Journal of Population Research (2024) 41:9
https://doi.org/10.1007/s12546-024-09331-4

ORIGINAL RESEARCH

Health selection, family division of labour and labour market participation of migrant and Australian born couples

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Accepted: 13 March 2024

Abstract

Australia is a multi-cultural society, with the majority of recent migrants arriving from non-English speaking Asian countries. Yet we know little about how ethnic diversity in the population is reflected in employment participation and within-family time exchange. This paper investigates how nonmarket time and labour market time vary across migrant groups from non-English speaking country backgrounds (NESCB) compared with English-speaking country background migrants and non-Indigenous Australians (ESB&AU). It uses a longitudinal instrumental variable method to deal with biases caused by endogeneity and unobserved heterogeneity. We find that nonmarket time is strongly influenced by family circumstances such as having young children and partner's circumstances (health status and life events including health shocks). The relationship of these factors with nonmarket time varies across our two major groups. For example, the relationship between a partner's life events and partner's health status and the other partner's nonmarket time are significantly greater for NESCB migrant couples than for ESB&AU couples. This connects with our initial theories about the collectivist cultural backgrounds in NESCB couples in maintaining gender roles or different levels of economic security facing NESB migrants that affect how they allocate caregiving and housework time, especially when a partner becomes ill or face a life event. This paper also shows clear evidence of health selection into the labour market, and a strong trade-off between nonmarket and market time in both groups.

Keywords Health selection · Family division of labour · Labour market participation · Ethnic groups · Australia

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Published online: 23 April 2024

Background and literature

Australia is a multicultural country with about 30% of its population born overseas (ABS, 2021b). In 2020, non-English speaking country background (NESCB) migrant groups predominantly from Asian countries such as China (excluding Hong Kong), India, Philippines, Vietnam, and Malaysia accounted for about 55% of the total top 10 biggest country sources of migrants, and about one third of total migrants in Australia (ABS, 2021b; Hugo, 2003; Wilson et al., 2022). In other words, migrants from Asia (with a NESCB) are a substantial and increasingly influential sub-population.

Australia's multicultural population brings together peoples with a diverse range of attitudes, practices, and resources which influence everyday activities including education, family-life, and employment. It is widely accepted that ethnicity, language and culture critically influence the way people live, their values, socioeconomic resources and wellbeing (Burr & Mutchler, 1993; Mackenbach, 2014; Pinquart & Sorensen, 2005). Australia's NESCB migrants mainly come from collectivist countries and cultures where people primarily rely on extended families and kinship groups to protect them from life's threats in exchange for loyalty (Hofestede, 1980). Anglophone countries such as Australia, the US, UK, and New Zealand are more individualistic (Hofestede, 2010, 2011). Such classifications while contestable point to major group differences in cultural practices between Australia's NESCB migrants and English-speaking residents. Alongside cultural differences are the potential language barriers that people from NESCB encounter, with research showing that limited English proficiency can compound other ethnic differences and experiences (including discrimination) to reduce social and economic inclusion and wellbeing (AIHW, 2022; Boese & Phillips, 2011). New immigrants are at a higher risk of disadvantage due to cultural and language differences, as well as discrimination in the labour market (Cobb-Clark & Crossley, 2004; Foroutan, 2008; Ressia et al., 2017a; Lee et al., 2020).

Little is known about how Australian oversea-born migrants' country of birth and ethnicity influence the division of labour market (i.e., paid work) and non-labour market (i.e., unpaid work) participation within families. The issue is highly topical as national debates in Australia resurface about how to maximise labour market participation, especially for women (including the need for more affordable formal childcare services) (ABS, 2017; Haque & Haque, 2021; Keating, 2006), while at the same time Australia's migration cap for 2022/2023 is being increased (Department of Home Affairs, 2021).[1] In this study, we investigate whether there are significant differences between a) migrants from non-English speaking country backgrounds (NESCB), in comparison to b) English speaking background (ESB) migrants and Australian born (AU) residents, in how they manage nonmarket work and labour market participation within the family, and what happens to the family division of labour when health circumstances (including partner's health) change. We propose

[1] Department of Home Affairs_ Planning Australia's 2022–23 Migration Program Discussion Paper.

that new immigrants, especially those with different cultural or linguistic backgrounds are more vulnerable to the impacts of health shocks in the household. This is because health shocks affect the economic behaviour of the individual and their spouse's economic behaviour that may increase their unpaid time for care.

Poor health generally leads to a decrease in labour market participation and transition into and out of the labour market (Ki et al., 2013; Schuring et al., 2007, 2013; Van Rijn et al., 2014), a process is called '*health selection*'. Overall, healthier people, regardless of age, remain in the labour market and work longer hours, all else being equal (Doan et al., 2022b; García-Gómez et al., 2010; Schuring et al., 2013). However, this is not only due to an individual's health, but could also be due to their partner's health. Poor spousal health may lead to a reduction in workhours or involuntary exit from workforce, especially by women, who often leave to care for an unwell partner and/or family members. A UK study found that workers' health and caring obligations, including caring for unwell family members and partner's working status, were the main reasons provided for their exit from workforce, rather than the family's pension and wealth (Prattley & Chandola, 2021). Australian data showed that 28% of people aged 40–64 who exited the labour market cited their own health issues as the second most important reason (after care responsibilities) for early retirement, and both an individual's health, and their partner's ill health account for 35% of early retirement in Australia (ABS, 2021a).

In this study, we examine not only whether a health shock (either individual's or their partner's) impacts labour market participation, but also the time allocated to (or available for) unpaid work. The impacts of poor health are likely to spill outside the boundaries of paid work time, to impact other aspects of life. For example, research shows that physical illness of a partner is a risk factor for marital dissolution, potentially due to the increased emotional and financial stress associated with supporting a sick partner. A partner's illness is likely to generate more domestic work for the other partner, usually a woman, and adversely affect both health and market time, regardless of age (McKenzie et al., 2015). We explore whether the impacts of a health shock on paid and unpaid work differ between NESCB migrants, and ESB migrants and Australian-born people, as a range of factors related to NESCB migrant status might impact, such as a family's financial and kin resources, their social networks, gender role attitudes and expectations, skills, education and training, among others.

As alluded to above, gender is also important. Globally, women's unpaid caring work limits their time in paid employment, contributing to gender income inequality. Women pay a 'penalty' in the labour market, because they often perform both domestic nonmarket and market work, particularly if they have young children. They often seek jobs that allow them to work fewer hours to accommodate the time constraints that arise from nonmarket work at home (Budig & England, 2001; Harkness & Waldfogel, 2003; Davies & Pierre, 2005; Doan et al., 2021, 2022b). Sometimes, where financial resources are available, relaxing time constraints (e.g., by outsourcing the housework) can free up women to commit to more market workhours and earn more (Halldén & Stenberg, 2018). However, most women experience financial constraints (e.g., cost of childcare, lack of childcare services, other service affordability), and for NESCB migrant women, there are additional language barriers

and cultural expectations to consider (e.g., men in Asian countries are expected to be breadwinners while women are family care-takers) (England & Folbre, 1999; Raymo et al., 2015). One distinctive feature of Asian families living in the West is a clearly-defined and deeply-entrenched gender division of labour within the family (Raymo et al., 2015) that results in gendered social and economic disadvantage for women relative to men (Sechiyama, 2013; Whyte, 2005). In the context of health shocks, the subsequent impacts are also likely gendered. For example, Karraker and Latham's (2015) study of American older couples show that the onset of illness of wives, but not of husbands, is a strong predictor of divorce. This could be partially explained by the gendered division of household/care-based labour and the gendered labour market time, which favours men.

There is limited research looking at the role of ethnicity (birthplace and language) in nonmarket (i.e., unpaid caregiving and home duties) and labour market participation within multicultural societies. This paper aims to address this gap in Australia; using poor health (i.e., health selection) as a lens (or catalyst) to examine ethnic differences in labour participation. We investigate whether NESCB couples display different arrangements for market and nonmarket time in the face of illness and other disruptive life events. In particular, we ask how ethnicity affects selection into labour and non-labour market participation when an individual and/or their partner become ill. We compare impacts on nonmarket time and labour market participation for two groups with different ethnic characteristics—a) Non-English speaking migrant couples and b) English speaking migrant and Australian born couples (combining the ESB and AU groups was prefaced by early investigations showing that English speaking migrants and Australian born couples have similar gender-role attitudes). We also consider whether impacts on market and non-market time are amplified by gender—given socio-cultural expectations that women are caregivers, particularly in NESCB families. Respondents' individual characteristics, including their health condition and household socio-economic conditions, are examined for their impacts on selection into participation, alongside influences from partner's health, partner's employment and partner's life events.

Our analysis offers several unique methodological and conceptual contributions to the literature including: *First,* we consider market time, nonmarket time, within-family time allocation (caring via having young children), respondent's health, partner's health, and shocks to partner (life events). This enables us to consider the family as an economic entity in which each partners' behaviours and their health affect each other. *Second*, as discussed in Carroll and Rhee (1994), Fernandez et al. (2006), Giuliano (2007), as part of our analyses we examine how individuals' economic behaviours such as labour market participation, and living arrangements differ among NESCB and ESB couples in a multicultural society like Australia. Given that Australia has almost a third of its population born overseas (ABS, 2021b) it offers an opportunity to examine how ethnicity or nativity plays a role in family time allocation and how family time sharing and caring influences labour market participation when a family member becomes ill. We make use of this information by modelling stratified samples—a) Non-English speaking migrant couples and b) English speaking migrant and Australian born couples. *Third*, we apply longitudinal instrumental variable models which enable us to address biases caused by endogeneity of

nonmarket time, and unobserved heterogeneity of individual's time use (see more details in the Method section).

Data and methods

Data and analysis sample

The data we used is from the Household, Income and Labour Dynamics in Australia (HILDA) survey. The HILDA survey is a household-based panel study of a nationally representative sample of Australians, surveying more than 17,000 individuals and 7,000 households annually since 2001. The survey collected detailed information on individual and household circumstances such as health, education, employment, income, and time use.

Our analysis was restricted to 2002–2019 waves (as nonmarket time was not available in 2001 wave) and couple people aged between 25 and 64 (we considered couple status at a certain year, that is, at any considered year, they have a partner, but they may be a single in the previous year or become single in the following year if they separate or divorce). We excluded young adults and students (as the HILDA Survey did not measure study time), and retired people.

Variables

Labour market participation (market workhours or market time) is our key outcome of interest. As we considered health selection into labour market participation, the market time in this case includes zero hours for those who did not work. The other important time each individual commits is nonmarket time or *unpaid time*. The amount of market and nonmarket time was modelled as two separate variables, so we could build into our models estimates mutual influence between them. *Market workhours* were measured as total hours per week usually worked in all jobs if employed and zero if not employed. The variable was constructed (by HILDA team) from a combination of usual hours or average hours if hours vary, and the hours were averaged over a 4-week period in all jobs. *Nonmarket workhours* were measured as total hours per week spent on household errands, housework, outdoor tasks, caring for children and disabled or elderly relatives. We top-coded weekly market workhours to 80 h per week and imputed zero hours for non-employed participants. Similarly, we imputed zero nonmarket hours for employed people who did not report any nonmarket hours.

To capture differences in ethnic and nativity background, in the main analyses we grouped Non-Indigenous Australians and English-speaking background migrants into one group ('ESB&AU') as most ESB migrants in Australia are from the UK, New Zealand, and the US based on country of birth. We assume that they share similar Anglo-derived cultural practices. Non-English speaking background migrants were included in a second group also based on country of birth ('NESCB'). In supplementary analyses we also explored the models with different groupings. We

repeat the analyses for the ESB and AU groups separately—to show their similarity and justify grouping them together in the main analyses. We also repeat the analyses separately for categories of people we term 'Western' and 'Eastern', to explore differences based more closely on geographical region of origin, which are also linked to culture. The 'Western' category included people born in Australia, New Zealand, Europe and the Americas (see Appendix 3).[2]

Models were adjusted for the following variables in both market and family or unpaid time equations which may affect time use: *age* (and age squared—was added to capture life cycle behaviours in labour and non-labour market time uses); *sex* (men = 1); *tertiary education* (yes = 1); having *preschool children* (yes = 1); own and partner's *self-assessed health* (good = 1/poor = *0*) which was constructed from the original variable "self-assessed health with 5 categories: excellent, very good, good, fair and poor" by regrouping into a binary variable "poor = 1 for fair and poor; good = 0 for excellent, very good, and good", own and partner's *life events* (yes = 1) including birth or adoption of new child, death of close friends/family members, death of spouse or child, serious accident/injuries/illness, pregnancy, *equivalized household non-wage income, socio-economic disadvantage index (SEIFA*), *urban* (yes/no), and *state* (8 states and territories) and *year* (18) dummies.

A statistical summary for key variables is presented in Table 1. All monetary variables such as wage and income variables were discounted to the 2016 price level. Overall, Table 1 shows that two groups, ESB&AU and NESCB migrants, are substantively different from each other. For example, the ESB&AU group has a greater employment participation rate, longer market hours, higher household non-wage income, and better socio-economic conditions than the NESCB group. In contrast, the NESCB group has longer nonmarket hours, a higher rate of tertiary education, more preschool children, and are more likely to be legally married. When looking at gender-role attitude variables in HILDA such as '*it is better for all family members involved if the man earns the money and the women takes care of family and children'*, '*mothers who do not need money should not work'*, '*whatever career women have, their most important role is of being mothers', 'marriage is a life time and should never end'*, and '*I am described as traditional*' (which were coded from 1 'strongly disagree' to 7 'strongly agree', the two groups are systematically significantly different. The NESCB migrant group is more likely to agree with these statements, while ESB&AU group is more likely to disagree, suggesting that the NESCB group leans to 'traditional' or 'conservative values', while the ESB&AU group leans to more 'progressive' ones. In addition, our grouping is in line with the literature on cultural grouping (Hofstede, 2010, 2011; Triandis, 2004) which describes North America and most European countries as 'individualist cultures' and Latin America, Eastern countries, Middle East, Asian countries as 'collectivist' cultures.

[2] We excluded Indigenous Australians from the Australian-born sample as this group accounts for a very small portion of the sample, and as they are unique in terms of socio-economic, historical and cultural characteristics; it is not appropriate to include them in either group.

Table 1 Descriptive statistics comparing coupled men and women, aged 25–64 (2002–2019)

	ESB&AU	NESCB	Difference (*p*-value)
Working (yes = 1/no = 0)	0.77	0.65	0.0000
Market workhours (for the employed)	38.8	37.8	0.0000
Market workhours (with zero-imputed)	32.0	29.3	0.0000
Nonmarket hours	32.4	33.6	0.0062
Nonmarket hours (imputed)	30.0	29.3	0.0004
Age (year)	44.5	44.3	0.0000
Sex (man = 1/women = 0)	0.49	0.46	0.0000
Tertiary education (yes = 1/no = 0)	0.28	0.45	0.0000
Self-assessed health (poor = 1/ good = 0)	0.14	0.15	0.0000
Life events (yes = 1/no = 0)	0.232	0.199	0.0000
Equivalized non-wage income ($000)	17.6	13.5	0.0000
Socio-economic index SEIFA (1–10)	6.10	5.23	0.0000
Partner's self-rated health (poor = 1/ good = 0)	0.156	0.162	0.0000
Having preschool children (yes = 1)	0.25	0.29	0.5970
Partner's life events (yes = 1/no = 0)	0.226	0.195	0.0000
Cohabitating type (1 = legally married; 0 = de facto)	0.80	0.92	0.0000
It is better if the man earns money and woman takes care of family (strong disagree (1) to strong agree (7))	2.90	3.97	0.0000
Mothers don't need money, shouldn't work (1–7 as above)	3.16	3.34	0.0000
Women's most important role is as mother (1–7 as above)	5.23	5.50	0.0000
Marriage should never end (1–7 as above)	3.92	4.93	0.0000
I am described as traditional (1–7 as above)	4.53	4.78	0.0000
Observations	113,666	18,134	

Authors' estimation from HILDA 2002–2019 sample. Estimates adjusted for sampling weights. ESC&AU group includes English speaking background migrants and Non-Indigenous Australians (Australian-born), NESCB group includes Non-English speaking country migrants

Empirical models

The market time for unemployed people is unobserved, so we added zero for these people. The dependent variable 'market time or employment participation' is continuous and varies between zero (for the unemployed) and a positive value (for the employed). In this case the Tobit model is an appropriate estimator (Verbeek, 2004). However, as we aim to address endogeneity of unpaid time and unobserved heterogeneity, a longitudinal instrumental variable method is needed. Unfortunately, an instrumental variable Tobit estimator for panel data is not available. We thus ignore the normality assumption of the dependent variable distribution and apply a longitudinal IV estimator (*xt-iv* regression). The joint estimation procedure is acceptable since non-fulfilment of the normality assumption may not be critical because the OLS still remains unbiased (Gujarati, 1995, p. 543).

Let Y^* denote market hours, and X_i is a vector of explanatory variables, the estimation equation is as follows:

$$Y_{it} * = b_1.NonmarketTime + b_2.X_{2it} + b_3.X_{3it} + u_{it} \text{ where } u_{it} \sim NID\left(0, \sigma^2\right) \quad (1)$$

where $\boldsymbol{Y_{it}}$ is labour market participation (or market hours) of individual i in year t. It takes positive values for employed people and zeros for unemployed people. $\boldsymbol{X_{2it}}$ is a set of health-related variables (self-assessed health, partner's health status, life events or shocks to health) and other non-health variables (household equivalized non-wage income, socio-economic disadvantage index SEIFA) to test health selection and non-health selection. $\boldsymbol{X_{3it}}$ is a set of controlling variables such as gender, tertiary education, age, age squared, urban, state, and year dummy.

There is interdependence between market and non-market time, that is, market time is affected by non-market time, and non-market time also affects market time (reverse causality). In other words, work time and non-market time are jointly determined. For this reason, we treat non-market time endogenous, that is, there is a reciprocal relationship between nonmarket time and market hours (i.e., cov(*NonmarketTime,* u_{it}) # 0). The estimated coefficient of *NonmarketTime* using the standard cross sectional or longitudinal models such as ordinary least squares (OLS), random effect (RE), and fixed effect (FE) model is biased. To address this bias, we employ the longitudinal Instrumental Variable (IV) model (*xtivreg2*) to jointly estimate a system of two Eqs. (1) and (2) as it can address the endogeneity of *NonmarketTime*.

$$NonmarketTime_{it} = a_0.Z_{it} + a_1.X_{3it} + e_{it} \quad (2)$$

where Z is a set of instruments, which directly affect nonmarket time. Our instruments include having *preschool children* and *partner's life events.*

Our argument for the use of these instrument variables (IV) is that these factors directly affect or generate more unpaid work, and longer unpaid work compromises time for market work. The instruments affect market time indirectly via non-market work time. Shocks to partner (partner's life events) would affect family work time and hence market time. Similarly, a preschool child dummy may not directly affect market time, but its influence on market time is through unpaid workload created by the presence of preschool children. The exclusion or orthogonal assumption also means that the instruments are pre-determined or exogenous to the outcome (current labour market time). For example, current market time cannot operate backwards to influence the decision to have children in the past (although current market time may affect current and future decisions of having children). There are many other important factors (rather than just current market time) that influence decisions of having children/fertility such as care responsibility, social support/childcare support (free or low-cost childcare) (Englelhardt et al., 2004; Pinnelli & Fiori, 2008; Cooke, 2008). For instance, the highest fertility in EU today is found in Scandinavian/Nordic countries where they have very low childcare costs, long maternity leave, and fairer shares of household division of unpaid labour (Balbo et al., 2013; Brewster & Rindfuss, 2000; Cooke, 2008; Goldscheider et al., 2015; Pinnelli & Fiori, 2008). Stability of partnerships also affects fertility (Goldscheider et al., 2015; Thomson et al.,

2012). Religion, social norms, and women's views about life also affect their fertility (Englelhardt et al., 2004). Our IV orthogonal test result (discussed in "Results" section), which enables us to accept the hypothesis of non-correlation between the preschool child variable and error term of the market time equation, supports this channel of a pathway effect rather than a DIRECT effect of preschool children on market time. We also proposed some other instruments such as partner's working status, partner's health status, and house ownership. However, results from a series of IV tests such as endogeneity, weak instrument and over-identification tests show that these IVs do not meet the exclusion assumption of the IV model (even they satisfy the relevance assumption) (see Appendix 2).

Although there is overwhelming evidence that health affects labour market time and use of nonmarket time, it is also true that time use affects health. These complex and reciprocal relationships between health and time use underscore the need to address multiple sources of endogenous biases in estimates (Cleland et al., 2012; Doan et al., 2022a; Farrell & Shields, 2002; Humphreys & Ruseski, 2011; Venn & Strazdins, 2017). We also use prior health status variable instead of contemporary health status to test robustness of the relationship between health and labour market participation.[3]

Models can be either standard (pooled) instrumental variable (IV) or longitudinal IV models. However, unobserved heterogeneity would affect both outcomes of interest in Eqs. (1) and (2). For example, hardworking people may work longer hours both at work and at home. The bias caused by these heterogeneity attributes are not addressed by cross-sectional (pooled) models, to capture time unobserved heterogeneity in our models we employed a longitudinal IV model (limited information maximum likelihood estimation—LIML) in our current study. We ran separate models for ESB&AU (including non-Indigenous Australians and English speaking background migrants) and NESCB groups to see how the instruments and partner's health impacted differently across the two groups.

Results

In this section we applied a longitudinal instrumental variable method (limited information maximum likelihood estimator-LIML) with two valid instruments as discussed earlier to address endogeneity of *Nonmarket time* and unobserved heterogeneity in modelling labour market participation. Our models enabled us to explore the influences of partner's factors, partner's health status, partner's life events, other domestic nonmarket tasks (childcare via having preschool children) on other partner's time uses. The results are presented in Table 2.[4]

[3] We tried both prior health status and contemporary health status in longitudinal models; the results did not change much (see Appendix 4). We thus reported results from models with contemporary health status measures in this paper.

[4] For the standard FE, RE and mixed effect (ME) models estimates, see Appendix 1. The estimation in Appendix 1 ignored the potential biases caused by endogeneity.

Table 2 Longitudinal IV estimates for overall couple sample aged 25–64 (LIML estimator)

Variables	ESB&AU		NESCB		NESCB (with English proficiency)		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Unpaid time (hours)		−0.4880**		−0.4052**		−0.4373**		−0.4732**
		(0.0136)		(0.0621)		(0.0665)		(0.0140)
Excluded instruments								
Preschool child (yes = 1)	12.6575**		9.5191**		8.8729**		12.6188**	
	(0.3198)		(1.0270)		(0.9722)		(0.3203)	
Preschool child *NESCB							−3.0074**	
							(1.0346)	
Partner's life events (yes = 1)	0.2516		1.1573 +		1.3050 +		0.2995 +	
	(0.1640)		(0.6464)		(0.7322)		(0.1683)	
Partner's life events*NESCB							0.5566	
							(0.5367)	
Covariates								
Age	1.5817**	3.1292**	1.3217	2.7520**	1.3801	3.0946**	1.5587**	3.0723**
	(0.2992)	(0.2847)	(1.1787)	(0.8743)	(1.2650)	(0.9492)	(0.3442)	(0.3004)
Age-squared	−0.0188**	−0.0349**	−0.0135**	−0.0356**	−0.0132**	−0.0379**	−0.0181**	−0.0350**
	(0.0012)	(0.0008)	(0.0045)	(0.0028)	(0.0050)	(0.0031)	(0.0013)	(0.0008)
Tertiary education (yes = 1)	−0.6175	5.4567**	4.6275	6.3533*	5.5745	6.0599 +	−0.0421	5.4368**
	(0.9645)	(0.7489)	(3.3569)	(3.1240)	(4.0567)	(3.5703)	(0.9316)	(0.7431)
SEIFA (1–10)	0.0532	0.1021*	−0.0131	0.2145	−0.0213	0.0537	0.0307	0.1337**

Table 2 (continued)

Variables	ESB&AU		NESCB		NESCB (with English proficiency)		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(0.0744)	(0.0479)	(0.2145)	(0.1402)	(0.2476)	(0.1462)	(0.0736)	(0.0480)
Household non-wage income ($000)	0.0035*	−0.0144**	0.0029	−0.0073	0.0071	−0.0048	0.0035*	−0.0134**
	(0.0015)	(0.0014)	(0.0060)	(0.0045)	(0.0066)	(0.0054)	(0.0016)	(0.0014)
Self-assessed health (poor = 1)	−0.6010*	−2.4427**	−1.4664	−2.2368**	−1.4993	−2.1779**	−0.7451*	−2.3864**
	(0.2734)	(0.2263)	(1.0715)	(0.6187)	(1.1943)	(0.6920)	(0.2992)	(0.2179)
Life events (yes = 1)	0.2452	−0.5405**	−0.5622	−1.6605**	−0.8112	−1.7760**	0.1087	−0.7433**
	(0.1634)	(0.1239)	(0.6856)	(0.4367)	(0.7756)	(0.4824)	(0.1786)	(0.1301)
Partner's self-assessed health (poor = 1)	0.3426	0.3852+	1.4339+	−0.3038	1.8349+	0.0565	0.3458	0.3139
	(0.2505)	(0.2108)	(0.8431)	(0.5575)	(0.9452)	(0.6191)	(0.2507)	(0.2094)
Partner's self-assessed health*NESCB							1.0072	−0.0538
							(0.8930)	(0.6101)
English proficiency					1.8454	3.0643+		
(well/very well = 1; not well/not at all = 0)					(1.6772)	(1.5929)		
Constant	−2.4878		−0.6948		−6.3504		−2.6706	
	(14.83)		(54.84)		(57.82)		(16.97)	
Observations	91,189	89,173	12,999	12,608	10,711	10,392	104,188	101,781
Number of groups	12,846	10,830	2,055	1,664	1,709	1,390	14,901	12,494

Table 2 (continued)

Variables	ESB&AU		NESCB		NESCB (with English proficiency)		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Instrumental variable tests								
First stage F-value for excluded instruments [Prob > F]	1707.0	[0.0000]	98.8	[0.0000]	79.3	[0.0000]	891.8	[0.0000]
Underindentification test								
Kleibergen-Paap rk LM statistic [*P*-value]	2772.5	[0.0000]	168.9	[0.0000]	137.3	[0.0000]	2917.0	[0.0000]
Weak identification test								
Kleibergen-Paap rk Wald F statistic	1707.0		98.8		79.3		891.8	
Stock-Yogo weak ID test critical val (10% maximal LIML size)	8.68		8.68		8.68		5.44	
Hansen J stats (overidentification test) Chi2 [*P*-value]	0.2190	[0.6395]	0.5810	[0.4459]	0.5440	[0.4607]	2.6450	[0.4497]
Endogeneity test of endogenous regressor (unpaid time)								
Chi2 [*P*-value]	894.2	[0.0000]	38.5	[0.0000]	37.0	[0.0000]	909.7	[0.0000]

Robust standard errors in parentheses, significant at ** $p<0.01$, * $p<0.05$, + $p<0.1$. Models controlled for urbanity, state and year dummies

The series of IV tests on a pooled sample in Appendix 2 show that '*preschool child dummy'* and '*partner's life event'* are valid instruments as the test results in models with two instruments (Z_1 and Z_2) passed the tests of weak instrument and endogeneity (we rejected the hypothesis that instruments were weak, and unpaid time is exogenous), and over-identification test (we accepted the null hypothesis that the instruments are not correlated with the error term in the main equation or the IVs are orthogonal), we hence use these two instrument in subsequent models in Tables 2, 3, and Appendix 3.

Our longitudinal IV estimates show that having preschool children is a very strong predictor of nonmarket time for both groups ESB&AU and NESCB. For example, compared with those without preschool children, people with young children committed around 9.5–12.6 h per week on nonmarket work (Tables 2, 3). Having a partner with poor health, or partner's disruptive life events also affect nonmarket time.

The estimated relationships between respondent's factors (health, life events) and his/her partner's nonmarket time are as many folds higher for the NESCB group than for the ESB group (Table 2). For example, the relationship between partner's life event and other partner's unpaid time is 0.2516 for ESB&AU group and 1.1573 for NESCB group (over four times of that of ESB&AU group). Similarly, the relationship between partner's poor health and the other partner's unpaid time is 0.3426 for ESB&AU group and 1.4339 for NESCB group (also over four times of that of ESB&AU group). The model with an extra control for English proficiency for NESCB group) (speak well/very well = 1; not well/not at all = 0) (columns 5–6, Table 2) did not result in any considerable changes in the estimated effects of the own health variable on time use variables, but partner's poor health and partner's life events more strongly affected the other partner's unpaid time compared with the model without the English proficiency control (i.e., adjusting for English proficiency which may remove the effect of generations in the NESCB group resulted in a rise of effect of partner's health and life's events on the other partner's time use). This implies that changes[5] in NESCB migrants' circumstances have a greater influence on their partner's time allocation. The stronger relationship of partner's poor health, and partner's life events and the other partner's nonmarket time in the NESCB group implies that one partner's nonmarket work is more correlated with other partner's circumstance changes in this group, suggesting a stronger mutual influence between two partners. In other words, ESB&AU partners are more independent of each other. Reflecting this, Table 1 shows that NESCB couples are more likely to be legally married, have stronger commitment between partners '*marriage should never end*', stronger gendered division of labour '*it is better if the man earns money and the woman takes care of family*', while ESB&AU couples are more likely to be in a cohabitating partnership, have less commitment between partners, and more equal family division of labour.

[5] Note that we employ longitudinal model so the effect is within-individual change of time use caused by changes in individual circumstances.

Table 3 Nativity and partner's health by gender, longitudinal IV estimates (LIML estimator)

Variables	Women				Men			
	ESB&AU		NESCB		ESB&AU		NESCB	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Unpaid time (hours)		−0.4991**		−0.4410**		−0.4990**		−0.4407**
		(0.0129)		(0.0589)		(0.0129)		(0.0590)
Excluded instruments								
Preschool child (yes = 1)	12.8893**		9.1567**		12.8902**		9.1422**	
	(0.3239)		(0.9711)		(0.3239)		(0.9714)	
Partner's life events (yes = 1)	0.2664+		1.0856+		0.2700+		1.1318+	
	(0.1608)		(0.6316)		(0.1609)		(0.6337)	
Covariates								
Age	1.6652**	3.1482**	1.4103	2.6935**	1.6644**	3.1468**	1.4364	2.7233**
	(0.2870)	(0.2779)	(1.0960)	(0.8418)	(0.2870)	(0.2779)	(1.0892)	(0.8418)
Age-squared	−0.0191**	−0.0348**	−0.0149**	−0.0352**	−0.0191**	−0.0348**	−0.0150**	−0.0352**
	(0.0012)	(0.0008)	(0.0046)	(0.0028)	(0.0012)	(0.0008)	(0.0046)	(0.0028)
Tertiary education (yes = 1)	−0.3933	5.8155**	4.3683	6.5142*	−0.3935	5.8154**	4.4712	6.5798*
	(0.9197)	(0.7162)	(3.1860)	(2.9388)	(0.9188)	(0.7161)	(3.1439)	(2.9351)
SEIFA (1–10)	0.0403	0.0911*	−0.0654	0.2135	0.0402	0.0908*	−0.0675	0.2146
	(0.0698)	(0.0460)	(0.2078)	(0.1362)	(0.0698)	(0.0460)	(0.2075)	(0.1363)
Household non-wage income ($000)	0.0035*	−0.0143**	0.0040	−0.0067	0.0035*	−0.0143**	0.0039	−0.0068
	(0.0015)	(0.0014)	(0.0055)	(0.0042)	(0.0015)	(0.0014)	(0.0055)	(0.0042)
Self-assessed health (poor = 1)	−0.6468*	−2.4739**	−1.6520	−2.6597**	−0.6455*	−2.4688**	−1.5990	−2.5967**

Table 3 (continued)

Variables	Women				Men			
	ESB&AU		NESCB		ESB&AU		NESCB	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(0.2672)	(0.2187)	(1.0148)	(0.6102)	(0.2672)	(0.2186)	(1.0173)	(0.6095)
Life events (yes = 1)	0.2519	−0.5293**	−0.4078	−1.6722**	0.2495	−0.5307**	−0.4269	−1.6693**
	(0.1552)	(0.1199)	(0.6543)	(0.4244)	(0.1552)	(0.1199)	(0.6551)	(0.4243)
Have a male partner with poor health	0.3139	0.4313	1.8013 +	0.7368				
(yes = 1/0 = otherwise)	(0.3794)	(0.2931)	(1.0531)	(0.7420)				
Have a female partner with poor health					0.2007	0.0668	0.3859	−0.9922
(yes = 1/ 0 = otherwise)					(0.3135)	(0.2962)	(1.1022)	(0.7896)
Constant	−5.5059		−1.2237		−5.4644		−2.3429	
	(14.1999)		(51.9031)		(14.1995)		(51.5791)	
Observations	98,280	96,170	14,216	13,804	98,280	96,170	14,216	13,804
Number of groups	13,516	11,406	2,187	1,775	13,516	11,406	2,187	1,775
Instrumental variable tests								
1st stage F-value for excluded instruments [Prob > F]	1811.4	[0.0000]	99.3	[0.0000]	1811.6	[0.0000]	99.03	[0.0000]
Underindentification test								
Kleibergen-Paap rk LM statistic [*P*-value]	2881.8	[0.0000]	173.4	[0.0000]	2881.9	[0.0000]	173.1	[0.0000]
Weak identification test								
Kleibergen-Paap rk Wald F statistic	1811.4		99.3		1811.6		99.03	
Stock-Yogo weak ID test critical val (10% maximal LIML size)	8.68		8.68		8.68		8.68	

Table 3 (continued)

Variables	Women				Men			
	ESB&AU		NESCB		ESB&AU		NESCB	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Hansen J stats (overidentification test) Chi2 [*P*-value]	0.473	[0.4916]	1.406	[0.2358]	0.587	[0.4437]	1.564	[0.2111]
Endogeneity test of endogenous unpaid time								
Chi2 [*P*-value]	1045.4	[0.0000]	50.2	[0.0000]	1045.0	[0.0000]	49.96	[0.0000]

Robust standard errors in parentheses, significant at ** $p<0.01$, * $p<0.05$, + $p<0.1$. Models controlled for urbanity, state and year dummies

The estimates using stratified samples (Western including non-Indigenous Australians vs Eastern migrants) show very similar results (see Appendix 3) to estimates using stratified samples (ESB&AU vs. NESCB) in Table 2.

We also expected that the relationship between one partner's circumstance changes and the other partner's nonmarket time is stronger for NESCB group. We expected that in modern societies or more individualist Western cultures (ESB&AU) when either the male or female partner is chronically ill or disabled the other partner is more likely to seek separation or divorce, while in the NESCB group, the more stable partnership and traditional social norms would reduce the risk of dissolution (Hewitt, 2008).[6] However, we also expected that gender would have an impact with women more likely to care for sick male partners.

To test the possibility that gender also plays a role, such that the relationship between partners' circumstance changes and the other partner's nonmarket time is strongest for NESCB women, we examined the variable 'have a male (or female) partner with poor health' in the models in Table 3. The estimates show that if a female partner has a male partner with poor health their unpaid time increases by 1.8013 h for NESCB group, but the effect is far less at 0.3139 h for ESB&AU group. If a male partner has a female partner with poor health, their unpaid time increases by much smaller amounts: 0.3859 h for NESCB group and 0.2007 h for ESB&AU group. The coefficient of 'have a partner with poor health' for ESB&AU group is small and statistically insignificant suggesting that there is no large difference in the relationship between partner's poor health and the other partner's nonmarket time between sexes in the ESB group. This is not the case for the NESCB. The relationship between partner's life events and other partner's unpaid or nonmarket time is also significantly larger for both women and men in the NESCB group (1.0856 and 1.1318) than for ESB&AU group (0.2664 and 0.2700) (see Table 3).

After adjusting for the endogeneity of nonmarket time using the longitudinal IV models (LIML estimation), our estimates in the second stage show that nonmarket time strongly affects labour market participation. Each hour increase in nonmarket work leads to a decline of about 0.49 h (for ESB&AU group) and 0.41 h (for NESCB group) in market time (Table 2). We also observe that if there is a change in own health, from good to poor health status, it leads to a reduction in market hours by about 2.4 h-2.5 h per week. This implies there is a clear health selection into labour market participation and work hours. In addition, own life events also affect negatively market time, and stronger for NESCB group.

It is something of a generalisation to attribute an individualist culture to the ESB&AU group and a collectivist culture to the NESCB group. Therefore, the analyses were repeated with different groupings tested. The estimates with categories of

[6] Zhang and Van Hook (2009) found that migrant couples where both spouses are foreign-born have a lower risk of divorce than those formed by two native-born spouses. We also ran models by migration status (migrants vs. non-migrant Australians) to be in line with Zhang and Van Hook (2009), but the gap in the effect of partner's health status on other partner's nonmarket time is very narrow. It is likely be due to the culture similarity (e.g., marriage/family connections) between ESB migrants and non-indigenous Australians. We believe that grouping ESB migrants with non-Indigenous Australians is a more reasonable approach.

people from Western countries, Eastern countries, as well as those who are Australian-born and ESB migrants, indicate that partner's life events and partner's health status have a much stronger association with the other partner's nonmarket time for people born in Eastern countries than for all the other groups (Western countries, Australian-born, and ESB migrants) (see Appendix 3). These analyses suggest that our ESB&AU group includes consistent patterns in the results, and that the NESCB migrants reflect people largely from Eastern countries (as both groupings also show consistent patterns in the results). Our analysis and the groupings we have tested in this paper focuses more on nativity or ethnicity, however, our interpretation of the findings is that the results, at least in-part, relate to culture differences in family division of labour between partners.

The estimated effects of nonmarket time on market time using longitudinal IV models in Tables 2 and 3 are significantly greater than that using the standard longitudinal models such as FE, RE and ME models in Appendix 1. This suggests that without addressing the endogeneity of nonmarket time and unobserved heterogeneity biases, the estimated effects of nonmarket time on market time were downward-biased.

Sensitivity analysis

Our instruments, preschool child dummy and partner's life events were tested to be valid for our target population of overall couple sample aged 25–64. However, it could be argued that for some people they may plan to have a child in the past and work part time today, such that there would be a potential correlation between market time and preschool child variable. To consolidate our findings and also as a sensitivity test, we ran an extra model using *only* partner's life event (e.g., serious accidents, injuries, illness) and its lag as instruments (which obviously meet the exogeneity condition). The estimates of the time trade-off as well as other variables are very well aligned with the estimates using both preschool child dummy and partner's life events as instruments in Table 2 (see Appendix 5).

Finding summary, discussion and limitations

Finding summary

This paper first investigates how domestic work time derived from home work and care responsibility from factors such as having young children, partner's health, and partner's life events affects nonmarket time, and then how own health and nonmarket time affect labour market participation, within a sample of Australian coupled people aged 25–64. We focus on how the effects vary across country of birth and/or ethnic groups using longitudinal IV models to account for biases caused by endogeneity of nonmarket time and unobserved heterogeneity.

We find that the amount of nonmarket time is determined by exogenous factors such as having preschool children and partner's circumstances (health status and life

events). The estimated association between these factors and nonmarket time vary substantially across different ethnic groups (ESB&AU compared to NESCB). The difference is particularly clear for the influence of partner's factors such as health status and life events (including health shocks). The effects of changes in partner's circumstance on the other partner's nonmarket time are significantly greater for the NESCB couples. This connects with our theories about the potential mechanisms operating for this population group including increased barriers to access support and services as well as greater marriage stability and collectivist culture in NESCB couples, likely resulting in maintaining (or even exacerbating) gender roles in caregiving and domestic work when a partner becomes ill.

Our estimated effects of nonmarket time on market time using longitudinal IV models are significantly greater than those using the standard longitudinal models (see Appendix 1). This suggests that without addressing endogeneity of nonmarket time and unobserved heterogeneity biases, the estimated effects were downward-biased (or underestimated). The heterogeneous behaviours across individuals may bias market and nonmarket time relationships. Our longitudinal IV models have addressed the heterogeneity biases as well as endogeneity of nonmarket time.

After correcting for the endogeneity of nonmarket time and unobserved heterogeneity using the longitudinal IV models, our estimates show that the amount of nonmarket time strongly affects labour market participation in both groups. Each hour increase in nonmarket time will lead to a decrease (a trade-off) of 0.41–0.49 h in market hours. We also observe clear evidence of health selection into the labour market participation. If there is a change in own health status (from good to poor), it leads to a reduction in market workhours by about 2.4 to 2.5 h per week.

Discussion

Nonmarket time adversely affects market time for both ESB&AU and NESCB groups. The relationship between individual's own health and market time (or health selection into employment) is clearly observed in both groups. However, in couples changes in partner's circumstances such as health status and life events and the other partner's nonmarket time varies greatly across the two groups tested. The relationships are stronger for NESCB couples than for ESB&AU couples.

This finding suggests that there are cultural factors, including the stability of partnerships (e.g., lower rate of divorce), and family collectivist goals that contribute to between-partner care and family division of labour. The NESCB groups in this sample are predominantly from collectivist societies, such as India, China, and other East Asian regions, where there are strong cultural views about marriage and gender norms/roles, and family collective goals related to family finances, legal and religious institutions (Davis & Greenstein, 2009; Hofstede, 2010, 2011; Triandis, 2004; Weber et al., 1998; Yen & Yang, 2011). The NESCB group, mainly from collectivist societies in Asia, Eastern Europe, Latin America (Hofstede, 2010, 2011; Triandis, 2004), is expected to have social norms/culture associated with stronger marriage stability that would enable one partner to sacrifice market time to take care of nonmarket work with less worry about their financial compromises (they are more like

to agree with 'it is better if the man earns money and woman takes care of family', 'marriage should never end'). There is evidence that migrants from NESCB face a lower risk of divorce/dissolution in Australia and other Western countries (Adserà & Ferrer, 2015; Furtado et al., 2013; Hewitt, 2008; Zhang & Van Hook, 2009).

Our findings support the assumption that cultural factors, including marriage stability, play important roles in between-partner time allocation and each-other caring across ethnic groups as collectivism acts as implicit mutual insurance against catastrophic losses (Weber et al., 1998). However, apart from the cultural factors, economic factors may also play a role. There is evidence that the unemployment rate for NESCB migrants is significantly higher than for Australian-born and ESB migrants. NESCB migrants' poor English skills, labour market discrimination and cultural activities are key factors behind their higher unemployment rate in Australia (Doan et al., 2023; Haque & Haque, 2021). NESCB migrants in Australia are more likely than ESB workers to experience challenges securing work, economic hardship, or precarious employment (Cobb-Clark & Crossley, 2004; Foroutan, 2008; Ressia et al., 2017a, 2017b). They are more likely to have less secure jobs, and precarious employment, which results in less financial security (Lee et al., 2020; Ressia et al., 2017b). These economic reasons explain the mutual support or reliance between partners when the other partner faces adverse shocks or life events.

NESCB women's nonmarket time is more likely to increase with her partner's poorer health and partner's life events than for their ESB&AU counterparts. One explanation is that when an ESB&AU person within a couple becomes chronically ill, their partner is more likely to seek separation or divorce, or find other ways (and has the economic resources) to outsource care, rather than reduce their market time to care for his/her ill partner (Matouschek & Rasul, 2008; Becker et al., 1977). In contrast, partners from the NESCB group, especially women, are likely to spend more time to care for their partner when he/she becomes ill, either because of lack of other social and economic resources, because this is what is expected culturally (e.g. gender and family-oriented norms) and/or potentially because of reduced risk of marriage dissolution. There are economic considerations and trade-offs in the context of health, gender, culture and the effects of time use and labour market participation. NESCB men are usually the major earners or the main breadwinners in the family (Blau & Kahn, 2015; Ortlieb & Winterheller, 2020), such that when the male partner becomes sick the female partner has fewer independent financial resources needed to either outsource care or leave the marriage (than may be the case in couples with more equitable work-non work gender roles). This argument around the inter-connectedness of resources (particularly financial resources) within NESCB couples (and a greater independence or individualisation of resources in ESB&AU couples) also helps explain the lower effects of partner's health and life events on other partner's nonmarket time for the ESB&AU couples than those of the NESCB couples. NESCB women in Australia are more likely than their ESB&AU counterparts to experience higher unemployment, less secure work, economic hardship, and/or precarious employment (Haque & Haque, 2021; Cobb-Clark & Crossley, 2004; Foroutan, 2008; Ressia et al., 2017a; Lee et al., 2020), which results in less financial security for NESCB migrants despite no apparent racial discrimination in Australian employment laws. The economic reasons might therefore also explain

more mutual support between NESCB partners, especially from women to men when their male partners face adverse health shocks or life events.

As discussed in Carroll and Rhee (1994), Fernandez et al. (2006), Davis & Greenstein, 2009, and Giuliano (2007), culture or social norms shapes individuals' economic behaviours such as labour market participation, and family living arrangements. They argue that immigrants replicate the behaviours in their country of origin and suggest that social norms in the country of origin affect individual's social and economic behaviours in their host country. To some extent, migrants particularly the first generation maintain their culture, religiosity, social norms and expectations including family goals, family organization, marital partnerships, and time allocation.

Given Australia is multi-cultural society with nearly 30 per cent of its population born overseas (ABS, 2021b), it offers an opportunity to examine how ethnicity (and cultural and linguistic differences/barriers) interacts with nonmarket time and labour market participation, via the process of within family time allocation, mutual support and health selection. Particularly, as a case study, this research explores how ethnicity and gender influence time allocation when one partner within a couple become ill or faces a major disruptive life event. We find that ethnicity or nativity (likely via linguistic and cultural differences) matters. When a partner within a couple becomes ill or faces a major life event being from a NESCB in contrast to a ESB&AU, differentially influences the effects on nonmarket time and labour market—particularly for women, where females from a NESCB are most likely to spend more time to care for an ill partner or do more unpaid work at home.

Australia is a diverse society with a rich multicultural background. However, new immigrants often face greater difficulties and are at a higher risk of disadvantage due to cultural and linguistic differences, as well as discrimination in the labour market (Cobb-Clark & Crossley, 2004; Foroutan, 2008; Ressia et al., 2017a; Lee et al., 2020). When comparing English-speaking background (ESB) immigrants and Non-Indigenous Australians with non-English speaking background (NESCB) immigrants, it becomes apparent that these two groups face different challenges. Key barriers to new migrants (using country of birth information from HILDA data as a proxy for new migrants or first generation migrants who are still linked to home country's culture) are English language and discrimination in the labour market (Doan et al., 2023; Haque & Haque, 2021). Moreover, new immigrants, especially those with different cultural or linguistic backgrounds, are more vulnerable to the impacts of health shocks and life events in the household. This is because health shocks and life events can affect the economic behaviour of both an individual and their spouse, who may need to provide additional support to care for their partner and their family.

NESCB immigrants lack the extended family support that would normally be available to them in their home country, as well as access to the resources and support available to native residents and citizens. For example, new migrants have to wait for at least four years to be eligible for Australian welfare support for permanent

visa holders.[7] As a result, NESCB migrants are at greater risk of a decline in economic participation, which amplifies economic losses resulting from poor health, health shocks, and adverse life events. To address these issues, policies should be implemented to support NESCB migrants. Providing support in areas such as language learning and employment opportunities can help new immigrants overcome the challenges they face, understand new cultural contexts, and be better supported within Australian society.

Limitations

Our analysis has some limitations. First, as we have explored conceptually, when a partner becomes chronically ill, the other partner may seek separation or divorce. This would lead to underestimation of the relationship between partner's ill health and the other partner's nonmarket time and subsequently labour market time. When we linked poor health with divorce or separation using HILDA 2002–2019 for those aged 25–64, we see that divorced/separated people have a significantly higher rate of poor health at 26.5% vs 14% (for non-separated/divorced couple people). The estimates from the remaining couple sample would therefore include some sample selection bias. Second, since we focus on the relationships between own health, partner's health, and partner's life events and nonmarket time and market time, we can only use a sample of couples, meaning that our estimates are not applicable across the general population. For example, our estimate from HILDA data for all people aged 25–64, the marriage breakup rate was 8.2% for NESCB migrants and 10% for ESCB migrants and Australia-born, the divorced or separated people were not included in the analysis sample. Third, this analysis overlooks a range of ethnic or cultural differences within the ESB&AU and the NESCB groups that are relevant to this study, such as gendered expectations, language expertise, and religious differences—while we have included some of these ideas in our discussion of results they have not been measured in our data.

The allocation of time is complex and may vary across different groups. Some may prioritize worktime over the unpaid time, while others may choose workhours based on their available time after domestic time and their resources. Within our data context, we do not know which of these groups people belong to. Our IV model corrected for the two-way relationship (paid and unpaid time) bias and provided estimates for the overall sample of Australian couples aged 25–64. However, to deeply understand how certain groups of people use their time, further qualitative and/or detailed time-use cohort studies are needed. The current study and methods only allow us to examine the time-use behaviours of average people in our target population, whereas specific people or specific groups of people may behave, including how they use their time, in very different ways conditional on their preferences as well as available resources.

[7] https://www.dss.gov.au/sites/default/files/documents/06_2019/newly-arrived-residents-waiting-period-english.pdf

Furthermore, all migrants are grouped using their country of birth in this study regardless of whether they grew up in their home country or immigrated to Australia when they were very young with an assumption that within each group cultural practices, social norms, partnership commitment has remained consistent. However, those who migrated to Australia when they were very young are likely to become acculturated meaning they have adopted some of the host country's cultural practices, social norms, and marital partnership (Prinz, 2019) as they have been exposed to more educational and surrounding environments in the host country. In addition, in this study we group English-speaking migrants and non-Indigenous Australians into one group, and all other non-English migrants into another group to make use of the HILDA sample. The NESCB and ESB groups were coded using a prioritisation method whereby the ESB group classification does not include people who identified as also being from another (i.e. multi) ethnic/racial/cultural background. Although we observed no significant differences in the effect estimates across groups of the Western, non-Indigenous Australian-born, and ESB migrants (Appendix 3), we recognise the considerable diversity among multicultural and both NESCB and ESB groups, and that collapsing these groups into one larger category for statistical analysis has limitations. Our groups reflect differences in 'nativity' or 'ethnicity' although these overlap with cultural differences when it comes to gendered family practices relevant to this study. Consequently, we have used the term 'culture' when we were discussing attribute differences between groups. Additionally, due to the small number of participants from Aboriginal and/or Torres Strait Islander backgrounds we were unable to include this group in the comparative analysis as a separate group. In future studies researchers might explore the differences between migrant generations, or conduct focussed studies on more specific cultural groups.

Appendix 1

See Table 4

Table 4 Standard longitudinal (RE, FE, mixed effect) estimates of determinants of labour market participation, couple sample, aged 25–64

Variables	Random effect (RE)		Fixed effect (FE)		Mixed effect (ME)	
	ESB&AU	NESCB	ESB&AU	NESCB	ESB&AU	NESCB
Nonmarket time (hours)	−0.1485**	−0.0998**	−0.1295**	−0.0841**	−0.1475**	−0.0991**
	(0.004)	(0.009)	(0.004)	(0.010)	(0.004)	(0.009)
Age	2.0852**	2.4235**	2.0409**	2.4092**	2.0811**	2.4176**
	(0.084)	(0.235)	(0.101)	(0.294)	(0.084)	(0.238)
Age-squared	−0.0273**	−0.0292**	−0.0264**	−0.0274**	−0.0273**	−0.0291**
	(0.001)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)
Education tertiary (yes = 1)	3.9726**	3.9095**	5.8746**	4.0814	4.0198**	3.9128**
	(0.362)	(0.798)	(1.090)	(3.211)	(0.371)	(0.804)
SEIFA (1–10)	0.2713**	0.3742**	0.0802	0.2602+	0.2634**	0.3715**
	(0.044)	(0.106)	(0.055)	(0.143)	(0.044)	(0.107)
Total non-wage income	−0.0164**	−0.0096*	−0.0154**	−0.0085+	−0.0164**	−0.0095*
	(0.001)	(0.005)	(0.001)	(0.005)	(0.001)	(0.005)
Self-assessed health (poor = 1)	−3.1852**	−2.9647**	−2.2241**	−1.7024**	−3.1363**	−2.9137**
	(0.217)	(0.545)	(0.228)	(0.581)	(0.219)	(0.553)
Life events (yes = 1)	−1.0543**	−1.1924**	−1.0253**	−1.2265**	−1.0533**	−1.1936**
	(0.105)	(0.269)	(0.107)	(0.274)	(0.105)	(0.269)
Partner's self-assessed health (poor = 1)	−0.3910*	−1.1486*	0.1927	−0.4619	−0.3615*	−1.1216*
	(0.183)	(0.470)	(0.192)	(0.500)	(0.183)	(0.471)
Constant	−1.6568	−19.2171**	−0.6737	−19.5182**	−1.5803	−19.1140**
	(1.777)	(5.369)	(2.344)	(7.351)	(1.793)	(5.412)
Observations	91,397	13,090	91,397	13,090	91,397	13,090
Number of xwaveid1	12,871	2,086	12,871	2,086	12,871	2,086

Robust standard errors in parentheses, significant at ** $p<0.01$, * $p<0.05$, + $p<0.1$. Models controlled further for urbanity, state and year dummies

Appendix 2

See Table 5

Table 5 Instrumental variable regression (LIML estimator) for couple sample aged 25–64, 2002–2019

Variables	Z_1		Z_2		Z_3		Z_4		Z_1+Z_2		Z_1+Z_3		Z_1+Z_4	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	UPH	PH	UPH	PH	UPH	PH	UPH	PH	UPH	PH	UPH	PH	UPH	PH
Nonmarket time (hours)		−0.419**		−0.362**		0.845**		−5.896**		−0.419**		−0.398**		−0.425**
		(0.011)		(0.104)		(0.088)		(1.166)		(0.011)		(0.012)		(0.013)
Excluded Instruments														
Preschool child	15.541**								15.506**		15.474**		15.755**	
(yes = 1)	(0.207)								(0.208)		(0.206)		(0.210)	
Partner's life events			1.768**						0.418*					
(yes = 1)			(0.208)						(0.201)					
House ownership					2.965**						2.566**			
(owned = 1/rent = 0)					(0.208)						(0.199)			
Working partner							−1.095**						1.360**	
(yes = 1)							(0.199)						(0.199)	
Instrument variable tests														
First stage F-value for excluded instruments [Prob > F]	6407	[0.0000]	74.1	[0.0000]	216	[0.0000]	25.1	[0.0000]	3210	[0.0000]	3393	[0.0000]	3216	[0.0000]

Table 5 (continued)

Variables	Z_1		Z_2		Z_3		Z_4		Z_1+Z_2		Z_1+Z_3		Z_1+Z_4	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	UPH	PH	UPH	PH	UPH	PH	UPH	PH	UPH	PH	UPH	PH	UPH	PH
Underindentification test														
Kleibergen-Paap rk LM statistic [*P*-value]	5255	[0.0000]	73.6	[0.0000]	216	[0.0000]	25.1	[0.0000]	5266	[0.0000]	5467	[0.0000]	5275	[0.0000]
Weak identification test														
Kleibergen-Paap rk Wald F statistic	6407		74.1		216		25.1		3210		3393		3216	
Stock-Yogo weak ID test critical value (10% maximal LIML size)	16.38		16.38		16.38		16.38		8.68		8.68		8.68	
Hansen J stats (overidentification test) Chi2 [*P*-val]	0.0	just identified	0.0	just identified	0.0	just identified	0.0	just identified	0.295	[0.5868]	420	[0.0000]	876	[0.0000]
Endogeneity test for Nonmarket time														
Chi2 [*P*-value]	585	[0.0000]	4.0	[0.0447]	304	[0.0000]	1061	[0.0000]	586	[0.0000]	415	[0.0000]	493	[0.0000]

Models further controlled in both stages for sex, age, age squared, education, household non-wage income, SEIFA, health status, life events, and partner's health status, urbanity, state, and year dummies. We also did not report constant terms and observations (which is 104,188) here to make the table succinct. UPH = unpaid hours, PH = paid or market hours, Z_1 = preschool child dummy, Z_2 = partner's life events, Z_3 = house ownership, Z_4 = partner's working status

Appendix 3

See Table 6

Table 6 Longitudinal IV estimates for overall couple sample aged 25–64, 2002–2019 for Western (white), Eastern (non-white), Australian-born, and ESB migrant samples (LIML estimator)

Variables	Western (white)		Eastern (non-white)		Australian-born		ESB migrants	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours 1st stage	Paid hours 2nd stage	Unpaid hours 1st stage	Paid hours 2nd stage	Unpaid hours 1st stage	Paid hours 2nd stage	Unpaid hours 1st stage	Paid hours 2nd stage
Unpaid time (hours)		−0.4715**		−0.4637**		−0.4802**		−0.5515**
		(0.014)		(0.062)		(0.013)		(0.062)
Excluded instruments								
Preschool child (yes = 1)	12.5938**		9.5181**		12.9659**		10.4610**	
	(0.317)		(1.091)		(0.329)		(1.080)	
Partner's life events (yes = 1)	0.2363		1.2676+		0.2775		0.0768	
	(0.165)		(0.695)		(0.171)		(0.512)	
Covariates								
Age	1.5758**	2.9699**	1.4228	3.3028**	1.7769**	2.8958**	0.4611	4.5425**
	(0.310)	(0.275)	(1.194)	(0.973)	(0.309)	(0.100)	(0.996)	(1.038)
Age-squared	−0.0182**	−0.0339**	−0.0173**	−0.0398**	−0.0193**	−0.0341**	−0.0177**	−0.0408**
	(0.001)	(0.001)	(0.005)	(0.003)	(0.001)	(0.001)	(0.004)	(0.003)
Tertiary education (yes = 1)	−0.4904	5.5388**	3.8402	5.9641+	−0.4421	5.7075**	−2.3007	2.5478
	(0.956)	(0.742)	(3.541)	(3.365)	(1.026)	(0.772)	(2.212)	(3.048)
SEIFA (1–10)	0.0285	0.0877+	0.1643	0.3667*	0.0688	0.0744	0.0588	0.2429

Table 6 (continued)

Variables	Western (white)		Eastern (non-white)		Australian-born		ESB migrants	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(0.072)	(0.047)	(0.242)	(0.164)	(0.081)	(0.050)	(0.180)	(0.150)
Household non-wage income ($000)	0.0036*	−0.0140**	0.0018	−0.0090+	0.0047**	−0.0135**	−0.0034	−0.0194**
	(0.002)	(0.001)	(0.007)	(0.005)	(0.002)	(0.002)	(0.005)	(0.004)
Self-assessed health (poor = 1)	−0.6302*	−2.4602**	−1.2359	−2.3017**	−0.5700*	−2.2757**	−0.7686	−3.4890**
	(0.267)	(0.220)	(1.234)	(0.716)	(0.290)	(0.237)	(0.798)	(0.718)
Life events (yes = 1)	0.1804	−0.5726**	−0.2055	−1.6427**	0.1487	−0.5840**	0.8651+	−0.1835
	(0.163)	(0.120)	(0.749)	(0.518)	(0.170)	(0.128)	(0.521)	(0.421)
Partner's self-assessed health (poor = 1)	0.2761	0.3810+	1.6367+	−0.4303	0.2713	0.4803*	0.8354	−0.1363
	(0.251)	(0.202)	(0.899)	(0.649)	(0.267)	(0.218)	(0.711)	(0.700)
Constant	−3.2309		1.7955		−11.8318		55.1232	
	(15.431)		(53.089)		(15.103)		(52.050)	
Observations	94,777	92,628	11,032	10,686	79,974	78,211	11,215	10,962
Number of groups	13,452	11,303	1,801	1,455	11,250	9,487	1,596	1,343
Instrumental variable tests								
First stage F-value for excluded instruments [Prob > F]	1677.5	[0.0000]	93	[0.0000]	1672.5	[0.0000]	103.6	[0.0000]
Underindentification test								
Kleibergen-Paap rk LM statistic [*P*-value]	2760.4	[0.0000]	156.9	[0.0000]	2699.0	[0.0000]	169.4	[0.0000]

Table 6 (continued)

Variables	Western (white)		Eastern (non-white)		Australian-born		ESB migrants	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Weak identification test								
Kleibergen-Paap rk Wald F statistic	1677.5		93.0		1672.5		103.6	
Stock-Yogo weak ID test critical val (10% maximal LIML size)	8.68		8.68		8.68		8.68	
Hansen J stats (overidentification test) Chi2 [*P*-value]	0.157	[0.4921]	0.698	[0.4035]	0.122	[0.7268]	3.224	[0.0726]
Endogeneity test of endogenous unpaid time								
Chi2 [*P*-value]	809.9	[0.0000]	54.3	[0.0000]	887.2	[0.0000]	61.6	[0.0000]

Robust standard errors in parentheses, significant at ** $p<0.01$, * $p<0.05$, + $p<0.1$. Models controlled for urbanity, state and year dummies

Appendix 4

See Table 7

Table 7 Longitudinal IV estimates (LIML estimator) for overall couple sample aged 25–64 using lag of health status

Variables	ESB&AU		NESCB		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Unpaid time (hours)		−0.5260**		−0.4680**		−0.5193**
		(0.0164)		(0.0793)		(0.0168)
Excluded instruments						
Preschool child (yes = 1)	11.5171**		8.0733**		11.4754**	
	(0.3586)		(1.2061)		(0.3590)	
Preschool child *NESCB					−3.2469**	
					(1.1693)	
Partner's life events (yes = 1)	0.5301**		1.6800*		0.5521**	
	(0.1776)		(0.7023)		(0.1824)	
Partner's life events*NESCB					1.0293+	
					(0.6112)	
Covariates						
Age	1.5695**	3.3777**	1.6081	3.3313**	1.6109**	3.3021**
	(0.3315)	(0.3024)	(1.1760)	(0.5800)	(0.3581)	(0.3156)
Age-squared	−0.0182**	−0.0358**	−0.0147*	−0.0352**	−0.0177**	−0.0356**

Table 7 (continued)

Variables	ESB&AU		NESCB		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(0.0014)	(0.0009)	(0.0057)	(0.0032)	(0.0015)	(0.0009)
Tertiary education (yes = 1)	−0.0689	5.5104**	5.7672	10.3313**	0.5413	5.9352**
	(1.0764)	(0.8708)	(3.6834)	(2.6169)	(1.0415)	(0.8322)
SEIFA (1–10)	0.0823	0.0971 +	0.1912	0.2111	0.0939	0.1241*
	(0.0821)	(0.0548)	(0.2742)	(0.1708)	(0.0847)	(0.0557)
Household non-wage income ($000)	0.0031*	−0.0132**	0.0053	−0.0035	0.0035*	−0.0121**
	(0.0016)	(0.0015)	(0.0071)	(0.0054)	(0.0016)	(0.0015)
Self-assessed health (lag) (poor = 1)	0.0476	−1.7490**	0.0098	−1.1252	0.0372	−1.6306**
	(0.2763)	(0.2383)	(1.1136)	(0.7561)	(0.3032)	(0.2374)
Life events (yes = 1)	1.3371**	−0.0766	0.8541	−1.2919**	1.2528**	−0.2598 +
	(0.1798)	(0.1385)	(0.7736)	(0.4949)	(0.1971)	(0.1427)
Partner's self-assessed health (lag) (poor = 1)	0.1889	0.0448	0.6328	−0.2695	0.2039	−0.0082
	(0.2886)	(0.2230)	(0.8563)	(0.7404)	(0.2885)	(0.2223)
Partner's self-assessed health (lag)*NESCB					0.3127	0.0337
					(0.9075)	(0.7474)
Constant	−5.1488		−14.0152		−8.3123	
	(16.3952)		(54.9333)		(17.7131)	
Observations	79,444	77,936	11,028	10,668	90,472	88,684
Number of groups	11,283	9,775	1,736	1,441	13,019	11,231

Robust standard errors in parentheses, significant at ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Models controlled for urbanity, state and year dummies

Appendix 5

See Table 8

Table 8 Longitudinal IV estimates for overall couple sample aged 25–64 using partner's life events as instrument (LIML estimator)

Variables	Overall		ESB&AU		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
Unpaid time (hours)		−0.439**		−0.538**		−0.435**
		(0.0513)		(0.0561)		(0.0576)
Excluded instruments						
Partner's life events (yes = 1)	0.6724**		0.5076**		0.6062**	
	(0.1835)		(0.1745)		(0.1789)	
Partner's life events*NESCB					0.4467	
					(0.5765)	
Partner's life events (lag) (yes = 1)	2.4292**		2.2779**		2.2817**	
	(0.1817)		(0.1672)		(0.1671)	
Partner's life events (lag)*NESB					0.8889	
					(0.6882)	
Covariates						
Age	1.4121**	2.9583**	1.4595**	3.2043**	1.3980**	2.9763**
	(0.3598)	(0.2988)	(0.3217)	(0.3062)	(0.3619)	(0.3019)
Age-squared	−0.018**	−0.035**	−0.018**	−0.036**	−0.017**	−0.035**

Table 8 (continued)

Variables	Overall		ESB&AU		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)
	Unpaid hours	Paid hours	Unpaid hours	Paid hours	Unpaid hours	Paid hours
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(0.0016)	(0.0012)	(0.0016)	(0.0013)	(0.0016)	(0.0013)
Tertiary education (yes = 1)	−0.0645	5.4176**	−0.5673	5.1968**	−0.0764	5.4629**
	(1.1483)	(0.7849)	(1.2127)	(0.8347)	(1.1525)	(0.7839)
SEIFA (1–10)	0.0598	0.1337**	0.0596	0.1164*	0.0530	0.1272*
	(0.0864)	(0.0511)	(0.0887)	(0.0540)	(0.0869)	(0.0512)
Household non-wage income ($000)	0.0029+	−0.0127**	0.0022	−0.0135**	0.0030+	−0.0127**
	(0.0016)	(0.0015)	(0.0016)	(0.0015)	(0.0016)	(0.0015)
Self-assessed health (poor = 1)	−0.7470*	−2.3035**	−0.5295+	−2.3672**	−0.7564*	−2.2761**
	(0.3211)	(0.2261)	(0.2946)	(0.2463)	(0.3230)	(0.2277)
Life events (yes = 1)	0.4226*	−0.7820**	0.6395**	−0.4534**	0.4062*	−0.8010**
	(0.1900)	(0.1383)	(0.1779)	(0.1440)	(0.1918)	(0.1403)
Partner's self-assessed health (poor = 1)	0.3024	0.3475+	0.3053	0.5415*	0.2988	0.4350*
	(0.2677)	(0.2024)	(0.2650)	(0.2236)	(0.2654)	(0.2122)
Partner's self-assessed health*NESCB					0.3345	−0.4009
					(0.9249)	(0.6240)
Constant	5.0733		2.4221		4.9335	
	(17.401)		(15.535)		(17.534)	
Observations	92,886	91,042	80,275	78,778	91,540	89,760

Table 8 (continued)

Variables	Overall		ESB&AU		Interacted model	
	(1)	(2)	(3)	(4)	(5)	(6)
	Unpaid hours 1st stage	Paid hours 2nd stage	Unpaid hours 1st stage	Paid hours 2nd stage	Unpaid hours 1st stage	Paid hours 2nd stage
Number of groups	13,332	11,488	11,294	9,797	13,052	11,272
Instrumental variable tests						
1st stage F-val for excluded instruments [Prob > F]	115.6	[0.0000]	108.9	[0.0000]	63.3	[0.0000]
Underindentification test						
Kleibergen-Paap rk LM statistic [*P*-value]	227.8	[0.0000]	217.0	[0.0000]	251.0	[0.0000]
Weak identification test						
Kleibergen-Paap rk Wald F statistic	115.6		108.9		63.3	
Stock-Yogo weak ID test critical value	8.68		8.68		8.68	
Hansen J stats (overid test) Chi2 [*P*-value]	0.5520	[0.4574]	0.5710	[0.4499]	1.5340	[0.2155]
Endogeneity test of endogenous unpaid time						
Chi2 [*P*-value]	54.6	[0.0000]	74.9	[0.0000]	65.8	[0.0000]

Robust standard errors in parentheses, significant at ** $p<0.01$, * $p<0.05$, + $p<0.1$. Models controlled for urbanity, state and year dummies. Note that due to small number of individuals in NESCB group experienced major life events due to its relatively small sample size, we used interacted models (columns 5 and 6) to improve the precision of the estimates

Acknowledgements This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey 2002-2019. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either DSS or the Melbourne Institute.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions. This paper is part of a larger project supported by an Australian Research Council Discovery Grant DP190100975.

Declarations

Conflict of interest The authors declare that there are no competing interests in conducting this research.

Ethical approval The current study uses a secondary dataset with an approved data access from the Melbourne Institute. Research Ethics approval was granted by Australian National University Human Ethics Committee, Ethics Approval Protocol: 2022/701.

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