim again, and more generally their perception of the overall prevalence of counterfeits. However, the effect on confidence in the system for removing counterfeits from circulation is modest in size and not statistically significant. Females, younger adults, and people with low income also tend to assess the counterfeit risk more negatively, and have less overall confidence in the system for removing counterfeits. Knowledge about banknote upgrades seems to have no effect on confidence (although it worsens perceptions around the existence of a counterfeiting problem), while the number of banknote security features known is positively correlated with higher confidence in the security of banknotes.

We then look at the effect of media coverage on counterfeits using state-level data. We find that more unique counterfeiting incidents being reported in the media is associated with more genuine banknotes being mistakenly submitted as suspected counterfeits, which we interpret as being indicative of heightened counterfeit risk perceptions. The effect, however, diminishes as the same set of counterfeiting incidents are picked up by more outlets.

2.   Data

2.1   Banknotes Survey Data

Since 2010, the Reserve Bank of Australia has commissioned The Market Intelligence Co. (TMIC) to conduct five online surveys with representative samples of the general public. The surveys were conducted in 2010, 2012, 2014, 2017 and 2019. The objectives were to investigate the public's perception, knowledge and awareness of Australian banknotes and banknote security features, and their experience with and attitudes towards counterfeits.

The surveys consisted of both multiple choice and free form response questions. All surveys followed a three-part structure. The first section surveyed participants' cash use habits and attitudes towards Australian banknotes. The second explored their past experiences with and perceptions of counterfeit risk. The third examined their awareness of recent developments regarding banknotes. In all surveys, participants also provided demographic information.

Since most of the questions were repeated, albeit with a different group of participants in each survey year, the surveys form a repeated cross-section dataset.

2.2   Characteristics of Respondents

In total, around 5,300 people aged 16 and above participated in the five surveys, with an average of around 1,000 people per survey. Set quotas for selecting participants by age, sex and state ensured that the sample was broadly representative of the Australian population (Table 1).

Table 1: Summary Statistics of Banknote Survey Respondents Across survey years	
	Share (%)
Demographics	
Female	50.2
16–24 years old	15.9
25–44 years old	35.4
45 years old and above	48.7
New South Wales	32.5
Victoria	25.1
Queensland	20.3
Metropolitan	65.2
Currently employed	55.8
Annual income < $100,000	73.3
Born outside of Australia	24.2
Experience with banknotes	
Received counterfeits in the past	7.3
Use cash daily as part of job	20.4
Had banknotes checked by cashier	34.3
Has had serious problems using banknotes	12.6
Behavioural questions	
Has heard of banknote upgrade plan[a]	32.0
Knows at least one security feature	76.1
Believes that they will receive a counterfeit	36.8
Believes that there is a counterfeiting problem[a]	31.0
Confident in the system to remove counterfeits from circulation[a]	65.9

Note: (a) Not all respondents answered these questions; of those who did answer, data show share answering 'yes'
Sources: Authors' calculations; RBA, online banknote surveys

2.3 Confidence in the Security of Australian Banknotes

Since a major objective of the surveys was to understand the Australian public's perception of counterfeit risk, and their confidence in banknotes more generally, participants were also asked the following questions:

- How confident are you with the system currently in place to remove counterfeits from circulation? (Not asked in 2010.)

- Do you think there is a counterfeiting problem in Australia? (Not asked in 2010.)

- How likely do you think it is you will receive a counterfeit banknote in Australia within the next 12 months? (Asked in all survey years.)

The responses to these questions across the surveys suggest that most people are confident in Australian banknotes: on average around 65 per cent of respondents were 'fairly' or 'very' confident in the current system for removing counterfeits from circulation, and only around 8 per cent were not confident (with the remainder expressing a neutral opinion); almost 70 per cent of respondents did not think that there was a counterfeiting problem in Australia; and more than 60 per cent of respondents believed they would not receive a counterfeit in the next year, while only 12–24 per cent believed they would receive a counterfeit (Figure 1). With the exception of the perceived risk of receiving a counterfeit (which has tended to rise over the past decade), responses were relatively stable across survey years.

Figure 1: Confidence in Australian Banknotes
Across survey years
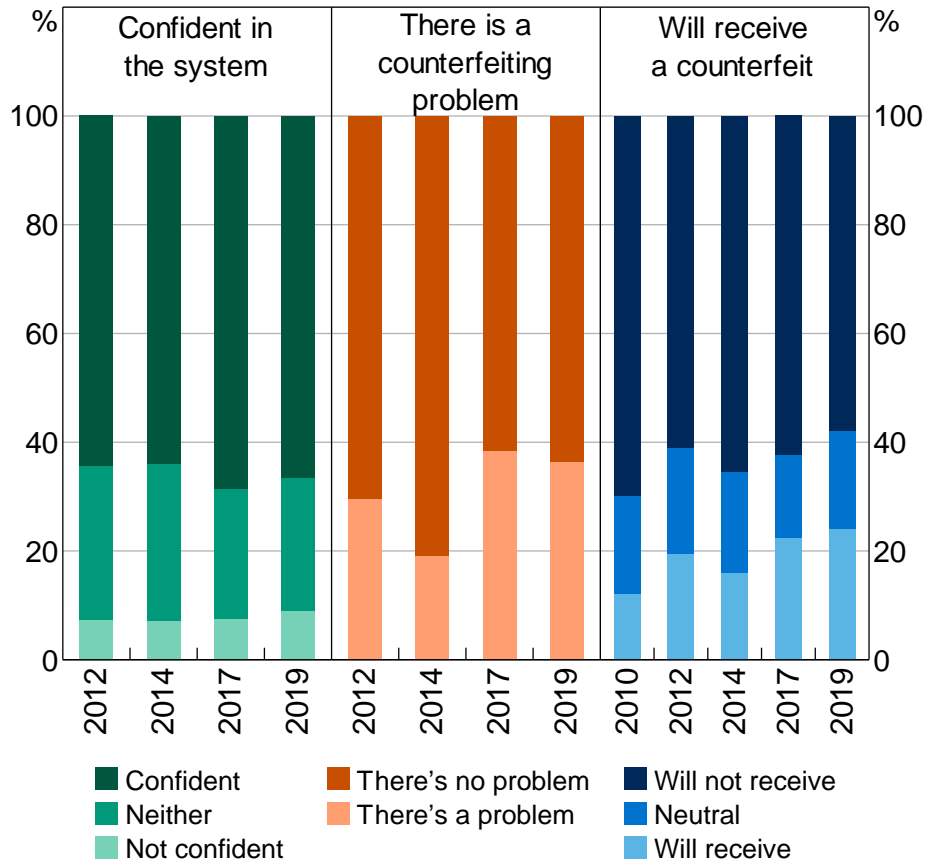
Sources: Authors' calculations; RBA, online banknote surveys

2.4   Media Reporting on Counterfeits

To examine the effect of media reporting on counterfeits, we employ a second dataset that includes the number of genuine banknotes mistakenly submitted as counterfeits (on average, around 5 per cent of suspected 'counterfeits' are found to be genuine banknotes), the actual number of counterfeits detected, and the number of media reports on counterfeiting as reported by the Isentia media monitoring service (both total reports and unique reported incidents). All variables are measured monthly at the state level, from February 2006 to November 2018. The national level summary statistics are presented in Table 2.

**Table 2: Summary Statistics of Counterfeits, Genuine Banknotes and Media Data –
National Level**
Collected monthly between February 2006 and November 2018

	Mean	Standard deviation	Minimum	Maximum
No of media reports	27	25	0	112
No of unique reported incidents	8	7	0	34
No of detected counterfeits	1,614	1,234	0	7,160
No of submitted genuine banknotes	62	49	0	221

Sources: Authors' calculations; Insentia; RBA, online banknote surveys

At the national level, there were on average 27 media reports on 8 unique counterfeit incidents per month. The average number of submitted genuine banknotes per month was around 60 (compared to around 1,600 actual counterfeits), with the $50 denomination the most commonly submitted. Mistakenly submitted genuine banknotes tend to be very old or worn, or of a different design to banknotes currently being issued (for example, the commemorative 'Federation $5' banknote).

3. Empirical Strategy

3.1 Survey Data Regressions

We first focus on identifying how demographic factors, personal experience with counterfeits, personal experience using banknotes, and awareness of banknote upgrades and banknote security features affect confidence in banknotes. In particular, we use answers to the three survey questions described in Section 2.3 as indicating a respondent's level of confidence, and we aim to test whether the aforementioned factors increase the perceived likelihood of receiving a counterfeit banknote within the next year, the belief that there is a counterfeiting problem in Australia, and the overall confidence in the system to remove counterfeits from circulation.

Equation (1) is the general form of the empirical models used in the paper:

$$f\left(Confidence_i\right) = \alpha + \beta'Factors_i + \gamma'Controls_i + \theta'Year_i + \varepsilon_i \tag{1}$$

The first measure of confidence is the 'perceived likelihood of receiving a counterfeit', where respondents were asked to rate their perceived risk on a scale of 0 to 10. We could treat this measure as either an ordinal variable (that is, a variable for which the order has meaning but the magnitude does not, so that a response of '2' is interpreted as being larger than a response of '1', but *not* twice as large as a response of '1'), or as a binary variable by collapsing the answers into two categories: likely to get a counterfeit in the next year (rating of 5 to 10) and not likely (rating of 0 to 4). An ordered logit model would be appropriate for an ordinal dependent variable of this kind, while for the second approach one would typically use a linear probability model (LPM) or standard probit and logit models. The question of whether Australia has a counterfeiting problem provides for only yes/no responses, so an LPM, probit or logit model would be appropriate. The question on an individual's confidence in the system to remove counterfeits also has a number of possible answers, and we again construct a binary variable: the 'not at all confident', 'not very confident', and 'neither [confident nor not confident]' responses are classified as 0 (not confident), while 'fairly confident' and 'very confident' are classified as 1 (confident). As a robustness check, we classify 'neither' separately in an ordered logit model (see Appendix A).

Throughout the paper our preferred modelling technique is to use a standard probit regression, as the output from such models is generally relatively easy to interpret. The complete set of robustness checks using other models and specifications can be found in Appendix A. In each regression, we control for the survey year, residential location of the respondent, and other cash-related questions asked in the surveys.[1] For the sake of clarity, we only present factors that are of interest in the regression tables.

---

[1] Cash-related questions include whether the respondent uses cash daily as part of their job and whether a cashier or bank teller has ever checked their banknotes.

3.2   Media Reporting Regressions

To empirically study how the media influences confidence in banknotes, we turn to the second dataset, which includes monthly state-level variables. We use fixed-effect panel regressions to study the effects of incidents and media reports on our dependent variable of genuine banknotes mistakenly submitted as counterfeits. The underlying assumption is that an increased number of genuine banknotes mistakenly submitted as counterfeits would, all else equal, indicate less confidence in banknote security. The form of the regressions is:

$$Genuines_{s,t} = \beta' Reported\ Incidents_{s,t} + \delta' Reports_{s,t} + \gamma' Controls_{s,t} + \alpha_s + \theta_t + \varepsilon_{s,t} \qquad (2)$$

The entities are states in Australia (denoted as s) while time is measured in months (denoted as t). The state fixed effect, given by α_s, controls for all time-invariant differences between states. The time effect θ_t accounts for variation over time that is the same across states. We also control for other time-varying differences between states such as the number of actual counterfeit detections, the quality of banknotes in circulation, population, employment rates, earnings per hour, inflation, and the total number of criminal proceedings.

4.   Results: The Determinants of Confidence in Australian Banknotes

In what follows, we focus on six dependent variables, which are:

1. the belief that one will receive a counterfeit next year;

2. the belief that there is a counterfeiting problem;

3. confidence in the system for removing counterfeits from circulation;

4. the belief that one will receive a counterfeit next year, conditional on having received a counterfeit in the past year;

5. the belief that one will receive a counterfeit next year, conditional on *not* having received a counterfeit in the past year; and

6. the probability of having received a counterfeit in the past 12 months.

While we estimate a single model for each of the above dependent variables, for clarity we break up the presentation of results and separately discuss the effects of demographics, past experience with counterfeits, past experience with banknotes and awareness of banknotes on the dependent variables.

4.1   Demographics

4.1.1   Sex

Table 3 contains our results as they pertain to demographics. There are a number of interesting differences between male and female respondents. Female respondents express a 4 percentage point higher perceived likelihood of being victims of counterfeiting in the future (Regression (1)),

and are 7 percentage points more likely to believe that there is a counterfeiting problem in Australia (Regression (2)). This is consistent with other studies on the fear of crime which report higher perceived risk of victimisation among women (May, Rader and Goodrum 2010; Rader and Cossman 2011; Tomsich, Gover and Jennings 2011; Snedker 2012). However, confidence in the system does not vary significantly by sex (Regression (3)). Thus, it appears that women may be more pessimistic when assessing crime risk, but they do not necessarily put less trust in public institutions to remove counterfeits from circulation.

Table 3: Average Marginal Effects of Demographic Variables

	Probability					
	Receive counterfeit in next year	There is a counterfeiting problem	Confident in the system	Receive counterfeit in next year[a]	Receive counterfeit in next year[b]	Received counterfeit in past year
	(1)	(2)	(3)	(4)	(5)	(6)
Sex (control category = male)						
Female	0.0367**	0.0712***	−0.0066	−0.0151	0.0405**	−0.0287***
	(0.0154)	(0.0143)	(0.0165)	(0.0465)	(0.0162)	(0.0077)
Age (control category = 45 years and above)						
16–24 years old	0.0050	−0.0620***	−0.1656***	0.1472**	−0.0126	0.0368**
	(0.0262)	(0.0235)	(0.0303)	(0.0720)	(0.0278)	(0.0144)
25–44 years old	0.0509***	−0.0142	−0.0877***	0.0375	0.0544***	0.0276***
	(0.0188)	(0.0175)	(0.0203)	(0.0675)	(0.0197)	(0.0094)
Income (control category = high income > $100k)						
Low income (≤ $40k)	0.0545**	0.0455**	−0.0415	−0.1068	0.0702***	−0.0114
	(0.0228)	(0.0215)	(0.0252)	(0.0816)	(0.0240)	(0.0113)
Middle income ($40k–$100k)	0.0165	0.0160	−0.0180	−0.0910	0.0283	0.0010
	(0.0178)	(0.0168)	(0.0195)	(0.0560)	(0.0188)	(0.0093)
Control for other factors	Y	Y	Y	Y	Y	Y
Demographic and year dummies	Y	Y	Y	Y	Y	Y
Observations	4,153	4,153	3,458	327	3,814	4,138

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
            (a) Restricted to respondents from all years who have received counterfeits in the past 12 months
            (b) Restricted to respondents from all years who have not received counterfeits in the past 12months
Sources: Authors' calculations; RBA, online banknote surveys

Interestingly, the females in our data are, on average, 3 percentage points less likely to have received a counterfeit in the past year compared with otherwise equivalent men (Regression (6)). By splitting the data by personal experience with counterfeits, we see that female non-victims are significantly more pessimistic than equivalent male non-victims (Regression (5)), while there is no significant disparity among counterfeit victims (Regression (4)). This disproportional perception of victimisation relative to actual likelihood of victimisation among women is well documented in the criminology literature (Scarborough *et al* 2010; Cops and Pleysier 2011), where the fear of crime despite not being a victim is commonly termed the 'fear-victimisation paradox' (Franklin, Franklin and Fearn 2008; Russo and Roccato 2010; Cops and Pleysier 2011; Alper and Chappell 2012).

4.1.2 Age

Empirical research that links age and the perceived risk of crime is inconclusive. Some studies show that the elderly have higher fears of crime (Sjöberg 2004; Cops, Pleysier and Put 2012), while others find either mixed or negative correlation between age and risk perception (Savage 1993; Andersson and Lundborg 2007). Our regression results suggest that compared with respondents 45 years or older, younger respondents aged between 25 and 44 years old are 5 percentage points likelier to believe that they will receive a counterfeit in the next year, and 9 percentage points less likely to have confidence in the system to remove counterfeits (Regressions (1) and (3)). The youngest group of respondents are 17 percentage points less likely to have confidence in the system. They also perceive themselves as much more susceptible to risk if they have been a victim of counterfeits in the past (15 percentage points higher than the eldest group; Regression (4)). Overall, older adults appear to be more trusting in the security of banknotes and in the system for removing counterfeits from circulation.

4.1.3 Income

Next, we explore how confidence varies with annual income. According to the fear of crime literature, reduced financial resources and capacity to manage crime risks leads to heightened feelings of insecurity (Kanan and Pruitt 2002; Jones, Abbott and Quilgars 2006; Kemshall 2006; Scarborough *et al* 2010). Since unknowingly accepting a counterfeit banknote can impose direct financial consequences on the crime victim, we would expect those on lower incomes to see a higher perceived counterfeit risk, all else equal. This is borne out in our results, as we find low income earners to have a higher perceived risk of receiving a counterfeit (5 percentage points), and a higher likelihood of believing that there is a general counterfeit problem (5 percentage points), although there is no statistically significant difference across income groups with regards to confidence in the system.

Across age and income groups, we do not find evidence for the 'fear-victimisation paradox': young adults are both more likely to perceive a counterfeiting problem and more likely to have received counterfeits, while there is no statistically significant variation in victimisation levels by income (Regression (6)). With the partial exceptions of Queensland and the Australian Capital Territory (ACT), there was no statistically significant variation in victimisation or confidence, by state of residence.[2]

4.2 Experience with Counterfeits

A common and unsurprising finding in the criminology literature is that people who have been the victim of a crime tend to feel more vulnerable, and tend to suffer psychological and emotional harm (Reiss and Roth 1994). This leads to higher levels of fear of crime among victims than non-victims (Reid, Roberts and Hilliard 1998; Jackson and Gray 2010; Russo and Roccato 2010; Orchowski, Untied and Gidycz 2012). Our results accord with this finding, as displayed in Table 4. On average, reporting having received a counterfeit in the past is associated with a 23 percentage point increase in the perceived likelihood of receiving another counterfeit in the next year (Regression (1)), and a 19 percentage point increase in the belief that there is a counterfeit problem (Regression (2)),

---

2   Respondents from Queensland and the ACT were slightly less likely to have reported receiving a counterfeit in the past, while those from the ACT were more likely to express confidence in banknote security.

although there is no statistically significant impact on overall confidence in the system (Regression (3)).[3]

Table 4: Average Marginal Effects of Experiences with Counterfeits

	Probability					
	Receive counterfeit in next year	There is a counterfeiting problem	Confident in the system	Receive counterfeit in next year[a]	Receive counterfeit in next year[b]	Received counterfeit in past year
	(1)	(2)	(3)	(4)	(5)	(6)
Experiences with counterfeits (control category = 'Have never received a counterfeit')						
Have received a counterfeit	0.2319***	0.1878***	−0.0439			
	(0.0291)	(0.0256)	(0.0302)			
Control for other factors	Y	Y	Y			
Demographic and year dummies	Y	Y	Y			
Observations	4,153	4,153	3,458			

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
(a) Restricted to respondents from all years who have received counterfeits in the past 12 months
(b) Restricted to respondents from all years who have not received counterfeits in the past 12months
Sources: Authors' calculations; RBA, online banknote surveys

It has been noted that while recent direct victimisation can strongly increase an individual's fear of crime, the effect tends to weaken over time periods as short as three months (Russo and Roccato 2010). Our data also provide evidence for the diminishing effect of counterfeit victimisation over time. In the 2017 and 2019 surveys, participants were asked whether they had received a counterfeit within the past 12 months or more than 12 months ago (Table 5). We find that people who reported having received a counterfeit recently are around 16 percentage points more likely to think they will receive a counterfeit in the next year compared with those who received a counterfeit more than 12 months ago; for comparison, those who reported having received a counterfeit more than 12 months ago are 17 percentage points more likely to expect another in the next year compared with those who have never received a counterfeit before (Regression (1)). We observe a similar diminishing effect on general beliefs about the existence of a counterfeiting problem in Australia (Regression (2)), but no effect on overall confidence in the system (Regression (3)).

---

3   Note that a heightened feeling of vulnerability amongst victims relative to non-victims does not contradict our earlier discussion on the fear-victimisation paradox: the first relates to victims of crime perceiving the likelihood of being a victim again as high, relative to non-victims; the second concerns non-victims only, and states that one particular group (females in our case) has a higher perceived likelihood of being a future victim despite having a lower actual likelihood.

Table 5: Average Marginal Effects of Experiences with Counterfeits
Using 2017 and 2019 surveys only

	Probability					
	Receive counterfeit in next year	There is a counterfeiting problem	Confident in the system	Receive counterfeit in next year[a]	Receive counterfeit in next year[b]	Received counterfeit in past year
	(1)	(2)	(3)	(4)	(5)	(6)
Experiences with counterfeits (control category = 'Have never received a counterfeit')						
Had counterfeits in past 12 months	0.3364***	0.3513***	0.0007			
	(0.0507)	(0.0502)	(0.0489)			
Had counterfeits > 12 months ago	0.1742***	0.2075***	−0.0600			
	(0.0489)	(0.0474)	(0.0483)			
Control for other factors	Y	Y	Y			
Demographic and year dummies	Y	Y	Y			
Observations	1,919	1,919	1,633			

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
(a) Restricted to respondents from all years who have received counterfeits in the past 12 months
(b) Restricted to respondents from all years who have not received counterfeits in the past 12months

Sources: Authors' calculations; RBA, online banknote surveys

4.3 Problems Using Banknotes

Another important facet of banknotes is their quality, and one aim of the Bank is to ensure that banknotes in circulation are of sufficiently high quality to effectively function as a means of payment for the public: better-quality banknotes, which are not torn or overworn, are less likely to be rejected by cashiers or machines. The banknotes survey data allow us to test whether past problems using banknotes affect the public's confidence in banknotes or their perception of banknote security.

Table 6 shows that having serious past problems in handling banknotes increases the perceived likelihood of receiving a counterfeit by 17 percentage points, after controlling for all other factors including having received counterfeits in the past (Regression (1)).[4] Having problems in handling banknotes is also associated with a 13 percentage point increase in the belief that there is a counterfeit problem in Australia (Regression (2)), and a 13 percentage point reduction in confidence in the system (Regression (3)); results hold for both those who have, and have not, received a counterfeit in the past (Regressions (4) and (5)). These results are quite striking, and suggest that serious negative experiences in using banknotes – for example, having had banknotes rejected by machines or cashiers – have a detrimental effect on the perceived risk of counterfeiting on par with having actually received a counterfeit in the past, and have a larger effect on confidence in the system to remove counterfeits than having actually received a counterfeit.

---

4 The problems being asked in the surveys include banknotes sticking together, being slippery and easy to drop, not being accepted into machines, tearing easily, and difficulty distinguishing between denominations.

Table 6: Average Marginal Effects of Experiences with Using Banknotes

	Probability					
	Receive counterfeit in next year	There is a counterfeiting problem	Confident in the system	Receive counterfeit in next year[a]	Receive counterfeit in next year[b]	Received counterfeit in past year
	(1)	(2)	(3)	(4)	(5)	(6)
Experiences using banknotes (control category = 'Have never had serious problems using banknotes')						
Had serious problems	0.1718***	0.1327***	−0.1320***	0.1614***	0.1671***	0.0837***
	(0.0222)	(0.0201)	(0.0234)	(0.0549)	(0.0244)	(0.0082)
Control for other factors	Y	Y	Y	Y	Y	Y
Demographic and year dummies	Y	Y	Y	Y	Y	Y
Observations	4,153	4,153	3,458	327	3,814	4,138

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
                (a) Restricted to respondents from all years who have received counterfeits in the past 12 months
                (b) Restricted to respondents from all years who have not received counterfeits in the past 12months
Sources: Authors' calculations; RBA, online banknote surveys

One possible channel through which banknote quality might affect confidence is by raising the public's overall level of trust in the banknote issuer: one might argue that if the central bank is capable of producing high quality banknotes that do not cause problems in use, it will also be capable of controlling counterfeiting effectively. Trust in the relevant authority has also been shown in the literature to be a crucial determinant of risk perceptions (Jackson, Allum and Gaskell 2006). Our study provides some limited support for this hypothesis, with overall confidence in the system for removing counterfeits from circulation more negatively affected by problems with using new series banknotes versus old series banknotes (Table 7, Regressions (3) and (5)). One interpretation of these results would be that respondents revise their perceptions of the Bank's overall capabilities and ability to deal with counterfeits following a banknote upgrade, and down-weight their experiences of old series banknotes.

Table 7: Average Marginal Effects of Experiences with Using Banknotes
Using 2017 and 2019 surveys only

	Probability					
	Receive counterfeit in next year	There is a counterfeiting problem	Confident in the system	Confident in the system[a]	Confident in the system[b]	Received counterfeit in past year
	(1)	(2)	(3)	(4)	(5)	(6)
Experiences using banknotes (control category = 'Have never had serious problems with the respective series')						
Had problems with old series	0.1601***	0.0966***	−0.0490	−0.0525	−0.0448	0.0904***
	(0.0389)	(0.0373)	(0.0386)	(0.0788)	(0.0465)	(0.0210)
Had problems with new series	0.1173***	0.0312	−0.0667**	−0.0208	−0.1001**	0.0713***
	(0.0343)	(0.0325)	(0.0349)	(0.0673)	(0.0416)	(0.0178)
Control for other factors	Y	Y	Y	Y	Y	Y
Demographic and year dummies	Y	Y	Y	Y	Y	Y
Observations	1,919	1,919	1,633	260	1,373	1,851

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
(a) Restricted to respondents from all years who have received counterfeits in the past 12 months
(b) Restricted to respondents from all years who have not received counterfeits in the past 12months

Sources: Authors' calculations; RBA, online banknote surveys

4.4 Awareness of Banknotes

4.4.1 Awareness of banknote upgrade program

Knowing how knowledge of a banknote series upgrade affects confidence in banknotes may help central banks to plan their public awareness campaigns more effectively. For example, if public awareness of an upcoming upgrade program raises confidence, the central bank could look to publically announce the upgrade project at a relatively early stage. On the other hand, if individuals associate the introduction of a new banknote series with the existence of a current counterfeiting problem (whether this is the case or not), the central bank may wish to delay any public announcement and devote resources to communicating the true state of counterfeiting.

The responses to the survey question 'Have you heard of the Reserve Bank of Australia's plans to upgrade Australia's banknotes?' allow us to test which hypothesis is correct. Table 8 shows that having heard of the banknote upgrade is correlated with a 4 percentage point increase in the belief that there is a counterfeiting problem in Australia (Regression (2)), although there is no statistically significant evidence that awareness affects the other two measures of confidence in banknote security (Regressions (1) and (3)). Hence there is some evidence that knowledge of a banknote upgrade program serves to raise concerns about counterfeiting. (For reference, in 2012 and 2014 around 8 per cent of respondents confirmed their awareness of the banknote upgrade, while in 2017 and 2019 more than half of respondents confirmed that they had heard of the Bank's plans to issue new $10 and $20 banknotes.)

Table 8: Average Marginal Effects of Awareness

	Probability					
	Receive counterfeit in next year	There is a counterfeiting problem	Confident in the system	Receive counterfeit in next year[a]	Receive counterfeit in next year[b]	Received counterfeit in past year
	(1)	(2)	(3)	(4)	(5)	(6)
Awareness of banknote upgrade (control category = didn't hear of New Generation Banknote Series (NGB))						
Heard of NGB	0.0201	0.0397**	0.0060	0.0694	0.0201	0.0542***
	(0.0192)	(0.0178)	(0.0203)	(0.0629)	(0.0201)	(0.0108)
Awareness of security features						
No of security features known	−0.0329***	0.0087	0.0543***	−0.0028	−0.0364***	0.0149***
	(0.0091)	(0.0085)	(0.0096)	(0.0329)	(0.0095)	(0.0048)
No of security features known (squared)	0.0033**	0.0001	−0.0044***	−0.0027	0.0042***	−0.0010
	(0.0013)	(0.0012)	(0.0013)	(0.0039)	(0.0014)	(0.0007)
Control for other factors	Y	Y	Y	Y	Y	Y
Demographic and year dummies	Y	Y	Y	Y	Y	Y
Observations	4,153	4,153	3,458	327	3,814	4,138

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
(a) Restricted to respondents from all years who have received counterfeits in the past 12 months
(b) Restricted to respondents from all years who have not received counterfeits in the past 12months

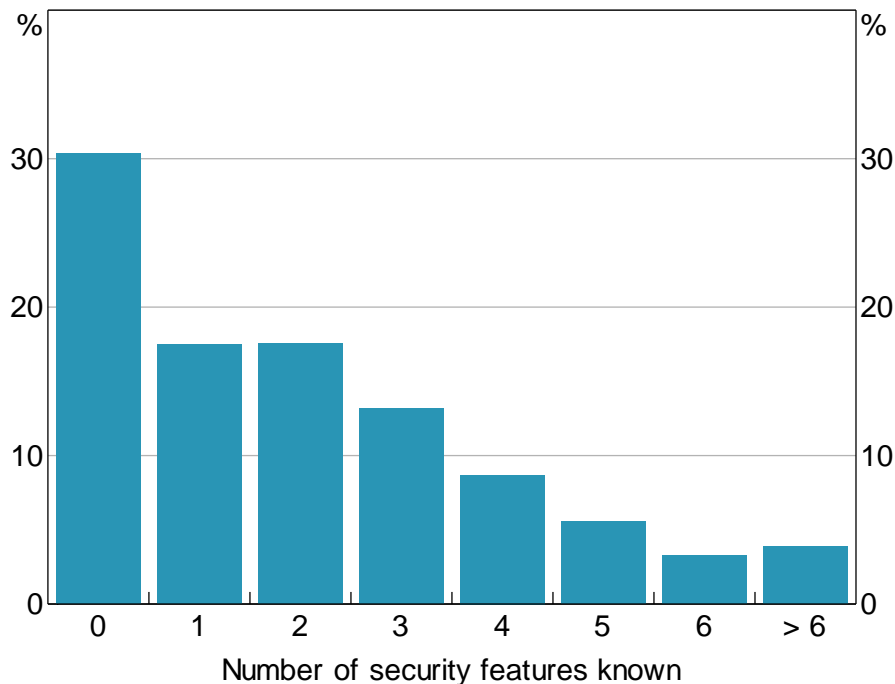Sources: Authors' calculations; RBA, online banknote surveys

4.4.2 Knowledge of security features

The effectiveness of banknote security features in deterring counterfeiting is based not just on the number and quality of security features that a banknote contains, but also on the public's familiarity with the security features – if a person does not know a particular security feature then they are unlikely to be able to use it to authenticate a banknote (Masuda, Pedersen and Hardeberg 2015). Many institutions have conducted studies to determine the optimal number of security features that a person should know to recognise and authenticate banknotes (Williams and Anderson 2007). For some central banks, the optimal number of public security features determines how many security features are disclosed to the public. In Australia, ten security features for the new series banknotes (Next Generation Banknote Series) are listed on the Bank's public website, although in practice most members of the public are aware of less than this (Figure 2). Similarly, research on US and euro banknotes show that most members of the public are not aware of many security features (Williams and Anderson 2007; de Heij 2007).

Despite the importance of assessing public awareness of security features, Williams and Anderson (2007) remark that there are few studies conducted on this topic. This section aims to extend the literature from an Australian viewpoint, to understand whether low awareness of banknote security features is associated with low confidence in Australian banknotes and increases in the perceived counterfeit risk. We assess the public's familiarity with banknote security features quantitatively by counting the number of security features that participants claim to know, via the survey question 'How can you tell a banknote is genuine?' We would expect a positive relationship

between the number of security features that an individual knows and their confidence in the security of Australian banknotes.

Figure 2: Distribution of Security Features Known

Sources: Authors' calculations; RBA, online banknote surveys

Regression (1) in the security features panel of Table 8 confirms that perceived counterfeit risk is reduced with each additional security feature known, although the effect diminishes slightly as individuals become aware of more and more additional features (that is, the coefficient on the number of features known is negative, while the coefficient on the square of that quantity is positive in Regression (1)). Awareness of security features does not have a statistically significant effect on overall belief about the existence or otherwise of a counterfeiting problem in Australia (Regression (2)), while knowing more security features increases confidence in the system at a diminishing rate (Regression (3)).

4.5   External Factor: The Media

Another important question to ask is whether an individual's subjective belief about counterfeit risk is influenced by external factors, such as the media. Pfeiffer, Windzio and Kleimann (2005) use German survey data to show that more television broadcasts of crime are associated with the belief that crime is rising (in contrast to the actual declining trend of police recorded crime). A study by Chan and Chan (2012) of Hong Kong media indicates that sensational newspaper stories tend to influence the public's perception of crime negatively. Other research on fear of crime has also shown that seeing the victimisation of others in one's social network or through television media may have a greater effect on the level of fear than being a victim oneself (Romer, Jamieson and Aday 2003; Wilcox, Jordan and Pritchard 2007; Chadee and Ng Ying 2013).

In this section we study how the frequency and intensity with which the media reports on banknote counterfeits affects the public's perception of counterfeit risk. We conjecture that, as the public are exposed to more media reports on counterfeit incidents, they are more likely to suspect the

authenticity of their banknote holdings. Thus, they will tend to submit more genuine banknotes to authorities as suspected counterfeits. To test for this hypothesis, we employ a fixed-effects panel regression of the monthly number of genuine banknotes submitted to authorities, broken down to the state level. We control for the actual number of counterfeits detected, the quality of banknotes in circulation, time effects, state fixed effects, and other time-varying state variables such as population, employment rates, inflation, hourly wages and criminal proceedings. For both actual counterfeits and genuine banknotes submitted in error as counterfeits, we date the submission as the earlier of: the date the counterfeit was detected; the date the counterfeit was submitted to authorities; and the date the counterfeit was processed by the Bank (these events should occur in the order listed, but in some cases our data are incomplete and so one or more of these dates are unknown).

Before presenting the empirical results, we look at how the total number of media reports on counterfeiting, the number of unique counterfeiting incidents reported in the media, and the number of genuine banknotes incorrectly submitted as counterfeits vary over time at the national level (Figure 3). The number of genuine banknotes submitted in error appears related to the number of unique counterfeiting incidents reported by the media, although with some lag. On the other hand, there appears to be less of a relationship between genuine banknotes being submitted and the total number of media reports.

Figure 3: Media Coverage and Genuine Banknotes Submitted in Error

National level, three-month moving average

LHS: — Total media reports — Genuine banknotes
RHS: — Unique reported incidents
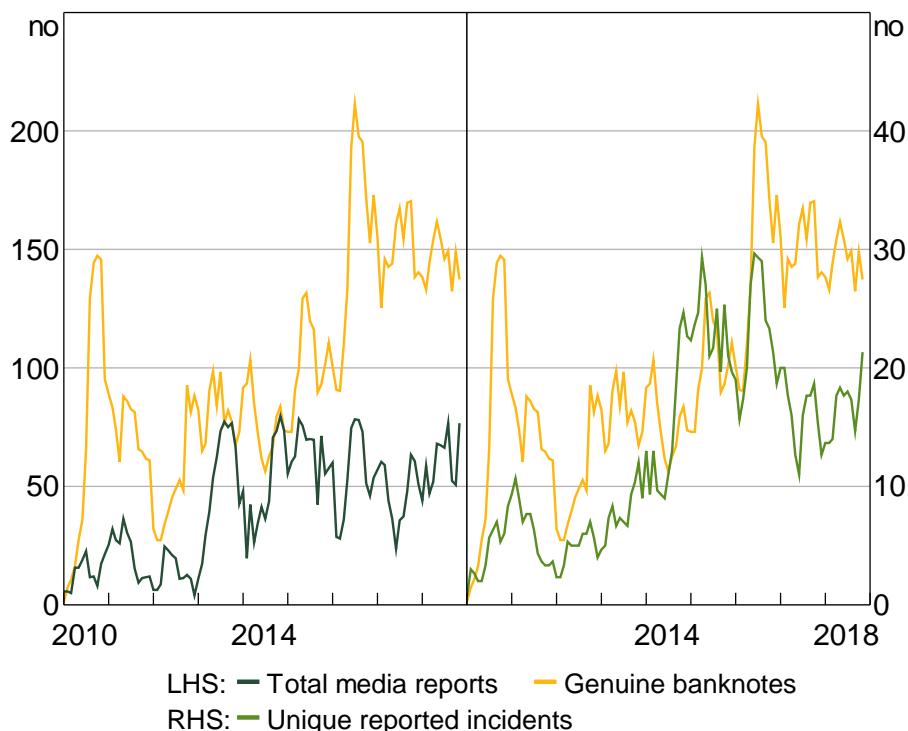
Sources: Authors' calculations; RBA

Table 9 presents the regression results of the number of genuine banknotes submitted in error on various measures of media reporting and with various other control variables included or excluded. All regressions paint a similar picture: a higher number of *unique* counterfeiting incidents being reported by the media increases the tendency to mistakenly submit genuine banknotes as counterfeits, although the effect does not take place immediately but with a roughly one month lag.

One extra unique counterfeiting incident reported by the media is associated with three extra genuine banknotes submitted the following month. Conversely, for a given number of unique counterfeiting incidents, the marginal effect of more media reports on the same set of incidents is negative. That is, as the same incidents are reported more times in the media, the effect of media coverage falls.

Table 9: Marginal Effects of Media Reports on the Number of Genuine Banknotes Submitted in Error

	Model		
	Random effect	Fixed effect	Fixed effect and time effect
Total number of media reports	−0.241***	−0.169**	−0.180**
	(0.090)	(0.082)	(0.076)
One-month lagged reports	−0.422***	−0.323**	−0.375**
	(0.159)	(0.143)	(0.150)
Number of unique incidents	1.017	0.477	0.481
	(0.696)	(0.686)	(0.696)
One-month lagged reported incidents	3.203**	2.572*	2.811**
	(1.437)	(1.336)	(1.360)
Log of detected counterfeits	0.149	3.371***	3.047***
	(0.450)	(0.794)	(0.798)
Quality of banknotes	−10.360***	−5.588***	−5.658***
	(1.590)	(1.644)	(1.691)
Time-varying state controls	Y	Y	Y
State fixed effects	N	Y	Y
Time fixed effects	N	N	Y
Observations	580	580	580

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
Sources: Authors' calculations; Insentia; RBA, online banknote surveys

5. Conclusion

In this paper we investigate various factors that might influence the general public's confidence in the security of Australian banknotes, using a unique series of online banknote surveys conducted for the Bank since 2010. We measure this confidence in three main ways: the perceived likelihood of receiving a counterfeit over the next 12 months; the belief that there is a counterfeiting problem in Australia; and confidence in the current system to remove counterfeits from circulation.

We find that past experience of problems using banknotes significantly worsens both perceived counterfeit risk and confidence in the system to remove counterfeits. This suggests that central banks can reduce perceptions of counterfeiting risk by improving the quality and usability of banknotes. Females, younger adults, people with low income, and those who reported having received counterfeits in the past are also found to assess the counterfeit risk more negatively. However, with the exception of being a younger adult, confidence in the system to remove counterfeits was largely unaffected by demographic factors or reported past experience with counterfeits. Awareness of a banknote upgrade program does not seem to have much effect on confidence, although it worsens perceptions of the current level of counterfeiting suggesting that

some people associate banknote upgrades as responding to a current counterfeiting problem. Finally, knowing more banknote security features is associated with higher confidence.

To assess the relationship between media coverage and public confidence in banknotes, we use monthly data on media reports on counterfeiting, genuine banknotes submitted in error as counterfeits, and actual counterfeit detections. As more unique counterfeit incidents are reported in the media, more genuine banknotes are mistakenly submitted as counterfeits, which we interpret as media coverage heightening the sense of counterfeit risk.

Appendix A: Robustness Checks

Table A1: Average Marginal Effects on Perceived Risk of Receiving Counterfeits

	Binary variable	Binary variable	Categories: 0–4, 5, 6–10	Categories: 0–3, 4–6, 7–10	Binary variable with 5 removed
	(OLS)	(Logit)	(Ordered logit)	(Ordered logit)	(Probit)
Female	0.0359**	0.0356**	0.0164	0.0179**	0.0110
	(0.0155)	(0.0154)	(0.0102)	(0.0071)	(0.0146)
16–24 years old	0.0060	0.0045	0.0100	0.0133	0.0385
	(0.0265)	(0.0260)	(0.0170)	(0.0119)	(0.0249)
25–44 years old	0.0519***	0.0518***	0.0419***	0.0356***	0.0625***
	(0.0190)	(0.0188)	(0.0122)	(0.0088)	(0.0178)
Low income (≤ $40k)	0.0561**	0.0552**	0.0343**	0.0197*	0.0276
	(0.0229)	(0.0227)	(0.0150)	(0.0107)	(0.0217)
Middle income ($40k–$100K)	0.0183	0.0173	0.0111	0.0037	0.0094
	(0.0181)	(0.0177)	(0.0115)	(0.0082)	(0.0165)
Have received a counterfeit	0.2352***	0.2314***	0.1735***	0.1167***	0.2067***
	(0.0292)	(0.0291)	(0.0180)	(0.0128)	(0.0243)
Had serious problems using banknotes	0.1778***	0.1703***	0.1312***	0.1009***	0.1728***
	(0.0239)	(0.0219)	(0.0141)	(0.0106)	(0.0193)
Use cash daily	0.0854***	0.0849***	0.0683***	0.0486***	0.0927***
	(0.0202)	(0.0202)	(0.0143)	(0.0104)	(0.0199)
Had notes checked	0.0472***	0.0477***	0.0389***	0.0250***	0.0485***
	(0.0162)	(0.0160)	(0.0108)	(0.0076)	(0.0154)
Heard of NGB	0.0197	0.0207	0.0175	0.0129	0.0180
	(0.0191)	(0.0193)	(0.0129)	(0.0092)	(0.0181)
No of features known	−0.0332***	−0.0330***	−0.0159***	−0.0116***	−0.0046
	(0.0093)	(0.0092)	(0.0060)	(0.0044)	(0.0088)
No of features known (squared)	0.0033**	0.0032**	0.0015*	0.0012*	0.0004
	(0.0013)	(0.0013)	(0.0008)	(0.0006)	(0.0013)
Other controls	Y	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y	Y
Observations	4,153	4,153	4,153	4,153	3,413

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses

Sources: Authors' calculations; RBA, online banknote surveys

Table A2: Average Marginal Effects on General Counterfeit Belief and Confidence in the System

	Probability				
	There is a counterfeiting problem		Confident in the system		
	Binary variable		Binary variable		Categories: Confident, Neither, Not confident
	(OLS)	(Logit)	(OLS)	(Logit)	(Ordered logit)
Female	0.0716***	0.0713***	−0.0071	−0.0078	−0.0027
	(0.0143)	(0.0143)	(0.0168)	(0.0166)	(0.0164)
16–24 years old	−0.0609**	−0.0610***	−0.1662***	−0.1653***	−0.1685***
	(0.0246)	(0.0234)	(0.0302)	(0.0305)	(0.0295)
25–44 years old	−0.0130	−0.0140	−0.0890***	−0.0873***	−0.0912***
	(0.0176)	(0.0176)	(0.0206)	(0.0204)	(0.0197)
Low income (≤ $40k)	0.0465**	0.0460**	−0.0416	−0.0422*	−0.0478*
	(0.0218)	(0.0215)	(0.0255)	(0.0254)	(0.0251)
Middle income ($40k–$100K)	0.0167	0.0162	−0.0183	−0.0184	−0.0210
	(0.0170)	(0.0168)	(0.0201)	(0.0196)	(0.0194)
Have received a counterfeit	0.2152***	0.1832***	−0.0442	−0.0416	−0.0825**
	(0.0292)	(0.0249)	(0.0325)	(0.0303)	(0.0326)
Had serious problems using banknotes	0.1508***	0.1288***	−0.1409***	−0.1315***	−0.1586***
	(0.0236)	(0.0195)	(0.0254)	(0.0230)	(0.0237)
Use cash daily	0.0721***	0.0695***	−0.0043	−0.0037	−0.0158
	(0.0193)	(0.0192)	(0.0217)	(0.0209)	(0.0208)
Had notes checked	0.1175***	0.1163***	−0.0075	−0.0078	−0.0175
	(0.0156)	(0.0154)	(0.0171)	(0.0172)	(0.0171)
Heard of NGB	0.0409**	0.0382**	0.0050	0.0050	−0.0040
	(0.0185)	(0.0177)	(0.0200)	(0.0204)	(0.0205)
No of features known	0.0076	0.0085	0.0551***	0.0543***	0.0516***
	(0.0087)	(0.0085)	(0.0097)	(0.0097)	(0.0095)
No of features known (squared)	0.0003	0.0002	−0.0046***	−0.0045***	−0.0042***
	(0.0013)	(0.0012)	(0.0013)	(0.0014)	(0.0014)
Other controls	Y	Y	Y	Y	Y
Year dummies	Y	Y	Y	Y	Y
Observations	4,153	4,153	3,458	3,458	3,458

Notes: ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level, respectively; standard errors are in parentheses
Sources: Authors' calculations; RBA, online banknote surveys

References

Alper M and AT Chappell (2012), 'Untangling Fear of Crime: A Multi-Theoretical Approach to Examining the Causes of Crime-Specific Fear', *Sociological Spectrum*, 32(4), pp 346–363.

Andersson H and P Lundborg (2007), 'Perception of Own Death Risk', *Journal of Risk and Uncertainty*, 34(1), pp 67–84.

Chadee D and NK Ng Ying (2013), 'Predictors of Fear of Crime: General Fear versus Perceived Risk', *Journal of Applied Social Psychology*, 43(9), pp 1896–1904.

Chan AKP and VMS Chan (2012), 'Public Perception of Crime and Attitudes toward Police: Examining the Effects of Media News', *Discovery – SS Student E-Journal*, 1, pp 215–237.

Cops D and S Pleysier (2011), '"Doing Gender" in Fear of Crime: The Impact of Gender Identity on Reported Levels of Fear of Crime in Adolescents and Young Adults', *The British Journal of Criminology*, 51(1), pp 58–74.

Cops D, S Pleysier and J Put (2012), 'Worrying about the Future and Fear of Crime among Young Adults: A Social Psychological Approach', *Journal of Youth Studies*, 15(2), pp 191–205.

de Heij H (2007), 'Public Feed Back for Better Banknote Design 2', De Nederlandsche Bank Occasional Studies, 5(2).

Franklin TW, CA Franklin and NE Fearn (2008), 'A Multilevel Analysis of the Vulnerability, Disorder, and Social Intergration Models of Fear of Crime', *Social Justice Research*, 21(2), pp 204–227.

Jackson J, N Allum and G Gaskell (2006), 'Bridging Levels of Analysis in Risk Perception Research: The Case of the Fear of Crime', *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 7(1), Article 20.

Jackson J and E Gray (2010), 'Functional Fear and Public Insecurities about Crime', *The British Journal of Criminology*, 50(1), pp 1–22.

Jones A, D Abbott and D Quilgars (2006), 'Social Inequality and Risk', in P Taylor-Gooby and JO Zinn (eds), *Risk in Social Science*, Oxford University Press, Oxford, pp 228–249.

Kanan JW and MV Pruitt (2002), 'Modeling Fear of Crime and Perceived Victimization Risk: The (In)Significance of Neighborhood Integration', *Sociological Inquiry*, 72(4), pp 527–548.

Kemshall H (2006), 'Crime and Risk', in P Taylor-Gooby and JO Zinn (eds), *Risk in Social Science*, Oxford University Press, Oxford, pp 76–93.

Masuda O, M Pedersen and JY Hardeberg (2015), 'Effects of Awareness to Security Features on the Confidence in Banknotes', *Journal of Print and Media Technology Research*, 4(2), pp 103–110.

May DC, NE Rader and S Goodrum (2010), 'A Gendered Assessment of the "Threat of Victimization": Examining Gender Differences in Fear of Crime, Perceived Risk, Avoidance, and Defensive Behaviors', *Criminal Justice Review,* 35(2), pp 159–182.

Orchowski LM, AS Untied and CA Gidycz (2012), 'Reducing Risk for Sexual Victimization: An Analysis of the Perceived Socioemotional Consequences of Self-Protective Behaviors', *Journal of Interpersonal Violence*, 27(9), pp 1743–1761.

Pfeiffer C, M Windzio and M Kleimann (2005), 'Media Use and its Impacts on Crime Perception, Sentencing Attitudes and Crime Policy', *European Journal of Criminology*, 2(3), pp 259–285.

Rader NE and JS Cossman (2011), 'Gender Differences in U.S. College Students' Fear for Others', *Sex Roles*, 64 (7-8), pp 568–581.

Reid LW, JT Roberts and HM Hilliard (1998), 'Fear of Crime and Collective Action: An Analysis of Coping Strategies', *Sociological Inquiry*, 68(3), pp 312–328.

Reiss, Jr AJ and JA Roth (eds) (1994), *Understanding and Preventing Violence, Volume 4: Consequences and Control*, The National Academies Press, Washington DC.

Romer D, KH Jamieson and S Aday (2003), 'Television News and the Cultivation of Fear of Crime', *Journal of Communication,* 53(1), pp 88–104.

Russo S and M Roccato (2010), 'How Long Does Victimization Foster Fear of Crime: A Longitudinal Study', *Journal of Community Psychology*, 38(8), pp 960–974.

Savage I (1993), 'Demographic Influences on Risk Perceptions', *Risk Analysis*, 13(4), pp 413–420.

Scarborough BK, TZ Like-Haislip, KJ Novak, WL Lucas and LF Alarid (2010), 'Assessing the Relationship between Individual Characteristics, Neighborhood Context, and Fear of Crime', *Journal of Criminal Justice*, 38(4), pp 819–826.

Sjöberg L (2004), 'Principles of Risk Perception Applied to Gene Technology', *Embo Reports*, 5(S1), pp S47–S51.

Snedker KA (2012), 'Explaining the Gender Gap in Fear of Crime: Assessments of Risk and Vulnerability among New York City Residents', *Feminist Criminology*, 7(2), pp 75–111.

Tomsich EA, AR Gover and WG Jennings (2011), 'Examining the Role of Gender in the Prevalence of Campus Victimization, Perceptions of Fear and Risk of Crime, and the Use of Constrained Behaviors among College Students Attending a Large Urban University', *Journal of Criminal Justice Education*, 22(2), pp 181–202.

Wilcox P, CE Jordan and AJ Pritchard (2007), 'A Multidimensional Examination of Campus Safety: Victimization, Perceptions of Danger, Worry about Crime, and Precautionary Behavior among College Women in the Post-Clery Era', *Crime & Delinquency*, 53(2), pp 219–254.

Williams MM and RG Anderson (2007), 'Currency Design in the United States and Abroad: Counterfeit Deterrence and Visual Accessibility', Federal Reserve Bank of St. Louis *Review*, 89(5), pp 371–414.