What Matters More, Perceived or Real Crime?

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Accepted: 1 April 2022 / Published online: 18 May 2022 © The Author(s) 2022

Abstract
Crime consistently penetrates public and political debate, where crime, either perceived or real, shapes one’s sense of security, safety and wellbeing. This matters, as the perceived versus real dilemma influences policy decisions. But what matters most? Here the evidence is mixed with often highly inconsistent findings. Against this background, and employing more recent and arguably more robust econometric models, we compare the effect of real crime and perceived crime on self-reported life satisfaction after controlling for the effect of victimisation. We also explore the heterogenous effects of real crime and perceived crime among different socioeconomic and demographic groups. Overall, our results, across all model specifications, demonstrate that perceived crime always matters, while real crime only matters to those on high-incomes. We also find that females tend to be more sensitive to their perceptions, while living outside major cities does not have a significant effect. Our results support our belief that more should be done to reduce the misperceptions of crime. Further, public media coverage related to crime should be more objective and informative to avoid inflating misperceptions and public distress.

Keywords Econometric modelling · Life satisfaction · Perceived crime · Real crime · Victimization

1 Introduction
Among a myriad of other determinants, an individual’s subjective well-being is influenced by a sense of security, perceptions of crime, and victimisation. While the negative effect of crime victimisation on self-reported life satisfaction has been confirmed in the empirical literature (Cohen, 2008; Johnston et al., 2018; Kuroki, 2013; Manning et al., 2016;
Powdthavee (2005), less research, with mixed results, has been undertaken on the relative contributions of real versus perceived levels of crime towards an individual’s life satisfaction. If we find that real crime has no effect on life satisfaction but perceived crime does, we must assume that there is some disjunction between what people think is happening to crime and what is actually happening. Conversely, if we find that real crime has an effect on life satisfaction but perceived crime does not, we must assume that real crime (or some factor or factors correlated with it) are influencing public perceptions of crime in ways not captured by our measures.¹

Evidence shows that the public perceive the volume of crime to be greater than official police statistics of recorded crimes and surveys on rates of victimisation (Hipp, 2013; Indermaur & Roberts, 2009; Weatherburn & Indermaur, 2004). Ambrey et al. (2014) show that the perceived level of crime approximately doubles real crime in Australian neighbourhoods and this discrepancy has increased over time. This biased perception about the level of crime may lead to excessive demand for criminal justice services and public sector agencies to manage crime (Davis & Dossetor, 2010). Moreover, this misperception may lead to increased fear of crime, which would restrict people’s activities and negatively affect individual life satisfaction. Therefore, it is critical to disentangle the effect of different crime measures: (i) victimisation; (ii) the real crime rate in a neighbourhood; and (iii) the perceived level of crime in a neighbourhood, as well as compare their relative effects on individual life satisfaction.

Focusing on (i) and (ii), Powdthavee (2005) reports that the regional crime rate has a negative effect on the life satisfaction of South African residents (both victims and non-victims), after controlling for the effect of being a victim of crime. The results are consistent with the work of Manning et al. (2016) who study Australian data. Di Tella & MacCulloch (2008) also find a negative effect of violent crime rate on individual’s happiness. However, they do not take into account other crime measures. To the contrary, using U.S. data, Cohen (2008) suggests that the effect of the county-level crime rate is no longer significant once the effect of victimisation is included. The mixed evidence on the effect of the real crime rate might be due to the difference in the type of crime category (e.g. offences against the person and property offenses) employed across these studies.

With regard to (iii)—perceived level of crime—the literature has focused on quantifying how fear of crime or the perception of crime in a local neighbourhood affects individual subjective well-being. Employing the European Social Survey (ESS), Moore (2006) presents evidence that fear of crime (using perception of neighbourhood safety as a proxy)² is detrimental to individual life satisfaction, while being a victim of crime or having a household member being a victim does not have a significant effect. In contrast Brenig & Proeger (2018), who employ data from ESS using a similar measure of fear of crime, find that both victimisation and fear of crime have a negative effect on self-reported life satisfaction with the effect of the former larger than the latter. Using South African data, Møller (2005) measures fear of crime in terms of perceived probability of victimisation and concern about personal safety. Møller reports that fear of crime has a more adverse effect on personal well-being than actual victimisation. This finding contradicts Cohen (2008) and Michalos & Zumbo (2000) who suggest that perceived crime has little effect on life satisfaction.

Few studies have examined all three afore-mentioned crime measures, with mixed results. Cohen (2008) concludes that only victimisation has a significant effect on life

¹ We thank an anonymous reviewer for helping us strengthen this conceptualisation of the paper.
² Perception of neighbourhood safety is derived from the question “How safe do you—or would you—feel walking alone in this area after dark?”
satisfaction, whereas some studies (see for example, Bilsky & Wetzels, 1997; Brunton-Smith & Sturgis, 2011; Skogan, 1987) show that victimisation is associated with an elevated fear of crime and other studies (see for example, Naplava, 2008; Tseloni & Zarafonitou, 2008; Wittebrood, 2002) reveal no relationship or a weak relationship. In other research, Hanslmairl (2013) finds that both victimisation and fear of crime exert a negative effect on life satisfaction while the county-level crime rate has no effect. On the contrary, using Australian data, Ambrey et al. (2014) report that all three crime variables have negative and significant effects on life satisfaction. They further postulate that perception of crime, in fact, matters more than the real crime rate.

Against this background, and in an attempt to provide clarity to what appears to be highly inconsistent results, we compare the effect of the real crime rate and perceived crime after controlling for the effect of victimisation on life satisfaction, employing more recent and arguably more robust econometric models. In addition, we explore whether there is heterogeneity in the effect of real crime and perceived crime among different socio-economic and demographic groups. We propose that examining the consequences of crime and victimisation should not stop at assessing victims’ level of fear. Here, a broader perspective allows us to examine how victimization, perceived crime and real crime affect daily life. Dealing with life satisfaction allows us to assess the importance of crime measures for peoples’ life in general and to compare it with other important life domains such as work, close social relations, and income.

1.1 Theory

Life satisfaction is a multi-dimensional construct that is dependent on domains including the social (e.g. social belongingness and acceptance) and physical environment (e.g. availability of community services, prevalence of crime and the provision of security) (Cohen, 2008; Grillo et al., 2010; James et al., 2009; Sirgy & Cornwell, 2002). In other words, life satisfaction not only focuses on the individual but also living and social conditions that shape the way we perceive and live in the environment. Research into life satisfaction aims to unpack the “conditions that affect individual and social well-being, and to what extent” (Frey, 2008, p. 4).

Crime and victimization are related to life satisfaction. As mentioned above, a number of empirical studies have examined the relationship between fear of crime, victimization and life satisfaction. The psychological consequences of fear of crime and victimization corroborate the above findings, but what is the mechanism/s that leads to a change in one’s life satisfaction? Although our primary focus in this article is on the perception of crime, victimization and the real crime rate, and fear of crime is not explicitly measured, we argue that the effect of fear of crime is likely to be reflected in the discrepancy between the measures of perceived and real crime—which in turn affects wellbeing.

A number of empirical studies have identified potential mechanisms. For example, Ross (1993) finds that fear of crime is associated with psychological distress which leads to lower life satisfaction. Ward et al. (1986) and Yin (1982) find that elderly people who have concerns about crime have lower satisfaction. In addition, victimization has been found to be associated with an increased susceptibility to suicidality and depression (Sorenson & Golding, 1990). Exploring the psychological consequences of victimization, Britt (2001) finds that victimization negatively affects perceived health and physical well-being, where this effect is contingent on type of victimization (property crime vs. violent crime) and age. Similar to Ross (1993); Norris & Kaniasty (1994) find that victimization leads to more
distress, with higher levels of depression, anxiety, somatization, hostility, and fear. These effects can be long-term, with victims displaying symptoms of distress up to 15 months after the incident; however, it appears that these effects diminish over time.

The diminishing impact of victimisation is a result of processes of adaptation regarding subjective wellbeing. The processes of adaptation can be observed by diminishing happiness that is observed when an individual buys a new good or has an increase in pay as the individual adapts to the new situation (Frey & Stutzer, 2002). This phenomenon is also observed for events such as the death of a close relative or a friend (Oswald & Powdthavee, 2008a), people who become disabled (Oswald & Powdthavee, 2008b), as well as, the expected declining impact of victimization as observed by Møller (2005).

The paper proceeds as follows. Section 2 presents seven hypotheses. Section 3 describes data and empirical strategy, with an in-depth discussion about different econometric models used to model life satisfaction (i.e. panel fixed effects, random effects ordered probit, fixed effects ordered logit). Finally, empirical results are discussed in Sect. 4, followed by the conclusion.

2 Hypotheses

As there has been a certain degree of consensus on the negative effect of victimisation across the literature, our hypotheses focus on real crime rate and perceived crime. The hypotheses are tested in regression frameworks that control for the effect of victimisation.

**H1** The real rate of crime in an individual’s local neighborhood has a negative effect on that individual’s life satisfaction.

**H2** The perceived rate of crime in an individual’s local neighborhood has a negative effect on that individual’s life satisfaction.

Hypotheses 3–7 center on the possible heterogeneity in the effects of perceived crime, after controlling for victimization and real crime. We are interested in the differences between female and male, young and old, rich and poor, cities and outer regions, and low and high levels of education. This choice of socio-demographic variables is influenced by the extant literature (Ambrey et al., 2014); we do not set a priori expectations and just postulate that there might be marginal differences among these groups.

**H3** The effect of perceived crime is different between females and males.

**H4** The effect of perceived crime is different between the young and the old.

**H5** The effect of perceived crime is different between those who live in cities and those who live outside cities.

**H6** The effect of perceived crime is different between the rich and the poor.

**H7** The effect of perceived crime is different between people with different levels of education.
Empirical Strategies

Data and Descriptive Statistics

We use data from the Household, Income and Labour Dynamics in Australia (HILDA) survey. The survey, currently, has 17 waves. However, data on perceived level of crime is only available in waves 2, 3, 4, 6, 8, 10, 12, 14 and 16 (years 2002, 2003, 2004, 2006, 2008, 2010, 2012, 2014 and 2016 respectively). We merge data from these waves to form an unbalanced panel, where the respondents are observed over at least 2 waves.

The dependent variable—life satisfaction—is derived from responses to the question “All things considered, how satisfied are you with your life”. This is an ordinal variable with 11 categories ranging from 0 (totally dissatisfied with life) to 10 (totally satisfied). The perceived crime variable is obtained from individuals’ responses to how common burglary or theft is in their neighbourhood. This variable ranges from 1 (never happens) to 5 (very common). Figure 1 shows that most individuals perceive crime as being ‘very rare’ (labelled 2) or ‘not common’ (labelled 3). Figure 2 reveals that people who have a higher level of crime perception have lower life satisfaction. In Fig. 2, the sample is split using the median of perceived crime variable, which equals 2.

With regard to the real crime variable, the New South Wales Bureau of Crime Statistics and Research (BOCSAR) provide data on the number of crime incidents for each local government area (LGA) in the state of New South Wales (NSW). To be consistent with the perceived crime variable, the real crime variable is computed by aggregating the annual number of incidents of burglary and theft offence, and then expressing this as number of offences per 1000 individuals in the LGA. In addition to being consistent with the

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3 We use the theft offence category, with the exclusion of fraud, in BOCSAR’s data as our primary model. We also examine three alternative models in sensitivity analyses: (1) theft and robbery; (2) theft (fraud excluded) and robbery; and (3) theft including fraud. In all cases, our substantive findings remain.
perceived crime variable, incidents of burglary and theft data have the advantage of being consistently reported and not influenced by factors such as policing effort. Some categories of crime, for example drug crime, may more accurately reflect changes in police activity than changes in the absolute level at which offenses occur.

By combining all available waves, the sample has 26,127 observations on 5533 individuals. Figure 3 shows the change in the real crime rate over the period 2002 to 2016. We observe that most LGAs in NSW have a lower crime rate in 2016 compared to 2002. Only 5 out of 128 LGAs experienced an increase in the crime rate over the sample period.

To compare the relative contribution of the real crime rate at the LGA level and the perceived crime level of individuals living in that LGA, the real crime rate (continuous) and perceived crime (ordinal) are standardized with 0 mean and 1 standard deviation. Over time, both real crime and perceived crime decline, but the rate of decline of the former is faster. Over the sample period (2002 to 2016), the average crime rate fell by 44% (from 50 incidents per 1000 individuals to 28), whereas the perceived crime only fell by 12% (from 2.71 to 2.39). The overall disparity between perceived crime versus the local crime rate is significant. Figure 4 illustrates the rate of change in perception of crime versus real crime in NSW LGAs. While real crime has been declining (negative percentage change in all years), perception of crime increased in the years 2006, 2008, 2010 and 2016. In 2012, both real crime and perceived crime decreased, but the drop in the real crime was less than the drop in perceived crime. Regarding crime victimisation, the variable is derived from whether a respondent was a victim of physical violence or a victim of property crime over the past 12 months. Only 3.9% of respondents were victims of property crime and 1.4% were victims of violent crime.

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4 Consultation with experts associated with NSW crime, statistics and policy suggested that no obvious reasons could be attributed to the change in trend between real and perceived crime in 2012. We are, therefore, unwilling to speculate on the reason for this phenomenon.
We also include socio-economic and demographic characteristics of respondents and other controls, in line with other literature on life satisfaction (see Ambrey & Fleming (2014) and MacKerron (2012) for a review of determinants of life satisfaction). In addition, following the recent contribution of Johnston et al. (2018), we control for a number of important time-varying life events that affect life satisfaction. These events include death of
| Variable description | Mean | Std. Dev. | Min. | Max. |
|----------------------|------|-----------|------|------|
| **Dependent variable** |      |           |      |      |
| Life satisfaction    | 7.961| 1.432     | 0    | 10   |
| **Independent variables** |      |           |      |      |
| **Demographic factors** |      |           |      |      |
| Age                  | 46.878| 17.899    | 15   | 100  |
| Male                 | .47  | .499      | 0    | 1    |
| Aboriginal and/or Torres Strait islander | .014 | .119 | 0 | 1 |
| Immigrant English (respondent was born in an English speaking country) | .091 | .288 | 0 | 1 |
| Immigrant non-English (respondent was born in an English speaking country) | .126 | .332 | 0 | 1 |
| Poor English         | .01  | .099      | 0    | 1    |
| Married              | .551 | .497      | 0    | 1    |
| Separated            | .033 | .178      | 0    | 1    |
| Divorced             | .08  | .272      | 0    | 1    |
| Widowed              | .06  | .238      | 0    | 1    |
| Defacto              | .077 | .266      | 0    | 1    |
| **Reference group for marital status: single** |      |           |      |      |
| Lone parent          | .082 | .275      | 0    | 1    |
| Number of children   | 1.745| 1.499     | 0    | 14   |
| Poor health (respondent has below average health status) | .185 | .388 | 0 | 1 |
| **Education attainment measures** |      |           |      |      |
| Year 12 (respondent’s highest level of education is year 12) | .134 | .34 | 0 | 1 |
| Certificate or diploma | .301 | .459 | 0 | 1 |
| Bachelor degree or higher | .258 | .437 | 0 | 1 |
| **Reference group of education: less than year 12** |      |           |      |      |
| **Employment and income measures** |      |           |      |      |
| Employed part-time   | .207 | .405      | 0    | 1    |
| Unemployed           | .028 | .164      | 0    | 1    |
| Variable description                                                                 | Mean  | Std. Dev. | Min. | Max. |
|--------------------------------------------------------------------------------------|-------|-----------|------|------|
| Non-participant                                                                      | .334  | .472      | 0    | 1    |
| Reference group: employed full time                                                 |       |           |      |      |
| Household income                                                                     | 37.691| 36.82     | 0    | 1024.37 |
| Hours worked                                                                         | 22.846| 21.13     | 0    | 112  |
| Others present (someone was present during the interview)                           | .353  | .478      | 0    | 1    |
| **Location measures**                                                                |       |           |      |      |
| Commute time (hours per week commuting to work)                                      | 2.611 | 3.979     | 0    | 30   |
| Years at current address                                                              | 11.175| 11.899    | 0    | 85.81 |
| Inner region (respondent lives in inner city region)                                 | .256  | .437      | 0    | 1    |
| Outer region                                                                         | .1    | .3        | 0    | 1    |
| Remote                                                                               | .003  | .056      | 0    | 1    |
| Reference group: respondent lives in major cities                                    |       |           |      |      |
| **Dwelling measures**                                                                |       |           |      |      |
| Renter (respondent is renting the home)                                              | .227  | .419      | 0    | 1    |
| Rent-free (respondent resides in the home rent free)                                 | .025  | .156      | 0    | 1    |
| Reference group: own home                                                             |       |           |      |      |
| Medium-rise (respondent resides in a townhouse or 1–3 storey apartment)              | .178  | .382      | 0    | 1    |
| High-rise (respondent resides in a 4 or more storey apartment)                       | .026  | .158      | 0    | 1    |
| Other dwelling (non-private, a caravan or houseboat)                                 | .005  | .071      | 0    | 1    |
| Reference group: separate house                                                       |       |           |      |      |
| **Major life events**                                                                |       |           |      |      |
| Death of spouse or children in the last 12 months                                     | .010  | .099      | 0    | 1    |
| Death of a close friend in the last 12 months                                        | .120  | .325      | 0    | 1    |
| Major worsening in finance                                                           | .027  | .162      | 0    | 1    |
| Major improvement in finance                                                         | .029  | .169      | 0    | 1    |
**Table 1** (continued)

| Variable description                              | Mean  | Std. Dev. | Min. | Max. |
|---------------------------------------------------|-------|-----------|------|------|
| *Crime measures*                                  |       |           |      |      |
| Victim of property crime                          | .039  | .193      | 0    | 1    |
| Victim of violent crime                           | .014  | .116      | 0    | 1    |
| Gaol (respondent was in gaol in the past 12 months) | .002  | .04       | 0    | 1    |
| Real crime rate (number of burglaries and thefts per 1000 people in the respondent’s LGA) | 34.74 | 22.13     | 7.64 | 284.04 |
| Perceived burglary and theft                      | 2.484 | .919      | 1    | 5    |
a spouse or child, death of a close friend, and major worsening or improvement in finance. Table 1 presents descriptive statistics of the included variables.

### 4 Econometric Models

To examine the effect of different crime measures on individual life satisfaction, we model life satisfaction as a function of socio-economic and demographic characteristics, crime measures and other controls. As the dependent variable is ordinal rather than cardinal, the ordered probit or ordered logit is more appropriate than OLS. For cross-sectional data, the majority of papers use ordered probit/logit models (Hanslmaier, 2013; Powdthavee, 2005). One limitation of the cross-sectional model is the risk of endogeneity due to unobserved individual-specific characteristics. Panel data models provide a promising solution to this issue. Ferrer-i-Carbonell & Frijters (2004) suggest that assuming ordinality or cardinality of life satisfaction makes little difference. In addition, the authors argue that not controlling for individual fixed effects will lead to biased estimates. However, a recent contribution by Schroeder & Yitzhaki (2017) show that there exists monotonic increasing transformations of the ordinal variable that reverse the results of Ferrer-i-Carbonell & Frijters (2004), implying that treating the ordinal variable as cardinal is inappropriate. There is no consensus in the literature on how to estimate a fixed effects estimator for the ordered probit/logit model (Baetschmann et al., 2015), while a random effects estimator can be biased if the individual random effect is correlated with the error term. Therefore, there are two main modelling approaches in the literature to investigate the effect of crime measures on life satisfaction:

(i) ordered probit model and control for country/region fixed effects and time fixed effects (Cohen, 2008; Di Tella & MacCulloch, 2008; Kuroki, 2013); and
(ii) OLS model with regional fixed effects and/or time fixed effects and/or panel (individual) fixed effects (Ambrey et al., 2014; Brenig & Proeger, 2018; Johnston et al., 2018).

The first approach (i) puts more weight on the ordinal nature of life satisfaction and the second approach (ii) focuses on reducing the risk of unobserved characteristics using fixed effects. In addition, the second approach makes it simpler in interpreting the magnitude of the coefficients and computing the willingness to pay for crime reduction or monetary compensation for crime victims.

In this paper, we model life satisfaction as an ordinal variable. Treating a dependent variable which is ordinal as cardinal leads to estimates which if used for prediction could predict values outside of the ordinal scale. To fully utilise the panel characteristics of HILDA data, we employ the random effects ordered probit estimator with Mundlak terms to reduce the risk of endogeneity. Moreover, we estimate the fixed effects ordered logit estimator as a robustness check. Therefore, our econometric models can overcome the controversy of treating ordinal variables as cardinal, as assumed by Ambrey et al., 2014 or Johnston et al., 2018. Further, random effects ordered probit with Mundlak terms and fixed effect ordered logit models out-performed the pooled ordered probit

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5 See "Appendix 1" for a summary of methodology used in key papers within the crime and life satisfaction literature.
models of Cohen, 2008 or Kuroki, 2013. Thus, our empirical strategies are more appropriate than those using either approach (i) or (ii) in the existing literature.

The random effects ordered probit model carries the following form:

$$y_{it}^* = \mu + X_{it}' \beta + \epsilon_{it}$$  \hspace{1cm} (1)

where \(i\) denotes an individual (respondent) and \(t\) denotes time, \(y_{it}^*\) is a latent variable that reflects the self-reported life satisfaction of individual \(i\) at time \(t\). \(\mu\) is a non-random intercept. The error term \(\epsilon_{it}\) is random noise, which includes a random-component that is individual-specific and constant over time \(t\), and a time individual specific white noise \(v_{it}\) (\(\epsilon_{it}=\alpha_i + v_{it}\)). In our baseline models (to test Hypotheses 1 to 4), \(X_{it}'\) is a vector of crime measures (victimisation variables and/or local crime rate and/or perceived crime), socio-economic and demographic characteristics and other controls, \(\beta\) is a vector of coefficients. In order to obtain unbiased estimates, the random effect \(\alpha_i\) has to be uncorrelated with the explanatory variables. This assumption might not hold, thus an approach proposed by Mundlak (1978) is employed (by adding the within-group means of all independent variables). This model has the advantage of controlling for unobserved time-invariant individual heterogeneity. The panel used in this paper is relatively short, which implies that differences across individuals rather than changes within an individual have more influence on life satisfaction. The Mundlak terms can be thought of as the “long term” impacts of a change in a particular variable (Gupta & Kristensen, 2008). With the Mundlak terms included, Eq. (1) becomes:

$$y_{it}^* = \tilde{X}_i' \gamma + X_{it}' \beta + \alpha_i + v_{it}$$  \hspace{1cm} (2)

where, \(\tilde{X}_i = \frac{1}{T} \sum_{t=1}^{T} X_{it}'\).

Individual life satisfaction \((y_{it}^*)\) is a latent variable that cannot be observed. Instead a categorical but ordered random variable \(y_{it}\) is estimated as a function of the explanatory variables with a set of cut off points \(z_j\) \((j=0,1,\ldots,10)\). In our case, \(j\) is overall life satisfaction score ranging between 0 and 10. The probability of choosing an overall life satisfaction level of \(j\) given the vector of explanatory variables \(X'\) corresponds to the region of the distribution where \(y_{it}^*\) falls between \(z_j\) and \(z_{j+1}\). The parameters of interest are estimated using a maximum likelihood function. The beauty of the random (as opposed to a fixed) effect model lies in its ability to measure the effect of time-invariant factors such as gender, whether an individual is an immigrant, or is Indigenous. Therefore, Eq. (2) is our main econometric model.

Although the Mundlak terms can reduce the risk of endogeneity, we search for an alternative fixed effects estimator to serve as a robustness check. There are several methods for estimating fixed effect ordered logit models in the literature; examples include the conditional logit estimation of Chamberlain (1980) or individual-specific dichotomization outlined by Ferrer-i-Carbonell & Frijters (2004). However, each approach has several limitations. Using Monte Carlo simulation, Baetschmann et al. (2015) show that the above approaches are inconsistent. The authors propose the “blow-up and cluster” (BUC) estimator. This estimator considers the ordinal nature of the dependent variable as well as the unobserved individual specific effects such as stable personality traits, cohort effects and measurement error. The BUC estimator replaces every observation in the sample with \(K-1\) copies of itself (\(K\) is the number of ordered outcomes, in this case, \(K\) is 11) and dichotomizes each of these copies at a different cut-off point. This approach
has been applied in recent studies by Manning et al. (2016) and Carlana (2019). Therefore, we employ the BUC estimator in the baseline models (to test Hypotheses 1, 2) and compare the estimates with the estimates of the random effects ordered probit models.

To test for possible heterogeneity in the effect of perceived crime (Hypotheses 3–7), in our extended models, vector $X$ includes the interaction terms between perceived crime and gender, age, income, location and education variables respectively. If the interaction term is statistically significant, the effect of perceived crime on life satisfaction is different in each group.

5 Results and Discussion

5.1 Base Line Models

5.1.1 Crime Measures

To test Hypotheses 1, 2, six regression specifications are estimated. The first specification includes the real crime variable derived from BOCSAR data, the second regression includes the perceived crime variable, and the third regression includes both the real crime and perceived crime variables. These three regressions are estimated using the random effects ordered probit models. The fourth to sixth regressions have the same right-hand-side variables as the first to third regressions respectively, however, they are estimated by the fixed effects ordered logit models (using the BUC estimator). Results are presented in Table 2.

For Hypothesis 1, we firstly examine the regression with real crime and without perceived crime (columns I and IV of Table 2). Real crime has a negative and significant effect (at the 5 percent level) on life satisfaction in the random effects model (column I). However, it is statistically nonsignificant in the fixed effects model (column IV). Once perceived crime is included in the regression, the effect of real crime is no longer significant at the conventional 5% level, as indicated in column (III). Therefore Hypothesis 1 is rejected at 5% but accepted at 10% in the random effect models, while it is rejected at any level in the fixed effect models.

Given that results of the random effects and fixed effects are slightly different with regard to the relevance of the real crime variable, we investigate the possible difference in the slope of the real crime variable by estimating the regression with all three crime measures in different sub-samples. Specifically, we estimate the model on the samples of the 1st and 4th quartiles of the real crime variable and do not find a significant effect of real crime. We also include a square term of the real crime variable, but it is also statistically nonsignificant.  

When we split the sample based on income (using the median), the real crime variable is statistically nonsignificant in the low-income group while it is negative and strongly significant in the high-income group (see columns I and II of Table 3). The effect for the high-income group remains significant when perceived crime is included (see column IV.

6 Results are available upon request.
|                | Ordered probit random effects | Ordered logit fixed effects |
|----------------|-------------------------------|-------------------------------|
|                | (I)                          | (II)                          | (III)                        | (IV)                          | (V)                          | (VI)                         |
|                | Real crime                   | Perceived crime               | Real versus Perceived        | Real crime                   | Perceived crime               | Real versus Perceived        |
| Age            | $-0.0518^{***}$ (0.0072)     | $-0.0435^{***}$ (0.0069)      | $-0.0469^{***}$ (0.0072)     | $-0.0296^*$ (0.0180)         | $-0.0266$ (0.0176)           | $-0.0273$ (0.0180)           |
| Age²           | $0.0004^{***}$ (0.0000)      | $0.0004^{***}$ (0.0000)       | $0.0004^{***}$ (0.0000)      | $0.0002$ (0.0002)            | $0.0002$ (0.0002)            | $0.0002$ (0.0002)            |
| Male           | $-0.0100$ (0.0335)           | $-0.0199$ (0.0333)            | $-0.0203$ (0.0333)           | $-0.0296^*$ (0.0180)         | $-0.0266$ (0.0176)           | $-0.0273$ (0.0180)           |
| Aboriginal     | $0.2808^{**}$ (0.1184)       | $0.2906^{**}$ (0.1177)       | $0.2882^{**}$ (0.1178)       | $0.0002$ (0.0002)            | $0.0002$ (0.0002)            | $0.0002$ (0.0002)            |
| Immigrant-English | $0.0759$ (0.0542)        | $0.0717$ (0.0539)             | $0.0706$ (0.0539)             | $-0.3764$ (0.2764)           | $-0.3577$ (0.2735)           | $-0.3576$ (0.2734)           |
| Immigrant non-English | $-0.2578^{**}$ (0.0492) | $-0.2779^{**}$ (0.0489)      | $-0.2768^{**}$ (0.0489)      | $-0.2900^{**}$ (0.1950)      | $-0.3007$ (0.1943)           | $-0.3018$ (0.1943)           |
| Poor English   | $-0.2630^*$ (0.1417)         | $-0.2528^*$ (0.1417)         | $-0.2534^*$ (0.1417)         | $-0.3764$ (0.2764)           | $-0.3577$ (0.2735)           | $-0.3576$ (0.2734)           |
| Married        | $0.3518^{***}$ (0.0546)      | $0.3463^{***}$ (0.0545)      | $0.3443^{***}$ (0.0546)      | $0.3901^{***}$ (0.1342)      | $0.3924^{***}$ (0.1349)      | $0.3916^{***}$ (0.1348)      |
| Separated      | $-0.0458$ (0.0826)           | $-0.0534$ (0.0826)           | $-0.0556$ (0.0826)           | $-0.3764$ (0.2764)           | $-0.3577$ (0.2735)           | $-0.3576$ (0.2734)           |
| Divorced       | $0.2014^{**}$ (0.0811)      | $0.1914^{**}$ (0.0810)       | $0.1876^{**}$ (0.0811)       | $-0.2990$ (0.1950)           | $-0.3007$ (0.1943)           | $-0.3018$ (0.1943)           |
| Widowed        | $0.1440^{***}$ (0.0700)     | $0.1323^{*}$ (0.0697)        | $0.1328^{*}$ (0.0698)        | $0.0534$ (0.1901)            | $0.0429$ (0.1901)            | $0.0413$ (0.1901)            |
| Defacto        | $0.2117^{***}$ (0.0491)     | $0.2129^{***}$ (0.0491)      | $0.2090^{***}$ (0.0491)      | $0.2654^{***}$ (0.1069)      | $0.2693^{**}$ (0.1073)       | $0.2682^{**}$ (0.1072)       |
| Lone parent    | $-0.1358^{***}$ (0.0471)    | $-0.1334^{***}$ (0.0471)     | $-0.1339^{***}$ (0.0471)     | $-0.2292^{**}$ (0.1020)      | $-0.2225^{**}$ (0.1020)      | $-0.2228^{**}$ (0.1020)      |
| Number of children | $-0.0738^{***}$ (0.0201) | $-0.0747^{***}$ (0.0201)     | $-0.0743^{***}$ (0.0201)     | $-0.1626^{***}$ (0.0486)     | $-0.1622^{***}$ (0.0491)     | $-0.1620^{***}$ (0.0491)     |
| Poor health    | $-0.4129^{***}$ (0.0279)    | $-0.4099^{***}$ (0.0279)     | $-0.4100^{***}$ (0.0279)     | $-0.6914^{***}$ (0.0587)     | $-0.6858^{***}$ (0.0588)     | $-0.6859^{***}$ (0.0588)     |
| Year 12        | $-0.1997^{***}$ (0.0567)    | $-0.1981^{***}$ (0.0567)     | $-0.1959^{***}$ (0.0567)     | $-0.4815^{***}$ (0.1223)     | $-0.4721^{***}$ (0.1226)     | $-0.4712^{***}$ (0.1226)     |
| Certificates   | $-0.1089^*$ (0.0587)         | $-0.1095^*$ (0.0587)         | $-0.1077^*$ (0.0587)         | $-0.3064^{**}$ (0.1310)      | $-0.2927^{**}$ (0.1312)      | $-0.2924^{**}$ (0.1312)      |
| Bachelors      | $0.0824$ (0.0818)            | $0.0788$ (0.0818)            | $0.0802$ (0.0818)            | $-0.1106$ (0.1781)           | $-0.1091$ (0.1781)           | $-0.1086$ (0.1780)           |
| Employed part time | $-0.0047$ (0.0387)  | $-0.0055$ (0.0387)            | $-0.0059$ (0.0387)            | $-0.024$ (0.0796)            | $-0.0258$ (0.0796)           | $-0.0260$ (0.0796)           |
### Table 2 (continued)

| Variable                  | Ordered probit random effects | Ordered logit fixed effects |
|---------------------------|-------------------------------|-----------------------------|
|                           | (I)                           | (II)                        | (III)                        | (IV)                           | (V)                           | (VI)                          |
|                           | Real crime                    | Perceived crime             | Real versus Perceived        | Real crime                    | Perceived crime               | Real versus Perceived         |
| Unemployed                | $-0.3112^{***}$ (0.0729)      | $-0.3130^{***}$ (0.0729)    | $-0.3142^{***}$ (0.0729)     | $-0.5888^{***}$ (0.1534)      | $-0.5956^{***}$ (0.1532)      | $-0.5959^{***}$ (0.1532)      |
| Non-participation         | $-0.1356^{**}$ (0.0591)       | $-0.1384^{**}$ (0.0591)     | $-0.1393^{**}$ (0.0591)      | $-0.3016^{**}$ (0.1258)       | $-0.3083^{**}$ (0.1254)       | $-0.3085^{**}$ (0.1254)       |
| Income                    | $0.0014^{***}$ (0.0004)       | $0.0014^{***}$ (0.0004)     | $0.0014^{***}$ (0.0004)      | $0.0028^{***}$ (0.0009)       | $0.0028^{***}$ (0.0009)       | $0.0028^{***}$ (0.0009)       |
| Hours work                | $-0.0067^{***}$ (0.0013)      | $-0.0067^{***}$ (0.0013)    | $-0.0067^{***}$ (0.0013)     | $-0.0129^{***}$ (0.0027)      | $-0.0129^{***}$ (0.0027)      | $-0.0129^{***}$ (0.0027)      |
| Other adult present       | $0.0868^{***}$ (0.0191)       | $0.0870^{***}$ (0.0191)     | $0.0872^{***}$ (0.0191)      | $0.1590^{***}$ (0.0377)       | $0.1594^{***}$ (0.0378)       | $0.1594^{***}$ (0.0378)       |
| Commute time              | $-0.0070^{**}$ (0.0028)       | $-0.0071^{**}$ (0.0028)     | $-0.0073^{**}$ (0.0028)      | $-0.0150^{**}$ (0.0058)       | $-0.0156^{**}$ (0.0057)       | $-0.0157^{**}$ (0.0057)       |
| Years at current add      | $-0.0068^{***}$ (0.0018)      | $-0.0065^{***}$ (0.0018)    | $-0.0065^{***}$ (0.0018)     | $-0.0127^{***}$ (0.0040)      | $-0.0121^{***}$ (0.0040)      | $-0.0121^{***}$ (0.0040)      |
| Inner region              | $0.0258$ (0.0522)              | $0.0257$ (0.0522)            | $0.0213$ (0.0523)             | $-0.0007$ (0.1131)             | $-0.0046$ (0.1125)             | $-0.0061$ (0.1129)             |
| Outer region              | $-0.0586$ (0.0845)             | $-0.0527$ (0.0844)           | $-0.0604$ (0.0845)            | $-0.0515$ (0.1888)             | $-0.0577$ (0.1885)             | $-0.0601$ (0.1892)             |
| Remote                    | $0.4197$ (0.3314)              | $0.4409$ (0.3318)            | $0.4499$ (0.3320)             | $0.4503$ (0.5340)              | $0.5366$ (0.5292)              | $0.5360$ (0.5282)              |
| Renter                    | $-0.1556^{***}$ (0.0341)      | $-0.1521^{***}$ (0.0341)    | $-0.1513^{***}$ (0.0341)     | $-0.2769^{***}$ (0.0716)      | $-0.2674^{***}$ (0.0716)      | $-0.2669^{***}$ (0.0716)      |
| Rent-free                 | $-0.1519^{***}$ (0.0661)      | $-0.1519^{***}$ (0.0661)    | $-0.1515^{***}$ (0.0661)     | $-0.2749^{***}$ (0.1318)      | $-0.2761^{***}$ (0.1318)      | $-0.2759^{***}$ (0.1318)      |
| Medium-rise               | $-0.0287$ (0.0325)             | $-0.0247$ (0.0325)           | $-0.0209$ (0.0326)            | $-0.0119$ (0.0674)             | $0.0011$ (0.0671)              | $0.0022$ (0.0673)              |
| High-rise                 | $-0.0330$ (0.0713)             | $-0.0344$ (0.0712)           | $-0.0275$ (0.0713)            | $-0.0508$ (0.1463)             | $-0.0506$ (0.1457)             | $-0.0478$ (0.1462)             |
| Other dwelling            | $-0.2214^{*}$ (0.1234)         | $-0.2177^{*}$ (0.1234)       | $-0.2140^{*}$ (0.1234)        | $-0.2496$ (0.2765)             | $-0.2415$ (0.2758)             | $-0.2398$ (0.2758)             |
| Death spouse/children     | $-0.4754^{***}$ (0.0807)       | $-0.4755^{***}$ (0.0807)    | $-0.4758^{***}$ (0.0807)     | $-0.7953^{***}$ (0.1886)      | $-0.8007^{***}$ (0.1892)      | $-0.8006^{***}$ (0.1892)      |
| Death of friend           | $-0.0450^{*}$ (0.0249)         | $-0.0446^{*}$ (0.0249)       | $-0.0444^{*}$ (0.0249)       | $-0.0781$ (0.0505)             | $-0.0770$ (0.0508)             | $-0.0768$ (0.0507)             |
Table 2 (continued)

|                | Ordered probit random effects | Ordered logit fixed effects |
|----------------|-------------------------------|----------------------------|
|                | (I)                           | (II)                       | (III)                      | (IV)                        | (V)                        | (VI)                       |
|                | Real crime                    | Perceived crime            | Real versus Perceived      | Real crime                  | Perceived crime            | Real versus Perceived      |
| Worse finance  | $-0.3796^{***}$ (0.0486 leq)  | $-0.3798^{***}$ (0.0486 leq) | $-0.3806^{***}$ (0.0486 leq) | $-0.6690^{***}$ (0.1053 leq) | $-0.6740^{***}$ (0.1052 leq) | $-0.6742^{***}$ (0.1052 leq) |
| Better finance | $0.1320^{***}$ (0.0454 leq)   | $0.1294^{***}$ (0.0454 leq) | $0.1299^{***}$ (0.0454 leq) | $0.2952^{***}$ (0.0921 leq) | $0.2874^{***}$ (0.0921 leq) | $0.2878^{***}$ (0.0920 leq) |
| Victim property crime | $-0.1359^{***}$ (0.0400 leq) | $-0.1158^{***}$ (0.0403 leq) | $-0.1152^{***}$ (0.0403 leq) | $-0.2946^{***}$ (0.0839 leq) | $-0.2551^{***}$ (0.0848 leq) | $-0.2549^{***}$ (0.0848 leq) |
| Victim violent crime | $-0.3598^{***}$ (0.0692 leq) | $-0.3545^{***}$ (0.0692 leq) | $-0.3559^{***}$ (0.0692 leq) | $-0.5533^{***}$ (0.1408 leq) | $-0.5394^{***}$ (0.1414 leq) | $-0.5395^{***}$ (0.1414 leq) |
| Goal           | $-0.4809^{***}$ (0.1956 leq)  | $-0.4741^{***}$ (0.1956 leq) | $-0.4735^{***}$ (0.1956 leq) | $-0.4940$ (0.3813 leq)      | $-0.4985$ (0.3831 leq)      | $-0.4987$ (0.3828 leq)      |
| Real crime     | $-0.0297^{**}$(0.0136 leq)    | $-0.0245^{**}$(0.0137 leq)  | $-0.0245^{**}$(0.0137 leq)  | $-0.0198$ (0.0347 leq)      | $-0.0198$ (0.0347 leq)      | $-0.0093$ (0.0351 leq)      |
| Perceived crime | $-0.0454^{**}$(0.0102 leq)   | $-0.0438^{***}$(0.0102 leq) | $-0.0438^{***}$(0.0102 leq) | $-0.0859^{***}$(0.0205 leq) | $-0.0853^{***}$(0.0206 leq) | $-0.0853^{***}$(0.0206 leq) |
| Obs            | 26,127                        | 26,127                      | 26,127                      | 23,464                      | 23,464                      | 23,464                      |
| Number of individuals | 5533                          | 5533                        | 5533                        | 4655                        | 4655                        | 4655                        |

Key crime variables are highlighted in bold
Clustered Standard errors are in parenthesis

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Cut-off points, time dummies and Mundlak terms are estimated but not reported in columns (I) to (III)
Table 3 Effect of real crime in low-income and high-income groups

|                  | (I)          | (II)          | (III)          | (IV)          |
|------------------|--------------|---------------|---------------|--------------|
|                  | Low income   | High income   | Low income    | High income  |
| Age              | −0.0561***   | −0.0658***    | −0.0512***    | −0.0616***   |
|                  | (0.0095)     | (0.0114)      | (0.0095)      | (0.0114)     |
| Age2             | 0.0004***    | 0.0006***     | 0.0004***     | 0.0006***    |
|                  | (0.0001)     | (0.0001)      | (0.0001)      | (0.0001)     |
| Male             | 0.0382 (0.0403) | −0.0459 (0.0480) | 0.0299 (0.0402) | −0.0607 (0.0478) |
| Aboriginal       | 0.2438 (0.1376) | 0.2730 (0.1771) | 0.2553 (0.1370) | 0.2681 (0.1762) |
| Immigrant-English| 0.1937*** (0.0715) | 0.0168 (0.0714) | 0.1897*** (0.0712) | 0.0160 (0.0710) |
| Immigrant non-English | −0.2636*** (0.0613) | −0.2328*** (0.0670) | −0.2852*** (0.0611) | −0.2499*** (0.0666) |
| Poor English     | −0.2257 (0.1638) | −0.4690 (0.3299) | −0.2165 (0.1638) | −0.4732 (0.3297) |
| Married          | 0.3799*** (0.0914) | 0.4220*** (0.0798) | 0.3644*** (0.0913) | 0.4193*** (0.0798) |
| Separated        | −0.1247 (0.1393) | 0.0252 (0.1171) | −0.1404 (0.1392) | 0.0167 (0.1170) |
| Divorced         | 0.0716 (0.1380) | 0.3299*** (0.1134) | 0.0547 (0.1379) | 0.3190*** (0.1134) |
| Widowed          | 0.2144*** (0.0927) | 0.1120 (0.1172) | 0.1981*** (0.0925) | 0.0935 (0.1168) |
| Defacto          | 0.1120 (0.0835) | 0.3838*** (0.0720) | 0.1128 (0.0835) | 0.3798*** (0.0720) |
| Lone parent      | −0.0959 (0.0698) | −0.2226*** (0.0750) | −0.0938 (0.0697) | −0.2207*** (0.0750) |
| Number of children | −0.1044*** (0.0340) | −0.0498* (0.0276) | −0.1060*** (0.0340) | −0.0495* (0.0276) |
| Poor health      | −0.3419*** (0.0389) | −0.5055*** (0.0444) | −0.3393*** (0.0389) | −0.5033*** (0.0444) |
| Year 12          | −0.1463** (0.0657) | −0.0110 (0.1722) | −0.1453** (0.0657) | −0.0239 (0.1720) |
| Certificates     | −0.0452 (0.0807) | 0.1860 (0.1278) | −0.0453 (0.0807) | 0.1778 (0.1277) |
| Bachelors        | 0.1432 (0.1159) | 0.3798*** (0.1860) | 0.1405 (0.1159) | 0.3512* (0.1858) |
| Employed part time | 0.0273 (0.0673) | −0.0300 (0.0531) | 0.0281 (0.0673) | −0.0323 (0.0531) |
| Unemployed       | −0.2119* (0.1100) | −0.3488*** (0.1338) | −0.2081* (0.1100) | −0.3677*** (0.1338) |
| Non-participation | −0.0397 (0.0979) | −0.2667*** (0.0887) | −0.0386 (0.0979) | −0.2768*** (0.0887) |
| Income           | −0.0013 (0.0017) | 0.0014*** (0.0004) | −0.0011 (0.0017) | 0.0014*** (0.0004) |
| Hours work       | −0.0030 (0.0022) | −0.0090*** (0.0017) | −0.0030 (0.0022) | −0.0092*** (0.0017) |
| Other adult present | 0.0845*** (0.0284) | 0.0833*** (0.0279) | 0.0844*** (0.0284) | 0.0840*** (0.0279) |
| Commute time     | −0.0026 (0.0054) | −0.0104*** (0.0035) | −0.0030 (0.0054) | −0.0106*** (0.0035) |
| Years at current add | −0.0086*** (0.0026) | −0.0061*** (0.0027) | −0.0084*** (0.0026) | −0.0056*** (0.0027) |
| Inner region     | −0.0161 (0.0764) | 0.0399 (0.0830) | −0.0189 (0.0764) | 0.0345 (0.0830) |
| Outer region     | −0.2172* (0.1212) | 0.1190 (0.1421) | −0.2115* (0.1211) | 0.1023 (0.1421) |
| Remote           | 0.3635 (0.3855) | 0.5254 (0.7714) | 0.3848 (0.3863) | 0.6026 (0.7717) |
| Renter           | −0.1722*** (0.0547) | −0.1276*** (0.0501) | −0.1711*** (0.0547) | −0.1242*** (0.0501) |
| Rent-free        | −0.1637* (0.0980) | −0.0738 (0.1004) | −0.1687* (0.0980) | −0.0711 (0.1004) |
of Table 3). This result may be due to high income individuals being acutely aware of the assets they possess and the potential loss they may experience should they become a victim of crime. In addition, high income individuals may become more cautious of victimisation should a neighbour and/or a known associate become a victim of crime. This is reflected by a slightly higher correlation between real and perceived crime among high-income groups ($r = 0.62$, $p < 0.001$) than low-income groups ($r = 0.55$, $p < 0.001$). A higher local crime rate might be translated into an increased fear of crime and affect individual life satisfaction as proposed by Powdthavee (2005). We further test Hypothesis 1 with alternative measures of the real crime rate, where fraud (a sub-category of theft) and/or robbery is included in addition to the theft offence category. Results are qualitatively unchanged.

Key crime variables are highlighted in bold

Standard errors are in parenthesis

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Estimation is done using Ordered Probit Random Effects. Cut-off points, time dummies and Mundlak terms are estimated but not reported

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Table 3 (continued)

|                | Real crime |                     | Real versus perceived crime |
|----------------|------------|----------------------|----------------------------|
|                | (I)        | (II)                | (III)                      | (IV)                       |
|                | Low income | High income         | Low income                 | High income                |
| Medium-rise    | −0.1005**  | 0.0518 (0.0470)     | −0.0907* (0.0513)          | 0.0564 (0.0470)            |
|                | (0.0512)   |                      |                           |                            |
| High-rise      | −0.1137 (0.1332) | −0.0059 (0.0921)   | −0.1038 (0.1331)            | −0.0020 (0.0921)           |
|                | −0.2072 (0.1589) | −0.4735** (0.2208) | −0.2011 (0.1589)            | −0.4647** (0.2208)         |
| Other dwelling | −0.5295*** (0.1029) | −0.3281** (0.1430) | −0.5290*** (0.1029)         | −0.3270** (0.1430)         |
| Death spouse/children | −0.0675** (0.0343) | −0.0348 (0.0394)   | −0.0684** (0.0343)          | −0.0328 (0.0394)           |
| Death of friend | −0.3710*** (0.0666) | −0.3830*** (0.0801) | −0.3736*** (0.0666)         | −0.3823*** (0.0801)        |
| Worse finance  | −0.1708*** (0.0729) | 0.0887 (0.0631)    | 0.1629** (0.0729)           | 0.0914 (0.0631)            |
| Better finance | −0.0890 (0.0594) | −0.1794*** (0.0591) | −0.0709 (0.0598)            | −0.1596*** (0.0596)        |
| Victim property crime | −0.4541*** (0.0951) | −0.1456 (0.1140)   | −0.4541*** (0.0951)         | −0.1404 (0.1140)           |
| Victim violent crime | −0.1575 (0.2383) | −1.2874*** (0.3868) | −1.1404 (0.2383)            | −1.3144*** (0.3866)        |
| Goal           | 0.0143 (0.0250) | −0.0586*** (0.0183) | 0.0164 (0.0251)             | −0.0521*** (0.0184)        |
| Real crime     |            |                      | 0.0342** (0.0143)          | −0.0456*** (0.0162)        |
| Perceived crime|            |                      |                            |                            |
| Obs            | 13,064     | 13,063               | 13,064                     | 13,063                     |

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Table 3 shows the results of random effects ordered probit models. Results of the fixed effects ordered logit models are presented in "Appendix 2."
except for the high-income group. Being a victim of property crime has a negative effect on life satisfaction for the high-income group, whereas being a victim of violent crime has a negative effect on life satisfaction for the low-income group. Hypothesis 1 is thus rejected (accepted) for the low-income (high-income) group. Rejecting hypothesis 1 is consistent with Cohen (2008) and Hanslmaier (2013) but in contrast to the findings of Ambrey et al. (2014).\(^8\)

Turning to the perceived crime variable, we test Hypothesis 2 in a regression that only includes victimisation and perceived crime variables, but not the real crime variable. Results in column (II) and (V) of Table 2 show that the estimated coefficients of perceived crime are negative and strongly significant in both random and fixed effects models. The detrimental and significant effect of perceived crime persists when all other crime measures are included (see columns III and VI of Table 2 as well as column IV of Table 3). Therefore, Hypothesis 2 is confirmed.

When we compare the results of random effects ordered probit models with those of fixed effects ordered logit, the results are similar in terms of the signs of coefficients and significance level.\(^9\) Therefore, several conclusions can be drawn:

- Crime victimisation has a negative effect on life satisfaction. This supports the findings in the existing literature. Violent crime exerts a more detrimental effect than property crime, as evidenced by the size of the two coefficients.
- Real crime in local areas does not have a direct significant effect on life satisfaction, except for high-income individuals. However, real crime might have an indirect effect on life satisfaction, which can be channelled through victimisation or perceived crime (higher local crime rate increases the probability of victimisation and raises fear of crime).
- Perceived crime has a negative effect on life satisfaction after controlling for all other crime measures. The results are robust across different econometric models. In other words, perceived crime matters more than real crime in determining individual well-being.
- The finding that real crime does not, in general have a direct significant effect on life satisfaction, whereas perceived crime does, suggests that there is a some disjunction between what people think is happening to crime and what is actually happening. Given evidence shows that the public perceive the volume of crime to be greater than official police statistics of recorded crimes and surveys on rates of victimisation, and our date suggests that perceived crime is falling at a slower rate than real crime, there are real welfare gains to be made through correcting these misperceptions.

5.1.2 Socio-Economic and Demographic Characteristics

Our regression results confirm several stylized facts in the existing life satisfaction literature. For instance, the effect of age is U-shaped, marriage or defacto (as compared to single) is associated with being more satisfied with life (Ambrey & Fleming, 2014; Blanchflower & Oswald, 2004). Within parenting measures, being a lone parent seems to

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\(^8\) In an unreported regression, we employ OLS panel fixed effects and the real crime variable is statistically nonsignificant across the different specifications.

\(^9\) Results of Tables 2, 3 are qualitative unchanged if regional dummies are included. We do not report the results with these additional dummies, as most of the dummies are statistically nonsignificant.
decrease the probability of being very satisfied with life. Furthermore, having more children might have a negative effect on life satisfaction, consistent with Ferrer-i-Carbonell & Frijters (2004). Poor physical health and being unemployed are associated with lower level of self-reported life satisfaction, which is in line with the a priori expectation. Moreover, spending too much time commuting to work also decreases life satisfaction. With regard to the income variable, results show that people with higher income tend to have higher levels of life satisfaction. However, a high number of working hours tends to decrease life satisfaction.

We do not find a significant effect of gender and educational attainment in our models, with the exception of completing Year 12 (negatively influences life satisfaction). In addition, location measures such as living in major cities or outer regions also does not appear significant. Among dwelling measures, people who reside in non-private property, a caravan or a houseboat (‘other dwelling’) tend to report lower life satisfaction, compared to those who live in a private house. Renters have lower life satisfaction than home-owners.

The random effects models allow for the estimation of time-invariant demographic factors. We find that people with an Aboriginal and Torres Strait Island status tend to be more satisfied with their life. With regard to country of origin, immigrants from non-English speaking countries tend to have lower life satisfaction than Australian born citizens.

### 5.1.3 Major Life Events

As expected, the death of a spouse or child has a negative effect on life satisfaction, and this effect is strongly significant across all models. Major changes in finance also significantly affect life satisfaction and the effects seem to be asymmetric. The magnitude of the worse finance coefficient is more than three times larger than the magnitude of the improvement in finance coefficient. We note that while a major worsening in finance decreases life satisfaction for all income groups, an improvement in finance only affects those on low-incomes.

### 5.1.4 Marginal Effects

To interpret the size of the coefficient estimates in our probit/logit model, we compute the marginal effects. Using the logit regression specification (column VI of Table 2), we find that the probability of having a life satisfaction score of 10 decreases by 2.5% (5.3%) if a person is a victim of property crime (violent crime). If perception of crime increases by 1 (for instance from category 1 to 2, or 2 to 3…), the probability of having a life satisfaction score of 10 falls by 0.9%. Therefore, the relative contribution of victimisation experience on life satisfaction is greater than perceived crime. The marginal effect of real crime is nonsignificant.

### 5.2 Extended Models

To test Hypotheses 3–7, we include the interaction terms between the perceived crime variable and each of the following variables: gender, age, location (living in cities or outside), income and education level respectively. Results are presented in Table 4.

In our extended specifications, perceived crime remains negative and significant while real crime is only weakly significant across models. The interaction terms between perceived crime and gender, income, and education attainment are nonsignificant. We
### Table 4: Heterogeneity in the effect of perceived crime

|                | (I)                      | (II)                      | (III)                     | (IV)                      | (V)                      | (VI)                      |
|----------------|--------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Gender         |                          |                           |                           |                           |                           |                           |
| Age            | −0.1155*** (0.0403)      | −0.1136*** (0.0403)       | −0.1124*** (0.0403)       | −0.1151*** (0.0403)       | −0.1155*** (0.0403)       | −0.1155*** (0.0403)       |
| Age & Age²     | −0.3562*** (0.0692)      | −0.3548*** (0.0692)       | −0.3548*** (0.0692)       | −0.3515*** (0.0692)       | −0.3560*** (0.0692)       | −0.3558*** (0.0692)       |
| Real crime     | −0.0245* (0.0137)        | −0.0237* (0.0137)         | −0.0234* (0.0137)         | −0.0233* (0.0137)         | −0.0243* (0.0137)         | −0.0248* (0.0137)         |
| Perceived crime| −0.0486*** (0.0129)      | −0.0797*** (0.0244)       | **0.0887** (0.0537)       | −0.0505*** (0.0125)       | −0.0371*** (0.0134)       | −0.0516*** (0.0135)       |
| Male × Perceived crime | 0.00108 (0.0177) |                          |                           |                           |                           |                           |
| Age × Perceived crime | **0.0008** (0.0005) | −**0.0074*** (0.0024)    |                           |                           |                           |                           |
| Age² × Perceived crime | **0.0001*** (0.0000)   |                          |                           |                           |                           |                           |
| Inner region × Perceived crime | −0.0042 (0.0201) |                          |                           |                           |                           |                           |
| Outer region × Perceived crime | **0.0694** (0.0282)   |                          |                           |                           |                           |                           |
| Remote region × Perceived crime | −0.0574 (0.1221) |                          |                           |                           |                           |                           |
| Income × Perceived crime | −0.0002 (0.0003) |                          |                           |                           |                           |                           |
| Above year 12 × Perceived crime | 0.0153 (0.0173) |                          |                           |                           |                           |                           |
| Obs            | 26,127                   | 26,127                    | 26,127                    | 26,127                    | 26,127                    | 26,127                    |

Key crime variables are highlighted in bold

Standard errors are in parenthesis

***p < 0.01, **p < 0.05, *p < 0.1. Estimation is done using random effects ordered probit. Cut-off points, time dummies and Mundlak terms are estimated but not reported.
therefore reject Hypotheses 3, 6, 7. Focusing on gender, we note no difference in the effect of perceived crime between females and males. When analysing male and female groups separately, the coefficient of perceived crime in the male regression is slightly greater than that of the female regression. The effect of perceived crime depends on age in a non-linear manner (as shown in column III of Table 4). As people get older, the adverse effect of perceived crime increases. However, when people are 74 years old or more, it appears that this adverse effect tends to reverse. We also find that the effect of crime perception tends to depend on where people live. The effect of perceived crime is less negative for people who live in outer regional areas (as opposed to people who live in major cities).

As the perceived level of crime matters more than real crime in determining individual life satisfaction, it is also important to explore potential heterogeneity in the perception of crime among different groups. In other words, what are the drivers of crime perceptions? A series of simpler-tests reveal interesting group differences. Perceived level of crime is 31% higher among crime victims compared to non-victims and this difference is statistically significant at the 1% level. Perception of crime is higher among those individuals who have previously been a victim of property crime (burglary and theft)—the score out of five for crime victims is 3.22, while it is only 2.45 for non-victims ($t(1083) = 24.11, p < 0.001$). The level of perceived crime of people who live in high-crime areas (above median) is about 12% higher than that of those living in low-crime (below median) areas ($t(25,612) = 25.47, p < 0.001$). We also find females perceive a slightly higher level of crime than males (2.49 vs. 2.47) ($t(25,936) = 2.18, p = 0.015$). However, there is no significant difference in the perception of crime across different levels of education or income.

6 Conclusions

This article employs modern econometric techniques to examine how different measures of crime shape individual wellbeing. This is important as crime consistently penetrates public and political debate, where crime, either perceived or real, and the policies developed by government to mitigate and moderate the harms of crime shape one’s sense of security, safety, freedom, and subsequent wellbeing.

But what matters most when developing policy responses to crime? Here the evidence is mixed with highly inconsistent findings. Such inconsistency makes the trade-off between crime prevention policies difficult. In other words, some policies may purely affect real crime rates and have little effect on the perception of crime, while others may have quite the opposite effect. In addition, how the criminal justice system interacts with the public to disseminate information may shape attitudes to how the public perceive the effectiveness of the criminal justice system in responding to crime. Also, poor dissemination of real crime may create a moral panic where individuals are overestimating the risk of victimization, which may place an unnecessary burden on the criminal justice system. That is, creating an artificial demand for criminal justice services. This of course is complicated by the inclusion of the influence of media who may, either intentionally or unintentionally, widen the discrepancy between perceived and real crime.

Using longitudinal HILDA data from 2002 to 2016, the paper employs panel data estimation while focusing on the ordinal nature of the life satisfaction variable. Results from both random effects ordered probit models and fixed effects ordered logit models show that among three crime measures, crime victimisation has the most detrimental effect on life
satisfaction. With regard to perception of crime versus the real crime rate in a local area, our results indicate that the former always matters, while the latter is only significant for the high-income group.

Exploring possible heterogenous effects of perceived crime among groups reveals interesting findings. In this study our focus was on gender, age, location (living in cities or outside), income and education level. We do not find a systematic difference between the effect of perceived crime for females and males in our sample. Also, the effect of perceived crime appears to be identical for people across different levels of education and income. However, the effect of crime perception tends to depend on where you live. Here we find that the effect of perceived crime is less negative for people who live in outer regional areas. Further, the effect of perceived crime depends on age in a non-linear manner. Therefore, as people get older, the adverse effect of perceived crime increases. But, this adverse effect tends to reverse when age exceeds 74. There are also group differences in the perception of crime between victims and non-victims, and between people who live in high-crime versus low-crime areas.

Our results highlight two future areas of perceptions of crime that should be further examined in terms of how policy can target those more vulnerable to mis-perceptions, which ultimately affect wellbeing. First, what policy levers can we manipulate to better inoculate older individuals to mis-perceptions of crime? Second, what is it about outer regional areas that make individuals who live in those areas less subjected to the effect of perceived crime? We also argue that the interaction between the criminal justice system and media in how they report crime should be more objective and informative to avoid inflating mis-perceptions and distress. Before conducting this research, however, it may be useful to undertake a more comprehensive study into the drivers of perceptions of different types of crime. In this study we have explored some possible drivers of perceptions of property crime, with a focus on key socio-demographics, but a more in-depth study may shed further light.

Policies that aim to reduce the mis-perception of crime should be subjected to economic analysis. This will assist in determining what programs and how much, in terms of resources, should be directed to available alternatives. Here we argue as does the majority of the literature that there are trade-offs to be made when resources are finite. In other words, there is an opportunity cost associated with selecting one course of action over another. Regression results from this paper can be applied to compute the monetary compensation for crime victims, as the negative effect of crime is substantial and can be long-lasting. The life satisfaction approach (experienced preference method) can be used for this purpose. Furthermore, the willingness to pay for reduction in perception of crime can be estimated, which can provide valid policy implications for the management of crime.
Appendix

Appendix 1: Literature Summary

| Author                        | Control for victimisation | Control for regional crime rate | Control for perceived crime | Type of data & sample | Econometric model                                                                 |
|-------------------------------|---------------------------|---------------------------------|-----------------------------|-----------------------|-----------------------------------------------------------------------------------|
| Ambrey et al. (2014)          | Negative effect           | Negative effect                 | Negative effect             | Panel, Australian     | OLS panel fixed effects                                                            |
| Brenig & Proeger (2018)       | Negative effect           | Not control for regional crime rate in main specifications | Negative effect             | Pooled, OECD           | Pooled OLS with region and time dummies as baseline model, ordered probit with region and time dummies as a robustness check |
| Cohen (2008)                  | Negative effect           | Insignificant effect            | Insignificant effect        | Panel, U.S            | Ordered probit                                                                    |
| Di Tella & Macculloch (2008)  | No                        | Negative effect                 | No                           | pooled, OECD          | Ordered probit with country and time dummies                                      |
| Hanslmaier (2013)             | Negative effect           | Insignificant effect            | Negative effect             | Cross-sectional, Germany | Logit model                                                                       |
| Johnston et al. (2018)        | Negative effect           | No                              | No                           | Panel, Australian     | OLS with regional fixed effects                                                   |
| Kuroki (2013)                 | Negative effect           | No                              | No                           | Panel, Japan           | Ordered probit with country and time dummies                                      |
| Manning et al. (2016)         | Negative effect           | Negative effect                 | No                           | Panel, Australian     | Fixed effects ordered logit                                                        |
| Moller (2005)                 | Negative effect           | No                              | Negative effect             | Cross-sectional, South Africa | Exploratory step-wise regression analysis                                          |
| Moore (2006)                  | Insignificant effect      | No                              | Negative effect             | Cross-sectional, European countries | OLS with country dummies                                                          |
| Powdthavee (2005)             | Negative effect           | Negative effect                 | No                           | Cross-sectional, South Africa        | Ordered probit                                                                   |
### Appendix 2: Effect of Real Crime in Low-Income and High-Income Groups (Fixed Effects Ordered Logit Models)

|                      | Real crime | Real versus Perceived crime |
|----------------------|------------|-----------------------------|
|                      | (I)        | (II)                        | (III)     | (IV)     |
| Low income           | High income|                             | Low income| High income|
| Age                  | −0.0363 (0.0277) | −0.0420 (0.0318) | −0.0328 (0.0277) | −0.0401 (0.0318) |
| Age2                 | 0.0002 (0.0002) | 0.0004 (0.0003) | 0.0002 (0.0002) | 0.0004 (0.0003) |
| Poor english         | −0.4183 (0.3206) | −0.4049 (0.5968) | −0.4031 (0.3176) | −0.4132 (0.5917) |
| Married              | 0.4320* (0.2342) | 0.5346*** (0.1980) | 0.4416* (0.2351) | 0.5375*** (0.1978) |
| Separated            | −0.2743 (0.3387) | −0.1446 (0.2813) | −0.2710 (0.3372) | −0.1530 (0.2811) |
| Divorced             | −0.0976 (0.3407) | 0.3085 (0.2659) | −0.0997 (0.3396) | 0.2942 (0.2661) |
| Widowed              | 0.1051 (0.3205) | −0.4406 (0.4398) | 0.1174 (0.3221) | −0.4479 (0.4395) |
| Defacto              | 0.1603 (0.1748) | 0.6615*** (0.1650) | 0.1661 (0.1750) | 0.6656*** (0.1648) |
| Lone parent          | −0.1674 (0.1568) | −0.3777** (0.1774) | −0.1620 (0.1577) | −0.3676** (0.1767) |
| Number of children   | −0.1676** (0.0783) | −0.1273 (0.0821) | −0.1685** (0.0784) | −0.1281 (0.0821) |
| Poor health          | −0.5536*** (0.0844) | −0.8919*** (0.0941) | −0.5493*** (0.0847) | −0.8855*** (0.0940) |
| Year 12              | −0.5086*** (0.1489) | 0.0252 (0.4559) | −0.5006*** (0.1494) | 0.0372 (0.4500) |
| Certificates          | −0.2222 (0.1933) | 0.3339 (0.3111) | −0.2117 (0.1942) | 0.3547 (0.3025) |
| Bachelors            | 0.0204 (0.2738) | 0.6447 (0.4670) | 0.0240 (0.2745) | 0.6300 (0.4626) |
| Employed part time   | 0.0630 (0.1456) | −0.0942 (0.1102) | 0.0659 (0.1453) | −0.1035 (0.1102) |
| Unemployed           | −0.3198 (0.2368) | −0.6179** (0.3075) | −0.3252 (0.2366) | −0.6261** (0.3086) |
| Non-participation     | −0.0640 (0.2130) | −0.4841** (0.2033) | −0.0647 (0.2127) | −0.5005** (0.2015) |
| Income               | 0.0011 (0.0040) | 0.0031** (0.0012) | 0.0011 (0.0040) | 0.0031** (0.0012) |
| Hours work           | −0.0043 (0.0048) | −0.0160*** (0.0039) | −0.0040 (0.0048) | −0.0162*** (0.0039) |
| Other adult present  | 0.1385** (0.0564) | 0.1616*** (0.0565) | 0.1366** (0.0564) | 0.1655*** (0.0566) |
| Commute time         | −0.0059 (0.0123) | −0.0228*** (0.0073) | −0.0076 (0.0123) | −0.0231*** (0.0073) |
| Years at current add | −0.0152** (0.0062) | −0.0110* (0.0061) | −0.0148** (0.0062) | −0.0104* (0.0060) |
| Inner region         | −0.1636 (0.1699) | 0.0350 (0.1774) | −0.1738 (0.1692) | 0.0324 (0.1774) |
| Outer region         | −0.4394 (0.2773) | 0.3871 (0.2908) | −0.4382 (0.2781) | 0.3706 (0.2897) |
| Remote               | 0.1041 (0.5815) | 14.3800*** (1.0063) | 0.1761 (0.5649) | 14.4251*** (1.0056) |
| Renter               | −0.3503*** (0.1227) | −0.2464*** (0.1079) | −0.3415*** (0.1231) | −0.2358*** (0.1079) |
| Rent-free            | −0.2167 (0.1755) | −0.0840 (0.2448) | −0.2260 (0.1744) | −0.0785 (0.2472) |

(Standard errors in parentheses.)
### Real crime

|                | (I)                | (II)                | (III)                | (IV)                |
|----------------|--------------------|--------------------|--------------------|--------------------|
| Medium-rise    | −0.1390 (0.1018)   | 0.1549 (0.1009)    | −0.1265 (0.1016)   | 0.1697* (0.1009)   |
| High-rise      | −0.1346 (0.2575)   | −0.0902 (0.1855)   | −0.1475 (0.2562)   | −0.0768 (0.1860)   |
| Other dwelling | −0.2477 (0.3738)   | −0.8872** (0.4161) | −0.2399 (0.3728)   | −0.8846** (0.4229) |
| Death spouse/  | −0.9166*** (0.2456)| −0.5991* (0.3258)  | −0.9223*** (0.2465)| −0.6058* (0.3264)  |
| children       |                    |                    |                    |                    |
| Death of friend| −0.1095 (0.0695)   | −0.0655 (0.0851)   | −0.1103 (0.0696)   | −0.0648 (0.0855)   |
| Worse finance  | −0.6574*** (0.1433)| −0.6867*** (0.1786)| −0.6602*** (0.1432)| −0.6861*** (0.1790)|
| Better finance | 0.3744*** (0.1487)| 0.2217* (0.1317)   | 0.3653** (0.1488)  | 0.2199* (0.1315)   |
| Victim property| −0.2568** (0.1296)| −0.3006** (0.1294)| −0.2173* (0.1309)  | −0.2672** (0.1307) |
| crime          |                    |                    |                    |                    |
| Victim violent | −0.8063*** (0.1914)| 0.0845 (0.2694)    | −0.7972*** (0.1919)| 0.1039 (0.2713)    |
| Goal           | −0.0567 (0.5053)   | −1.6985*** (0.5499)| −0.0718 (0.5095)   | −1.7084*** (0.5559)|
| Real crime     | **0.0986 (0.0673)**| **−0.1069*** (0.0381)| **0.1084** (0.0678)| **−0.0970** (0.0381)|
| Perceived crime|                    |                    |                    |                    |
| Obs            | 23,573             | 19,980             | 23,573             | 19,980             |
| Pseudo$R^2$    | 0.0405             | 0.0434             | 0.0414             | 0.0442             |

Key crime variables are highlighted in bold.
Clustered robust standard errors in parentheses.

|***p < 0.01, **p < 0.05, *p < 0.1 |

Observations include the copies. Original observations range from 10,097 to 10,225 obs.

**Funding** Open Access funding enabled and organized by CAUL and its Member Institutions. No funding was received for this research.

**Availability of Data and Material** HILDA data is available on request from https://melbourneinstitute.unimelb.edu.au/hilda. BOCSAR data is available on request from https://www.bocsar.nsw.gov.au/Pages/bocsar_crime_stats/bocsar_crime_stats.aspx.

**Code Availability** STATA code is available from authors on request.

**Declarations**

**Conflict of interest** None to declare.

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