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Towards a causal link between food insecurity and buy-now-pay-later use by young Australians

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Manuscripts

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3 **Towards a causal link between food insecurity and buy-now-pay-later use by young**
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5 **Australians**
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10 **ABSTRACT**
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12
13 *Purpose*
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17 This paper aims to understand if Buy-now-pay-later (BNPL) services, a digital type of
18 credit that targets young consumers, acts as a protective or a risk factor for food insecurity
19 among young consumers in Australia.
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24 *Design/methodology/approach*
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28 The study uses survey data from a representative sample of young consumers aged 18-24
29 from all internal states and territories in Australia. Propensity score matching is used to test two
30 hypotheses: i) BNPL drives young consumers to food insecurity and ii) food insecurity leads
31 young consumers to use BNPL.
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38 *Findings*
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41 There is evidence that BNPL use is driving young Australian consumers to experience
42 food insecurity, but there is no evidence of food insecurity driving the use of BNPL services.
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47 *Practical implications*
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50 The evidence of BNPL driving young consumers to experience food insecurity calls for
51 the adoption of practices and stronger regulation to ensure that young users from being
52 overindebted.
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3 *Originality/value*
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6 Although the link with more traditional forms of credit (such as personal loans) and
7 consumer wellbeing has been explored more broadly, this project is the first attempt to have
8 causal evidence of the link between BNPL and food insecurity in a high-income country, to the
9 best of the authors' knowledge. This evidence helps to fill the gap about the protective or risky
10 nature of this type of digital financial product, as experienced by young Australians.
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20 *Keywords:* Food insecurity; Buy Now Pay Later; Causal link; Young Australians; Propensity
21 Score Matching.
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24 *Article Type:* Research Paper
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INTRODUCTION

The uptake of Buy Now, Pay Later (BNPL) services by young Australians and the problematic instances of overindebtedness linked to its use have sparked public debate in Australia, including [plans to change the legislation around consumers' credit protections a parliamentary hearing amidst the move to regulate BNPL as a credit product](#) (Senate Economics References Committee, 2019; ASIC, 2020, 2018; Vivien Chen, 2020; Chen, O'Brien, and Ramsay, 2018; Johnson, Rodwell, and Hendry, 2021; [Australian Government, 2022, 2023](#); [O'Brien, Ramsay and Ali, 2024](#)), as it has in other countries ([Soni, 2023](#); [Lee, 2023](#); [Lupşa-Tătaru et al., 2023](#); [Guttman-Kenney, Firth, and Gathergood, 2023](#); [Gilbert and Scott, 2023](#)). Young consumers have been early adopters of digital financial products (ASIC, 2020, 2018), but using BNPL can sometimes lead to overindebtedness (Davies and Cook, 2021) [and financial vulnerability \(Powell et al., 2023\)](#). The impacts of this financial vulnerability can be significant, and shape young consumers' future trajectories and financial wellbeing. One key impact of financial strife is the ability to access food (Murray et al., 2021; Kleve et al., 2018). The risks of falling into food insecurity seem substantial, however the causal relationship between these two variables has not been adequately explored.

The blurred lines between credit and debt imbued in both marketing and the de-regulation of BNPL as credit have been claimed to make young consumers particularly vulnerable to become over-indebted using BNPL as well as more traditional forms of credit ([Relja, Ward, and Zhao, 2024a](#); [Raj, Jasrotia and Rai, 2024](#); Hohnen, Gram, and Jakobsen, 2020; Davies and Cook, 2021, ASIC, 2020). In fact, research looking into the financial lives of young consumers often

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3 presents them as vulnerable to risk and struggling to manage their financial world because of
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5 what has been described as their higher impulsivity and low financial literacy (Carlsson *et al.*,
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7 2017; Gärling, Michaelsen, and Gamble, 2020; Porter, Bowman, and Curry, 2020; Farrugia *et*
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9 *al.*, 2021; Darrat, Darrat, and Darrat, 2023; [Fook and McNeill, 2020](#)). The impacts of financial
10
11 insecurity associated with overindebtedness (Dias, Sharma, and Fitzimons, 2022) are
12
13 exacerbated for young consumers transitioning to adulthood in precarious economic times
14
15 (Cuervo *et al.*, 2022). A suite of flow-on effects related to insecure finances can have a
16
17 substantial impact on young consumers. Essential needs such as eating, and the ability to
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19 purchase sufficient and healthy food, are a key symptom of financial insecurity (Murray *et al.*,
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21 2021; Kleve *et al.*, 2018).
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26 Research about the link between debt and food insecurity in high-income countries such
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28 as Australia is just emerging. In this literature, it has been argued that the use of credit can have
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30 two effects. First, it can be a protective factor, allowing people at risk of food insecurity to access
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32 the financial resources to purchase and prepare food (Lee *et al.*, 2018; Gaines *et al.*, 2014).
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34 Second, it can be a risk factor, since those who are in disadvantaged positions can find
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36 themselves trapped in debt cycles that prevent them from achieving the financial stability that
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38 would let them secure a sustained access to food (Knol *et al.*, 2018; Brennan, Zevallos, and
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40 Binney, 2011). While this literature has focused on the use of credit cards and other traditional
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42 lending products, more recently available digital lending products such as BNPL have not been
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44 widely studied (Carlsson *et al.*, 2017; Francis, Blumenstock, and Robinson, 2017).
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49 This paper contributes to the literature by improving our understanding about the causal
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51 link between BNPL use and food insecurity among young Australians (aged 18-24), which can
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53 lead to a more critical debate about credit use in young consumers' everyday lives (Hohnen,
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3 Gram, and Jakobsen, 2020) and the substantial impacts they can have. We examine two
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5 hypotheses: First, BNPL is driving people to experience food insecurity. Second, food insecurity
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7 is leading young consumers to use BNPL services. Clarifying the direction of causality or the
8
9 simultaneous causality of these two opens the door for different types of financial policies that
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11 will support young consumers' financial security.
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15 The remainder of this introduction reviews existent evidence about BNPL adoption and
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17 food insecurity among young consumers, with a focus on young Australians. The next section
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19 describes the data and methods used to test these hypotheses, followed by the presentation of
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21 results. The final section discusses and concludes.
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24 25 26 27 *Buy-Now-Pay-Later services* 28 29 30 31

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33 Buy Now Pay Later services offer registered users the ability to defer the payment for
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35 their purchases until a later date without charging for interest. They charge fees to merchants and
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37 to their users when they do not make their payments on time (ASIC, 2018). In Australia, young
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39 consumers (under 25 years old) made up for 22.4% of all BNPL users in 2018-19 (Roy Morgan,
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41 2019; ASIC, 2018) and 47% of users who incurred late fee payments were 18-29 years old
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43 (ASIC, 2020). BNPL transactions in Australia tripled between the 2017-18 and 2019-20 financial
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45 years (Fisher, Holland and West, 2021). This increasing popularity of BNPL services occurs in a
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47 wider context of change towards digitalisation in the financial market (Caddy, Delaney, and
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49 Fisher, 2020; Guttman *et al.*, 2021; Dudley-Nicholson, 2022).
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54 There is no consensus on what drives young consumers to use BNPL and other digital
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56 financial services, although convenience and perceived transparency are often quoted as
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3 incentives (Hjorthol, Grøtan, and Dorotic, 2021; Farrugia *et al.*, 2021). Personal attributes such
4 as impulsivity, attitudes towards the product and low financial literacy also play a role (Hjorthol,
5 Grøtan, and Dorotic, 2021; Frigerio, Ottaviani, and Vandone, 2020; Shen, 2014; Gerrans, Baur,
6 and Lavagna-Slater, 2021; Lučić, Uzelac, and Previšić, 2021). In the case of small amount credit
7 contracts (i.e. credits for up to \$2,000 that do not require collateral), there is evidence that gender
8 and income level do not play a role in small-amount-credit-contract uptake, although these
9 credits are more likely to be taken up by unemployed, sole parents, those in disadvantaged areas
10 and with a low educational level (Davies and Cook, 2021). For welfare recipients and people in
11 conditions of disadvantage, personal debt has been linked to attitudes towards debt, the pursuit of
12 materialism, low levels of self-control and structural trends in marketing and mass-consumption
13 (Brennan, Zevallos, and Binney, 2011; Squires and Ho, 2023).

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Young consumers morally differentiate between ‘bad’ forms of credit, which include credit cards, and ‘good’ credit, which offers them the opportunity to accumulate capital or otherwise provides a sense of advancement in their lives, such as student loans (Hohnen, Gram, and Jakobsen, 2020; Coffey *et al.*, 2023; Squires and Ho, 2023). It has been reported that young consumers do not see BNPL services as debt but as a product of consumption itself, unless the users incur in late payment fees, in which case BNPL reverts to being seen as a form of debt (Farrugia *et al.*, 2022; Hohnen, Gram, and Jakobsen, 2020) or as a product of consumption itself, as opposed debt. BNPL companies themselves also present their products as a form of responsible consumption that is inclusive (Alders, 2023) and fun, improving attractiveness to young people who see them as a ‘way to pay’ rather than a form of credit (Cook et al., 2023).

However, young Australians have also been reported to see indebtedness through BNPL as a

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3 moral failure that only happens to naive people who cave into mundane desires of consumption,
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5 when they have not experienced overindebtedness themselves (Coffey *et al.*, 2023).
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8 Almost a third (31%) of young (15-21 years old) BNPL users reported buying something
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10 they were not able to afford and struggled to pay later in July 2020 and February-March 2021
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12 (Moneysmart Network, 2021) and slightly under 40% have multiple BNPL accounts (Boshoff,
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14 Grafton, Grant and Watkins, 2022). For those who have been overly indebted with BNPL or
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16 other financial services, there is evidence of feelings of shame, stigma, stress and overall poor
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18 wellbeing (Davies and Cook, 2021). Therefore, while BNPL appears to occupy a niche position
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20 among a larger suite of financial products, its causal relationship with symptoms of
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22 disadvantage, such as food insecurity, is unclear.
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29 *Food insecurity*

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35 The most commonly accepted definition of food security is the one developed by the
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37 Food and Agricultural Organization (FAO), which states that ‘Food security is a situation that
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39 exists when all people, at all times, have physical, social and economic access to sufficient, safe
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41 and nutritious food that meets their dietary needs and food preferences for an active and healthy
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43 life’ (HLPE, 2020). This definition implies that financial circumstances are not the only cause of
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45 food insecurity. For example, disruptions to the food supply chain or living in a remote location
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47 can also trigger food insecurity experiences (Timba, Morrison, and Paine, 2022; Thornton,
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49 Lamb, and Ball, 2016; Rossimel *et al.*, 2016). However, research has shown that individuals’ and
50
51 households’ financial situation are a key determinant of food insecurity experiences (Murray *et*
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53 *al.*, 2021; Kleve *et al.*, 2018, Gundersen and Ziliak, 2018).
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3 While food insecurity has long been the focus of researchers (ie. West and Price, 1976),
4 regular measures are not undertaken in Australia. However, It has been estimated that 12% of
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8 Australians experienced moderate or severe food insecurity between 2019 and 2021 (FAO, 2022;
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10 Bowden, 2020). Research about food insecurity among young consumers in Australia and other
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12 countries has focused on higher education students (e.g. Gallegos, Ramsey, and Ong, 2014; Pia
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14 Chaparro *et al.*, 2009; Lee *et al.*, 2018). Depending on the measurement tools used, research
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16 estimates that 38% of students experienced food insecurity at the University of Tasmania in 2020
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18 (Murray *et al.*, 2021) and 48% of students at the University of Newcastle were in a similar
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20 situation between October 2017 and March 2018 (Whatnall *et al.* 2020).
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24 Multiple situations and characteristics have been linked to the probability of young
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26 consumers experiencing food insecurity. These include socio-demographic factors, such as
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28 unemployment or under-employment, housing, geographic location and access to financial
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30 resources (Bowden, 2020), being of Indigenous descent, having a disability, a low
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32 socioeconomic background (Sophie Arkoudis *et al.*, 2018; Schwartz, Buliung, and Wilson, 2019;
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34 Guo, Huang, and Porterfield, 2019; McKay, Haines, and Dunn, 2019; Lee *et al.*, 2018) and
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36 limited access to financial or household assets (Chang, Chatterjee and Kim, 2014; Guo, 2011).
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39 The impacts of COVID-19 have also been strongly linked to food insecurity, with 28% of those
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41 seeking food relief during the pandemic saying they had not experienced food insecurity before
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43 (Raifman, Bor, and Venkataramani, 2021; Foodbank, 2020). The link between food insecurity
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45 and overindebtedness, as a cause, or a consequence, of food insecurity is less clear.
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52 *Food insecurity and credit*
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3 Research exploring the link between the use of credit and experiences of food insecurity
4 among young consumers has mainly focused on university students and the toll of student debt.
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8 Researchers have tended to characterise credit products as a protection against food insecurity, as
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10 students who had access to credit cards or alternative financing were less likely to experience
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12 food insecurity, although students who had financial aid debt were more likely to experience
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14 food insecurity (Gaines *et al.*, 2014; Knol *et al.*, 2018). In the U.S., Aronson and Fleming (2023)
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16 explained how students who graduated from their degrees used educational loans to pay for
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18 living expenses as part of a strategy to overcome financial obstacles such as the inability to pay
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20 for food.
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24 Payday loans, another form of small credit contract to be repaid when borrowers receive
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26 their next wage, have been explored elsewhere (Bhutta, Goldin, and Homonoff, 2016; Charron-
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28 Chénier, 2020). This research points out that providers' unethical practices lead people to
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30 experience financial and material deprivation. But people also strategically use credit to avoid
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32 experiencing food insecurity, especially when they are on the fringe of such experience
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34 (Fitzpatrick and Coleman-Jensen, 2014; Bhutta, Goldin, and Homonoff, 2016; Stop the Debt
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36 Trap Alliance, 2019; ~~Vivien~~ Chen, 2020; Charron-Chénier, 2020).
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40 Further studies examining overindebtedness have pointed at life events such as leaving
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42 home and becoming a parent as triggers of debt problems among young consumers (Oksanen,
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44 Aaltonen, and Rantala, 2016) and in countries without an extensive welfare system, student debt
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46 can compound these challenges (Pérez-Roa and Ayala, 2020). The increasing cost of basic needs
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48 including food has also been linked as a cause of overindebtedness in young adulthood (Hauff,
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50 Gärling, and Lindblom, 2019). Overindebtedness has also been linked to compulsive buying
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3 behaviours that result in cycles of debt in different countries (Aw *et al.*, 2018; Park, 2021; Lučić,
4 Uzelac, and Previšić, 2021).

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8 In summary, the link between BNPL and other forms of credit and food insecurity is not
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10 clear. While it can be seen as a resource to help young consumers afford their basic needs and
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12 prevent them from experiencing food insecurity, it could also lead to overindebtedness and a
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14 higher risk of food insecurity. This paper explores both hypotheses.
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17 18 19 **MATERIALS AND METHODS** 20 21 22 23 24 25 26

27 *Methods* 28 29 30 31

32 In order to estimate the causal effect of an event (i.e. using BNPL or experiencing food
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34 insecurity) on an outcome (i.e. experiencing food insecurity or using BNPL), the outcomes with
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36 and without the event need to be compared. In the case of the first hypothesis in this paper, two
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38 outcomes are compared a) whether or not a person experiences food insecurity given that they
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40 used BNPL; with b) whether or not they would experience food insecurity, had they not used
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42 BNPL.
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46 Since a person cannot have simultaneously used and not used BNPL, an alternative way
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48 of estimating b) is required. In this paper, this is accomplished by using propensity score
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50 matching (Dehejia and Wahba, 2002; Heckman, Ichimura, and Todd, 1998). Propensity score
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52 matching has been used to investigate the effect of food stamps on food insecurity (Gibson-Davis
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54 and Foster, 2006) and to examine the effect of app introduction on consumer spending (Liu,
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Lobschat, Verhoef and Zhao, 2019), among many other applications (Thoemmes and Kim, 2011).

Propensity score matching matches a person who participated in the event (e.g. used BNPL) with a person who did not participate in the event (e.g. did not use BNPL) based on how likely they are to participate in the event (e.g. use BNPL). The assumption is that the outcome of the person (e.g. experiencing or not food insecurity) who did not participate in the event but had a similar probability of participating in the event as a person who participated in the event is a close approximation to b); the outcome of the person who participated in the event had they not participated in it. For the first hypothesis, participants with a similar probability of using BNPL are matched and compared by their probability of experiencing food insecurity. This is done in three steps:

1. Estimating the probability of using BNPL using a set of participant characteristics.
2. Finding a match for those with a similar probability of using BNPL using a matching algorithm.
3. Comparing the probability of experiencing food insecurity between those with a similar probability of using BNPL, using a chi-squared test.

Similarly, for the second hypothesis, young consumers who experience food insecurity are matched with those who do not experience food insecurity, but have a similar probability of experiencing it. Then the prevalence of BNPL use is compared between young consumers experiencing food insecurity and young consumers who do not for this matched sample, using a chi-squared test. The analysis was performed in R using the MatchIt package (Ho *et al.*, 2011).

The focus is on the average treatment effect (ATE) – the effect of using BNPL/experiencing food insecurity on the overall population – and not on the average treatment

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3 effect on treated; that is, the effect of using BNPL/experiencing food insecurity on BNPL
4 users/young consumers experiencing food insecurity. For this reason, when selecting a matching
5 algorithm, options were limited to those algorithms that estimate the ATE. After assessing
6 balance, optimal pair matching (Hansen and Klopfer, 2006) was selected over alternative
7 matching approaches (optimal full matching, coarsened exact matching, exact matching and
8 subclassification matching) based on the matched sample size, the minimum, mean and
9 maximum standardised mean difference, and the maximum difference in the empirical
10 cumulative density functions (eCDF, i.e. Kolmogorov–Smirnov test statistic) (Austin and Stuart,
11 2015). ~~This~~ These results are shown in Table A1 and the supplemental material.
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27 *Data*

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32 This paper uses data from the 2021 Australian Youth Barometer (Walsh *et al.*, 2021), a
33 nationally representative sample of young Australians (aged 18-24 years) collected between
34 August 27th and September 23rd, 2021. Participants were recruited from Roy Morgan's Online
35 Panel and an external provider to secure quotas by age, gender and location through all internal
36 states and territories in Australia. The project received ethics approval from the authors'
37 institution's Human Research Ethics Committee.
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46 The Youth Barometer survey instrument collected data on a wide set of aspects of young
47 Australians lives (e.g. education, work, financial lives, wellbeing and perspectives about the
48 future) and their demographic characteristics. The survey measured food insecurity using a
49 single question: 'In the last two years, was there any time you have run out of food and were
50 unable to purchase more?' with response options 'Yes,' 'No' and 'Prefer not to say.' There are
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3 alternative instruments to measure the severity of food insecurity beyond a binary classification
4 of experiencing food insecurity or not (McKay, Haines, and Dunn, 2019). However, for the
5 purpose of answering the research question in this paper, the binary instrument used to measure
6 food insecurity in the Youth Barometer is preferable to a severity measure as it directly classifies
7 respondents into two possible categories: experiences food insecurity or does not experience
8 food insecurity. This survey question has been used to estimate the prevalence of food insecurity
9 in Australia in the National Health Survey by the Australian Bureau of Statistics (ABS, 2006).

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19 The use of BNPL products was measured using the question: ‘Buy Now, Pay Later’
20 services allow immediate purchase, with delayed payment (e.g. AfterPay, Zip Pay etc.). Do you
21 ever use Buy Now, Pay Later services?’ The response options for this question adopted a 5-point
22 frequency Likert-like scale (‘Never,’ ‘Rarely,’ ‘Sometimes,’ ‘Often’ or ‘Very often’). For the
23 analysis in this paper, those who selected ‘Never’ were recoded as not using BNPL and those
24 who selected any other option were recoded as BNPL users. Recoding this variable facilitates the
25 analysis using propensity score matching since it allows BNPL use to be understood as a
26 treatment. This implies that some information about the frequency of BNPL use is lost, but the
27 gains in bias reduction when using propensity score matching in comparison to alternative
28 propensity methods compensate for such information loss (Austin, 2011).

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42 The analysis uses additional variables to predict the probability of using BNPL services
43 and of experiencing food insecurity. A description of the questions in the survey questionnaire is
44 available in the supplemental material.

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49 The total sample size was 505 respondents. After removing those who replied ‘Prefer not
50 to say’ to the questions measuring food insecurity and disability, 482 observations remain.
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54 Deleting this-these observations implies that there are no missing responses for the analysis. In
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3 the sample, 103 respondents were classified as experiencing food insecurity and 256 respondents
4 used BNPL products. The supplemental Table 1 material provides additional details about the
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6 sample composition and shows how similar this is to the composition of the population of young
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8 Australians according to census data. In the remainder of this paper, frequency weights are used
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10 to adjust the sample by age, gender and location to make sure the analysis is representative of the
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12 Australian population of young consumers.
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17 [Insert Table 1 here]
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22 According to this data, 53.8% of young Australians have used BNPL and 21.3%
23 experience food insecurity. Food insecurity is more prevalent among those who use BNPL, as
24 29.8% of those who use BNPL experience food insecurity. In contrast, 11.4% of those who do
25 not use BNPL experience food insecurity. Similarly, BNPL use is more prevalent among those
26 who experience food insecurity, as 75.2% of those who experience food insecurity use BNPL
27 products, which is lower than the use of BNPL among those who do not experience food
28 insecurity (48%).
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41 Variable selection

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46 A crucial step when using propensity score matching is to select the variables that predict
47 selection into the treatment group (i.e. using BNPL or experiencing food insecurity). In this
48 analysis, previous research on both BNPL and broader credit use and food insecurity dictated the
49 variables that were included in the predictive models, as well as the availability of data.
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3 To predict BNPL use, the model includes socioeconomic status (SES), gender, First
4 Nations backgrounds and housing situation as demographic characteristics that have been linked
5 to credit uptake (Davies and Cook, 2021; Moneysmart Network, 2021; Blue *et. al.*, 2023; Walsh
6 *et.al.*, 2021). A variable indicating how often the young consumer would seek help from
7 government agencies if the ran short of money (Government financial support) is included as a
8 proxy for receiving welfare as it has been shown that attitudes towards debt can differ among this
9 demographic group (Brennan, Zevallos, and Binney, 2011; Squires and Ho, 2023). Experiences
10 of long (over four weeks) unemployment in the previous two years (Unemployed) is included as
11 a measure of employment precarity that has been shown to increase the probability of getting in
12 debt (Davies and Cook, 2021). An indicator of ability to stick to a budget, defined as whether the
13 young consumer reports running out of money for food more often than for leisure activities is
14 included as overindebtedness has been linked to lack of self-control, impulsivity and financial
15 literacy (Brennan, Zevallos, and Binney, 2011; Squires and Ho, 2023). Similarly, attitudes
16 toward the credit product have been shown to influence young consumers' uptake (Relja, Ward,
17 and Zhao, 2024b; Hjorthol, Grøtan, and Dorotic, 2021; Frigerio, Ottaviani, and Vandone, 2020;
18 Shen, 2014; Gerrans, Baur, and Lavagna-Slater, 2021; Lučić, Uzelac, and Previšić, 2021;
19 Farrugia *et al.*, 2022; Hohnen, Gram, and Jakobsen, 2020). In the model, this is measured by the
20 effect that young consumers perceive BNPL has on young people's financial behaviour in
21 Australia (View of BNPL). Finally, the model includes a measure of the perceived importance of
22 social media in regard to money management (Social media) to capture the overall influence of
23 social media in young consumers' financial behaviour (Brennan, Zevallos, and Binney, 2011;
24 Squires and Ho, 2023; Relja, Ward, and Zhao, 2024b).
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The model that predicts experiencing food insecurity includes SES as individuals' and households' financial situation are a key determinant of food insecurity experiences (Murray et al., 2021; Kleve et al., 2018). First Nations background), as well as a proxy for receiving welfare (Government financial support), self-reported disability status (Disability) and an indication of experiences of unemployment (Unemployed) are included as these groups have been shown to be more likely to experience food insecurity (Bowden, 2020; Sophie Arkoudis et al., 2018; Schwartz, Buliung, and Wilson, 2019; Guo, Huang, and Porterfield, 2019; McKay, Haines, and Dunn, 2019; Lee et al., 2018). Housing situation and the frequency with which young consumers experience financial difficulties in the previous two years (Financial difficulties) are included as both variables have been linked to food insecurity experiences (Bowden, 2020). Finally, the perceived severity of the impact of the COVID-19 pandemic on the young consumer's financial situation (COVID impact) has been the pandemic has been shown to drive people to experience food insecurity for the first time (Raifman, Bor, and Venkataramani, 2021; Foodbank, 2020).

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According to Youth Barometer data, Both both BNPL users and young Australians experiencing food insecurity tend to have a First Nations background, experience unemployment and report stronger impacts of COVID on their financial situation than their non-user or food secure peers. Additionally, in comparison with non-users, BNPL users tend to have a lower SES, are more likely to live outside their family homes, have a more positive view of BNPL and think that social media has a more important role in the management of their finances. Young consumers experiencing food insecurity are also more likely to have a disability and receive government support more frequently than young consumers who do not experience food insecurity (see supplemental material for formal tests).

RESULTS

Table 1-2 shows the estimation results for four different logit models estimating ~~predicting~~ the probability of using BNPL products (for the first hypothesis) and the probability of experiencing food insecurity (for the second hypothesis). The predictor models were constructed based on the variables that were identified as relevant during the literature review. Joint tests of statistical significance for categorical variables are included in the supplementary material.

Among all candidate variables, BNPL use is predicted by the variables: First Nations, housing, budget, view of BNPL and social media, while food insecurity is predicted by: First Nations, housing, unemployed, financial difficulties and COVID impact. However, when evaluating the models' predictive accuracy, the models including all variables are slightly more accurate (75.7% for BNPL use and 86.1% for food insecurity) than the models excluding the non-significant predictive variables (74.3% for BNPL use and 84.9% for food insecurity). For this reason, the matching process is executed using all the variables included in the model. These results do not meaningfully change when using only statistically significant variables as predictors in the model, as shown in the supplementary material.

The characteristics of BNPL users and non-users are imbalanced, with the standardised difference across all predictor variables ranging between 0.01 and 0.66, with a mean of 0.23. These differences are more pronounced when comparing young Australians experiencing with those not experiencing food insecurity, with a standardised difference across all predictor variables ranging between 0.02 and 0.92, with a mean of 0.32. These imbalances indicate that BNPL users and non-users, and young consumers who experience food insecurity and those who do not, are different to each other and hence differences in food insecurity prevalence or BNPL

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3 use among these groups cannot be attributed to BNPL use or food insecurity on their own. For
4 this reason, it is necessary to use a matching method to infer any causal link between BNPL use
5 and food insecurity.
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12 [Insert Table 24 here]
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17 The second step is to find an algorithm to match BNPL users and non-users and young
18 consumers experiencing, and not experiencing, food insecurity. Exact matching methods (exact
19 matching and coarsened exact matching) only matched 5 BNPL users with 5 non-users, and 10
20 young consumers experiencing food insecurity with 13 food secure people. These sample sizes
21 are too small to conduct any further analysis and hence these methods were discarded. In turn,
22 the optimal full matching and subclassification matching algorithms match all observations by
23 default. When examining the match based on individual variables (Figures A1 and A2), the
24 subclassification matching algorithm generates the best matching quality for most individual
25 variables. When using subclassification to match observations based on their predicted BNPL
26 use, the standardised mean difference across all predictor variables ranged between 0 and 0.11,
27 with a mean of 0.04. In turn, the standardised mean difference across all predictor variables when
28 using optimal full matching ranged between 0 and 0.18, with a mean of 0.07.
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44 When matching observations according to their predicted food insecurity status,
45 subclassification matching also produced the best matching quality, with a standardised mean
46 difference across variables ranging between 0.01 and 0.52, and with a mean of 0.12. The
47 standardised difference across all predictor variables when using optimal full matching also
48 ranged between 0 and 0.54, but the mean of 0.17 was higher. The Kolmogorov-Smirnov
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3 statistics (the maximum difference in the eCDF) are similar for these two matching methods
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5 when matching both BNPL use and food insecurity status, but are slightly better (closer to zero)
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7 for the subclassification matching algorithm, which was chosen to continue the analysis. The
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9 results of using optimal full matching and other matching methods are shown in Table A2.
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15 *Is BNPL use driving people to food insecurity?*
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21 In the original sample, the prevalence of food insecurity was higher among young
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23 Australians who used BNPL than among non-users. Around 29.8% of BNPL users experienced
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25 food insecurity, while 11.4% of BNPL non-users did so [\(Table 3\)](#).
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28 As we saw before, however, BNPL users are different to non-users in characteristics such
29
30 as their housing situation and views of BNPL. We use a subclassification matching algorithm to
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32 compare young Australians who are similarly likely to use, or not use BNPL. We make the
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34 assumption that if they are similar based on the characteristics we observe, they are also similar
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36 in other characteristics that we do not observe and which drive them to use BNPL. Using this
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38 sample, we estimate that around 28.1% of BNPL users experience food insecurity, while 13.5%
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40 of BNPL non-users did so. This difference is statistically significant, and it is also substantial;
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42 food insecurity prevalence is 2.1 higher among BNPL users than among non-users. As shown in
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44 [the appendix Table 3](#) and supplementary files, this finding is robust to different model
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47 specifications and matching methods.
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51 [\[Insert Table 3 here\]](#)
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3 *Is food insecurity leading young consumers to use BNPL services?*
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8 As shown in Table 4, BNPL use is more frequent among young consumers experiencing
9 food insecurity. While 48% of those who do not experience food insecurity have used BNPL
10 services, 75.2% of those experiencing food insecurity have used BNPL.
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15 As before, young consumers experiencing food insecurity are different to those who do
16 not experience it in characteristics such as their experiences of financial security and the impact
17 of COVID on their financial situation. We used subclassification matching and assume that
18 young consumers who experience food insecurity are similar to those who do not in ways that
19 can be captured by the characteristics that we observe. Based on this matched sample, we
20 estimate that around 58.6% of young consumers experiencing food insecurity have used BNPL
21 services and 51.8% of young consumers who have not experienced food insecurity have used
22 these services (Table 4). This difference is not statistically significant, which means that there is
23 no evidence to say that food insecurity is driving young consumers to use BNPL. This finding is
24 also robust to different model specifications and matching methods (supplemental material).
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43 To summarise, our propensity score matching analysis finds evidence to support the
44 claim that BNPL is driving young Australians to experience food insecurity, but we do not find
45 evidence of food insecurity driving the adoption of BNPL services. The implications of these
46 findings are discussed in the next section.
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CONCLUSIONS

To the best of our knowledge, this is the first study to investigate the link between the adoption of BNPL services and food insecurity for young consumers in Australia. It is also the first study to attempt a causal exploration of this relationship. The propensity score matching methodology used in the paper provides evidence of BNPL driving young consumers to food insecurity but not of food insecurity driving the use of BNPL.

This paper did not provide a measure of overindebtedness, rather it measured product use. Nonetheless, this result is consistent with the literature linking overindebtedness with compulsive buying (Aw *et al.*, 2018) and showing that overindebtedness has severe impacts on young consumers' wellbeing (Davies and Cook, 2021) and with the high risk of problematic behaviours young consumers engage with when using BNPL (ASIC, 2018, 2020). It is therefore plausible that the route through which young BNPL users are more likely to experience food insecurity is through overindebtedness. Based on this argument, multiple claims have been made about the need for better and more financial literacy education to ensure young consumers have the tools to make informed decisions about the adoption of BNPL and other financial products and to avoid overindebtedness (Shen, 2014; Oksanen, Aaltonen, and Rantala, 2016; Frigerio, Ottaviani, and Vandone, 2020; Moneysmart Network, 2021).

Alternative interventions may target compulsive buying behaviours that lead to overindebtedness (Aw *et al.*, 2018; Park 2021; Lučić, Uzelac, and Previšić, 2021). Such behaviours have been linked with materialism, obsessive-compulsive tendencies, low self-esteem, family conflict and excessive social media use. Therefore, compulsive buying may be reduced by decreasing the immediacy with which purchases can be made using this kind of

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3 services, as well as by helping individuals increased their self-awareness and seeking
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5 psychological support depending on the severity of their compulsive tendencies (Pahlevan Sharif
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7 and Yeoh, 2018; Maccarrone-Eaglen and Schofield, 2019; Darrat, Roberts, Pullig, and David,
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9 2019; She *et al.*, 2021; Darrat, and Darrat, 2023). Nonetheless, further research is needed to
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11 understand overindebtedness in BNPL and in digital financial products, and the role that
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13 entrenched disadvantage has on this causal path beyond the effects of product features such as
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15 the payment frequency it offers, how it influences perceived financial constraints or its
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17 accessibility (Coffey *et al.*, 2023; Aronson and Fleming, 2023; De La Rosa and Tully, 2022, Dias
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19 *et al.*, 2022; Riley and Klein, 2021).

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24 The lack of evidence supporting food insecurity as a driver for the adoption of BNPL
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26 services may indicate that BNPL services are not engaging particularly vulnerable young
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28 consumers. Although this might be considered a responsible lending practice, in an industry that
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30 has shifted the responsibility of lending on to the consumer (Hjorthol, Grøtan, and Dorotic,
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32 2021), further research needs to be conducted to understand why-whether and why young
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34 Australians experiencing food insecurity do not often consider BNPL as a potential financial
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36 strategy to cope with their food insecurity experience, as it is the case for other financial products
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38 such as credit cards or payday loans (Murray *et al.*, 2021; Kleve *et al.*, 2018; Brennan, Zevallos,
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40 and Binney, 2011; Fitzpatrick and Coleman-Jensen, 2014). Possible explanations are that BNPL
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42 providers refuse service to those already experiencing food insecurity, that previous studies that
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44 have reached this conclusion have focused on consumers who experience structural disadvantage
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46 and not on the general population (as it is the case of this study), or that BNPL services are not
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48 linked to merchants that would allow young consumers to make strategic purchases to avoid
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50 experiencing food insecurity. Future research could explore these possibilities.
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3 In relation to the existing literature about debt and food insecurity, this paper provides
4 support for views of buy-now-pay-later as a risk factor that can drive people to situations of
5 economic precarity, to the point of experiencing food insecurity, as it has been found to be the
6 case for credit cards and traditional lending (Knol *et al.*, 2018; Brennan, Zevallos, and Binney,
7 2011). This evidence helps to fill the gap about the protective or risky nature of this type of
8 digital financial product, as experienced by young Australians. Further research is required to
9 understand if this relationship holds for young consumers in other countries where these services
10 are regulated in similar or different ways.
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21 This paper also supports the need for stronger regulation for BNPL to ensure that users
22 do not experience negative impacts such as food insecurity. ~~This regulation could be oriented
23 towards the transparency of BNPL products, as the experience with payday loans has highlighted
24 the viability of such measures. Indeed, such consideration of regulation was being explored by
25 the Australian Government (2022) at the time of writing (i.e. potentially subjecting BNPL
26 companies to the same type of lending requirements imposed on credit providers through
27 Australia's National Consumer Credit Protection Act. BNPL products are not currently subject to
28 these credit laws because they do not charge interest). Nonetheless, regulators need to anticipate
29 the alternative avenues of credit that young consumers will seek to substitute their inability to
30 access BNPL services in the same way (Bhutta, Goldin, and Homonoff, 2016).the following
31 subsection discusses how this paper contributes to the existing regulatory debate in more detail.~~
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50 *Implications for BNPL regulation*

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Currently, BNPL providers do not need an Australian credit licence and are not subject to responsible lending obligations as providers of others forms of credit (e.g. banks providing credit cards). Following a consultation process, The Australian Government (2022, 2023) proposed that BNPL providers should hold an Australian credit license and be subject to a modified version of responsible lending obligations, as well as strengthening the BNPL industry code. This alternative has been received as a compromise that would allow the industry to keep offering a low-cost credit alternative that is less harmful than more risky forms of credit (e.g., payday or pawn loans, O'Brien, Ramsay and Ali, 2024). Nonetheless, at the time of preparing this paper, this recommendation has not been formally incorporated into legislation.

These proposed changes assume that BNPL providers do not effectively select consumers to ensure that they can enter the credit arrangement they offer. The evidence presented here indicates that BNPL providers are unlikely to engage young consumers that are already at risk of experiencing food insecurity and hence current procedures that BNPL providers use may effectively select consumers that are not at risk of financial hardship to the extent of experiencing food insecurity.

Since we find that BNPL use is likely to drive young people to experience food insecurity, our results support the requirement of holding an Australian credit licence, as it implies that BNPL should have hardship arrangement provisions in place. Nonetheless, it has been argued that the problem is not the lack of regulation but of enforcement of existing standards (O'Brien, et.al., 2023).

More broadly, our results support changes in legislation that prevent young consumers from overspending using BNPL. For example, by ensuring that BNPL accounts for multiple providers and other forms of credit are considered when estimating young consumers' credit

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2
3 limit. Excessive credit limits from BNPL services may induce consumers into debt spirals that
4 conduce to financial hardship (Johnson, 2023), which combined with its ease of use and young
5 consumers' perception BNPL as a 'way to pay' (Cook et al., 2023) or as form of consumption
6 (Alders, 2023, Farrugia et al., 2022; Hohnen, Gram, and Jakobsen, 2020), leads young
7 consumers to experience food insecurity.

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15 Soni (2023) argues that both merchants and BNPL services benefit from consumers'
16 overspending and highlights the need to regulate merchants' promotion of BNPL services as a
17 credit product. Cervi and colleagues (2023) advocate for an even broader framework that
18 acknowledges the intersections between finance, data analytics, regulation and ethics that shape
19 consumer vulnerability. This approach is more likely to ensure that alternative avenues of credit
20 that young consumers will probably seek to substitute BNPL with (Bhutta, Goldin, and
21 Homonoff, 2016) are less problematic than BNPL.

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31 Our findings and existing evidence of the influence that BNPL marketing strategies have
32 on young consumers' perceptions and use of BNPL support this type of broader strategy (Relja,
33 Ward, and Zhao, 2024a; Raj, Jasrotia and Rai, 2024; Hohnen, Gram, and Jakobsen, 2020; Davies
34 and Cook, 2021; Brennan, Zevallos, and Binney, 2011; Squires and Ho, 2023).

APPENDIX

Balance assessment

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52 Table A1 shows how alternative matching methods compare in terms of balance using
53 the mean, minimum and maximum standardised mean difference, the empirical cumulative
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3 density function mean and maximum, and the standardised pair difference. A better performance
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5 is indicated by reduced differences in the distributions of BNPL users/non-users or young
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7 consumer experiencing and not food insecurity.
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10 [Insert Table A1 here]
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12 Figures A1 and A2 show love plots for matching methods. These plots show how
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14 different groups are for each variable in the predictive models. The methods that perform better
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16 are the ones that result in the highest reductions of differences between groups.
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19 **FIGURE A1**

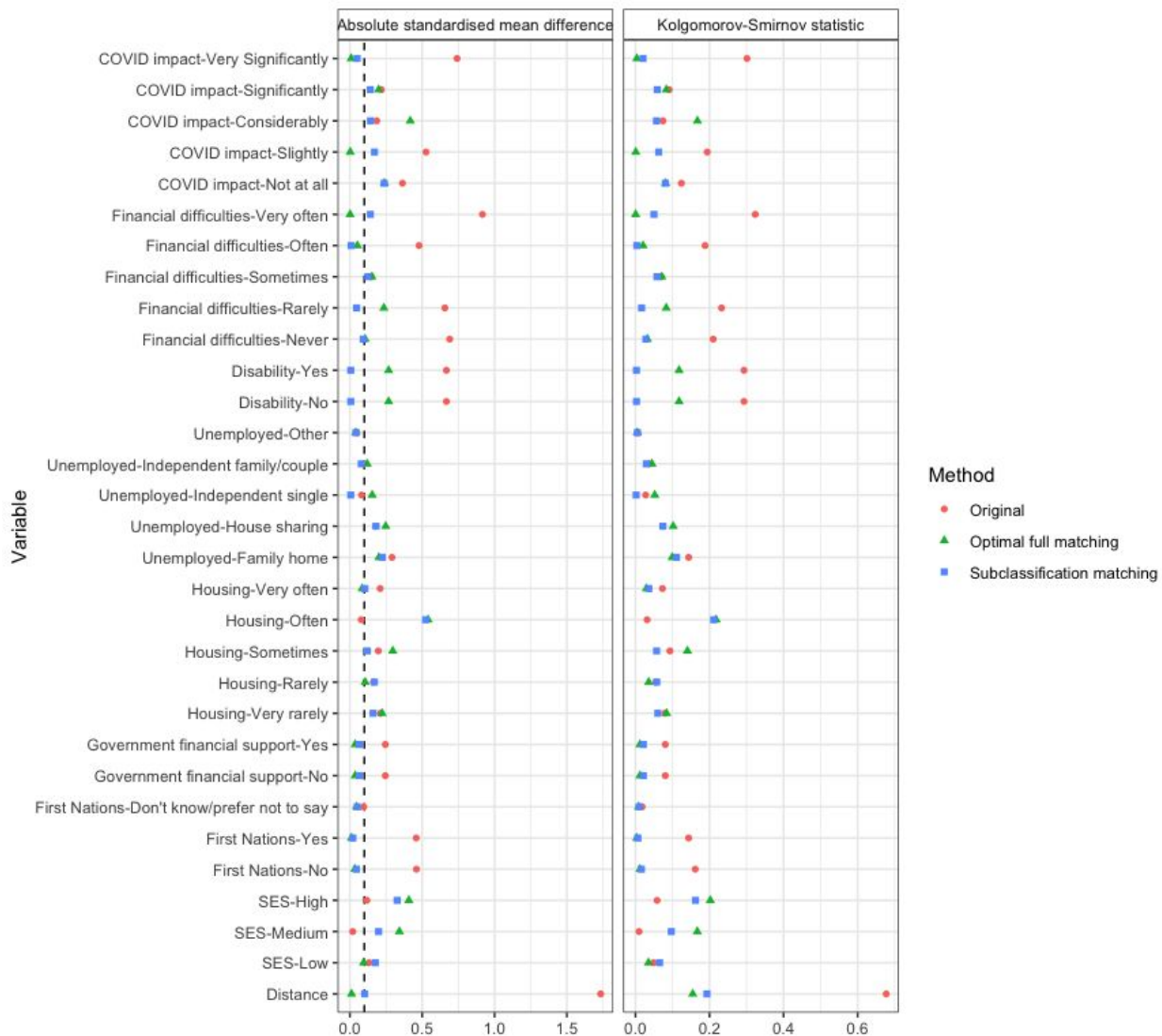
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21 LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL USE USING ALL
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FIGURE A2

LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL-USEFOOD
INSECURITY USING ALL PREDICTORS



Average treatment effects using alternative matching methods

[Insert Table A2 here]

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Towards a causal link between food insecurity and buy-now-pay-later use by young

Australians – Tables

TABLE 1
SURVEY AND WEIGHTED SAMPLE BY RESPONDENT CHARACTERISTICS

<u>Variable</u>	<u>n</u>	<u>Percentage</u>	<u>Weighted n</u>	<u>Weighted percentage</u>	<u>Population percentage</u>
<u>BNPL usage</u>					
<u>Non user</u>	<u>226</u>	<u>46.9</u>	<u>222.7</u>	<u>46.2</u>	
<u>BNPL user</u>	<u>256</u>	<u>53.1</u>	<u>259.3</u>	<u>53.8</u>	
<u>Food insecurity</u>					
<u>Food secure</u>	<u>379</u>	<u>78.6</u>	<u>379.2</u>	<u>78.7</u>	
<u>Food insecure</u>	<u>103</u>	<u>21.4</u>	<u>102.8</u>	<u>21.3</u>	
<u>SES</u>					
<u>Low</u>	<u>77</u>	<u>16</u>	<u>73.1</u>	<u>15.2</u>	<u>20.2</u>
<u>Medium</u>	<u>182</u>	<u>37.8</u>	<u>187.2</u>	<u>38.8</u>	<u>36.7</u>
<u>High</u>	<u>223</u>	<u>46.3</u>	<u>221.7</u>	<u>46</u>	<u>42.9</u>
<u>Gender</u>					
<u>Woman</u>	<u>259</u>	<u>53.7</u>	<u>228.1</u>	<u>47.3</u>	<u>48.9</u>
<u>Man</u>	<u>208</u>	<u>43.2</u>	<u>238</u>	<u>49.4</u>	<u>51.1</u>
<u>Non-binary/gender diverse/agender</u>	<u>15</u>	<u>3.1</u>	<u>15.9</u>	<u>3.3</u>	
<u>First Nations</u>					
<u>No</u>	<u>434</u>	<u>90</u>	<u>430.5</u>	<u>89.3</u>	<u>90.2</u>
<u>Yes</u>	<u>34</u>	<u>7.1</u>	<u>36.4</u>	<u>7.6</u>	<u>4.7</u>
<u>Don't know/prefer not to say</u>	<u>14</u>	<u>2.9</u>	<u>15.1</u>	<u>3.1</u>	<u>5.1</u>
<u>Government financial support</u>					
<u>Very rarely</u>	<u>94</u>	<u>19.5</u>	<u>94.5</u>	<u>19.6</u>	
<u>Rarely</u>	<u>69</u>	<u>14.3</u>	<u>72</u>	<u>14.9</u>	
<u>Sometimes</u>	<u>157</u>	<u>32.6</u>	<u>153.8</u>	<u>31.9</u>	
<u>Often</u>	<u>103</u>	<u>21.4</u>	<u>102.9</u>	<u>21.3</u>	
<u>Very often</u>	<u>59</u>	<u>12.2</u>	<u>58.9</u>	<u>12.2</u>	
<u>Housing</u>					
<u>Family home</u>	<u>246</u>	<u>51</u>	<u>245.6</u>	<u>50.9</u>	
<u>House sharing</u>	<u>94</u>	<u>19.5</u>	<u>94.8</u>	<u>19.7</u>	
<u>Independent single</u>	<u>57</u>	<u>11.8</u>	<u>59.7</u>	<u>12.4</u>	
<u>Independent family/couple</u>	<u>78</u>	<u>16.2</u>	<u>75.5</u>	<u>15.7</u>	
<u>Other</u>	<u>7</u>	<u>1.5</u>	<u>6.5</u>	<u>1.3</u>	
<u>Unemployed</u>					
<u>No</u>	<u>192</u>	<u>39.8</u>	<u>190.7</u>	<u>39.6</u>	
<u>Yes</u>	<u>290</u>	<u>60.2</u>	<u>291.3</u>	<u>60.4</u>	
<u>Budget</u>					
<u>Leisure <= Food</u>	<u>308</u>	<u>63.9</u>	<u>309.7</u>	<u>64.3</u>	

<u>Variable</u>	<u>n</u>	<u>Percentage</u>	<u>Weighted n</u>	<u>Weighted percentage</u>	<u>Population percentage</u>
<u>Leisure > Food</u>	<u>174</u>	<u>36.1</u>	<u>172.3</u>	<u>35.7</u>	
<u>View of BNPL</u>					
<u>Very negative</u>	<u>103</u>	<u>21.4</u>	<u>99.4</u>	<u>20.6</u>	
<u>Slightly negative</u>	<u>137</u>	<u>28.4</u>	<u>137.9</u>	<u>28.6</u>	
<u>Neutral</u>	<u>124</u>	<u>25.7</u>	<u>123.9</u>	<u>25.7</u>	
<u>Slightly positive</u>	<u>83</u>	<u>17.2</u>	<u>85.2</u>	<u>17.7</u>	
<u>Very positive</u>	<u>35</u>	<u>7.3</u>	<u>35.6</u>	<u>7.4</u>	
<u>Social media</u>					
<u>Not at all important</u>	<u>160</u>	<u>33.2</u>	<u>161</u>	<u>33.4</u>	
<u>Slightly important</u>	<u>68</u>	<u>14.1</u>	<u>70.1</u>	<u>14.6</u>	
<u>Moderately important</u>	<u>102</u>	<u>21.2</u>	<u>100.2</u>	<u>20.8</u>	
<u>Very important</u>	<u>91</u>	<u>18.9</u>	<u>88.9</u>	<u>18.4</u>	
<u>Extremely important</u>	<u>61</u>	<u>12.7</u>	<u>61.8</u>	<u>12.8</u>	
<u>Disability</u>					
<u>No</u>	<u>433</u>	<u>89.8</u>	<u>432.6</u>	<u>89.8</u>	
<u>Yes</u>	<u>49</u>	<u>10.2</u>	<u>49.4</u>	<u>10.2</u>	
<u>Financial difficulties</u>					
<u>Never</u>	<u>88</u>	<u>18.3</u>	<u>85.5</u>	<u>17.7</u>	
<u>Rarely</u>	<u>111</u>	<u>23</u>	<u>112.5</u>	<u>23.3</u>	
<u>Sometimes</u>	<u>165</u>	<u>34.2</u>	<u>166.3</u>	<u>34.5</u>	
<u>Often</u>	<u>73</u>	<u>15.1</u>	<u>73.2</u>	<u>15.2</u>	
<u>Very often</u>	<u>45</u>	<u>9.3</u>	<u>44.5</u>	<u>9.2</u>	
<u>COVID impact</u>					
<u>Not at all</u>	<u>82</u>	<u>17</u>	<u>84.5</u>	<u>17.5</u>	
<u>Slightly</u>	<u>109</u>	<u>22.6</u>	<u>111.6</u>	<u>23.1</u>	
<u>Considerably</u>	<u>108</u>	<u>22.4</u>	<u>108.4</u>	<u>22.5</u>	
<u>Significantly</u>	<u>101</u>	<u>21</u>	<u>98.2</u>	<u>20.4</u>	
<u>Very Significantly</u>	<u>82</u>	<u>17</u>	<u>79.2</u>	<u>16.4</u>	

NOTE. — Sample size: 482. Source for population percentages: ABS (2021, 2023)

TABLE 12

ESTIMATION RESULTS (ODDS RATIOS) FOR THE PROBABILITY OF USING
BNPL AND THE PROBABILITY OF EXPERIENCING FOOD INSECURITY

	(1)	(2)	(3)	(4)
	BNPL user	BNPL user	Food insecure	Food insecure
Intercept	0.093*** (1.67)	0.111*** (1.428)	0.005*** (3.442)	0.004*** (3.281)
SES-Medium	1.277 (1.417)		0.76 (1.525)	
SES-High	0.813 (1.41)		0.533 (1.54)	
Gender-Man	0.767			

	(1)	(2)	(3)	(4)
	(1.27)			
Gender-Non-binary/gender diverse/agender	2.78			
	(1.974)			
First Nations-Yes	3.135**	3.289**	4.021***	3.993***
	(1.741)	(1.765)	(1.625)	(1.656)
First Nations-Don't know/prefer not to say	7.427**	6.279**	0.814	0.828
	(2.353)	(2.26)	(2.036)	(1.927)
Government financial support-Rarely	1.103		1.34	
	(1.49)		(1.762)	
Government financial support-Sometimes	1.529		1.236	
	(1.375)		(1.68)	
Government financial support-Often	1.231		0.64	
	(1.431)		(1.809)	
Government financial support-Very often	1.175		1.358	
	(1.556)		(1.82)	
Housing-House sharing	1.951**	1.971**	1.236	1.192
	(1.325)	(1.326)	(1.511)	(1.474)
Housing-Independent single	2.218**	2.194**	2.16	1.99
	(1.415)	(1.417)	(1.64)	(1.648)
Housing-Independent family/couple	2.598**	2.612***	2.232**	2.067*
	(1.45)	(1.442)	(1.498)	(1.506)
Housing-Other	0.266	0.241	8.343***	6.29**
	(2.436)	(2.733)	(2.147)	(2.049)
Unemployed-Yes	1.266		2.449**	2.211**
	(1.283)		(1.467)	(1.448)
Budget-Leisure > Food	1.608**	1.84***		
	(1.272)	(1.265)		
View of BNPL-Slightly negative	2.325***	2.342***		
	(1.367)	(1.365)		
View of BNPL-Neutral	7.8***	8.205***		
	(1.402)	(1.405)		
View of BNPL-Slightly positive	21.775***	21.593***		
	(1.508)	(1.509)		
View of BNPL-Very positive	10.057***	11.65***		
	(1.748)	(1.748)		
Social media-Slightly important	0.748	0.783		
	(1.426)	(1.409)		
Social media-Moderately important	1.708*	1.744*		
	(1.368)	(1.362)		
Social media-Very important	1.86*	1.807*		
	(1.414)	(1.397)		

	(1)	(2)	(3)	(4)
Social media-Extremely important	1.03	1.016		
	(1.488)	(1.476)		
Disability-Yes			0.846	
			(1.506)	
Financial difficulties-Rarely			2.019	2.198
			(3.235)	(3.2)
Financial difficulties-Sometimes			7.813*	7.909*
			(3.055)	(2.933)
Financial difficulties-Often			25.118***	23.785***
			(3.175)	(2.976)
Financial difficulties-Very often			126.181***	115.904***
			(3.375)	(3.047)
COVID impact-Slightly			1.119	1.279
			(2.1)	(2.005)
COVID impact-Considerably			1.498	1.526
			(1.92)	(1.929)
COVID impact-Significantly			3.129*	3.283*
			(1.989)	(1.93)
COVID impact-Very Significantly			6.826***	7.026***
			(1.952)	(1.897)
Accuracy rate	0.757	0.743	0.861	0.849
Deviance	493.936	506.037	306.502	312.469
AIC	542.849	536.964	351.587	343.646
N	482	482	482	482

NOTE.— *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis.

TABLE 3

AVERAGE TREATMENT EFFECT OF USING BNPL ON FOOD INSECURITY STATUS FOR DIFFERENT MATCHING METHODS USING ALL PREDICTORS

Method	Non user	BNPL user	
Original	11.44	29.81	***
Optimal full matching	14.96	29.59	**
Subclassification matching	13.50	28.13	***

NOTE.— *** p<0.01, ** p<0.05, * p<0.1.

TABLE 4

AVERAGE TREATMENT EFFECT OF FOOD INSECURITY ON BNPL USE FOR DIFFERENT MATCHING METHODS USING ALL PREDICTORS

<u>Method</u>	<u>Food secure</u>	<u>Food insecure</u>	
<u>Original</u>	<u>48.00</u>	<u>75.21</u>	<u>***</u>
<u>Optimal full matching</u>	<u>51.68</u>	<u>62.29</u>	
<u>Coarsened exact matching</u>	<u>60.16</u>	<u>27.89</u>	
<u>Exact matching</u>	<u>60.16</u>	<u>27.89</u>	
<u>Subclassification matching</u>	<u>51.83</u>	<u>58.61</u>	

NOTE.— *** p<0.01, ** p<0.05, * p<0.1.

TABLE A1
BALANCE ASSESSMENT CRITERIA FOR DIFFERENT MATCHING
METHODS PREDICTING BNPL USE AND FOOD INSECURITY USING ALL
PREDICTORS.

Method	Sample	Statistic	Std Mean Difference	eCDF Mean	eCDF Max	Std Pair Distance
BNPL Use						
Optimal full matching	Matched	Mean	0.07	0.03	0.03	0.71
		Minimum	0.00	0.00	0.00	0.16
		Maximum	0.18	0.07	0.07	1.03
	Reduction	Mean	86.06	86.06	86.06	
		Minimum	1.95	1.95	1.95	
		Maximum	578.13	578.13	578.13	
Coarsened exact matching	Matched	Mean	0.04	0.02	0.02	0.00
		Minimum	0.00	0.00	0.00	0.00
		Maximum	0.18	0.08	0.08	0.00
	Reduction	Mean	141.19	141.19	141.19	
		Minimum	1.09	1.09	1.09	
		Maximum	1925.69	1925.69	1925.69	
Exact matching	Matched	Mean	0.04	0.02	0.02	0.00
		Minimum	0.00	0.00	0.00	0.00
		Maximum	0.18	0.08	0.08	0.00
	Reduction	Mean	141.19	141.19	141.19	
		Minimum	1.09	1.09	1.09	
		Maximum	1925.69	1925.69	1925.69	
Subclassification matching	Matched	Mean	0.04	0.01	0.01	0.72
		Minimum	0.00	0.00	0.00	0.15
		Maximum	0.11	0.04	0.04	0.99
	Reduction	Mean	81.65	81.65	81.65	
		Minimum	12.36	12.36	12.36	
		Maximum	195.67	195.67	195.67	
Food Insecurity						
Optimal full matching	Matched	Mean	0.17	0.07	0.07	0.61
		Minimum	0.00	0.00	0.00	0.14

Method	Sample	Statistic	Std Mean Difference	eCDF Mean	eCDF Max	Std Pair Distance
Coarsened exact matching	Reduction	Maximum	0.54	0.22	0.22	1.13
		Mean	136.03	136.03	136.03	
		Minimum	2.68	2.68	2.68	
	Matched	Maximum	1631.81	1631.81	1631.81	
		Mean	0.06	0.03	0.03	0.00
		Minimum	0.00	0.00	0.00	0.00
		Maximum	0.19	0.07	0.07	0.00
		Mean	94.09	94.09	94.09	
		Minimum	13.87	13.87	13.87	
	Reduction	Maximum	589.27	589.27	589.27	
		Mean	0.06	0.03	0.03	0.00
		Minimum	0.00	0.00	0.00	0.00
Maximum		0.19	0.07	0.07	0.00	
Mean		94.09	94.09	94.09		
Minimum		13.87	13.87	13.87		
Exact matching	Matched	Maximum	589.27	589.27	589.27	
		Mean	0.12	0.05	0.05	0.70
		Minimum	0.01	0.00	0.00	0.08
	Reduction	Maximum	0.52	0.21	0.21	1.04
		Mean	105.33	105.33	105.33	
		Minimum	0.62	0.62	0.62	
Subclassification matching	Reduction	Maximum	903.64	903.64	903.64	

NOTE.— Std: Standardised. eCDF: Empirical Cumulative Density Function

TABLE A2

AVERAGE TREATMENT EFFECT OF USING BNPL ON FOOD INSECURITY STATUS AND OF FOOD INSECURITY ON BNPL USE FOR DIFFERENT MATCHING METHODS USING ALL PREDICTORS

Method	Non user	BNPL user		Food secure	Food insecure	
Original	11.44	29.81	***	48.00	75.21	***
Optimal full matching	14.96	29.59	**	51.68	62.29	
Coarsened exact matching	0.00	0.00		60.16	27.89	
Exact matching	0.00	0.00		60.16	27.89	
Subclassification matching	13.50	28.13	***	51.83	58.61	

NOTE.— *** p<0.01, ** p<0.05, * p<0.1.

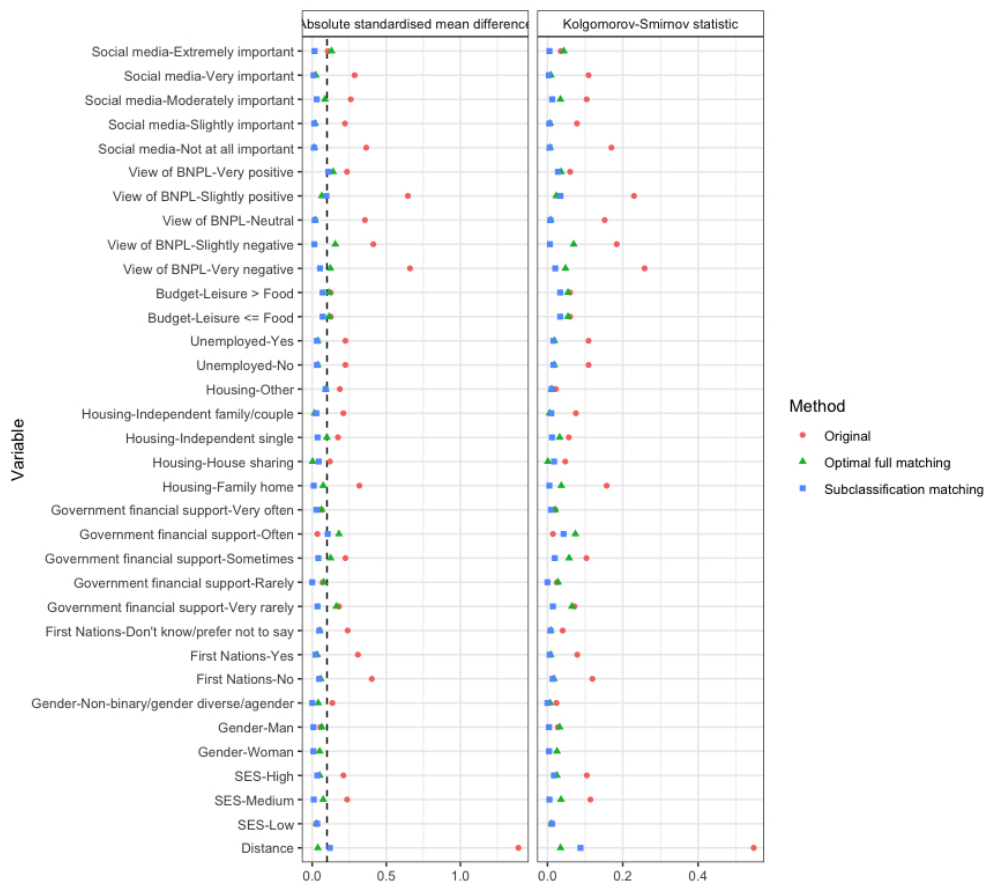


FIGURE A1 LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL USE USING ALL PREDICTORS

577x513mm (38 x 38 DPI)

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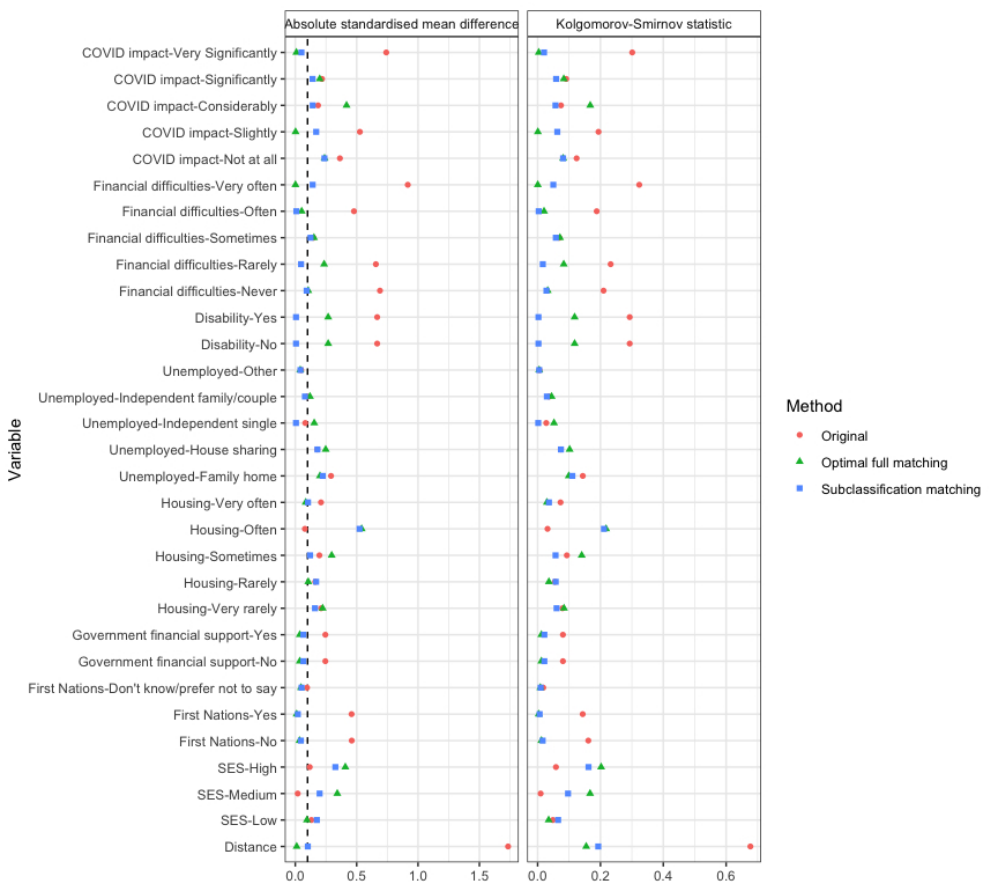


FIGURE A2 LOVE PLOT FOR MATCHING METHODS PREDICTING FOOD INSECURITY USING ALL PREDICTORS

577x513mm (38 x 38 DPI)

Towards a causal link between food insecurity and buy-now-pay-later use by young Australians – Supplemental material

The following information supports the robustness of the findings in the paper “Towards a causal link between food insecurity and buy-now-pay-later use by young Australians” to an alternative model specification that only includes statistically significant predictors to perform the matching procedures.

Variables in the study

The following independent variables were included in the analysis:

- Socioeconomic status (SES): Corresponds to the ABS’ Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) for the participant’s postcode. A higher value of the index indicates a higher SES.
- Gender: ‘How do you describe your gender?’ with response options ‘Woman,’ ‘Man’ or ‘Non-binary/gender diverse/agender.’
- First Nations: ‘Would you consider yourself to be of Aboriginal or Torres Strait Islander descent?’ with response options ‘yes,’ ‘no’ or ‘don’t know/prefer not to say.’
- Government financial support: ‘Where would you go for help if you ran short of money?– Government agencies (i.e.: Centrelink)’ with response options ‘Never,’ ‘Rarely,’ ‘Sometimes,’ ‘Often’ or ‘Very often.’
- Housing: ‘What would best describe your current housing situation?’ with response options family home, house sharing, independent living as a single person, independent living as a family or couple or other.
- Unemployed: ‘Have you experienced unemployment for a period of 4 weeks or more, in the last 2 years?’ with response options yes or no.
- Budget: A binary indicator of the participant’s ability to stick to a budget. The variable takes the value of 1 if the participant declared running out of money for ~~accommodation~~ food more often than running out of money for leisure activities, indicating poor budgeting abilities.
- View of BNPL: ‘In your view, do Buy Now, Pay Later services have negative or positive effects on young peoples’ financial behaviour in Australia?’ with response options ‘Very negative,’ ‘Slightly negative,’ ‘Neutral,’ ‘Slightly positive,’ or ‘Very positive.’
- Social media: ‘How important is social media in regards to the following: Managing money’ with response options ‘Not at all important,’ ‘Slightly important,’ ‘Moderately important,’ ‘Very important,’ ‘Extremely important’ or ‘Not applicable.’ Not applicable was recoded as ‘Not at all important.’
- Disability: ‘Do you identify as having a disability?’ with response options ‘yes’ or ‘no.’
- Financial difficulties: ‘How often have you experienced financial difficulties, in the last 2 years?’ with response options ‘Never,’ ‘Rarely,’ ‘Sometimes,’ ‘Often’ or ‘Very often.’

- COVID impact: 'How has the COVID-19 pandemic affected the following areas of your life? Financial situation,' with response options 'Not at all,' 'Slightly,' 'Considerably,' 'Significantly,' 'Very Significantly' or 'Not applicable.' Not applicable was recoded as 'Not at all.'

Table S1 shows how BNPL users and non-users are and young consumers who experience and not food insecurity are from each other. This motivates the need for a matching approach to understand any causal effects.

TABLE S1

DISTRIBUTION OF OBSERVED VARIABLES OVERALL AND BY BNPL USAGE AND FOOD INSECURITY

Variable	Overall	Non user	BNPL user		Food secure	Food insecure
SES				**		
Low	15.2	15.7	14.7		14.1	19.0
Medium	38.8	32.7	44.1		38.6	39.6
High	46.0	51.6	41.2		47.2	41.4
Gender						
Woman	47.3	47.1	47.5			
Man	49.4	50.9	48.1			
Non-binary/gender diverse/agender	3.3	2.0	4.4			
First Nations				***		***
No	89.3	95.7	83.8		92.8	76.6
Yes	7.6	3.3	11.2		4.5	18.8
Don't know/prefer not to say	3.1	1.0	5.0		2.7	4.5
Government financial support						**
Very rarely	19.6	23.5	16.3		21.3	13.4
Rarely	14.9	16.3	13.8		16.1	10.6
Sometimes	31.9	26.3	36.7		29.9	39.2
Often	21.3	20.6	22.0		22.0	18.9
Very often	12.2	13.3	11.3		10.7	18.0
Housing				***		
Family home	50.9	59.4	43.7		54.0	39.6
House sharing	19.7	17.1	21.8		18.1	25.5
Independent single	12.4	9.3	15.0		11.8	14.5
Independent family/couple	15.7	11.6	19.1		14.9	18.6
Other	1.3	2.5	0.3		1.2	1.8
Unemployed				**		***
No	39.6	45.4	34.5		45.8	16.5
Yes	60.4	54.6	65.5		54.2	83.5
Budget						

Variable	Overall	Non user	BNPL user	Food secure	Food insecure
Leisure <= Food	64.3	67.5	61.5		
Leisure > Food	35.7	32.5	38.5		
View of BNPL				***	
Very negative	20.6	34.5	8.7		
Slightly negative	28.6	38.5	20.1		
Neutral	25.7	17.5	32.7		
Slightly positive	17.7	5.3	28.3		
Very positive	7.4	4.2	10.2		
Social media				***	
Not at all important	33.4	42.5	25.5		
Slightly important	14.6	18.8	10.9		
Moderately important	20.8	15.2	25.6		
Very important	18.4	12.6	23.5		
Extremely important	12.8	10.9	14.4		
Disability					**
No	89.8			91.5	83.4
Yes	10.2			8.5	16.6
Financial difficulties					***
Never	17.7			22.2	1.2
Rarely	23.3			28.3	5.0
Sometimes	34.5			36.0	29.1
Often	15.2			11.2	30.0
Very often	9.2			2.3	34.7
COVID impact					***
Not at all	17.5			20.2	7.8
Slightly	23.1			27.3	7.9
Considerably	22.5			24.1	16.6
Significantly	20.4			18.4	27.5
Very Significantly	16.4			10.0	40.1

NOTE. — Weighted sample. *** p<0.01, ** p<0.05, * p<0.1 for Chi-squared tests of association.

TABLE S2

~~SURVEY AND WEIGHTED SAMPLE BY RESPONDENT CHARACTERISTICS~~

Variable	n	Percentage	Weighted n	Weighted percentage
BNPL usage				
Non-user	226	46.9	222.7	46.2
BNPL user	256	53.1	259.3	53.8
Food insecurity				
Food-secure	379	78.6	379.2	78.7
Food-insecure	103	21.4	102.8	21.3
SES				

Variable	n	Percentage	Weighted n	Weighted percentage
Low	77	16	73.1	15.2
Medium	182	37.8	187.2	38.8
High	223	46.3	221.7	46
Gender				
Woman	259	53.7	228.1	47.3
Man	208	43.2	238	49.4
Non-binary/gender diverse/agender	15	3.1	15.9	3.3
First Nations				
No	434	90	430.5	89.3
Yes	34	7.1	36.4	7.6
Don't know/prefer not to say	14	2.9	15.1	3.1
Government financial support				
Very rarely	94	19.5	94.5	19.6
Rarely	69	14.3	72	14.9
Sometimes	157	32.6	153.8	31.9
Often	103	21.4	102.9	21.3
Very often	59	12.2	58.9	12.2
Housing				
Family home	246	51	245.6	50.9
House-sharing	94	19.5	94.8	19.7
Independent single	57	11.8	59.7	12.4
Independent family/couple	78	16.2	75.5	15.7
Other	7	1.5	6.5	1.3
Unemployed				
No	192	39.8	190.7	39.6
Yes	290	60.2	291.3	60.4
Budget				
Leisure <= Food	308	63.9	309.7	64.3
Leisure > Food	174	36.1	172.3	35.7
View of BNPL				
Very negative	103	21.4	99.4	20.6
Slightly negative	137	28.4	137.9	28.6
Neutral	124	25.7	123.9	25.7
Slightly positive	83	17.2	85.2	17.7
Very positive	35	7.3	35.6	7.4
Social media				
Not at all important	160	33.2	161	33.4
Slightly important	68	14.1	70.1	14.6
Moderately important	102	21.2	100.2	20.8
Very important	91	18.9	88.9	18.4
Extremely important	61	12.7	61.8	12.8
Disability				
No	433	89.8	432.6	89.8
Yes	49	10.2	49.4	10.2
Financial difficulties				
Never	88	18.3	85.5	17.7
Rarely	111	23	112.5	23.3

Variable	n	Percentage	Weighted n	Weighted percentage
Sometimes	165	34.2	166.3	34.5
Often	73	15.1	73.2	15.2
Very often	45	9.3	44.5	9.2
COVID-impact				
Not at all	82	17	84.5	17.5
Slightly	109	22.6	111.6	23.1
Considerably	108	22.4	108.4	22.5
Significantly	101	21	98.2	20.4
Very Significantly	82	17	79.2	16.4

NOTE.— Sample size: 482

Joint significance test for predictive models

Table S2 shows the results of joint significance tests for the inclusion of multicategorical variables in the predictive model. Individual tests in Table 2 show differences between the relevant category and the reference category, while tests in Table S2 show the link of the variable as a whole on BNPL use/ food insecurity.

TABLE S3S2

JOINT SIGNIFICANCE TESTS FOR VARIABLES PREDICTING BNPL USE AND FOOD INSECURITY.

Variable	Chisq	Df	Ddf
BNPL Use			
SES	3.4	2	457
Gender	4.7	2	457
First Nations	12.6	2	457 ***
Government financial support	2.0	4	457
Housing	14.9	4	457 ***
Unemployed	1.0	1	457
Budget	3.8	1	457 **
View of BNPL	82.5	4	457 ***
Social media	8.2	4	457 *
Food Insecurity			
SES	2.5	2	459
First Nations	9.0	2	459 ***
Disability	0.1	1	459
Government financial support	3.6	4	459
Housing	7.0	4	459 *
Unemployed	6.5	1	459 **
Financial difficulties	77.8	4	459 ***
COVID impact	21.4	4	459 ***

NOTE. — Df: Degrees of freedom. Ddf: Denominator degrees of freedom. *** p<0.01, ** p<0.05, * p<0.1.

Initial imbalance between groups

Tables S3 and S4 present summary statistics that demonstrate how imbalanced the groups of BNPL users/ non-users and young consumers experiencing food insecurity and those who do not are. The difference between the tables is whether the predictive models exclude independent variables that were found to not be statistically significant from the predictive model.

TABLE S3

INITIAL SAMPLE UNBALANCE FOR DIFFERENT MATCHING METHODS
PREDICTING BNPL USE AND FOOD INSECURITY USING ALL PREDICTORS.

Statistic	Std Mean Difference	Variance Ratio	eCDF Mean	eCDF Max
<u>BNPL Use</u>				
Distance	1.39	0.9	0.33	0.55
Mean	0.23		0.09	0.09
Minimum	0.01		0.00	0.00
Maximum	0.66		0.26	0.26
<u>Food Insecurity</u>				
Distance	1.73	2.98	0.40	0.68
Mean	0.32		0.12	0.12
Minimum	0.02		0.01	0.01
Maximum	0.92		0.32	0.32

NOTE. — Std: Standardised. eCDF: Empirical Cumulative Density Function

TABLE S4

INITIAL SAMPLE UNBALANCE FOR DIFFERENT MATCHING METHODS
PREDICTING BNPL USE AND FOOD INSECURITY USING ONLY STATISTICALLY
SIGNIFICANT PREDICTORS.

<u>Statistic</u>	<u>Std Mean Difference</u>	<u>Variance Ratio</u>	<u>eCDF Mean</u>	<u>eCDF Max</u>
<u>BNPL Use</u>				
<u>Distance</u>	<u>1.32</u>	<u>0.92</u>	<u>0.30</u>	<u>0.51</u>
<u>Mean</u>	<u>0.29</u>		<u>0.10</u>	<u>0.10</u>
<u>Minimum</u>	<u>0.11</u>		<u>0.02</u>	<u>0.02</u>
<u>Maximum</u>	<u>0.66</u>		<u>0.26</u>	<u>0.26</u>
<u>Food Insecurity</u>				
<u>Distance</u>	<u>1.65</u>	<u>2.93</u>	<u>0.41</u>	<u>0.66</u>
<u>Mean</u>	<u>0.40</u>		<u>0.15</u>	<u>0.15</u>
<u>Minimum</u>	<u>0.05</u>		<u>0.01</u>	<u>0.01</u>
<u>Maximum</u>	<u>0.92</u>		<u>0.32</u>	<u>0.32</u>

NOTE. — Std: Standardised. eCDF: Empirical Cumulative Density Function

Sample sizes for matching methods

Tables S5 and S6 show the initial effective sample size and number of observations, as well as the number of observations that were matched, not matched and discarded. Notice that none of the observations were discarded using any of the methods. Preferable methods have a higher number of matched observations. The difference between the tables is whether the predictive models exclude independent variables that were found to not be statistically significant from the predictive model.

TABLE S5

SAMPLE SIZES FOR DIFFERENT MATCHING METHODS PREDICTING BNPL USE AND FOOD INSECURITY USING ALL PREDICTORS.

Method	Group	Initial ESS	Initial n	Matched ESS	Matched n	Unmatched	Discarded
BNPL Use							
Optimal full matching	Non user	214.9	226	102.9	226	0	0
	BNPL user	244.2	256	128.7	256	0	0
Coarsened exact matching	Non user	214.9	226	5.0	5	221	0
	BNPL user	244.2	256	4.7	5	251	0
Exact matching	Non user	214.9	226	5.0	5	221	0
	BNPL user	244.2	256	4.7	5	251	0
Subclassification matching	Non user	214.9	226	128.1	226	0	0
	BNPL user	244.2	256	172.0	256	0	0
Food Insecurity							
Optimal full matching	Food secure	361.1	379	192.7	379	0	0
	Food insecure	97.9	103	13.6	103	0	0
Coarsened exact matching	Food secure	361.1	379	11.7	13	366	0
	Food insecure	97.9	103	7.9	10	93	0

Method	Group	Initial ESS	Initial n	Matched ESS	Matched n	Unmatched	Discarded
BNPL Use							
Exact matching	Food secure	361.1	379	11.7	13	366	0
	Food insecure	97.9	103	7.9	10	93	0
Subclassification matching	Food secure	361.1	379	304.6	379	0	0
	Food insecure	97.9	103	13.3	103	0	0

NOTE. — ESS: Effective sample size. n: Number of observations.

TABLE S6

INITIAL SAMPLE UNBALANCE FOR DIFFERENT MATCHING METHODS PREDICTING BNPL USE AND FOOD INSECURITY USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS.

Statistic	Std Mean Difference	Variance Ratio	eCDF Mean	eCDF Max
<u>BNPL Use</u>				
Distance	1.32	0.92	0.30	0.51
Mean	0.29		0.10	0.10
Minimum	0.11		0.02	0.02
Maximum	0.66		0.26	0.26
<u>Food Insecurity</u>				
Distance	1.65	2.93	0.41	0.66
Mean	0.40		0.15	0.15
Minimum	0.05		0.01	0.01
Maximum	0.92		0.32	0.32

NOTE. — Std: Standardised. eCDF: Empirical Cumulative Density Function

TABLE S7

SAMPLE SIZES FOR DIFFERENT MATCHING METHODS PREDICTING BNPL USE AND FOOD INSECURITY USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS.

Method	Group	Initial ESS	Initial n	Matched ESS	Matched n	Unmatched	Discarded
BNPL Use							
Optimal full matching	Non user	214.9	226	94.8	226	0	0

Method	Group	Initial ESS	Initial n	Matched ESS	Matched n	Unmatched	Discarded
Coarsened exact matching	BNP user	244.2	256	119.3	256	0	0
	Non user	214.9	226	111.2	140	86	0
	BNP user	244.2	256	83.6	114	142	0
	Non user	214.9	226	111.2	140	86	0
Exact matching	BNP user	244.2	256	83.6	114	142	0
	Non user	214.9	226	133.9	226	0	0
Subclassification matching	BNP user	244.2	256	162.9	256	0	0
	Non user	214.9	226	133.9	226	0	0
Food Insecurity							
Optimal full matching	Food secure	361.1	379	168.3	379	0	0
	Food insecure	97.9	103	11.0	103	0	0
Coarsened exact matching	Food secure	361.1	379	100.3	120	259	0
	Food insecure	97.9	103	27.5	58	45	0
Exact matching	Food secure	361.1	379	100.3	120	259	0
	Food insecure	97.9	103	27.5	58	45	0
Subclassification matching	Food secure	361.1	379	312.8	379	0	0
	Food insecure	97.9	103	13.6	103	0	0

NOTE. — ESS: Effective sample size. n: Number of observations.

TABLE S8S7

BALANCE ASSESSMENT CRITERIA FOR DIFFERENT MATCHING METHODS PREDICTING BNPL USE AND FOOD INSECURITY USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS.

Method	Sample	Statistic	Std Mean Difference	eCDF Mean	eCDF Max	Std Pair Distance
BNPL Use						
Optimal full	Matched	Mean	0.06	0.02	0.02	0.43

1							
2							
3	matching	Minimum	0.01	0.00	0.00	0.16	
4		Maximum	0.15	0.06	0.06	0.67	
5		Mean	68.85	68.85	68.85		
6		Reduction	Minimum	2.60	2.60	2.60	
7			Maximum	98.51	98.51	98.51	
8			Mean	0.02	0.01	0.01	0.00
9		Matched	Minimum	0.00	0.00	0.00	0.00
10			Maximum	0.04	0.02	0.02	0.00
11	Coarsened exact		Mean	93.69	93.69	93.69	
12	matching	Reduction	Minimum	85.23	85.23	85.23	
13			Maximum	100.00	100.00	100.00	
14			Mean	0.02	0.01	0.01	0.00
15		Matched	Minimum	0.00	0.00	0.00	0.00
16			Maximum	0.04	0.02	0.02	0.00
17			Mean	93.69	93.69	93.69	
18	Exact matching	Reduction	Minimum	85.23	85.23	85.23	
19			Maximum	100.00	100.00	100.00	
20			Mean	0.05	0.02	0.02	0.63
21		Matched	Minimum	0.01	0.01	0.01	0.13
22			Maximum	0.13	0.04	0.04	0.98
23			Mean	74.48	74.48	74.48	
24	Subclassification	Reduction	Minimum	42.06	42.06	42.06	
25	matching		Maximum	96.40	96.40	96.40	
26							
27							
28							
29							
30							
31							
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59							
60							

NOTE. — Std: Standardised. ECDF: Empirical Cumulative Density Function

The love plots in Figures S1 and S2 also show how different matching methods perform. They additionally show which variables drive differences between groups (BNPL users and no-users, and young consumers who experience food insecurity and those who do not).

FIGURE S1

LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL USE USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS

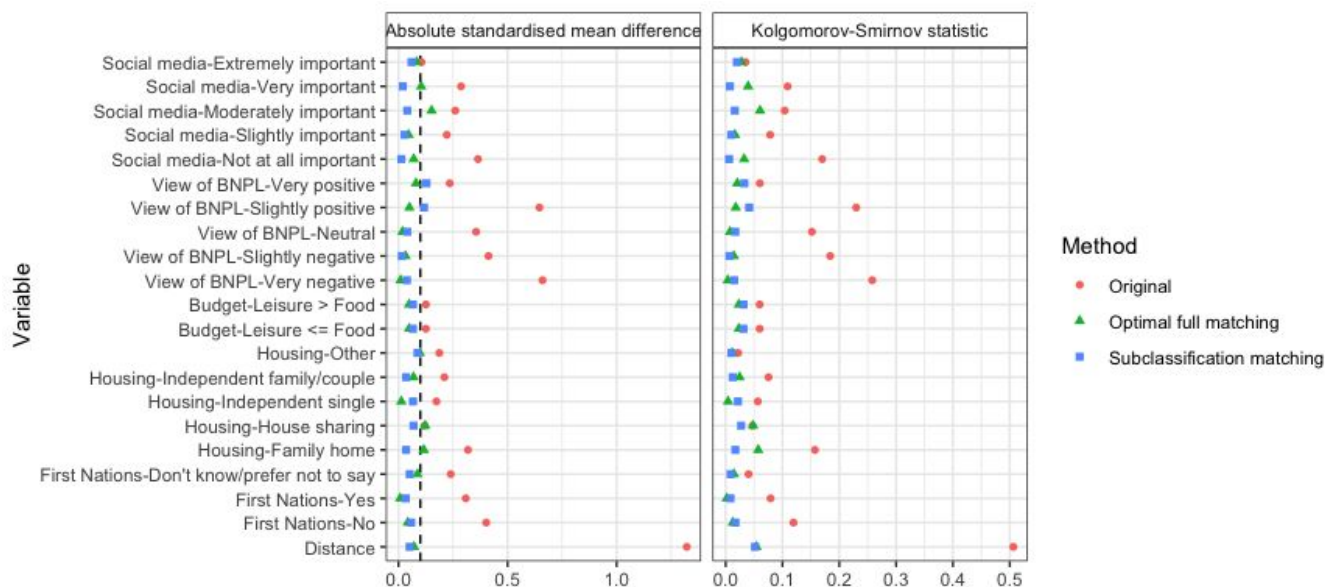
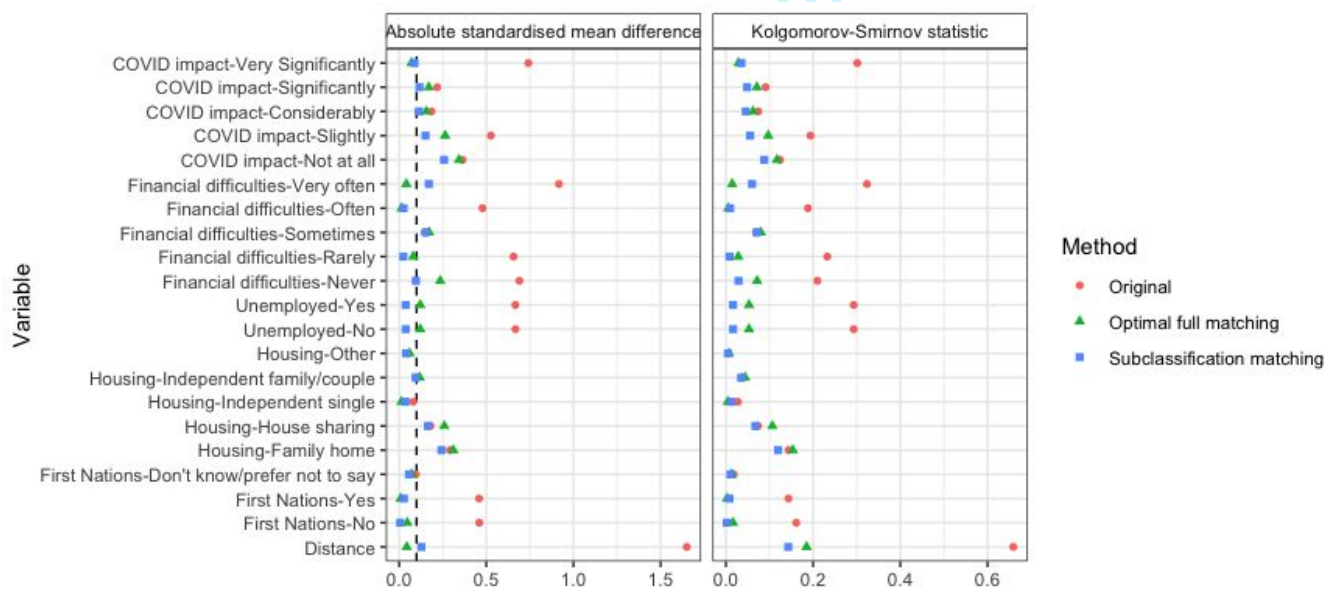


FIGURE S2

LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL USE USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS



Treatment effects

Table S8 shows alternative treatment effects to those shown in the main text of the article. These alternative average treatment effects are estimated using predictive models that only include statistically significant predictors. The results again show that there is evidence that BNPL is driving young consumers to experience food insecurity, but there is no evidence of food insecurity driving the adoption of BNPL services.

TABLE S9S8

AVERAGE TREATMENT EFFECT OF USING BNPL ON FOOD INSECURITY STATUS AND OF FOOD INSECURITY ON BNPL USE FOR DIFFERENT MATCHING METHODS ~~PREDICTING BNPL USE~~ USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS.

Method	Non user	BNPL user		Food secure	Food insecure	
Original	11.44	29.81	***	48.00	75.21	***
Optimal full matching	16.12	32.03	**	54.39	53.01	
Coarsened exact matching	10.33	25.15	**	62.59	52.71	
Exact matching	10.33	25.15	**	62.59	52.71	
Subclassification matching	14.26	28.64	***	52.45	57.86	

NOTE. — *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

FIGURE S1

~~LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL USE USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS~~

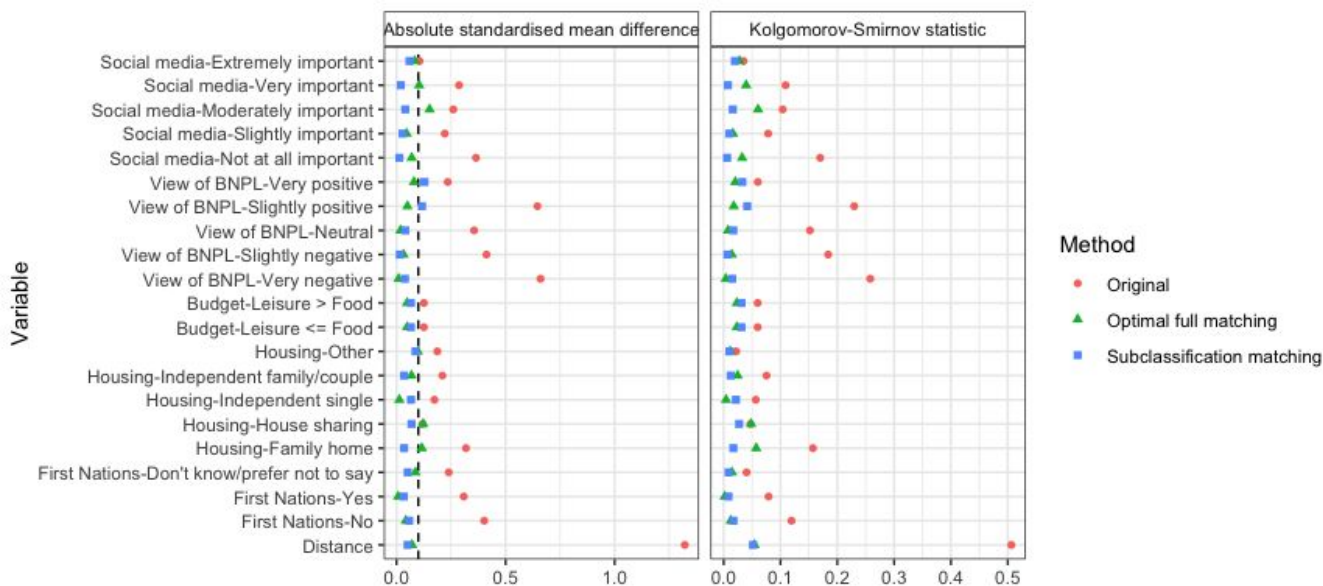


FIGURE S2

LOVE PLOT FOR MATCHING METHODS PREDICTING BNPL USE USING ONLY STATISTICALLY SIGNIFICANT PREDICTORS

