Unencumbered and still unequal? Work hour - Health tipping points and gender inequality among older, employed Australian couples

Tinh Doan [a,*], Christine LaBond [a], Cathy Banwell [a], Perri Timmins [b], Peter Butterworth [a], Lyndall Strazdins [a]

[a] *Research School of Population Health, Australian National University, Canberra, Australia*
[b] *Safe Work Australia, Canberra, Australia*

A R T I C L E   I N F O

A B S T R A C T

Could working into older age offer women an opportunity to 'catch up' their careers and redress their financial disadvantage in retirement? This is a period of relative 'unencumbrance' from childrearing, potentially freeing women's time for more paid work. Here, we examine whether women aged 50 to 70 are able to increase their workhours, and what happens to their mental health, vitality and wealth. We used a representative household-based panel of employed older Australians (the HILDA survey). The longitudinal bootstrapped 3SLS estimation technique adjusted for reciprocal relationships between wages, workhours, and health, modelled in the context of domestic work time. We found that, relative to their same-aged male counterparts, older women spent 10 h more each week on domestic work, and 9 h less on work that earned income. When women sought to add more paid hours on top of their unpaid hours, their mental health and vitality were impaired. Men were typically able to maintain their workhours and health advantage by spending fewer hours each week on domestic work. Unable to work longer without trading-off their health, and paid less per hour if they did so, our analysis questions whether working into older age offers women a road out of inequality and disadvantage.

1. Introduction

1.1. A 'new' labor force: women and older workers

The composition of the labor force is changing in most affluent countries as women's and older adult's participation increases. From 1990 to 2016, the participation rate for women aged 15–64 increased by about 5.7% across the OECD, and the rate of increase for Australian women was almost double this, reaching 10.5% for the same period (OECD, 2022). Similarly, between 2000 and 2016, older adults' participation rates increased faster than that of the overall labor force. For example, the participation rate for workers aged 55–64 increased by 14.4% (from 50% to 64%) for the OECD average and 16.4% (from 46% to 62.5%) for Australia (OECD, 2022). However, the increase in women's — including older women's — participation has not necessarily improved gender equality in employment outcomes. For example, managers are almost twice as likely to be male (61%) than female (39%) and women's earnings are just 86% of men's (ABS, 2020a). This income gap is part of a starker gender gap when all entitlements, packages and bonuses are considered, with the Australian Workplace Gender Equality Agency (WGEA) estimating a total remuneration gap of around 21% in 2019 (WGEA, 2019). Over the life course wage earnings, the remuneration and career progression gaps accumulate, leading to large inequities in many women's savings and security in retirement. Despite a new labor force in terms of gender and age composition, and despite decades of effort to redress discrimination, employment outcomes continue to be unequal.

A major driver of gender inequity in pay and progression is the work hour disparity between men and women. Although weekly workhours have declined, this average conceals a large and gendered difference in time on the job. When women are employed, they often hold part-time jobs (OECD, 2022), while men work in jobs with long full-time hours and this is largely due to the unequal amount of time women, relative to men, spend on caregiving and domestic work (Maume, 2006). This gendered polarization in work hours drives pay and other inequality, especially between couples in the same household (Landivar, 2015), and it is strongest in countries and workplaces where long full-time hours are expected and rewarded. For example, in 2018, a third of Australian men

worked more than 45 h a week (nearly one in ten worked more than 60), for women the rate was one in ten, and nearly one half of employed Australian women worked part-time (less than 34 h a week) (ABS, 2020b). Employers offer part-time jobs as a way to minimize their operation costs. Some workers seek them for reasons of flexibility, study or health, others because they are not able to find full-time employment. Gender norms also influence who takes part - time jobs, which are common in feminized industries such as education, healthcare and social services, administration and support, retail, arts and recreation, and hospitality (RBA, 2018). Yet the most important driver of women's lower work hours is women's unequal share of care and domestic work, which peaks when they are of child-bearing and rearing age (Anxo et al., 2011; Craig, 2007). Health locks in this gendered workhour disparity, because if women combine longer work hours with significant care or domestic work, they can impair their mental health (Dinh et al., 2017).

The impact of the unequal share of care and domestic work on women's careers and livelihoods is well documented. It raises the question of what happens to women's employment once unequal childrearing responsibilities reduce. Could working into older age offer women the opportunity to 'catch up' financially because women's (family) time constraints weaken? Arguably, an aging workforce could enable a fairer workforce if women can devote the same time as men do to paid work, assuming that their domestic work similarly approximates men's. In the current paper, we ask whether women aged 50 to 70 are able to 'catch up' to men in the hours they work, without compromising their health. Our focus is on mental health and vitality (physical fatigue).

1.2. At what point do workhours affect mental health and vitality?

Although most research focusses on the health harms of workhours, there is evidence that working at least some hours improves mental health, due to the benefits of social inclusion and greater income (Dooley & Prause, 2009; Karsten & Klaus, 2009). Similarly, underemployment or working fewer hours than preferred typically has a negative effect on health and wellbeing (Dooley et al., 2000; Milner et al., 2015). However, this does not mean all workhours are equally healthy. Although underemployment is generally linked to poor mental health, workhours only benefit health up to a point (Kleiner & Pavalko, 2010). Working too many hours adversely affects health and can contribute to a wide range of health disorders, both mental and physical, although the optimal number of hours varies across studies (e.g., Amagasa & Nakayama, 2013; Bannai & Tamakoshi, 2014; Milner et al., 2015; Sparks et al., 1997). This pattern of results suggests that there exists 'tipping points' for work hours, which are the points (in terms of hours worked each week) at which more paid work becomes harmful.

Reducing full-time workhours by 4 h per week in Portugal, France, and Korea to either 35 or 40 h had a positive effect on workers' health outcomes related to injuries, death rate, fatigue, job satisfaction and leisure satisfaction (Lee & Lee, 2016; Lepinteur, 2019) indicating that multiple aspects of health can benefit. Thus the length of the working week is not only important for individual mental and physical health, but can affect the health of whole populations. However, research on workhours and health often uses pre-defined, arbitrary and categorical definitions of long workhours, ranging from 40 to 60 h per week (Milner et al., 2015), or more than 12 h per day (e.g. Dembe et al., 2005) rather than model non-linear relationships. The health effects of working 8–9 (40–45 h per week) or 11–12 h per day (55–60 h per week) may differ, and this is obscured in simple workhour categorizations.

1.3. Older workers, workhours, mental health and vitality

Another complexity for estimating workhour–health relationships in the older workforce is the role played by underlying health status. On the one hand, older adults may have more skills and resources to cope with stressful circumstances (Folkman et al., 1987). Such factors may help older workers including women to sustain longer workhours without compromising their mental health or becoming fatigued, even if their physical health is declining. On the other hand, some aspects of health, which is part of the stock of human capital, depreciate as people age (Haveman et al., 1994), even though health–promoting resources such as wealth can accumulate (Daley & Woods, 2014). Thus older age and associated health-related changes may restrict capacity for longer workhours in both men and women. Mature pink-collar, blue-collar and other lower skilled workers, for example, are less likely to remain in the workforce or work longer hours due to the physical demands of their work (LaBond et al., 2020, pp. 1–10; Doan et al., forthcoming). Job-related health problems are generally higher for older than younger workers (OECD, 2006) and many older people who want to keep working retire involuntarily due to health conditions. There is evidence for an emerging 'two worlds of aging' – one world for older adults who are generally healthy and wealthy (and able to sustain working as they age) and another who have poorer health and lack income, who are unable to sustain working when they are older (Crystal et al., 2017; Doan et al., forthcoming).

Currently, 28% of older Australians aged 40–64 report being forced to retire for health reasons. Older Australians' health and their partner's health count for 35% of early retirement (Productivity Commission, 2015).[1] Although workers who remain in the labor market are likely to be healthier than those who exit it, the impact of declining health status is likely to grow as they age. In previous research (Doan et al., forthcoming), they showed that underlying health status and its effect on workhour tipping points changed even between those aged 50–60 and 61–70. When older workers reported chronic or long-term health conditions, their mental health tipping points lowered by an average 7–11 h each week or by 3 h per week for workers older than 60.

This paper tests the hypothesis that workhour-health tipping points among partnered older workers are gendered, reflecting a persisting inequality in the labour market and in the home, especially women's continuing, greater share of domestic work. Because health, workhours and earnings form a system with interacting, reciprocal relationships, we model it as such, using simultaneous methods to estimate multiple and interacting pathways. This approach addresses the complex causal processes shaping health and gender outcomes at play in an ageing workforce and we can introduce measure of unpaid workhours into the models. However, our estimated, average tipping points for the older workers are likely upward biased due to health selection, which may have an increasingly strong effect on an older workforce's capability to work longer hours, a problem we explore further in our results.

1.4. Gendered jobs or gendered time?

There is emerging evidence for gendered differences in the relationships between workhours and health, however only a few studies consider older men and women. Averaging over all ages, Australian research indicates large differences between men and women in the workhour and mental health relationship. Milner et al. (2015) showed that the mental health of workers in highly skilled occupations (managers and professionals) was negatively affected by long workhours of 49 h or more per week, and they found a stronger effect on women than men in the age group 49–59 years. A second study estimated a 13-h per week difference for workhour and health trade-offs for mental health (average tipping points of 46.7 h per week for men and 34.1 h for women, Dinh et al., 2017). The study further demonstrated that these unequal hour-health relationships in the labour market were a function of unequal workloads in the home. This study was also one of the few who attempted to model workhour health relationships in terms of a tipping point or non-linear relationship, modeling workhour

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[1] https://www.pc.gov.au/research/completed/superannuation-post-retirement.

continuously, and estimated on a sample of employed adults aged 25–64.

Industry sex-segregation may be another contributor to gender differences in tipping points. Men and women are concentrated in different types of jobs, occupations and industries and these entail different pay, conditions and workhour regimes. Thus male-dominated industries typically offer higher wages and expect longer work hours compared with female-dominated industries (Doan at el., 2021; Blau & Kahn, 2017; Minnotte et al., 2010). In the US and Australia men predominate in "good jobs" and senior roles which deliver pay and prestige premiums but expect long hours and availability (Cha & Weeden, 2014; Wilkins & Wooden, 2014). These rewards for long hours disincentivize men to share care (Williams et al., 2013). In contrast, women predominate in shorter hour jobs which can be feasibly combined with domestic work and care, and these jobs are also usually more junior (Valletta & Bengali, 2013; Wilkins & Wooden, 2014). Women's jobs therefore tend to be casual, of poorer quality and pay, offering them less autonomy, flexibility and security even while they are more compatible with family workloads (Charlesworth et al., 2011). While poorer quality jobs and working conditions are likely to reduce women's ability to work longer without compromising their health (OECD, 2006; Read & Gorman, 2010), they do not explain Milner et al. (2015)'s finding that work-hour–health tipping points are lower for women managers relative to men.

Dinh et al. (2017) linked gender differences in workhour-health tipping points to gender differences in unpaid time. They found that average gender gaps in workhour and health tipping points were similar to gaps estimated on Australian workers with high or low care and domestic workloads. Doan et al. (2021) decomposed gender workhour differentials and found that sex segregation of jobs and a greater and unequal share of domestic work were the most important drivers of women's reduced workhours in Australia. As well as spending more hours on care and domestic work, the types of unpaid work women do further compromises their availability for employment. For example, men are more likely to do yard work and play with children, but do less routine family care such as feeding, cooking and home management than women (Craig & Mullan, 2010; Mattingly & Bianchi, 2003). In contrast, women's domestic work and care tends to be time sensitive such as cooking and feeding, dropping off or picking up children from school or daycare. These activities are inflexible as well as time consuming, compromising capacity to work for pay (Emslie & Hunt, 2009).

However, average workhours, domestic work and care time hides distinct, gendered, changes in time spent in work and care over the life-course. For example, in their study of the US, France, Italy and Sweden, Anxo et al. (2011) found that in all four countries women's employment dramatically declines when they have children (e.g., the rate drops from 82 to 58% in the US and 74 to 54% in Italy). Women who do not leave the labor force reduce their hours, especially when they have young preschool children. Women's decreases in paid hours are mirrored by corresponding and equally marked increases in domestic work and care time. As women move through the child bearing and rearing stages, workhours typically begin to increase as children grow older, although they tend to remain lower than men's. In contrast to women, Anxo et al. (2011) found little to no perceptible changes in men's paid working hours over the life course, either when they become fathers or as their children grow up.

Women thus enter older age (defined as 50–70 years) with disrupted careers and the likelihood that they hold or had held jobs in industries with fewer opportunities and lower pay. However, one major constraint on their employment equality may have changed – their time. Older age employment therefore captures a period in women's life course when they might be more equally 'unencumbered' and this may enable them to work and earn more, reducing inequality while it improves financial security. In this paper, we ask whether older women aged 50 to 70 are able to work as many hours as older men do, without compromising

their mental health or vitality.

2. Data, research hypotheses and empirical method

2.1. Data

The Household, Income and Labour Dynamics in Australia Survey (HILDA) data were used in this study. HILDA is a nationally representative household-based panel study that began in 2001. Each wave has more than 7,000 households containing more than 17,000 household members. Response rates have been consistently high (over 90%; see Summerfield, 2011). The survey gathers information about household members' employment, domestic time, health and socio-economic characteristics. Our data is from waves 2005–2018 as some relevant variables such as work conditions were not collected before wave 2005. We limited the sample to employed adults aged 50–70 years for whom we had data on mental health, vitality, wages, workhours and covariates. Due to missing data, attrition and recruitment of new respondents, the number of observations varies across waves, creating an unbalanced panel. As we also used partner's employment and education as either control variables or instruments in models, the sample is further restricted to older workers with at least one partner employed.

2.2. Research hypotheses

We propose that there are weekly workhour limits for older workers beyond which mental health and vitality deteriorate, and that these vary across gender and are conditional on unpaid time. Our study sample is drawn from 50 to 70 year-old men and women who are partnered.

2.3. Estimation method

2.3.1. Simultaneity between health, work time and wage income

The relationship between health and workhours is complex, because workers' health and hours of work mutually influence each other. Health is considered to be both input and outcome of work time and income (O'Reilly & Rosato, 2013) as discussed above. This creates a reciprocal effect or simultaneity across workhours, wage income and health that challenges conventional analysis approaches such as Ordinary Least Squares (OLS). OLS estimates are likely to be upward biased because of the correlation between the error terms and unobserved factors that affect both workhours and health in the workhours and health equations. For example, some unobservable factors e.g., time spent on health promoting behaviors may affect both individual's workhours and their health, influencing or distorting the relationship between them. For these reasons, OLS estimation is likely to bias the relationship between workhour and health outcomes.

Instead we followed the Three Stage Least Squares (3SLS) to estimate the relationships between wages, hours and health as part of a system with reciprocal effects (Dinh et al., 2017). The advantage of 3SLS over Two Stage Least Squares (2SLS) is that it can correct for correlations between-equation error terms (Zellner & Theil, 1992). However, both methods assume that the error terms are homoscedastic and non-autocorrelated, and this can lead to inconsistent estimates of standard errors. Although this can be addressed by using a Generalized Method of Moments (GMM) (Baum et al., 2003), GMM models require large sample sizes to be reliable, and place high demands on computer storage and speed when there are multiple panels as in our data. To overcome the disadvantages, we employed a bootstrapping estimation technique to a 3SLS approach which is able to produce consistent estimates of standard errors (Efron & Tibshirani, 1993). We applied this model to the couple sample and sub-samples stratified by gender and unpaid time constraint.

2.3.2. Empirical estimation model

The 3SLS bootstrapping estimation as applied to a three-equation

simultaneous model is as follows:

$$H_{i,t} = \alpha_0 + \alpha_t + \alpha_1 H_{i,t-1} + \alpha_2 \ln W_{i,t} + \alpha_3 T_{i,t} + \alpha 4 T^2_{i,t}$$
$$+ \sum_{j=5}^{n} a_j \; Xh_{j,i,t} + e_{i,t} \qquad (1)$$

$$T_{i,t} = \beta_0 + \beta_t + \beta_1 T_{i,t-1} + \beta_2 \ln W_{i,t} + \beta_3 H_{i,t}$$
$$+ \sum_{j=4}^{k} \beta_j \; Xt_{j,i,t} + u_{i,t} \qquad (2)$$

$$\ln W_{i,t} = \gamma_0 + \gamma_t + \gamma_1 H_{i,t} + \gamma_2 T_{i,t} + \sum_{j=3}^{m} \gamma_j \; Xw_{j,i,t} + v_{i,t} \qquad (3)$$

In this simultaneous equation system, the dependent variables are health ($H_{i,t}$: mental health, vitality), weekly workhours ($T_{i,t}$), and log of hourly wage rate ($\ln W_{i,t}$) of individual i in year t. We also controlled for a set of covariates (*Xh, Xt, Xw*) in the corresponding equations. The time-specific effects on health, workhours and wages were captured in α_t, β_t, γ_t. The lagged dependent variable is also entered as a predictor to adjust for large variation between observations due to its historical trend and auto-correlation (Arellano & Honoree, 2001). The error terms (*e, u, v*) capture measurement errors and unobserved factors. Details of variables used in each equation are described below.

Health equation (1): Apart from workhours (*T*) and wage rate in logarithm (*lnwage*), we added workhours squared (T^2) to test for non-linear relationships between workhours and health. We also included potential work experience, ethnicity, marital status, work flexibility, work intensity, employment type, occupation, gender, smoking, drinking, and lag of physical activity and lag of general health (all likely to be predictors of health and to adjust for gender differences in job conditions). We added urbanity, state, and year dummies to capture the differences in health due to geographic and time factors. In this paper, we focused on mental health and vitality rather than general or physical health because we used weekly workhours, a short-term measure of market time. The effects of workhours on mental health and vitality are likely to be observed in a relatively short period of time, whereas any impacts on general health and physical functioning may take longer time before they become observable.

The potential endogenous variables of equation (1) were weekly workhours and wage rate. Instruments for these variables should be correlated with workhours and wage rate but not correlated with the error term of this equation (i.e., the excluded instruments have no direct effect on health outcome). The potential instruments (*z*) were partner's employment status, partner's education, and household non-wage income. We assume that these variables were likely to directly influence an individual's employment, workhours and wages, but only indirectly affect their health. We acknowledge that these instruments may violate the exclusion restriction, Cov(*z, error terms*) = 0. Under the 3SLS approach, we are unable to directly test this possibility; however we carried out the weak instruments and relevance instrument tests. The test results showed that our instruments are relevant.[2]

Workhours equation (2): we included both wage rate (in log) and health on the right-hand side of the equation. We also controlled for marital status, gender, *prior* general health, occupation, location, state, and year dummies. The potential instruments for the workhour equation must have no direct effect on workhours, but be correlated with wages and health. We therefore used lag of log wage, lag of health outcome, and socio-economic status such as financial distress as instruments.

Wage equation (3): we followed the Mincerian wage earnings equation (Mincer, 1974) to build the wage model. This equation included education and potential experience (its squared term was not added as our sample includes older people (aged 50–70), the non-linear relationship between age or experience with income no longer exists for these older workers as they are older than the age where wage income

reaches the peak (Heckman, 1976)). Gender, ethnicity, location, state, and year dummies were also included to capture wage differences across groups, states and years. The prior health (or lagged health) variable was included to capture the influence of workers' health on their productivity and wages. The health variable also represents job-related hazards which may sometimes attract additional pay as a result (Haveman et al., 1994). Workhours were also added in the wage equation as a predictor for wage rate, via wage premiums, overtime and penalty rates. Longer workhours lead to longer (equivalent) work experience that can alter wage rate. Commonly used instruments for the wage equation are those that predict education, but do not directly affect wages. These include father's education, mother's education, sibling's education, partner's education, and parents' socio-economic status. In our case, partner's education level was a stronger predictor of other partner's education than father's education and mother's education and we selected it as our excluded instrument.

2.4. Variables and measures

2.4.1. Dependent variables

Five items from the Short Form 36 (SF-36) were summed to assess *mental health* (Ware et al., 2000). Three items assess nervousness and depression ('Have you been a very nervous person?', 'Have you felt so down in the dumps that nothing could cheer you up?' and 'Have you felt downhearted and blue?') and the other two happiness and calmness ('Have you felt calm and peaceful?' and 'Have you been a happy person?'). *Vitality* was constructed from four questions to assess energy, fatigue and exhaustion ('Feel full of life', 'Have a lot of energy', 'Felt worn out', and 'Felt tired'). Item responses ranged from 1, 'none of the time', to 6, 'all of the time'. The raw scale scores for both measures were calculated by summing and then transforming to a 0–100 scale, with a higher score meaning better health.

Mental health and vitality reflect symptoms that are likely to be responsive over the short term to workhours. The components of vitality capture contemporary feelings about health status, for example, after a long or hard work day, people 'felt tired'. In this paper, we focused on mental health and vitality rather than general or physical health because we used weekly workhours, a short-term measure of market time (the only work time that is available in HILDA). Any effect of work hours on mental health and vitality is likely to be observed in a short period of time e.g., weekly, while it would take longer time to show impacts on chronic and long-term conditions such as general health and physical health/physical functioning.

Weekly *workhours* were measured by respondents' reported hours worked in all paid employment. Hourly *wage rate* (wage in logarithm) was calculated by dividing weekly wages and salary from all jobs by weekly workhours. All the monetary variables in this paper were discounted to the 2016 price.

2.4.2. Covariates

Covariates are presented in Table 1.

In our models, we were aware of potential reverse causality between general health and our health outcome variables (mental health and vitality). As such, we controlled for *prior* general health to avoid such possible reverse causality biases. We used physical functioning to detect health selection bias.

3. Empirical results

3.1. Descriptive statistics

Table 2 provides summary statistics of the key variables for employed, partnered men and women aged 50–70 showing that older men are more likely to work longer hours, earn higher weekly wages or hourly wage rates on average. They also have more work flexibility and less intensity in their jobs, more secure jobs, and more senior jobs such

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[2] We did not present the test results here, but it would be available upon request.

Table 1
Covariate definition and coding.

Variable	Definition
Unpaid workhours	Hours usually spent each week caring for own and other's children (on a regular, unpaid basis), caring for disable/elderly relatives, doing domestic errands, outdoor tasks and housework, cooking and laundry.
General health	Scored (worst) 0–100 (best), 5 items (e.g., I get sick easier than other people).
Physical functioning	Scored (worst) 0–100 (best). 10 items e.g., vigorous activities, climbing several flights of stairs, walking 100 m
Experience	Potential work experience, age minus school years minus 6
Sex	Male = 1, female = 0
Marital status	Married or cohabiting = 1, otherwise = 0
Urban	Yes = 1, No = 0
Education (self and partner's)	7 groups: Year 11 or below (1) to post-graduate (7)
Equivalised household non-wage income	Household income all sources excluding own salary/wages, adjusted with OECD-modified equivalence scale (1 household head, 0.5 each additional adult and 0.3 each child).
Financial distress	Scored (best) 0–100 (worst), computed from 6 items, e.g., 'Could not pay electricity, gas or telephone bills on time'
Partner's employment	Employed = 1, otherwise = 0
Partner's workhours	Weekly hours all jobs
Work flexibility	Scored 0–100, from 3 items e.g., 'I have a lot of freedom to decide when I do my work'
Work intensity	Scored 0–100, from 3 items e.g., 'I have to work fast in my job'
Job control	Coded 1 (lowest) to 7 (high job control)
Occupation	ANZSCO one-digit occupation includes managers, professional, clerical, technician and trade, machinery operators, laborers, community and personal service workers, or sales workers.
Employment type	Three categories: Fixed-term, casual, on-going or permanent
Physical activity	High = 1 (more than 3 times of moderate or intensive activity >30 min week); low = 0 (all other categories)
Smoking	never, past, current
Alcohol consumption	Four categories: never drink, rarely drink/no longer, moderate drinker, heavy drinker
Ethnicity	9 dummy variables: Non-Indigenous Australian, Indigenous/Torres Strait Islander, New Zealanders, Europeans, Middle East and North Africans, East and Southeast Asians, South and Central Asians, Americans, and Central & Southern Africans.
State	8 states and territories
Year	14 years, 2005–2018

Note: About 3.5% of the sample aged 15 or over reported very high unpaid hours over 80h per week (equivalent to over 11.4 h/day), so we adjusted these by using this simple equation: 168h *minus* (7h*7days for sleeping) *minus* workhours. If the adjusted unpaid hours are still greater than 80h, we then further adjust it to a maximum of 80 h/week.

as manager. Women are more likely to be employed in casual jobs and fixed term contracts, in community and personal services, clerical and administrative jobs and sales, and less likely to have managerial roles. Although more female workers have tertiary education degrees than male counterparts, they worked shorter paid hours and earned less, and are more likely to report financial hardship, poorer mental health, vitality and physical functioning relative to men. Interestingly, the difference in time spent on domestic work in this older group is still large, with women working about 10 h more than men. Though care time has reduced significantly by 57%, women's other domestic time has increased by an average of 14–15%, leaving only a 13% decrease in their net unpaid time compared with younger women. This is slightly larger than the typical reduction in men's unpaid time (10.6%) (Appendix 1). The gendered unpaid time gap reduces slightly from 11.7h to 9.7 h/week in relation to the group aged 25–49.

Table 2
Descriptive statistics, employed Australians aged 50–70 (2005–2018).

Variable description	Women		Men		P-value
	Mean	SD	Mean	SD	Women-men difference
Work variables					
Weekly workhours (hours, all jobs)	31.9	14.3	41.0	14.3	0.0000
Weekly wage ($, all jobs)	922.7	726.1	1305	1233.0	0.0000
Wage per hour ($)	30.9	48.4	32.8	41.7	0.0015
Wage per hour (in log)	3.36	0.53	3.50	0.61	0.0000
Unpaid weekly workhours	28.3	18.5	18.6	14.2	0.0000
Total paid and unpaid hours	57.9	20.7	58.1	18.9	0.0000
Health variables					
Mental health score (0–100)	76.2	16.0	78.5	14.9	0.0000
Vitality score (0–100)	60.8	19.5	65.0	17.8	0.0000
General Health (0–100)	69.9	19.6	68.9	18.5	0.0000
Physical Functioning (0–100)	82.6	19.1	85.7	18.5	0.0000
Worker characteristics					
Years after schooling	38.2	5.7	38.5	5.8	0.0000
Marital status (Married/de facto = 1)	0.73	0.45	0.83	0.38	0.0000
Urban (Urban = 1; Rural = 0)	0.86	0.35	0.85	0.36	0.0000
Ethnicity (%)					
[1] Non-Indigenous Australian	71.5	45.2	69.0	46.3	0.0006
[2] Indigenous/Torres Strait Islanders	1.1	10.5	1.0	10.1	0.9383
[3] New Zealanders	2.4	15.2	3.2	17.6	0.0388
[4] Europeans	13.8	34.5	15.5	36.2	0.0000
[5] Middle East and North Africa	0.9	9.4	1.5	12.3	0.0000
[6] East and South East Asia	5.5	22.9	4.1	19.8	0.0000
[7] South & Central Asians	1.7	12.9	2.6	15.9	0.0000
[8] America	1.3	11.2	1.4	11.9	0.0094
[9] Central and Southern Africans	1.8	13.4	1.6	12.5	0.5874
Education (%)					
[1] Postgrad - masters or doctorate	5.7	23.3	7.2	25.9	0.0018
[2] Grad diploma, grad certificate	9.7	29.6	6.8	25.3	0.0000
[3] Bachelor or honours	14.1	34.8	13.7	34.3	0.0479
Tertiary education	*29.5*		*27.7*		
[4] Advanced diploma, diploma	12.0	32.4	11.6	32.0	0.1654
[5] Cert III or IV	18.8	39.1	31.0	46.2	0.0000
[6] Year 12	10.4	30.5	8.6	28.1	0.0008
[7] Year 11 and below	29.3	45.5	21.1	40.8	0.0000
Household characteristics					
Equivalized household non-wage income (in $000)	20.6	54.8	22.3	54.8	0.2247
Financial hardship (0–100)	3.57	11.3	2.95	10.7	0.0000
Partner's employment (working = 1)	0.82	0.38	0.74	0.44	0.0000
Partner's workhours	34.4	20.6	23.5	18.2	0.0000
Work-related variables					
Work intensity (1–7)	4.65	1.44	4.50	1.34	0.0000
Work flexibility (1–7)	3.95	1.86	4.46	1.71	0.0000
Type of employment contract (%)					
[1] Fixed term contract	9.0	28.6	8.6	28.0	0.0837
[2] Casual employment	17.6	38.1	14.2	35.0	0.0000
[3] Permanent or ongoing contract	73.4	44.2	77.2	42.0	0.0000
Occupation (%)					
[1] Managers	11.1	31.5	20.5	40.4	0.0000

(continued on next page)

Table 2 (*continued*)

| Variable description | Women | | Men | | P-value |
	Mean	SD	Mean	SD	Women-men difference
[2] Professionals	26.5	44.1	21.8	41.3	0.0000
[3] Technicians, Trades Workers	3.8	19.2	17.4	37.9	0.0000
[4] Community and Personal Service	15.1	35.8	5.7	23.2	0.0000
[5] Clerical and Administrative Workers	26.9	44.3	8.1	27.3	0.0000
[6] Sales Workers	6.8	25.2	4.1	19.9	0.0000
[7] Machinery Operators and Drivers	1.3	11.3	13.2	33.8	0.0000
[8] Labourers	8.5	27.8	9.2	28.9	0.0000
Health protective behaviours					
Physical activities (High = 1)	0.097	0.296	0.128	0.334	0.0000
Smoking (%)					
Never smoke	55.2	49.7	45.7	49.8	0.0000
Past smoker	31.6	46.5	38.7	48.7	0.0000
Current smoke but not daily	1.8	13.2	2.3	15.0	0.0062
Current smoke	11.4	31.8	13.3	34.0	0.0000
Alcohol drinker (%)					
Never drank	11.1	31.4	5.1	22.1	0.0000
Rarely drink/no longer drink	31.8	46.6	20.8	40.6	0.0000
Moderate drinkers	55.1	49.7	63.8	48.0	0.0000
Heavy drinkers	2.1	14.4	10.2	30.3	0.0000

Note: Estimates were adjusted for sample weight.

3.2. Estimation results

3.2.1. Workhour-health tipping points by gender

In this section we report estimates of the relationship between workhours and mental health, and between workhours and vitality by gender. For brevity, we only report estimates of workhours, squared terms and corresponding computed tipping point in Table 3 and hereinafter. The estimates of workhours and their squared terms are statistically significant in all models, and their signs are expected. The point of maximum or optimal health (which we term the 'tipping point') is where the first derivative of the estimation health function equals zero, the solution to this zero-first derivative is the turning (or tipping) point. The tipping points in Table 3 were estimated in this way.

Table 3 shows the average workhour-health tipping points of 39 h per week for mental health and 38.4 h for vitality. Workhours over these thresholds will adversely affect mental health and vitality, on average, in the employed population aged 50–70. The gap in the tipping points between older men and women for both health measures is about 7–8 h meaning that women can work 7–8 fewer hours than men each week before their health is adversely affected.

The gap in the tipping points is relatively large, although most older women are likely to be spending less time on childcare they are typically spending more time than their male counterparts on domestic work. However, the HILDA data show that older employed women (aged 50–70) spent only an average of 2 h less on unpaid work time than younger women aged 25–49 who were employed (Appendix 1). In addition, older women spend 10 more hours each week than older men on care or domestic work; representing a modest narrowing of the unpaid time gaps found among younger Australian women and men (Appendix 1).

Fig. 1 shows the expected inverted U-shape between work time and mental health for both men and women. Women not only have a lower workhour-health tipping point, but also have a steeper curve after the turning point. This suggests that long workhours cause more harm, on average, to women's mental health than to men's, likely due to their interaction with unequal domestic workloads. In addition, the curve for women is generally lower than men's curve, a gap which widens as workhours increase, reflecting the established gendered patterning of mental health and psychological distress typically found in the population.

Fig. 2 also shows the expected inverted U-shaped relationship between workhours and vitality. As with mental health, the workhour vitality decline is also considerably steeper than their male counterparts, indicating that the health harms of working past the tipping point typically exacts a correspondingly greater cost on women's vitality and energy relative to men.

3.2.2. Constrained time and workhour-health tipping points

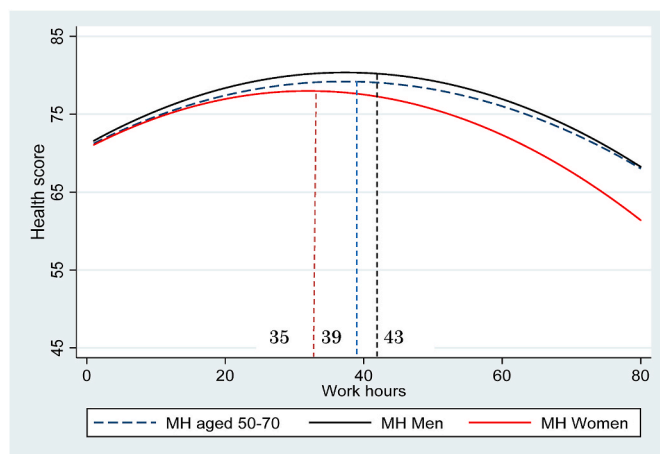We hypothesized that if older women workers no longer spend

Fig. 1. Workhours and mental health relationship by gender.

Table 3
Workhour-health tipping points by gender for mental health and vitality.

| | Mental Health | | | Vitality | | |
	Overall	Men	Women	Overall	Men	Women
Tipping point (h)	39.0	42.7	35.0	38.4	41.8	34.6
Workhours	0.6083**	0.7763**	0.5943+	0.8060**	0.7112+	1.4054**
	(0.1659)	(0.2584)	(0.3394)	(0.2063)	(0.4006)	(0.4405)
Workhours squared	−0.0078**	−0.0091**	−0.0085+	−0.0105**	−0.0085+	−0.0203**
	(0.0022)	(0.0031)	(0.0050)	(0.0027)	(0.0048)	(0.0064)
Observations	13,946	7,401	6,545	13,946	7,401	6,545
R-squared	0.4219	0.4253	0.4111	0.4732	0.4632	0.4407

Note: Bootstrapped standard errors in parentheses with 1,000 replications, significant **p < 0.01, *p < 0.05, + p < 0.1. Apart from the model specification in equations (1)–(3) and variables mentioned in section 2.3, the health equation was further adjusted for work flexibility, work intensity, ethnicity, marital status, employment contract type, work experience, gender, unpaid time, occupation, lag of general health, smoking and drinking status, lag of physical activity, state, urbanity and year dummies. The workhour equation controlled for marital status, gender, lag of general health, occupation, and state, urbanity and year dummies. The wage equation controlled for education level, work experience, ethnicity, gender, and state, urbanity and year dummies.
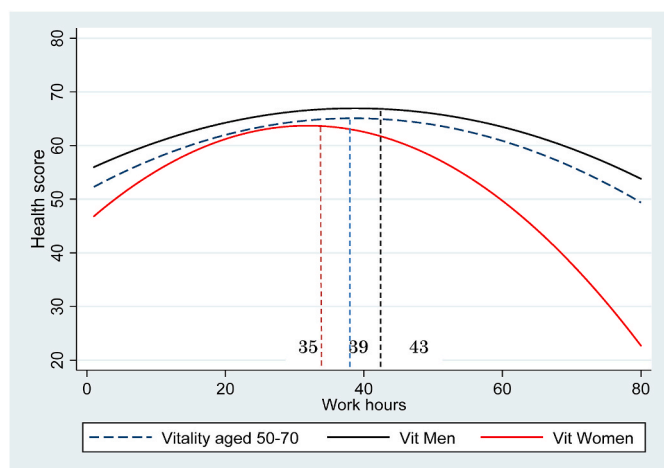
Fig. 2. Workhours and vitality relationship by gender.

significant time on care and domestic work, their time would be freed for paid work, shifting average tipping point closer to men's. However, the decline in unpaid time among our older aged sample was smaller than we expected (see Appendix 1). Here we examine how time constraint outside of work affects workhour-health tipping points for mental health and vitality.

In Tables 4–5, we reported gender-stratified and interacted models. The stratified models estimate the relationship (between workhours and health) for men and women separately. The advantage of this model is that it allows other covariates to have gendered effects, rather than average across them. The shortcoming of this model is that sample size becomes smaller because we split the sample into two groups. The smaller sample size affects the power of prediction and estimates are less precise (i.e., less statistically significant). In contrast, the interacted models (interacted sex with workhours) can improve precision of estimates, that is, it can produce statistically significant estimates due to larger sample size. However, this model is based on an assumption that the average effects of all variables except workhours on health are the same for both sexes. This assumption may not hold in reality. We therefore prefer the stratified model estimates over the interacted model estimates.

Table 4 shows that the gap between tipping points for low and high unpaid time groups and mental health is 7 h on average, similar to the gap estimated between men and women (Table 3). The gap between the low and high unpaid time groups for men is larger than for women (8 versus 5 h respectively). A similar pattern is observed for vitality (Table 5). Note however that estimates from the stratified models for men in the high unpaid time groups are not statistically significant, and

should be interpreted with caution.

Tables 4–5 also show that both men and women with lower unpaid time have higher tipping points than their counterparts' tipping points who have higher unpaid time. However, within the same unpaid time level, men can work, on average, significantly longer workhours than women in the same unpaid time level. This likely reflects that, within each different time use strata, men are typically doing less unpaid work than women.

3.2.3. Sensitivity analyses

For robustness, we modified model specifications by excluding workhours from the wage equation, which left estimates of the tipping points almost identical. Second, we used information in the HILDA on '*percentage of time spent in jobs in last* 12 months' to adjust weekly workhours to approximate annual workhours. The estimates based on annual workhours produced very similar results to the estimates using weekly workhours. Last, to improve generalizability, partners' variables were excluded, and our sample was expanded to include both coupled and non-coupled adults aged 50–70 years old. We used a dummy variable for partner employment status (three values: having no partner, having a non-working partner, or having a working partner), while partner's education was replaced with mother's and father's education. The estimated tipping points remained relatively unchanged (Appendix 2, all are available on request).

3.3. Potential selection bias

Our estimated tipping points could be biased upward because our sample (like most studies) only includes the relatively healthy 50–70 year olds who are able to remain in the labour market. Here, we show the extent employed people are healthier than their non-employed counterparts and explore how this may inflate our tipping point estimates. Mental and physical health is both key to the human health. In principle, any health measure (mental health, physical health, or other health measures) could be used to test for health differences between working and non-working. We chose physical functioning because it is likely less responsive to workhours in the short term (weekly) than mental health, avoiding a reciprocal relationship problem (between workhours and mental health).

We used the accumulative kernel distribution of physical functioning to compare the groups. We controlled for age, gender, education, race, and income in order to adjust their influence on physical functioning. In Fig. 3, the horizontal axis is physical functioning, with higher scores indicating better functioning. There is a large non-overlapped area between the distributions of the working and non-employed groups. Most employed people are on the right-hand side of the distribution, while there are more non-employed people on the left-hand side of the distribution.

Table 4
Time constraints and mental health, employed Australians aged 50-70.

Unpaid time	High unpaid time ($\geq$=27.6h)				Low unpaid time ($<$27.6h)			
	All	Men-stratified	Women-stratified	Gender interacted model	All	Men-stratified	Women-stratified	Gender interacted model
Tipping point	36	39	33	38/34 (M/F)	43	47	38	44/41 (M/F)
Workhours	0.3695**	0.1421	0.4568*	0.4165**	0.5990**	0.6460**	0.5141**	0.5873**
	(0.1393)	(0.2771)	(0.2044)	(0.1419)	(0.0940)	(0.1260)	(0.1767)	(0.0940)
Workhours2	−0.0052**	−0.0018	−0.0070*	−0.0061**	−0.0069**	−0.0069**	−0.0068**	−0.0072**
	(0.0019)	(0.0032)	(0.0030)	(0.0020)	(0.0011)	(0.0014)	(0.0024)	(0.0011)
Workhours*male				0.0459				0.0481**
				(0.0327)				(0.0180)
Observations	4,103	1,507	2,596	4,103	9,946	5,986	3,960	9,946
R-squared	0.4335	0.4608	0.4241	0.4322	0.4205	0.4317	0.4146	0.4208

Note: Bootstrapped standard errors in parentheses with 1,000 replications, **p < 0.01, *p < 0.05, + p < 0.1. The median unpaid time for women aged 50–70 was used as a cut-off to define high and low unpaid time constraint (women account for 65% of those above the median unpaid time, men account for 35%; while men account for 59% of those below the median unpaid time, and women account for 41%). Other covariates see Note for Table 3.

Table 5
Time constraints and vitality, employed Australians aged 50-70.

| Unpaid time	High unpaid time (>=27.6h)				Low unpaid time time (<27.6h)			
	All	Men-stratified	Women-stratified	Gender interacted model	All	Men-stratified	Women-stratified	Gender interacted model
Tipping point	36	41	33	38/35 (M/F)	40	47	36	44/40 (M/F)
Workhours	0.8169**	0.4903	1.6568**	0.8861**	0.9338**	0.6442**	1.0587**	0.6929**
	(0.1589)	(0.3081)	(0.2332)	(0.1619)	(0.1347)	(0.1494)	(0.2109)	(0.1116)
Workhours2	−0.0113**	−0.0060	−0.0249**	−0.0128**	−0.0117**	−0.0069**	−0.0146**	−0.0086**
	(0.0021)	(0.0036)	(0.0035)	(0.0023)	(0.0017)	(0.0016)	(0.0028)	(0.0013)
Workhours*male				0.0987**				0.0671**
				(0.0372)				(0.0223)
Observations	4,103	1,507	2,596	4,103	9,859	5,986	3,960	9,946
R-squared	0.4876	0.5119	0.4297	0.4845	0.4583	0.4564	0.4533	0.4643

Note: as seen in Note of Table 4.
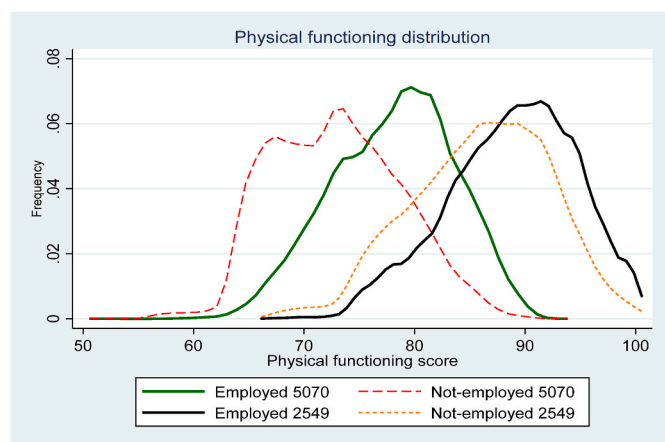
Fig. 3. Physical functioning gap between employed and non-employed, older and younger group comparison.

The plot indicates employed people generally have better physical functioning than non-employed people, and the distinction is wider among older adults. The large gaps between the employed and non-employed are also observed for the younger group aged 25–49. Comparison of physical functioning between employed compared and non-employed people for both age groups is significantly different (p < 0.001). Thus our estimates are based on older adults with relatively good underlying health.

Another selection bias is the care of children, partners or aged parents which can result in people leaving the labour market. We compared care and other unpaid time between employed and non-employed people amongst the 50–70 group. We observed that non-employed people spend more time on these tasks than employed people (Table 6). The gap between employed and non-employed people groups' unpaid time is mainly driven by time spent on other unpaid activities,

and less so by care.

We also attempted to address sample selection bias by including all older adults (working or not) in the models. Some models for the data can treat workhours as a dummy variable (Yes if workhours are observed, and No if otherwise), so that the sample covers all observations including non-working people. However, models with a binary treatment variable of work time do not allow us to estimate tipping points. A second approach we tried was to use GSEM (Generalized Structural Equation Modelling) in which Tobit was applied for work time and wage equations to cover both employed and unemployed people – we imputed zero hours and zero wages for non-working people. However, there are too many 'missings' for work-related covariates used in the models for non-working people. Our estimates are therefore based on older adults who may have relatively fewer time constraints outside of employment and health, and are likely to be upward biased.

4. Discussion and conclusions

4.1. Finding summary and discussion

Having a population that continues to work while older, benefits governments (through reducing welfare supports), workplaces (by retaining skills and experience) and individuals (by boosting retirement savings). How might working while older also benefit gender equality? Could it help reduce employment gaps in hours and wage earnings and offer older women the chance to catch up? We estimate workhour-health tipping points — the point beyond which more hours harm mental health and vitality — for older Australians using 14 years of nationally representative data. We found that workhour -health tipping points typically vary by gender, with a gap of between 7 and 8 h per week: a full working day. In our sample of relatively healthy and part-nered older adults, men could work on average 43 or 42 h per week before their mental health or vitality deteriorated. Older women, in contrast, could work up to 35 h per week, beyond which their health was impaired and this lower tipping point reflects their continued, greater share of unpaid work in the home. Older men's time advantage at work

Table 6
Unpaid time and employment participation, Australians age 50 to 70.

Unpaid time	Employed (h)	Non-working (h)		Working & involuntary non-working difference	Working & voluntary non-working difference
		Involuntary	Voluntary		
Care	4.60	6.83	6.74	−2.2	−2.1
Domestic	19.1	24.9	26.7	−5.8	−7.6
Total	23.1	29.5	29.7	−6.4	−6.6

Note: **Involuntary** non-working includes people those who are unemployed and looking for work, or persons not in the labour force but are marginally attached to the labour force who (i) want to work and are actively looking for work but not available to start work in the reference week; or (ii) want to work and are not actively looking for work but are available to start work within four weeks. **Voluntary** non-working includes persons not in the labour force and are not marginally attached if they: (i) do not want to work; or (ii) want to work but are not actively looking for work and are not available to start work within four weeks. Further data investigation shows that voluntary non-working people have much better financial conditions e.g. they have a significantly lower financial distress index, and significantly higher non-wage household income and household assets.

is somewhat smaller than that estimated for younger samples, where a 13 h per week workhour–health advantage has been observed for men relative to women (see Dinh et al., 2017). Although less care time for older workers, especially women, may contribute to a smaller workhour-health gap in the older workforce, women's time typically remains 'encumbered' even as they age. Unpaid time continues to be unevenly shared after children leave home. Our estimates show a 10-h difference (greater than one working day a week), which means women enter the labor market with a constraint on their time that men usually lack. Such time constraints off the job drive the unequal time-health trade-offs on the job. Thus when we stratify our older workers by high and low unpaid time commitments, we find similar, on average, workhour-health tipping points gaps of between 4 and 7 h each week. We expected older women's time would be relatively freer from care and unpaid work commitments and enable them to spend similar hours to men in the labor market. This paper finds that unequal out-comes for women in the labor market and outside of it remain even as they age, with long-term implications for their financial futures.

Using the same model and dataset for younger women aged 25–49, we also find that the gap between workhour health tipping points for low and high unpaid hours (10–12 h/week for mental health, and 8–9 h/week for vitality, depending on stratified or interacted models) was significantly larger for younger women than older women. Floderus et al. (2009) argue that being a woman and mother is not the cause of poor health, but the combination of work, home and children is key because of the time demands all three entail. Other research is articu-lating how time is a determinant of health and health inequalities (Strazdins et al., 2011), especially gender–linked health inequality, and this current study shows how it remains integral to gender equality in both health and opportunity even into mature age.

Older women are typically busier than men outside workhours. Their unpaid time reduces minimally in relation to younger women, even though they perform less child care. We looked further into components of the unpaid time data for older workers to uncover what drives the gap (Appendix 1). We found that compared with younger workers, older workers' unpaid time commitments declines on average by 10–13%. However domestic time such as cooking, shopping, house and yard work significantly increases by about 15%, even while older female workers' care time reduces by 59% (older female workers spent 20% of their unpaid time on caring, while the younger female workers' care time accounts for over 40% of their unpaid time). Why don't older men take on more domestic duties as they age? Possibly, there is a complex mix of factors reflecting lags in changes in normative gendered roles, and the continuing expectation for long full-time hours (Cha & Weeden, 2014; Sullivan et al., 2018; van Egmond et al., 2010). As our stratification by high and low unpaid time suggest, when men take on more unpaid work they face similar lowered, tipping points, placing them at a similar disadvantage in a labor market which favors and rewards longer hours and availability (Williams et al., 2013).

4.2. Study limitations and conclusion

The 14 years of longitudinal data used in this study offers flexibility in our modeling and enables us to look at the variation in health out-comes over time as well as use lagged models and bootstrapping 3SLS estimators. The simultaneous approach with the bootstrapping estima-tion technique advances previous research on workhours and health because it addresses simultaneity and reciprocal relationships, and heteroscedasticity in the error terms. The approach allows us to robustly estimate tipping points of the work time-health relationships however we do not wish to imply causality. Other models using time-differed or fixed effect approaches may be better to deal with biases caused by possible correlations between unobservable time invariant specific characteristics and outcome variables, however they lack the capacity to treat the data as a system of linked relationships.

Our estimates are likely to be upward biased; we expect that tipping-points for older works – women and men - who are less healthy or more constrained in terms of time or other resources would be considerably lower. Many women struggle to return to the labour market at all after a period of intensive child bearing and rearing. Our sample consisted of currently employed people who were likely to be relatively healthier than most non-working counterparts in this age group, and even less 'encumbered' than many. Nor did our sample include self-employed people. We are thus unable to estimate the work time-health tipping points for these groups as we have no information on their market hours and wages. Our tipping points thus representative averages for employed, partnered adults aged 50–70 rather than for the general population and may be biased by health and other selection effects. We further note that our sample was of coupled men and women (due to our choice of instruments) although that our sensitivity analysis indicated little difference in average tipping points for the models estimated on the full (coupled and single) population. Finally, we note that our study and its findings describe effects averaged across groups (in this case by gender and age). Behind these average effects there lie variations in individual experiences based on differencing circumstances, resources and contexts. Along with problems of time, many mature-aged men and women face constraints and discrimination that cross multiple axes.

Despite these limitations, we show that older working women are typically unable to substantially increase their workhours beyond 35 h per week, a significantly lower number of workhours (and therefore earnings) than men, without a negative effect on their mental health or vitality. This limit – an hourglass ceiling – is due to their continuing unequal share of domestic work, a persisting, unequal time 'encum-brance' despite care-related constraints reducing. Over most of their lives, women are disadvantaged in terms of time and finances, including when they become older (see Fig. I, II, III and IV in Appendix 3). Consequently, they are less likely to catch up financially and in other ways, even while they extend their working lives. This has as its root cause a labour market which continues to reward workers who match the ideal 'unencumbered' male by expecting long work hours and availability. This pushes households into either – or decisions about work and family divisions early in their employment history. It also creates a disincentive to fully share care or domestic work at any point in the life-course. Our study demonstrates how gendered inequalities in the home, linked to an outdated model of availability and time devotions in the workplace, compromises healthy, fair ageing. Paradoxically, efforts to support a fairer and healthier aging population require workhour limits that will enable all worker to also be care-givers from the outset.

Ethical statement

This study is a part of broader project which was approved by the Australian National University Human Research Ethics Committee.

Author statement

Tinh Doan conducted data analysis and modelling, drafted the paper, edited and revised the paper Christine LaBond, Perri Timmins, and Peter Butterworth contributed to initial ideas and paper conceptualization Cathy Banwell helped with editing and provided arguments and dis-cussion Lyndall Strazdins conceptualized, revised, and edited the paper Unencumbered and still unequal? Work hour - health tipping points and gender inequality among older, employed Australian couples.

Declaration of competing interest

None.

Acknowledgements and Funding sources

Appendix 1

Appendix 1
Unpaid time change over the age groups, employed people sample

Hours	All			Women			Men		
	25–49	50–70	% change	25–49	50–70	% change	25–49	50–70	% change
Care time	10.7	4.6	−57.0%	13.9	5.7	−59.0%	7.9	3.7	−53.2%
Domestic time	16.7	19.1	14.4%	20.4	23.4	14.7%	13.4	15.3	14.2%
Unpaid time	26.4	23.1	−12.5%	32.5	28.3	−12.9%	20.8	18.6	−10.6%
% Care time	41%	20%		43%	20%		38%	20%	
% Domestic time	59%	80%		57%	80%		62%	80%	
Total	100%	100%		100%	100%		100%	100%	

Note: care time includes time spent in caring for elderly/sick, your kids and other's kids; domestic time includes time spent in housework, errands, outdoor tasks; and unpaid time is sum of the care time and domestic time. We adjusted for unrealistically high care, domestic and unpaid time.

Appendix 2

Appendix 2
Summary of estimated tipping points using whole working sample, aged 50-70

	Mental health			Vitality		
	All	Men	Women	All	Men	Women
Tipping point (h)	38.8	42.9	34.8	38.0	41.6	34.4
Workhours	0.5975**	0.6609**	0.6196	0.7828**	0.5325	1.5323**
	(0.0908)	(0.1388)	(0.4461)	(0.1070)	(0.4336)	(0.1695)
Workhours-squared	−0.0077**	−0.0077**	−0.0089	−0.0103**	−0.0064	−0.0223**
	(0.0012)	(0.0017)	(0.0065)	(0.0014)	(0.0053)	(0.0024)
Observations	12,901	6,736	6,165	12,901	6,736	6,165
R-squared	0.4262	0.4300	0.4173	0.4755	0.4677	0.4357
P-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: as seen in Note of Table 3.

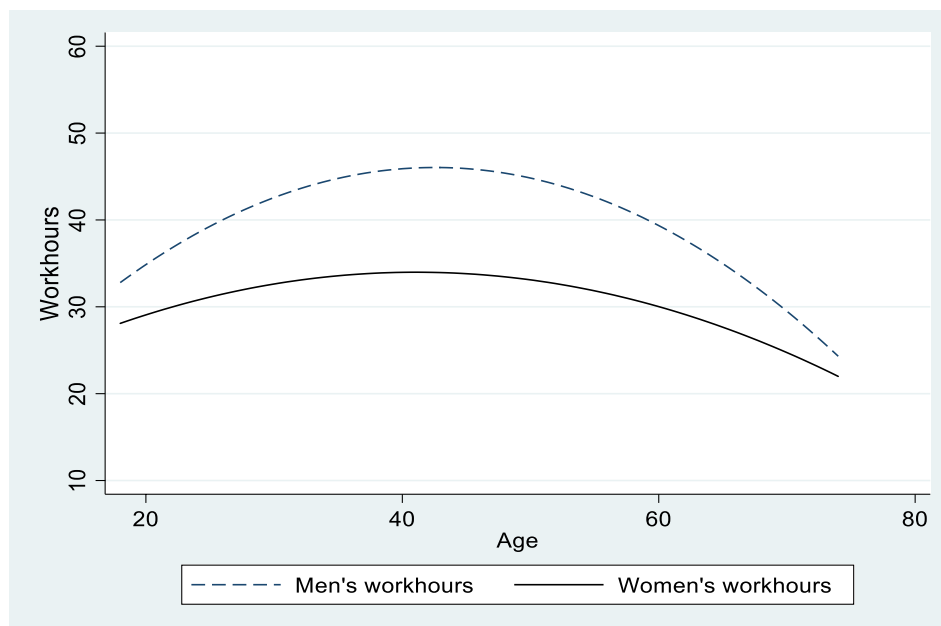## Appendix 3. Women are always disadvantaged

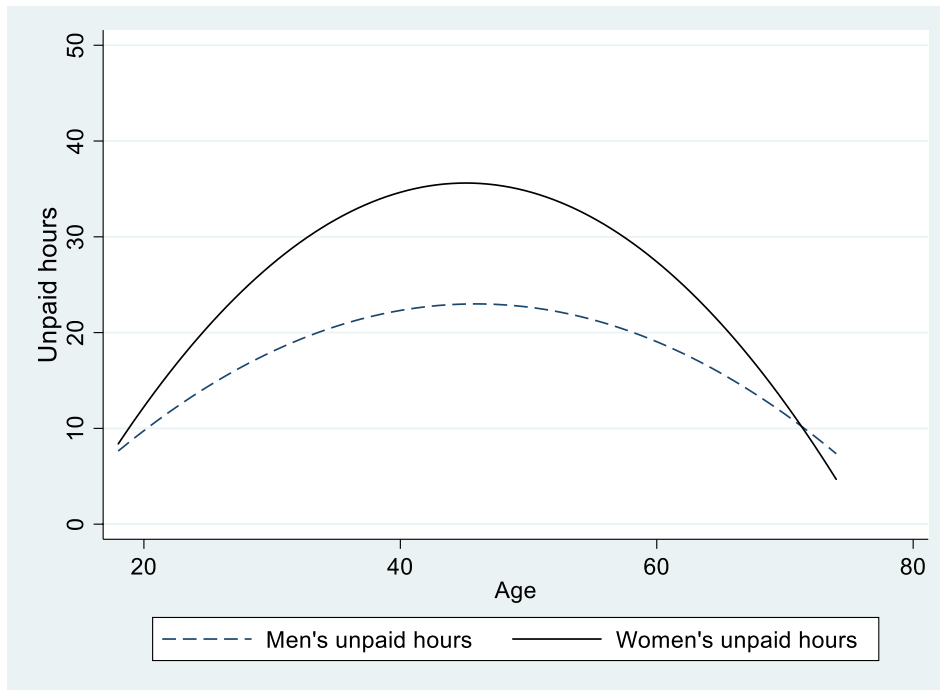**Fig. I.** Weekly work hours by age and sex (aged 18–75)

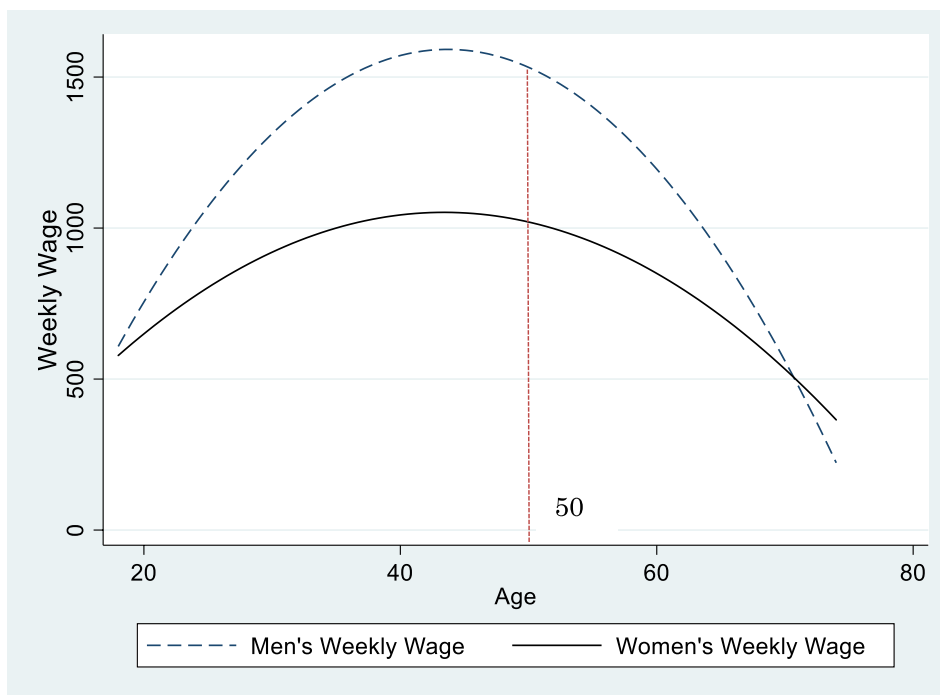**Fig. II.** Weekly unpaid hours by age and sex for employed people (aged 18–75)

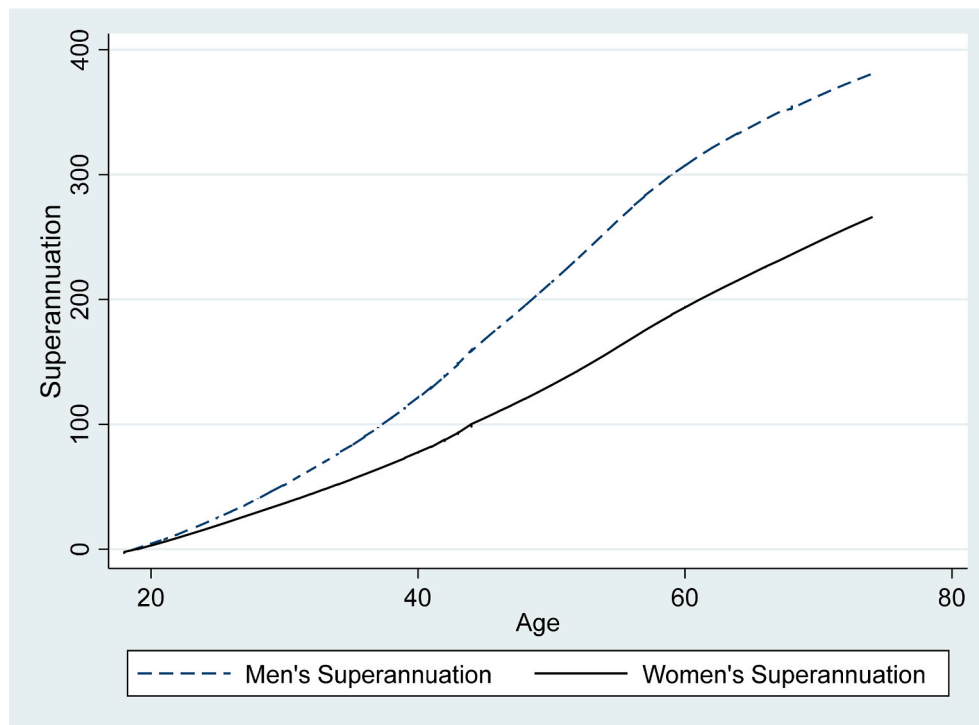**Fig. III.** Weekly wage income by age and sex (aged 18–75)

Fig. IV. Superannuation in $AU1000 by age and sex (aged 18–75)

References

ABS. (2020a). *Gender indicators, Australia*. December. available at,2020 https://www.abs.gov.au/statistics/people/people-and-communities/gender-indicators-australia/latest-release.

ABS. (2020b). *Insights into hours worked, August 2020*. Available at https://www.abs.gov.au/articles/insights-hours-worked-august-2020.

Amagasa, T., & Nakayama, T. (2013). Relationship between long working hours and depression: A 3-year longitudinal study of clerical workers. *Journal of Occupational and Environmental Medicine, 55*, 863–872.

Anxo, D., Mencarini, L., Pailhé, A., Solaz, A., Tanturri, M., & Flood, L. (2011). Gender differences in time use over the life course in France, Italy, Sweden, and the US. *Feminist Economics, 17*(3), 159–195.

Arellano, M., & Honoree, B. (2001). Chapter 53-panel data models: Some recent developments. In J. H. James, & L. Edward (Eds.), *Handbook of econometrics* (pp. 3229–3296). Elsevier.

Bannai, A., & Tamakoshi, A. (2014). The association between long working hours and health: A systematic review of epidemiological evidence. *Scandinavian Journal of Work, Environment & Health, 40*, 5–18.

Baum, C., Schaffer, M., & Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. *STATA Journal, 3*(1), 1–31.

Blau, F., & Kahn, L. (2017). The gender wage gap: Extent, trends, and explanations. *Journal of Economic Literature, 55*(3), 789–865.

Charlesworth, S., Strazdins, L., OBrien, L., & Sims, S. (2011). Parents' jobs in Australia: Work hours polarisation and the consequences for job quality and gender equality. *Australian Journal of Labour Econonmics, 14*, 35–57.

Cha, Y., & Weeden, A. (2014). Overwork and the slow convergence in the gender gap in wages. *American Sociology Review, 79*(3), 457–484.

Craig, L. (2007). How employed mothers in Australia find time for both market work and childcare. *Journal of Family and Economic Issues, 28*(1), 69–87.

Craig, L., & Mullan, K. (2010). Parenthood, gender and work-family time in the United States, Australia, Italy, France, and Denmark. *Journal of Marriage and Family, 72*(5), 1344–1361.

Crystal, S., Shea, G., & Reyes, M. (2017). Cumulative advantage, cumulative disadvantage, and evolving patterns of late-life inequality. *The Gerontologist, 57*(5), 910–920.

Daley, J., & Woods, D. (2014). *The wealth of generations*. Grattan Institute Report No. 2014-13. Available at https://grattan.edu.au/wp-content/uploads/2014/12/820-wealth-of-generations.pdf.

Dembe, E., Erickson, B., Delbos, G., & Banks, M. (2005). The impact of overtime and long work hours on occupational injuries and illnesses: New evidence from the United States. *Occupational and Environmental Medicine, 62*(9), 588–597.

Dinh, H., Strazdins, L., & Welsh, J. (2017). Hour-glass ceilings: Work-hour thresholds, gendered health inequalities. *Social Science & Medicine, 176*, 42–51.

Doan, T., Labond, C., Yazidjoglou, A., Timmins, P., Yu, P., & Strazdins, L. (forthcoming). Health and occupation: The limits to older adults' work hours. Ageing and Society.

Doan, T., Thorning, P., Furuya, K., & Strazdins, L. (2021). What contributes to gendered work time inequality? An Australian case study. *Social Indicators Research, 155*, 259–279.

Dooley, D., & Prause, J. (2009). *The social costs of underemployment: Inadequate employment as disguised unemployment*. Cambridge: Cambridge University Press.

Dooley, D., Prause, J., & Ham-Rowbottom, K. (2000). Underemployment and depression: Longitudinal relationships. *Journal of Health and Social Behavior, 41*(4), 421–436.

Efron, B., & Tibshirani, R. (1993). *An introduction to the bootstrap*. New York: Chapman & Hall.

van Egmond, M., Baxter, J., Buchler, S., & Western, M. (2010). A stalled revolution? Gender role attitudes in Australia, 1986-2005. *Journal of Population Research, 27*(3), 147–168.

Emslie, C., & Hunt, K. (2009). 'Live to work' or 'work to live'? A qualitative study of gender and work-life balance among men and women in mid-life. *Gender, Work and Organization, 16*(1), 151–172.

Floderus, B., Hagman, M., Aronsson, G., Marklund, S., & Wikman, A. (2009). Work status, work hours and health in women with and without children. *Occupational and Environmental Medicine, 66*(10), 704–710.

Folkman, S., Lazarus, S., Pimley, S., & Novacek. (1987). Age differences in stress and coping processes. *Psychology and Aging, 2*(2), 171–184.

Haveman, R., Wolfe, B., Kreider, B., & Stone, M. (1994). Market work, wages, and men's health. *Journal of Health Economics, 13*(2), 163–182.

Heckman, J. (1976). A life-cycle model of earnings, learning, and consumption. Part 2: Essays in Labor Economics in Honor of H. Gregg Lewis (Aug., 1976) *Journal of Political Economy, 84*(4), S11–S44. The University of Chicago Press.

Karsten, P., & Klaus, M. (2009). Unemployment impairs mental health: meta-analyses. *Journal of Vocational Behavior, 74*(3), 264–282.

Kleiner, S., & Pavalko, E. (2010). Clocking in: The organization of work time and health in the United States. *Social Forces, 88*(3), 1463–1486.

LaBond, C., Banwell, C., Pescud, M., Doan, T., & Strazdins, L. (2020). *Blue collar timescapes: Work, health, and pension eligibility age for mature age Australian bus drivers*. Critical Public Health.

Landivar, L. C. (2015). The gender gap in employment hours: Do work-hour regulations matter? *Work, Employment & Society, 29*(4), 550–570.

Lee, J., & Lee, K. (2016). Can working hour reduction save workers? *Labour Economics, 40*, 25–36.

Lepinteur, A. (2019). The shorter workweek and worker wellbeing: Evidence from Portugal and France. *Labour Economics, 58*, 204–220.

Mattingly, J., & Bianchi, M. (2003). Gender differences in the quantity and quality of free time. *Social Forces, 81*(3), 999–1030.

Maume, J. (2006). Gender differences in restricting work efforts because of family responsibilities. *Journal of Marriage and Family, 68*(4), 859–869.

Milner, A., Smith, P., & LaMontagne, D. (2015). Working hours and mental health in Australia: Evidence from an Australian population-based cohort, 2001-2012. *Occupational and Environmental Medicine, 72*(8), 573–579.

Mincer, J. (1974). *Schooling, experience, and earnings.* New York: National Bureau of Economic Research.

Minnotte, K., Cook, A., & Minnotte, M. (2010). Occupation and industry sex segregation, gender, and workplace support: The use of flexible scheduling policies. *Journal of Family Issues, 31*(5), 656–680.

O'Reilly, D., & Rosato, M. (2013). Worked to death? A census-based longitudinal study of the relationship between the numbers of hours spent working and mortality risk. *International Journal of Epidemiology, 42*(6), 1820–1830.

OECD. (2006). Work disincentives and barriers to employment. In *Live longer, work longer.* Paris: OECD Publishing.

OECD. (2022). *Labour force participation rate (indicator).* https://doi.org/10.1787/8a801325-en Accessed on 05 April 2022).

Productivity Commission. (2015). *Superannuation policy for post-retirement. Research paper volume 1: Chapters, July 2015.*

RBA. (2018). *The evolving Australian labour market. Speech at business educators Australasia 2018 biennial Conference Canberra, 5 October 2018.* Reserve Bank of Australia.

Read, J., & Gorman, B. (2010). Gender and health inequality. *Annual Review of Sociology, 36*, 371–386.

Sparks, K., Cooper, C., Fried, Y., & Shirom, A. (1997). The effects of hours of work on health: A meta-analytic review. *Journal of Occupational and Organizational Psychology, 70*(4), 391–408.

Strazdins, L., Griffin, A. L., Broom, D. H., Banwell, C., Korda, R., Dixon, J., … Glover, J. (2011). Time scarcity: Another health inequality? *Environment and Planning A, 43*(3), 545–559.

Sullivan, O., Gershuny, J., & Robinson, J. (2018). Stalled or uneven gender revolution? A long-term processual framework for understanding why change is slow. *Journal of Family Theory & Review, 10*(1), 263–279.

Summerfield, M. (2011). HILDA user manual - release 9. In *Melbourne Institute of applied economics and social research.* University of Melbourne.

Valletta, R., & Bengali, L. (2013). What's behind the increase in part-time work? *FRBSF Economic Letter, 24*(August 26).

Ware, E., Snow, K., Kosinksi, M., & Gandek, B. (2000). *SF_36 health survey manual and interpretation guide.* Lincoln RI.

WGEA. (2019). Bridging the gender gap-beware of the trolls. Available at https://www.wgea.gov.au/newsroom/bridging-the-gender-gap-beware-of-the-trolls.

Wilkins, R., & Wooden, M. (2014). Two decades of change: The Australian labour market, 1993-2013. *The Australian Economic Review, 47*(4), 417–431.

Williams, J., Blair-Loy, M., & Berdahl, J. (2013). Cultural schemas, social class, and the flexibility stigma. *Journal of Social Issues, 69*(2), 209–234.

Zellner, A., & Theil, H. (1992). Three-stage least squares: Simultaneous estimation of simultaneous equations. In *Henri Theil's contributions to economics and econometrics* (pp. 147–178). Dordrecht: Springer.