



Original research article

Does energy poverty impede job search success? Evidence from the unemployed in Australia

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ARTICLE INFO

Keywords:

Energy poverty
Unemployment
Job search
Financial hardship

ABSTRACT

Despite sustained periods of economic growth, energy poverty remains widespread. This article focuses on indirect consequences of energy poverty in the labour market. We postulate that energy poverty acts as an obstacle during the job search process. We follow 1925 unique Australian unemployed persons (who we follow for 2660 periods of unemployment), approximately 10 % of whom experience energy poverty, and conduct a matching analysis. We find that although energy poverty increases job search intensity, it also increases time-to-employment, reduces time-in-employment in the first twelve months following the identification of energy poverty and lowers the employment status twelve months afterwards. Our findings suggest that energy poverty reduces job search quality. Since income is an important driver of energy poverty, the indirect (adverse) effects of energy poverty in the labour market may drive energy poverty entrenchment. Policies aimed at helping unemployed workers escape energy poverty, particularly those with limited social capital, access cheaper energy and/or reduce energy consumption, may prove valuable.

1. Introduction

The recent surge in energy prices put energy poverty front and centre in policy [1] and academic discourses. This attention to energy poverty is not surprising, because the direct adverse effects of energy poverty on wellbeing and health are well-documented [2–5].

To date, the indirect effects of energy poverty have received less attention, one of which is its potential effect on job search behaviour of the unemployed. Bienvenido-Huertas [6] and Vera-Toscano and Brown [7] demonstrate that the unemployed are particularly vulnerable to energy poverty. Indeed, Nelson et al. [8] find that ‘*unemployed households have an energy spend to income ratio more than 30% higher than low-paid households*. (p. 268)’.

To the best of our knowledge, no research into the relationship between energy poverty and job search behaviour and outcomes exists. If energy poverty, as we will motivate shortly, indeed adversely affects job search outcomes, it will reinforce the (energy) poverty cycle, potentially causing energy poverty entrenchment, hence why the link between energy poverty and a set of job search behaviour and outcome variables is the focus of this article.

Energy poverty may hinder unemployed workers’ job search akin to

how financial hardship [9] and unemployment benefit eligibility requirements [10] affect job search efficacy. That is, energy poverty is an established dimension of the construct financial hardship [11,12] and Gerards and Welters [9], Herkenhoff and Ohanian [13] and Herkenhoff et al. [14] show that hardship reduces job search effectiveness; Gerards and Welters [15] question employment stability if employment is secured. The literature attributes financial hardship to those who recently and at least occasionally, were unable to heat the home (i.e., energy poverty), went without meals, pawned or sold something, or asked help from welfare/community organizations, for financial reasons [11,12]. However, these four dimensions of financial hardship may not be equally strong dimensions (e.g., see Butterworth and Crosier [16], who discuss the weaknesses of hardship measures). If energy poverty is a strong dimension of financial hardship, it may—on its own—have adverse effects on job search behaviour and outcomes, which is the premise of this article.

In this article we borrow insights from the job search obstacle literature and evaluate whether ‘was unable to heat home’ adversely affects job search behaviour and outcomes. Job search obstacles come in two types. They may be attentional (e.g., family commitments) and/or emotional (e.g., distress following repeated job application rejections)

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<https://doi.org/10.1016/j.erss.2025.104377>

Received 22 May 2025; Received in revised form 26 September 2025; Accepted 3 October 2025

Available online 8 October 2025

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[17]. Energy poverty may cause both attentional and emotional obstacles. The literature shows links between energy poverty and self-assessed health [4,5] and subjective wellbeing [2,3] suggesting energy poverty may constitute an emotional obstacle. People experiencing energy poverty may also allocate time and effort to reduce energy bills (e.g., comparing energy tariffs of energy suppliers or reduce energy consumption through energy saving equipment or insulation) [18], suggesting energy poverty may also constitute an attentional obstacle during the job search process.

The literature measures energy poverty both subjectively and objectively [4,19–21]. ‘Was unable to heat home (for financial reasons)’ is considered a subjective measure. Measures that are considered objective focus on a household’s energy expenditure and/or energy expenditure’s share in household income. Recent comparisons of objective and subjective energy poverty measures with respect to their effect on health [4,19] show stronger adverse effects of subjective than objective measures. That should not surprise, because objective measures fail to attribute energy poverty to households that make every effort (including not heating the home occasionally) to reduce their energy expenditure, which is possibly the most energy-poor group of households (see also [7]). Accordingly, Semple et al. [22] recommend that energy poverty metrics reflect the ‘*lived experience*’ or ‘*on-the-ground*’ experience in order not to overlook vulnerable households.

We use longitudinal data from the Household, Income and Labour Dynamics in Australia (HILDA) survey¹ to explore the relationship between energy poverty—operationalised as ‘was unable to heat home’—and job search behaviour and outcomes for unemployed workers. Inability to heat the home is perhaps not a circumstance one associates with Australia, a country known for its mild winters. However, sub-standard minimum energy performance requirements for residential buildings mean energy costs to heat the home can nonetheless be substantial [27]. Importantly, to draw a causal relationship between energy poverty and job search outcomes, we need to control for factors that jointly determine the incidence of energy poverty and job search outcomes. We will use propensity score matching (PSM) techniques (exploiting the richness of the HILDA data to conditionally control for a large set of joint determinants).

The article is organized as follows. Section 2 describes the job search process, which is the context within which we study the effects of energy poverty. Section 3 describes the data, estimation strategy and dependent and independent variables, whilst Section 4 presents the results. Sections 5 and 6 provide a discussion of the results and conclusionary remarks, respectively.

2. Job search process and obstacles

In this section, we briefly sketch the job search process to provide the context within which we study the effects of energy poverty. This context forms the backdrop to understand our choice of potentially confounding variables explained in Section 3.4. We follow Van Hooft et al. [28] who portray job search as a three-stage process. The first stage centers around goal exploration and clarification. During goal exploration, the unemployed worker aligns their employment preferences and ambitions with the labour market opportunities that, given their skills and experience and prevailing labour market conditions, are available to

them [29]. Subsequently, during goal clarification, the unemployed worker chooses the preferred career opportunity from the range of opportunities that goal exploration uncovered [30]. Goal exploration and clarity are elements of the job search strategy. Crossley and Highhouse [31] differentiate focused from haphazard search strategies, where the latter lack in terms of goal exploration and clarity. Haphazard (rather than focused) search strategies have been linked to (1) fewer job offers obtained and lower job satisfaction (when a job is secured) for unemployed workers [31] and (2) lower perceived qualifications match and job quality for labour market entrants [32].

In stage two the unemployed worker confirms the employment goal and maps out the necessary steps to achieve it, i.e., the unemployed worker explicates the intended job search behaviour. In a quantitative review of the relevant literature, Van Hooft et al. [28] conclude that job search intentions indeed increase the job find rate. There may at least be two reasons for this finding. First, in absence of articulated job search intentions, the unemployed worker may revert to routine (search) behaviours. Since job search involves non-routine tasks, routine (search) behaviours are likely sub-optimal [33]. Second, articulated job search intentions were also found to facilitate job search evaluation during job search [34], which may help the unemployed worker to stay on track or identify required changes to the job search process.

Once the unemployed worker has clarified the employment goal and articulated the required job search behaviour, stage three starts: the unemployed worker enacts their job search intentions. However, during stage three, obstacles may arise that create a discrepancy between intended and actual job search behaviour. Melloy et al. [17] distinguish two types of obstacles, which the unemployed worker may face during the job search process: attentional and emotional obstacles—see Fig. 1.

Attentional obstacles are ‘outside’ the unemployed worker and may depend on the length of the job search process or arise independently. For example, benefit eligibility requirements, which tighten with the length of the job search process, have been found to increase perceptions of time pressure (i.e., are attentional obstacles) [35] and to adversely affect job search outcomes of unemployed workers [10]. However, attentional obstacles may also act independently of job search duration, such as family responsibilities, which may compete with time dedicated to job search [36].

Emotional obstacles are ‘inside’ the unemployed worker and may also depend on job search duration or arise independently. Song et al. [37] for example, show how job search causes distress, i.e., the duration of the job search process itself may hinder the sustained enactment of the intended job search behaviour. Distress caused by factors external to the job search process, for example credit constraints, may also constitute emotional obstacles during the job search process, and have also been found to adversely affect the outcome of that process [14].

To avoid actual job search behaviour falling short of intended job search behaviour, the empirical research points at the relevance of self-regulatory capabilities [17,38,39]. Also, self-regulatory acts, such as access to coping mechanisms when obstacles arise during the job search process [40] and ex-ante awareness that obstacles may arise during the job search process [41] have been shown to help the unemployed worker to stay on track when obstacles arise.

Energy poverty, the focus of this study, may also cause attentional and emotional obstacles. The energy (or fuel) poverty literature has established an adverse effect of energy poverty on subjective well-being [2,3] and self-assessed health [4,5], suggesting energy poverty may cause emotional obstacles. The literature shows two pathways through which energy poverty adversely affects wellbeing and self-assessed health. Energy poverty may cause thermal discomfort, which subsequently causes reduced wellbeing and or self-assessed health [42,43]. Alternatively, and in line with our study, through its association with financial distress, energy poverty produces reductions in wellbeing and or self-assessed health [44].

Energy poverty may also produce attentional obstacles. Unemployed workers experiencing energy poverty may want to explore opportunities

¹ The HILDA survey follows nearly 8000 households since 2001, adding just over 2000 households in 2011. All adult household members are interviewed individually (typically in September) through telephone interviews and self-completion questionnaires [23]. The HILDA survey is included in the Cross-National Equivalent File, evidencing its credibility and comparability to for example the United Kingdom Households: a Longitudinal Study (UKHLS), German Socio-Economic Panel (G-SOEP), and American Panel Study of Income Dynamics (PSID). Survey attrition is relatively low and non-response is largely random [24,25] implying no systematic attrition bias [26].

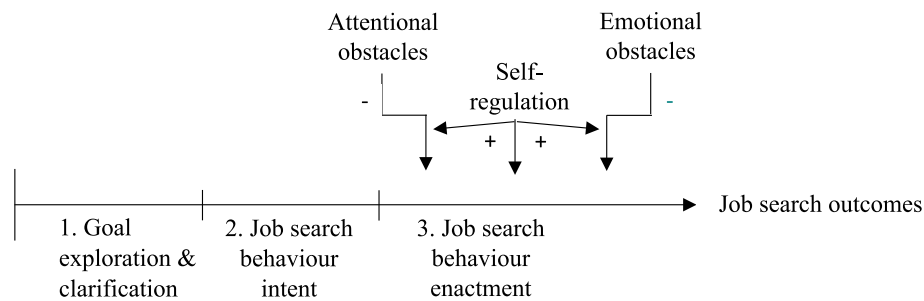


Fig. 1. Obstacles during the (three-stage) job search process.

(Source: Authors' own visualization, synthesizing concepts from the literature discussed in this section.)

to reduce energy bills either by searching for cheaper energy suppliers or by considering measures to reduce energy consumption (e.g., energy saving equipment or insulation) [18,45]. However, precarious tenancy relations, unstable incomes and lack of social support may explain why the energy poor struggle to employ these energy bill reduction strategies [45]. Indeed, Esplin et al. [46] show that unemployed workers are less likely to switch electricity provider, making it likely that they are paying higher prices.

In sum, it is conceivable that energy poverty, as an obstacle to the job search process, affects the job search behaviour and outcomes of unemployed workers, which is at the heart of our empirical investigation.

3. Empirical model

3.1. Data

The financial hardship measure (incorporating energy poverty) commonly used in the hardship literature and which Gerards and Welters [9] show reduces job search effectiveness is based on survey questions and—specific to our analysis—attributes financial hardship to each respondent who in a HILDA survey wave (typically conducted in September) responds in the affirmative to the question: ‘Since January did any of the following happen to you because of a shortage of money?’:

- (i) Pawned or sold something
- (ii) Went without meals
- (iii) Was unable to heat home
- (iv) Asked for help from welfare / community organizations

These items have been available in each wave of the HILDA data since its inception in 2001. Using all currently available annual waves, spanning 2001–2023, our sample comprises respondents who, in a particular wave, report to be (i) unemployed, (ii) looking for work, (iii) between 15 and 65 years of age, and (iv) who are present in the data in the preceding and subsequent wave (but not necessarily unemployed in these adjacent waves) and (v) whose current spell of unemployment is observed in the data in full (to minimize sample selection effects).²

Table 1 shows the incidence of inability to heat home as our energy poverty measure as well as the other three financial hardship dimensions. About one third of the sample of unemployed workers experienced financial hardship. Among those who experienced financial hardship, ‘pawned or sold something’ and ‘asked help from welfare / community organisation’ are the most prevalent strategies employed to address financial hardship; ‘was unable to heat home’ the least prevalent.

We follow the financial hardship literature and define energy

² We require respondent presence in the previous wave (1) to capture the start of the uncompleted spell of unemployment in our data (and avoid sample selection bias), and (2) to include respondent information from the preceding wave into the analysis (i.e., exploit the longitudinal character of the data set). We need respondent presence in the subsequent wave to establish job search outcomes.

Table 1

Descriptive statistics financial hardship including ‘was unable to heat home’ as a measure of energy poverty.

<i>N</i> = 3446	Frequency	% share of total sample	% share of those with financial hardship
<i>Incidence of financial hardship:</i>			
No financial hardship	2406	69.8	
Financial hardship	1040	30.2	
<i>Financial hardship involving:</i>			
- Asked for help from welfare / comm. org.	569		54.7
- Pawned or sold something	554		53.3
- Went without meals	454		43.7
- Was unable to heat home	254		24.4

poverty as a dummy variable taking value ‘1’ for respondents who tick ‘was unable to heat home’ (254 observations). It takes value ‘0’ for respondents who do not experience financial hardship (i.e., who experience none of the four dimensions of financial hardship) (2406 observations). Consequently, we exclude respondents who experience financial hardship without energy poverty.³ The final sample for the analysis therefore contains 2660 observations, based on 1925 unique respondents (i.e., some respondents enter our analysis multiple times—see also Section 3.2).

3.2. Estimation strategy

To draw a causal relation between energy poverty and job search behaviour and outcomes, we need to control for its joint determinants, or otherwise risk introducing endogeneity into the analysis. Some of these joint determinants are rarely quantified in surveys. For example, personality traits and other non-cognitive traits have been linked to energy poverty [20,47]. Simultaneously, personality traits have been linked to self-regulatory capabilities [48], which, as argued in Section 2, are important to maintain job search quality [17,38].

Researchers exploring a causal link between energy poverty and an outcome variable of choice (e.g., health, wellbeing, obesity) have either used panel regression analysis [4,5,19,21,44,47] or propensity score matching [2,4] to account for endogeneity.

Assuming personality traits do not change over time, panel regression analysis can account for time-invariant joint determinants without measurement. To address potential endogeneity from time-varying joint

³ In the supplementary information, we will follow the energy poverty literature and define energy poverty as a binary present / absent variable without making additional restrictions for other dimensions of financial hardship. The results are qualitatively similar to Table 5 (see Table S.2).

determinants, panel regression analysis applies instrumental variable techniques [4,5,19,21,44,47], where the instrument causes variation in energy poverty but not in the outcome variable (other than through energy poverty).

However, besides the difficulty to find suitable instruments [2,47], the transience of the respondents' unemployment status renders the application of panel regression analysis to our study unfavorable. To illustrate, we identify 1925 unique unemployed respondents in our survey, of whom 1469 (or 76 %) report to be unemployed in one wave, but not the next (i.e., who find employment within twelve months of becoming unemployed—short-term unemployed). We could apply panel regression analysis to the remaining 456 respondents, most of whom are continuously unemployed in at least two consecutive waves. However, the result of such an analysis would apply to long-term unemployed workers only, i.e., suffer from selection bias.

Consequently, we adopt (propensity score) matching analysis [2,4], which – in an era of increasingly detailed surveys – can circumnavigate the problem of joint determination.⁴ In our propensity score matching (PSM) analysis, respondents with energy poverty are matched to those without energy poverty, but with similar scores on the included variables relevant to the (joint) determination of energy poverty and labour market outcomes. Conditional on successful matching, respondents are similar in all respects except their energy poverty status and the resulting estimate of energy poverty on the outcome variable is causal.

3.3. Dependent variables

We use one measure of job search behaviour and three measures of job search outcomes, which are commonly used in labour market research [10,15,49,50]. They are (a) job search intensity, measured at period 't', which is the number of weekly job search hours, (b) 'months-in-employment' between periods 't' and 't + 12', which is the number of months spent in employment in the first twelve months following period 't', (c) 'months-to-employment' between periods 't' and 't + 12', which is the number of months it took the unemployed respondent to find employment within the first twelve months following period 't', and (d) the employment status at period 't + 12'. These four measures are the outcome variables in the PSM analysis.

Table 2 presents (differences in) means for the four outcome variables, using the respondent's energy poverty status to split the sample. We note that respondents with energy poverty spend more hours per week looking for work, take longer to find employment, spend less time in employment in the first twelve months following period 't' and are

Table 2

(Differences in) means of dependent variables by energy poverty status (two-sided *t*-tests).

	No energy poverty		Energy poverty
<i>Job search behaviour</i>			
Job search intensity at 't' (hours per week)	5.76	***	7.36
<i>Job search outcomes</i>			
Months-to-employment between 't' and 't + 12'	5.50	***	7.12
Months-in-employment between 't' and 't + 12'	6.61	***	4.63
Employed status at 't + 12' (1 if employed)	0.66	***	0.47
Number of observations	2406		254

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

⁴ We specify cluster robust standard errors in our analysis to account for the fact that 456 unique respondents enter the analysis more than once.

less likely employed twelve months later.

3.4. Control variables

Establishing a broad set of control variables is imperative to the success of the PSM analysis. Leaning on economic theory, the relevant empirical literature on the job search process and on energy poverty, and the richness of the HILDA dataset, we compile a range of time-variant and time-invariant variables that we will include in the PSM estimation to attain conditional independence (see Table 3 for (differences in) means by energy poverty status). For the relation of proposed control variables with job search behaviour and outcomes, Section 2 provided a brief backdrop, but we refer to extensive literature reviews in Gerards and Welters [9,10,15].

First, we include variables that relate to the respondent's unemployment history and benefit eligibility status. Previous spells of unemployment (during which respondents draw from financial buffers) heighten the likelihood that the current spell causes (energy) poverty [8]. Past labour market performance may—as a time-invariant fixed effect—also predict future job search behaviour and outcomes [15]. The length of the current unemployment spell increases the likelihood of the experience of (energy) poverty and is simultaneously likely to affect job search behaviour and outcomes. Hence the inclusion of 'Time in unemployment as a share of time since completing full-time education' and 'Time (months) currently in unemployment' as control variables. Table 3 shows that respondents with energy poverty indeed experience poorer historical labour market performance and a longer uncompleted spell of unemployment. Since unemployment benefit eligibility is means tested in Australia (for both income and assets), benefit eligibility signals that a household is on the lower part of the financial means distribution, which concomitantly raises the likelihood of (energy) poverty [7,8]. The risk of future benefit eligibility loss may induce respondents to spend cautiously today, perhaps reconsidering energy consumption levels. Both the applicability of unemployment benefits and the threat of losing eligibility are linked to job search behaviour and outcomes. We include unemployment benefit eligibility (in period 't' and 't - 12') and the applicability of a 'Mutual Obligations' requirement as controls. In Australia, unemployment benefit eligibility may be conditional on the completion of tasks and activities (i.e., mutual obligations) [10]. Failure to comply may jeopardize access to benefits. Table 3 shows that respondents with energy poverty are indeed more likely to have access to unemployment benefits and face or have faced 'Mutual Obligations' requirements. Finally, we also include the reason for the start of the current spell of unemployment as a control for selection, however, Table 3 shows no such selection effects.

Second, we include variables that relate to the household's financial position, which affects both the incidence of (energy) poverty and labour market behaviour [7–9]. We include household income, household savings and household credit card debt. Table 3 reveals that respondents with energy poverty have lower household income, lower household savings and lower credit card debts, perhaps indicating their lack of access to credit cards (or lower credit limits).

Third, we include household composition, which affects both the likelihood of energy poverty [7,8] and job search behaviour and outcomes (e.g., caring responsibilities may narrow the range of suitable job opportunities). We note in Table 3 that single households are more likely in energy poverty [7].

Fourth, we include respondent characteristics that may both affect energy poverty and labour market behaviour / outcomes. Table 3 shows that respondents in energy poverty are older, have lower educational attainment, are more likely female, Indigenous and more likely to have a health condition that limits the type/amount of work they can do, broadly echoing findings from earlier research [7].

Fifth, we include the big five personality traits (as further time-invariant fixed effects), as they [47] and other non-cognitive traits [20] have been linked to energy poverty. Simultaneously, the big five

Table 3(Differences in) means of control variables by energy poverty status (two-sided *t*-tests).

	No energy poverty		Energy poverty
<i>Unemployment history / benefit eligibility</i>			
Time in unemployment as a share of time since completing full-time education	0.23	**	0.27
Time (months) currently in unemployment	8.01	***	11.11
Unemployment benefit recipient at time 't - 12' and 't'			
Both at 't - 12' and 't' (sustained dependence)	0.10	***	0.20
Only at 't - 12', not at 't' (recently became ineligible)	0.02		0.02
Not at 't - 12', only at 't' (recently became eligible)	0.24	***	0.43
Neither at 't - 12' nor at 't' (sustained independence)	0.65	***	0.35
'Mutual Obligations' requirement			
No (never)	0.77	***	0.58
Yes, completed	0.09	***	0.17
Yes, ongoing	0.14	***	0.25
Reason for latest job separation			
Never employed	0.06		0.06
End-of-contract	0.17		0.16
Laid-off	0.28		0.33
Quit	0.43		0.42
Other/unknown	0.06	*	0.04
<i>Household financial position</i>			
Gross weekly household income (x\$1000)	1.45	***	0.76
Household bank account savings (x\$1000)	21.12	***	5.37
Household credit card debt (x\$1000)	1.31	***	0.67
<i>Household characteristics</i>			
<i>Household composition</i>			
Couple without dependent children	0.26	***	0.19
Couple with dependent children	0.36	***	0.21
Single with dependent children	0.10		0.13
Single without dependent children	0.05		0.06
Single	0.15	***	0.31
Single with non-related adults	0.07	**	0.11
<i>Respondent characteristics</i>			
Age (years)	34.50	***	36.96
Educational attainment			
Year 12 or below	0.50		0.50
Certificate III or IV	0.23	**	0.30
Advanced diploma	0.07		0.05
Bachelor's degree or higher	0.19	*	0.15
Sex (1 if male)	0.52	**	0.46
Indigenous (1 if yes)	0.06	***	0.11
At least one parent employed when respondent was 14 (1 if yes)	0.93	*	0.89
English first language learned (1 if yes)	0.90		0.90
Long term health condition/disability			
No	0.75	***	0.60
Yes, but no impact on type/amount of work that can be done	0.09		0.11
Yes, limits type/amount of work that can be done	0.16	***	0.29
<i>Big Five Personality traits (self-regulatory capabilities)^a</i>			
Openness to experience	4.31	***	4.74
Extroversion	4.32		4.26
Agreeableness	5.23		5.29
Conscientiousness	4.77	***	4.56
Emotional stability	4.94	***	4.67
<i>Social capital</i>			
Index of Social Support	11.86	***	2.92
Active member community club (1 if yes)	0.29	***	0.21
Feeling part of their local community	6.12	***	5.11
<i>Dwelling-related energy consumption</i>			
Moved dwelling in last 12 months (1 if yes)	0.24	***	0.35
Home ownership (1 if yes)	0.53	***	0.26
<i>External circumstances relevant to energy costs</i>			
Price electricity (consumer price index)	113.31		115.14
Price gas and other household fuels (consumer price index)	107.77		109.99

Table 3 (continued)

	No energy poverty		Energy poverty
<i>External circumstances relevant to labour market behaviour and outcomes</i>			
Residing in a major metropolitan area (1 if yes)	0.57	***	0.46
Regional unemployment rate	5.31		5.37
Labour force participation rate	64.97		65.00
Underutilisation rate (%)	13.23		13.16
Trade union density	17.75		17.56
Casualization rate	24.19		24.22
Net replacement rate (in unemployment)	40.67		40.56
Covid19 (1 if applicable)	0.18		0.17
Year	2013.3		2013.5
Number of observations	2406		254

Notes: ^a The Big Five Personality traits are scored from one (not applicable) to seven (very applicable).*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$ on two-sided *t*-tests.

personality traits have been linked to self-regulatory capabilities [48], which, as argued above, are important to maintain job search quality [17,38]. We note that respondents with energy poverty are more open to experience, but less conscientious and less emotionally stable.

Sixth, we include three variables measuring the respondent's access to social capital, which—if available—the respondent can access to avoid (energy) poverty [45], but also to find employment. We include the index of social support [51], their engagement in community activities [52] and to what extent they feel part of their local community (scale from zero to ten) [53], to gauge a respondent's social capital, and note that respondents with energy poverty fair worse.

Seventh, we include two variables that relate to dwelling-related energy consumption. Specifically, we include a variable indicating whether the respondent has moved dwelling in the last 12 months, which may indicate a change in dwelling-related energy consumption but may also change the local labour market in which the respondent searches for work. We also include a variable indicating homeownership in the analysis, recognizing that homeownership both facilitates the implementation of energy-saving infrastructure [8,18,54–57] and spatially constrains job search [58,59]. We observe that respondents with energy poverty are more likely to have moved dwelling in the last twelve months and are more likely renters.

Eighth, we include external circumstances relevant to energy costs. We control for the consumer price indices of 'electricity' and 'gas and other household fuels' per state and year, in recognition of state-level variation in these prices [57], obtained from the Australian Bureau of Statistics website.

Ninth, we include a set of variables that intend to capture external circumstances relevant to labour market behaviour and outcomes. We include a dummy variable indicating whether the respondent resides in a major metropolitan area, recognizing differences between metropolitan and regional labour markets in Australia [60]. We include the regional unemployment rate and at the state-level we measure the underutilization rate (unemployment plus underemployment), the vacancy rate, the labour force participation rate, trade union density, the casualization rate, and the net replacement rate to control for changing labour market conditions (all sourced from the Australian Bureau of Statistics website). We include a COVID19 dummy variable (applicable to the years 2020 and 2021) to acknowledge the impact of the pandemic on the labour market [61] and on residential energy demand [62]. Finally, we include a year dummy to ensure localized matches (time-wise). We note that respondents with energy poverty are more likely to reside in non-metropolitan areas.

In sum, we have compiled a list of control variables, which (a) covers a broad range of potential joint determinants of energy poverty and labour market behaviour and outcomes, (b) includes 11 time-invariant controls to capture (unobserved) individual fixed-effects, (c) span

three waves of data implying we use (lagged) information from periods 't' and 't - 12' to explain outcomes beyond period 't', and (d) focus on respondents whose uncompleted spell of unemployment is observed in full in the data.

4. Results

In the first stage of the PSM analysis, we estimate the propensity to be in energy poverty for each respondent (see Table S.1 in the supplementary information), based on the control variables as described in Section 3.4. We note that (p -value < 0.05) being single in a household with non-related adult(s) raises the likelihood of energy poverty, whilst higher household income and higher household savings reduces the likelihood. Further, we observe that women and respondents with a disability that reduces their work capacity have a higher incidence of energy poverty. In terms of personality, openness to experience increases the likelihood of energy poverty, whereas conscientiousness reduces it, as do social capital ('Index of social support' and 'Feeling part of their local community') and homeownership.

4.1. Quality of the propensity score matching procedure

Using the propensity (to be in energy poverty) scores, we then match respondents with and without energy poverty. Fig. S.1 in the supplementary information contrasts the energy poverty propensity distribution of those with energy poverty to those without it. We observe overlap between the two groups, which facilitates matching on the control variables.

We employ an Epanechnikov kernel specification with a bandwidth of 0.06 [15,49]. Table 4 contains matching quality indicators. The matching procedure has eliminated all significant (mean) differences for the control variables between those with and without energy poverty. Post matching mean and median standardized biases are within and below the recommended 3 %–5 % range, respectively [63]. The p -value of the joint significance test and the Pseudo- R^2 provide further evidence for high quality matching.

4.2. Estimation results

Table 5 contains the results of the PSM analysis. Energy poverty increases job search intensity ($p = 0.070$). However, job search intensification does not translate into success. It takes unemployed respondents with energy poverty more time to find employment ($p = 0.041$) and they spend less time in employment in the first twelve months ($p = 0.008$) than those without energy poverty. Finally, the probability to be in employment twelve months after the identification of energy poverty is lower ($p = 0.030$). More intensified job search but poorer labour market

outcomes suggest energy poverty reduces job search quality.

4.3. Robustness to unobserved heterogeneity

Key to the causality claim of the PSM analysis is its robustness to omitted control variables. To demonstrate its robustness, we use Table S.1 to identify core determinants of energy poverty (all explanatory variables which are statistically significant (at 5 %) in stage one of the PSM analysis), of which there are ten. We select three of these ten explanatory variables, which relate to separate areas of potential unobserved heterogeneity. They are 'Long term health condition / disability' (which is a labour market performance deteriorating respondent condition), 'Feeling part of their local community' (which picks up characteristics of the respondent's neighbourhood), and 'Conscientiousness' (which is a character trait). Subsequently, we rerun the PSM analysis without these three explanatory variables, i.e., they become artificially unobserved in the analysis.

This PSM analysis will suffer from 'introduced' unobserved heterogeneity, unless the matching analysis, based on the remaining explanatory variables, matches energy-poor and non-energy-poor participants also on the three omitted explanatory variables (in their absence). Evidence of which, indicates that the main PSM analysis (Table 5) also balances energy-poor and non-energy-poor participants on truly unobserved explanatory variables.

We derive propensity scores for all respondents from a PSM analysis that omits 'Long term health condition / disability', 'Feeling part of their local community', and 'Conscientiousness'. We explore the propensity score range 0.25 to 0.75 (approximately plus / minus one standard deviation from the mean) with 0.1 propensity score increments (see Table 6). The first column shows that differences between energy-poor and non-energy-poor participants are statistically significant at 1 % for each of the omitted core explanatory variables in absence of matching (except the health condition/disability subcategory 'Yes, but no impact on type/amount of work that can be done'). However, this changes if we compare energy-poor and non-energy-poor respondents with similar propensity scores (stemming from a PSM analysis that omits 'Long term health condition / disability', 'Feeling part of their local community', and 'Conscientiousness' as explanatory variables). Table 6 shows that only three of 25 mean differences remain statistically significant; none at 1 %.

The findings in Table 6 indicate that our main PSM analysis, which is rich in explanatory variables, is robust to unobserved heterogeneity.

5. Discussion

Despite sustained periods of economic growth, energy poverty affects sizeable shares of households in the United States [64], Europe [65] and Australia [66]. It is therefore important to not only understand the determinants of energy poverty and the direct effects of energy poverty on affected households, but also the indirect effects, particularly if they contribute to energy poverty entrenchment. This article focuses on the indirect effect of energy poverty on job search behaviour and outcomes of unemployed workers.

We combine insights from the job search literature and the energy poverty literature to hypothesize that energy poverty adversely affects job search outcomes of unemployed workers. That is, the former body of literature highlights the impeding effects of emotional / attitudinal obstacles during the job search process on its outcome [17,36]. The latter body of literature shows that energy poverty has attributes of the types of obstacles discussed in the job search literature [18,44,45]. Exploiting Australian data on 1925 unique unemployed workers, who we follow for a joint total of 2660 periods of unemployment, we conduct a propensity score matching (PSM) analysis to establish the causal effect of energy poverty on four outcomes of the job search process of unemployed workers. We find that energy poverty increases job search intensity, increases time-to-employment, reduces time-in-employment in the first

Table 4
Matching quality indicators (outcome variable: employed status 't + 12').

	Before matching	After matching
Number of variables with significant difference in means at up to 5 % ^a	26	0
Number of variables with absolute standardized bias		
< 1 %	0	13
1 % - 3 %	4	16
3 % - 5 %	6	10
≥ 5 %	40	11
Maximum standardized bias	78.9	11.1
Mean standardized bias	19.2	3.4
Median standardized bias	13.6	2.4
p -value of joint sign. Test	0.000	1.000
Pseudo R-squared	0.231	0.014
Number of observations outside common support	–	0
Total number of variables	50	50

Notes: ^a tested using t -test.

Table 5

Matching estimates of ‘was unable to heat home’ on job search behaviour and outcomes.

	ATT	Se	N	n treated	n untreated	Off support	Mean Bias	Median Bias
<i>Job search behaviour</i>								
Search intensity at ‘t’	1.22*	0.67	2660	254	2406	0	3.4	2.4
<i>Job search outcomes</i>								
Months-to-employment between ‘t’ and ‘t + 12’	0.78**	0.38	2660	254	2406	0	3.4	2.4
Months-in-employment between ‘t’ and ‘t + 12’	−1.03***	0.39	2660	254	2406	0	3.4	2.4
Employed status ‘t + 12’	−0.09**	0.04	2660	254	2406	0	3.4	2.4

Note: Coefficients are average treatment effects on the treated. We use the Epanechnikov kernel, common support, bandwidth 0.06, robust standard errors (499 bootstraps) clustered on the individual. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 6Statistically significant differences in means for omitted core independent variables by (subjective) energy poverty status (two-sided *t*-tests).

Omitted core independent variables	Whole sample	Propensity score range				
		0.25–0.35	0.35–0.45	0.45–0.55	0.55–0.65	0.65–0.75
Long term health condition/disability						
No	***	–	*	–	–	–
Yes, but no impact on type/amount of work that can be done	–	–	–	–	–	–
Yes, limits type/amount of work that can be done	***	–	–	–	–	–
Feeling part of their local community	***	**	–	–	**	–
Conscientiousness	***	–	–	–	–	–

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

twelve months following the identification of energy poverty and reduces the likelihood to be employed twelve months after the identification of energy poverty.

More intense job search, but poorer job search outcomes suggest that reduced job search quality is the mechanism through which energy poverty reduces job search outcomes. The job search literature flags three phases in the job search process where obstacles may lead to reduced job search quality, which subsequently impairs the quality of the job search outcome. First, overcoming obstacles may compete with time dedicated to (job search) goal orientation and clarification, leading to the adoption of low quality (haphazard) search strategies [31,32]. Second, addressing obstacles may compete with time allocated to expressing job search intentions [28]. Job search intentions spur high-quality job search behaviour [33] and maintenance of high-quality job search behaviour [34]. Third, obstacles may weaken the unemployed worker’s focus on the job search process producing sub-optimal search behaviour [17].

An important limitation of our analysis (and avenue for future research) is that we do not establish whether energy poverty indeed impedes unemployed workers’ job search quality. Whilst the combination of increased job search intensity and poorer subsequent job search outcomes certainly hints in the direction of reduced job search quality, alternative explanations exist. We can think of two. First, energy-poor unemployed workers may have higher reservation wages (i.e., are more selective). Research looking at financial hardship more broadly does not find evidence to support this [15]. Second, employers discriminate against energy-poor unemployed workers. We cannot test the discrimination thesis, but consider it unlikely, because energy poverty is not an observable characteristic of an applicant.

Finally, the article focuses exclusively on the Australian context. Results need not be transferable to other countries.

6. Conclusions

This study demonstrates, using Australian longitudinal data, that energy poverty adversely affects job search outcomes of unemployed workers, particularly time-in-employment in the first twelve months following the identification of energy poverty and the employment status twelve months out. We argue that energy poverty is an obstacle during the job search process, which reduces the quality of the search process.

Consequently, the sustained prevalence of energy poverty among households in OECD countries has indirect effects in the labour market, next to the established direct effects on (self-assessed) health and wellbeing.

Alleviating energy poverty among unemployed workers therefore has broader benefits, however, our analysis shows that addressing energy poverty is not straightforward. Unemployed workers do not control many of the determinants of energy poverty that we elucidated in our analysis (age, gender, Indigenous status, and personality traits) or if they do, those determinants first require an improved labour market position (household income, household savings and homeownership). This poses a catch-22 for the energy poor unemployed as alleviating energy poverty requires obtaining (stable) employment, whilst energy poverty hampers obtaining stable employment. Policy interventions that can help affected unemployed workers to solve either of these two unfavorable conditions may kill two birds with one stone.

We find that access to social capital protects against energy poverty. Hence, policy initiatives that facilitate access to information that unemployed workers may obtain from their social networks if they had such networks, would help the unemployed workers with low levels of social capital. Access to social capital may help accessing (1) competing (cheaper) energy suppliers, (2) home improvement agencies (or access to subsidy programs to fund improvements), (3) landlords (in case approval is required) and (4) support from family and friends (e.g., to obtain advice on energy conservation measures or to save energy by showering at a friend’s place) [45,67]. Policies that facilitate access to the above can be instrumental in alleviating energy poverty [18] and indirectly in improving job search for unemployed workers with low levels of social capital.

Alternatively (or concurrently), policy initiatives that help energy-poor unemployed workers find and sustain employment may also help address energy poverty. Particularly policy aimed at strengthening the self-regulatory capabilities of energy-poor unemployed workers [17,38,39] may help them navigate obstacles. That said, microeconomic labour market policies will only be effective if there is sufficient macroeconomic labour demand to meet supply. That condition was rarely met in the Australian labour market during the study period, broadly reducing the effects of microeconomic labour market policies to job queue shuffling [68]. Activist fiscal policy to achieve full employment is needed to support unemployed workers back to work structurally [69].

CRediT authorship contribution statement

Riccardo Welters: Writing – original draft, Visualization, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Ruud Gerards:** Conceptualization, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This article uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) survey. The HILDA project was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this article, however, are those of the authors and should not be attributed to either FaHCSIA or the Melbourne Institute.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.erss.2025.104377>.

Data availability

The Household, Income and Labour Dynamics in Australia (HILDA) data are accessible through the Melbourne Institute.

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