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ABSTRACT

Labour Force Participation of Mature Age Men in Australia: The Role of Spousal Participation*

In this paper we estimate the interdependence of labour force participation decisions made by Australian couples from 2001 to 2011. We focus on couples with a mature age husband, and estimate the interdependence of the participation decision of the couple. We find that the decision of a wife to work or not influences positively, and in a causal fashion, the decision of her husband to work or not. In our paper we use counterfactual analysis to estimate the impact of the increasing labour force participation of a wife on her husband's participation. We find that the increased labour force participation of married women observed between 2002 and 2011 has been responsible for about a 4 percentage points increase in the participation of their mature age husbands.

JEL Classification: J14, J21

Keywords: labour force participation, spousal status, joint decision making, male employment trends, Australia

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1 Introduction

Since the mid-1990s, most Organization for Economic Cooperation and Development (OECD) countries, including the United States, the United Kingdom, Canada, Germany, Spain, France, and the Netherlands have witnessed a significant increase in the labour force participation rates of mature age men (Schirle, 2008). For Australia, the participation rate of such age men has significantly increased during the last decade. OECD countries view the retirement decisions of mature age people with great interest, mainly due to the demographic changes in Western economies and the pension implications of increased longevity (DEEWR, 2003; Buddelmeyer et al., 2010).

This paper focuses on one core aspect of labour force participation, namely on the interdependence of the participation decisions and outcomes of mature-age couples. Existing literature has shown that the retirement status of a wife significantly affects the retirement preference of a mature-aged husband. In contrast, wives seem to be less sensitive to the participation status of their husbands (Gustman and Steinmeier, 2000; Coile, 2004). In this paper we examine whether changes in mature age men's participation rates can be explained by the variation in their spousal participation rates. We also investigate how these relationships may have changed over time.

Using the Household, Income and Labour Dynamics in Australia (HILDA) Survey, we find that the participation rate of mature age men increased from 62 per cent in 2001 to 73 per cent in 2011 and, in the same period, the participation rate of their wives increased from 50 to 63 per cent. The first step of our analysis uses multivariate regression to estimate the labour force participation propensity of mature age men, and to examine how the participation of a husband may be influenced by the participation of his wife. In the general, the labour market context of the continuing increasing female participation, this relationship is important.

The second step of our analysis uses our multivariate regression results to decompose the degree to which the participation of a husband is dependent on his personal characteristics and circumstances, on the participation propensity of his wife, or on other, unobservable, factors. The use of participation estimation results to carry out decomposition analysis is important in the context of continual demographic and economic change. We find that the participation of men is influenced in a positive way by the participation of their wives. Our results suggest that increasing female labour force participation has a positive effect on male labour force participation through the increase in the labour supply of mature age husbands.

We develop our analysis further by modelling an important factor that has been ignored in the previous literature, namely that the labour force participation of mature age men may be persistent. Persistence refers to the cases where the individual's participation status in one period may be correlated with that of future periods. Without controlling for the persistence of the participation of a husband, the effect of the participation of his wife may be overstated when there is a positive correlation between the participation of the wife this year, and the participation of her husband in the previous year. Our regression and decomposition results show that the role of labour force participation of the wife in driving up her husband's participation rate can be overstated if the participation persistence of the husband is ignored. Estimation results confirm this by showing that the incorporation of persistence reduces the magnitude of the effect of the participation of a wife on the participation of her husband. Decomposition analysis using the method used by DiNardo et al. (1996) shows that 35 to 38 per cent of mature age men's increasing participation during the period from 2002 to 2011 is attributable to the growing labour force participation of their wives. The participation rate of mature age men would have been about 4 percentage points lower, had the participation rate of their wives not risen from 48 per cent in 2002 to 63 per cent in 2011.

The paper is organised as follows. We discuss data and recent trends in participation in Section 2. Section 3 describes the link between data and theory. Section 4 describes the empirical framework. Section 5 reports the main results. The last section concludes.

2 Data and Recent Trends in Participation

This paper uses the first 11 waves (2001-2011) of the HILDA survey. A detailed description of the data is in Wooden and Watson (2007). Starting from 2001, HILDA is Australia's first and only large-scale, nationally representative household panel survey. It collects rich information on people's demographics, education, labour market dynamics, and health status..

For this analysis, we focus on males aged between 55 and 64. Australian mature age men and their spouses are matched using household and relationship identifiers in the data. Couples where the husband or the wife have unknown or missing labour force status are excluded. Observations with missing information on any key variables displayed in Table 1 are also dropped. We also exclude from the sample any husband who is more than 15 years younger or older than his wife, as the labour supply behaviour of couples with extreme age differences can be quite different. This gives us a final sample of 6,684 person-years from 2001 to 2011.

Table 1 presents the summary statistics of Australian mature age men's labour force participation and other key variables used for this study. For all married men, the participation rate has risen from 0.62 in 2001 to 0.73 in 2011. The trend of increasing participation in Australia is similar to the corresponding trends in the United States, the United Kingdom, and Canada. During the same time, the spousal participation rate of these men increased substantially from 0.50 in 2001 to 0.63 in 2011-an increment of 13 percentage points. One interesting observation is that most of the increase in the participation of men took place during the period from 2001 to 2007, when the rate climbed from 0.62 to 0.72. During the remaining years in the data (2008–2011), the participation rate was largely unchanged-from 0.70 in 2008 to 0.73 in 2011. Interestingly, the same pattern also held for their spouses. Female participation increased from 0.50 in 2001 to 0.61 in 2007, but remained very stable at around 0.63 during the period from 2008 to 2011. It seems that the labour force participation rates for both mature age men and their wives increased following a shared direction and speed.

Table 1: Characteristics of Married Men Aged 55–64, Australia

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Participation rate	0.62	0.63	0.66	0.68	0.68	0.71	0.72	0.70	0.73	0.73	0.73
Age	59.33	59.25	59.05	59.10	59.16	59.13	59.23	59.31	59.32	59.40	59.55
Education:											
Year 12 and below	0.45	0.43	0.43	0.43	0.42	0.40	0.37	0.36	0.35	0.33	0.31
Diploma or certificate	0.41	0.40	0.37	0.36	0.36	0.38	0.39	0.40	0.39	0.39	0.41
University degree	0.15	0.17	0.20	0.20	0.21	0.22	0.24	0.24	0.25	0.28	0.28
Number of children	0.48	0.45	0.46	0.43	0.42	0.48	0.45	0.48	0.50	0.54	0.56
Not born in English–speaking country	0.20	0.19	0.17	0.15	0.15	0.14	0.12	0.13	0.13	0.13	0.14
Long–term health condition	0.38	0.36	0.42	0.39	0.42	0.40	0.39	0.39	0.38	0.37	0.35
Area:											
Major city	0.58	0.59	0.58	0.56	0.57	0.58	0.56	0.56	0.55	0.56	0.58
Regional or remote Australia	0.42	0.41	0.42	0.44	0.43	0.42	0.44	0.44	0.45	0.44	0.42
State:											
NSW	0.32	0.30	0.29	0.28	0.29	0.29	0.30	0.30	0.30	0.30	0.31
VIC	0.27	0.27	0.27	0.26	0.26	0.26	0.23	0.23	0.21	0.23	0.22
QLD	0.18	0.18	0.20	0.20	0.19	0.19	0.19	0.20	0.21	0.19	0.19
SA	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.10	0.11	0.11	0.12
WA	0.10	0.10	0.11	0.11	0.11	0.11	0.10	0.11	0.11	0.12	0.11
TAS	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.02
NT	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
ACT	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Spouse:											
Participation rate	0.50	0.48	0.52	0.54	0.56	0.59	0.61	0.63	0.64	0.63	0.63
Age	56.11	55.99	55.77	55.98	56.03	56.20	56.32	56.37	56.30	56.53	56.79
Age difference	3.23	3.26	3.28	3.12	3.13	2.97	2.92	2.94	3.01	2.88	2.76
Mother employed when wife was 14	0.37	0.38	0.38	0.40	0.42	0.44	0.43	0.43	0.46	0.46	0.47
Observations	631	571	584	552	575	565	561	586	636	613	810

Note: Data Source: HILDA, 2001–2011.

Before we examine the contents of Table 1 in more detail, we examine the relationship between the participation of husbands and wives more closely. Table 2 presents the labour force participation rates of (i) all mature age married men; (ii) all mature age men with a participating wife; and (iii) all mature age men with a non-participating wife. Table 2 reveals three broad patterns: (i) the participation rates are much higher for those men whose wives are in the labour force; (ii) the proportions of men in the labour force with participating wives remain relatively stable between 2001 and 2011; (iii) in contrast, the participation rates of husbands with a non-participating wife increased significantly from 0.42 in 2001 to 0.51 in 2011.

Patterns (ii) and (iii) indicate that the increase in the participation of wives that we observed in Table 1 (from 50 per cent in 2001 to 63 per cent in 2011) cannot be the sole reason for the increase in the participation rate of their husbands (from 62 per cent in 2001 to 73 per cent in 2011). However, Tables 1 and 2, jointly, suggest that the increase in the participation of wives is indeed an important reason. Over the whole observation period, a mature age man with a participating wife is 37 percentage points (0.85-0.48) more likely to be a labour force participant than a mature age man with a non-participating wife. Observation of the trend of this difference shows that the participation rate of men with a participating wife increased by only 3 percentage points between 2001 and 2011 (from 83 to 86 per cent), while for men with a non-participating wife the corresponding increase was 9 percentage points (from 42 to 51 per cent).

We now return to the broad content of Table 1, which presents, by year, the means for all control variables that we use in our analysis. These are largely factors that can be expected to influence or to at least be correlated with the labour force participation decision. Like most labour market decisions, the retirement decisions of mature age men will be associated with or affected by their education levels. Age can be expected to play a role in many ways, including the preference for leisure, where we know that, on average, an individual's marginal utility of leisure increases with age. We would therefore expect that age would exert a positive influence on the propensity to retire.

We account for the number of children within the household, whether the husband was

Table 2: Participation Rates of Mature Age Men

	All Married Men	Wife in Labour Force	Wife not in in Labour Force
2001	0.62	0.83	0.42
2002	0.63	0.84	0.44
2003	0.66	0.84	0.47
2004	0.68	0.83	0.49
2005	0.68	0.83	0.49
2006	0.71	0.85	0.49
2007	0.72	0.87	0.48
2008	0.70	0.85	0.46
2009	0.73	0.86	0.50
2010	0.73	0.85	0.52
2011	0.73	0.86	0.51
All years	0.69	0.85	0.48

Note: Data Source: HILDA, 2001–2011.

born in a non-English-speaking country, and whether he has a long-term health condition. Whether the husband has a long-term health condition, as several studies have demonstrated, is a significant determinant of retirement decisions (Au et al., 2005; Dwyer and Mitchell, 1999). Similarly, whether the husband was not born in an English-speaking country may influence labour force participation. The inclusion of a region variable (whether the husband lives in a major city or in a regional or remote area in Australia), and the set of variables indicating the State or Territory of residence serve to control for the labour market conditions which face each individual. We also report wife-related information, namely the age of the wife and the age difference between the couple. The larger the age gap between husband and wife, the more likely it is that the retirement of the husband may be financially supported by the income of the working wife. In this sense, controlling for the age difference between the couple would serve to capture some of the income effect stemming from the participation of the wife.

3 Linking Theory with Data

How could the participation decision of a married woman influence the participation of her husband? There will be an income effect, which predicts that a husband will work less when his wife works. The reason is that when the wife works, she will bring more income to the family so that the husband will be able to afford to buy more of all the goods of which he would like to have more, including leisure time. The income effect is expected to increase the husband's consumption of leisure time and to reduce his propensity to participate in the labour force, which means the income effect is always negative.

There will also be a substitution effect, which will be a bit more complex. If the couple make independent leisure decisions, then the substitution effect should not affect the decision of the husband to work or not, in which case there will be no substitution effect. If the couple make interdependent leisure decisions, and they prefer to share leisure time together (positive preference for shared leisure), then the decision of the wife to participate should make it more likely that the husband will also decide to participate, in which case the substitution effect will be positive. If the couple make interdependent leisure decisions, but they prefer not to share leisure time together (negative preference for shared leisure), then the decision of the wife to participate should make it less likely that the husband will also decide to participate, in which case the substitution effect will be negative. The actual substitution effect can be expected to vary between couples, and its direction cannot be predicted.

The sum of the income and substitution effects will form the overall participation effect observed in our data. If estimation shows that the overall impact is non-negative, we will not be able to draw any definite conclusions. If we find a positive overall impact, then we will have evidence to suggest that, on average, the couples in our data have a positive preference for shared leisure.

4 Empirical Methodology

Our empirical approach has three steps. In the first step, we use a probit model to estimate the effect of the wife's labour force participation on her husband's participation, treating the wife's status as exogenous; in the second step, we use a bivariate probit model to estimate the joint participation decisions among couples, treating the participation status of the wife as an endogenous variable, the variation of which is modelled using the instrumental variable approach. The final step applies the method of DiNardo et al. (1996) to the probit and the bivariate probit estimates to decompose the estimated change in mature age men's participation rates into several constituents.

4.1 Probit Regression

Following Schirle (2008), we write the husband' labour force participation decision as:

$$L_{it}^{H*} = U^H(C_{it}, L_{it}^H, X_{it}^H, L_{it}^W | L_{it}^H = 1) - U^H(C_{it}, L_{it}^H, X_{it}^H, L_{it}^W | L_{it}^H = 0) \tag{1}$$

where C_{it} denotes the normal consumption goods, X_{it} are the vector of husband's individual characteristics, and L_{it}^H and L_{it}^W respectively represent the labour force participation status of the husband and his wife. If the utility U^H from participating in the workforce $U^H(C_{it}, L_{it}^H, X_{it}^H, L_{it}^W|L_{it}^H{=}1)$ exceeds the utility from non–participation $U^H(C_{it}, L_{it}^H, X_{it}^H, L_{it}^W|L_{it}^H{=}0)$, the husband will decide to join the labour force.

Suppose equation (1) takes a linear form, the model we can write:

$$L_{it}^{H*} = \gamma^H L_{it}^W + X_{it}\beta^H + \varepsilon_{it}^H \tag{2}$$

which can be estimated using the probit model. The sign of the parameter γ^H shows whether a wife's participation in the labour force will increase her husband's participation or not.

4.2 Bivariate Probit Regression

Now consider that husbands' and wives' labour supply decisions are jointly determined, and their supply decisions are described by the latent variables L_{it}^{H*} and L_{it}^{W*}. Similarly, using linear specifications, a couple's participating decisions can be described as:

$$L_{it}^{H*} = \gamma^H L_{it}^W + X_{it}\beta^H + \varepsilon_{it}^H \tag{3}$$

$$L_{it}^{W*} = X_{it}\beta^W + Z_{it}^W \delta^W + \varepsilon_{it}^W \tag{4}$$

Equations (3) and (4) can be regarded as the normal two–stage least squares estimation problem. We expect γ^H to be positive if the shared leisure effect dominates the income effect. It should be noted that the identification of the model relies on the exclusion of Z_{it}^W from the husband's equation (3). This implies that we need to find at least one variable that affects a wife's labour participation, but not her husband's.

In this analysis, Z_{it}^W is defined as a binary variable which is equal to 1 if the wife's mother was employed when the wife was 14 years old, and 0 otherwise. The logic behind the choice of the instrument is that a mother's employment preferences will affect her daughter's through familial and intergenerational transmission of working preferences (Del Boca et al., 2000; Neumark and Postlewaite, 1998; Morrill and Morrill, 2013). However, mother–in–law's employment status many years ago (when the wife was only 14) should not affect her daughter's husband's current participation in the labour force (when the husband is aged between 55 and 64) in the same way, if at all.

4.3 Decomposition methodology

We follow the work of DiNardo et al. (1996) to decompose the change in mature age men's participation rates during 2002–2011 in Australia.

The decomposition consists of two stages. In each stage of the decomposition, counterfactual participation rates are created representing what the participation rate in 2011 would have been if each factor had remained at its 2002 levels. We begin by adjusting the 2002 participation rate for changes in mature age men's characteristics, followed by adjusting this participation rate for changes in the likelihood of married women to participate in the labor force.

Let t denote year 2011 and s denote year 2002. The probability that a husband participates in the labour force at time t is given by:

$$P_t(L^H = 1) = \sum_{x^H} \sum_{l^W} P_t(L^H = 1, X^H = x^H, L^W = l^W) \tag{5}$$

The first stage of the decomposition gives the counterfactual probability of labour force participation of year 2011, had old men's characteristics X^H remained at the 2002 level, with the wives' participation status L^W still at the 2011 level. The counterfactual probability is given by:

$$P_{c1,t}(L^H = 1) = \sum_{x^H} \sum_{l^W} P_t(L^H = 1, X^H = x^H, L^W = l^W) * \psi_{X^H|L^W} \tag{6}$$

where the reweighting function $\psi_{X^H|L^W}=\frac{P_s(X^H=x^H|L^W=l^W)}{P_t(X^H=x^H|L^W=l^W)}$ captures the changes that have occurred in the distribution of mature age men's characteristics between year s and year t.

For the second stage of the decomposition, a second counterfactual probability is created that also accounts for changes in older wives likelihood to participate in the labour force. That is, the counterfactual probability is

$$P_{c2,t}(L^H = 1) = \sum_{x^H} \sum_{l^W} P_t(L^H = 1, X^H = x^H, L^W = l^W) * \psi_{X^H|L^W} * \psi_{L^W} \tag{7}$$

where the second reweighting function $\psi_{L^W}=\frac{P_s(L^W=l^W)}{P_t(L^W=l^W)}$ captures the changes in older wives' participation decisions. This second counterfactual probability represents the probability that an old man will be a labour force participant in the year 2011, keeping the old man's characteristics X^H and his wife's participation status L^W, both at their 2002 levels.

The decomposition relies on the estimation of the two reweighting functions $\psi_{X^H|L^W}$ and ψ_{L^W}. The first reweighting function $\psi_{X^H|L^W}$ is equal to $\frac{P(T=s|X^H=x^H,L^W=l^W)/P(T=s|L^W=l^W)}{P(T=t|X^H=x^H,L^W=l^W)/P(T=t|L^W=l^W)}$, using the Bayes's rule. $P(T=t|X^H=x^H, L^W=l^W)$ is the predicted probability obtained from a probit regression of the time dummy $(T=t)$ on covariates X^H and the wife's participation variable L^W. Probability $P(T=t|L^W=l^W)$ is similarly estimated using a probit model with the wife's participation L^W as the only covariate.

The second reweighting function $\psi_{L^W}=\frac{P_s(L^W=l^W)}{P_t(L^W=l^W)}$ is equal to $\frac{P_s(L^W=1)}{P_t(L^W=1)}$ when $L^W=1$, and is equal $\frac{P_s(L^W=0)}{P_t(L^W=0)}$ to when $L^W=0$. As L^W is a binary variable, $P_s(L^W=1)$ is the participation rate of wives in year s. Other probabilities are estimated in a similar way.

With the two reweighting probability variables, we can obtain the counterfactual estimates, and quantify and decompose the contributions of (i) men's characteristics, (ii) their wives' labour force participation, and (iii) unexplained effects, to the total observed change in mature age men's participation rates in Australia during the last decade.

5 Estimation Results

5.1 Probit and Bivariate Probit Estimation Results

As discussed in the methodology section, we estimate the relationship between the labour force participation of the husband and that of their wife using a probit model, which assumes the two decisions are made independently, and a bivariate probit model, which assumes the two decisions are interdependent. We employ two sets of control variables to represent the factors that may influence the participation decision. Besides the participation status of wives, the baseline estimation includes the husband's education dummies, age, and the number of children in the household as characteristics that would affect his participation decision. A full set of year dummies is also included. The baseline estimation has been designed to have the same set of variables as Schirle (2008), principally for reasons of comparability. As the data set we use is sufficiently rich, we build a second specification which adds variables indicating whether the husband was not born in an English-speaking country, whether the husband has a long-term health condition, the age of the wife, a dummy variable indicating whether the husband is working in a major city in Australia, and a full set of State dummies.

The probit estimation results are presented in Table 3. The baseline specification shows that there is a large positive and significant association between the labour force participation of the wife and that of her husband. The model estimates that the participation of the wife will increase the participation of her husband by 33 percentage points. This estimate is much larger than the estimates found for the United States (18.6 percentage points), the United Kingdom (22.8 percentage points), and Canada (26.8 percentage points) in Schirle (2008), who uses the same set of control variables as in our basic specification. The introduction of additional controls in the augmented second specification, lowers the estimated effect of the participation of the wife and the age and education of the husband on the participation of the husband. The impact of the participation of the wife on the participation of her husband is reduced in the second specification-down to 21 percentage points.

Table 3: Probit Model Estimates

	(1)		(2)	
	Coefficient	Marginal effect	Coefficient	Marginal effect
Wife in labour force	0.969	0.326	0.986	0.214
	(0.029)	(0.014)	(0.033)	(0.022)
Age	–0.105	–0.025	–0.114	–0.013
	(0.006)	(0.003)	(0.007)	(0.002)
Education:				
Year 12 and below				
Certificate or diploma	0.076	0.019	0.039	0.004
	(0.033)	(0.009)	(0.036)	(0.004)
University degree	0.383	0.074	0.240	0.022
	(0.052)	(0.012)	(0.054)	(0.006)
Number of children	–0.023	–0.006	0.036	0.004
	(0.022)	(0.005)	(0.024)	(0.004)
Not born in English–speaking country			–0.352	–0.051
			(0.057)	(0.013)
Long–term health condition			–0.846	–0.170
			(0.045)	(0.021)
Wife age			0.015	0.002
			(0.007)	(0.001)
Major city			0.111	0.013
			(0.042)	(0.005)
Constant	6.056		6.071	
	(0.366)		(0.389)	
State dummy	NO		YES	
Year dummy	YES		YES	

Note: The dependent variable is husband's participation in labour force. Standard errors are in parentheses. Sample included married men aged 55–64 in 2001–2011. Marginal effects are evaluated for men with the following characteristics: wife in labour force; 60 years old; with certificate or diploma; no children at home; born in an English–speaking country; no long–term health condition; wife aged 55; living in a major city in Victoria and in wave 2006.

Education is also found to influence Australian mature age men's participation significantly. Better-educated mature age men are more likely to participate in the labour force. Moreover, age has a negative impact on the participation decision, which is consistent with the expectation that older people have a stronger preference for leisure and are more likely to retire than younger people are. We do not find a significant association between the number of children in the household and mature age men's labour force participation decisions. If a man has a long-term health condition, he is 17 percentage points less likely to join the workforce. Being born in a non-English-speaking country also serves as a barrier to men's participation in the labour force. Interestingly, we do find that husbands are more likely to participate in the labour force if their wives are older, which means that a younger wife is more likely to have a non-participating husband.

The probit model assumes that the labour force participation decisions of a wife and her husband are independent of one another. As we consider this assumption of independence to be unrealistic, we model the interdependence using a bivariate probit model. The identification of the model relies on the availability of at least one variable that can influence the participation decision of the wife, but not that of her husband. The variable we use is a binary indicator of whether or not the mother of the wife was in paid employment when the wife was 14 years old. Recall that our choice of instrument is based on evidence that a mother's employment preferences will influence her daughter's preferences through familial and intergenerational transmission of working preferences. At the same time, it is sensible to expect that the employment status of the mother-in-law so many years ago (when the wife was only 14) should not have any influence on the current participation of the husband (especially when the husband is aged between 55 and 64).

The bivariate probit estimation results are displayed in Table 4. The ρs, which indicate the correlation between the unobservable characteristics between husband's and wife's participation equations-are all statistically significant, indicating that the participation decisions are indeed made jointly.[1] The coefficient of the instrumental variable indicating whether wife's mother was in paid employment is highly significant in both specifications. The F-statistics on the excluded instrument are respectively 27.23 and 18.40.3 Estimation results using the baseline specification show that wives whose mother was employed when they were 14 are 7.5 percentage points more likely to participate today.

Table 4 shows that whether the wife participates or not has a large, positive, and signif-

[1]This finding supports our choice of a decomposition methodology that controls for unobservables.

Table 4: Bivariate Probit Model Estimates

	(1)				(2)			
	Husband		Wife		Husband		Wife	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Wife in labour force	1.601	0.543			1.916	0.564		
	(0.346)	(0.115)			(0.117)	(0.055)		
Age	–0.074	–0.015	–0.101	–0.034	–0.087	–0.009	–0.034	–0.009
	(0.021)	(0.006)	(0.005)	(0.002)	(0.009)	(0.002)	(0.007)	(0.002)
Education:								
Year 12 and below								
Certificate or diploma	0.049	0.010	0.083	0.029	0.009	0.001	0.064	0.017
	(0.037)	(0.008)	(0.031)	(0.010)	(0.035)	(0.004)	(0.033)	(0.008)
University degree	0.316	0.051	0.189	0.059	0.162	0.015	0.139	0.033
	(0.070)	(0.015)	(0.048)	(0.013)	(0.050)	(0.005)	(0.048)	(0.009)
Number of children	–0.039	–0.008	0.066	0.022	0.041	0.004	–0.017	–0.004
	(0.022)	(0.004)	(0.024)	(0.008)	(0.024)	(0.003)	(0.024)	(0.006)
Not born in English–speaking country					–0.193	–0.024	–0.339	–0.095
					(0.059)	(0.009)	(0.044)	(0.016)
Long–term health condition					–0.647	–0.113	–0.294	–0.082
					(0.057)	(0.017)	(0.033)	(0.010)
Wife age					0.040	0.004	–0.074	–0.008
					(0.005)	(0.001)	(0.004)	(0.001)
Major city					0.103	0.012	–0.022	–0.008
					(0.044)	(0.005)	(0.041)	(0.010)
Wife's mother was employed when wife was 14			0.216	0.075			0.182	0.050
			(0.041)	(0.015)			(0.043)	(0.012)
Constant	3.882		5.831		2.491		6.301	
	(1.429)		(0.305)		(0.691)		(0.293)	
State dummy	NO		NO		YES		YES	
Year dummy	YES		YES		YES		YES	
ρ	0.422				–0.639			
	(0.249)				(0.088)			

Note: The dependent variable is husband's participation in labour force. Standard errors are in parentheses. Sample included married men aged 55–64 in 2001–2011. Marginal effects are evaluated for men with the following characteristics (where applicable): wife in labour force; 60 years old; with certificate or diploma; no children at home; born in an English–speaking country; no long–term health condition; wife aged 55; living in a major city in Victoria and in wave 2006 icant effect on whether the husband participates. Both model specifications show similar results regarding the effect of the participation of a wife. If a wife is in the labour force, her husband is about 55 percentage points more likely to participate, and this marginal effect is also much larger than the estimates produced by Schirle (2008) using the same basic specification for the United States (21.9 percentage points), the United Kingdom (19.8 percentage points), and Canada (19.1 percentage points). We note that when we model the interdependence of the decisions (Table 4) the estimated effect of the participation of the wife on the participation of her husband is much larger than when we do not (Table 3).

5.2 Considering the Effects of Persistence in the Labour Force Participation of Husbands

The existing literature has shown that the labour market status is highly likely to be persistence over time (Stewart, 2007; Buddelmeyer et al., 2010). We find this also to be true for the labour force participation of mature age men. The HILDA data show that the pair-wise correlation coefficient between the participation of the husbands in two consecutive years is as high as 0.768, which means that if a husband was in the labour force in the last year, he is very likely to be in the labour force this year. A simple OLS regression of the participation variable in period t on the participation status in period $t-1$ (without using other controls) reveals that a mature age husband is 79 per cent more likely to participate in the labour force if he participated in the previous period. The R^2 obtained from the simple regression shows that 59 per cent of the variation of participation status in period t can be explained by the status in period $t-1$, which means that this is a strong fit.

Ignoring the persistence in the labour force participation of mature age men may bias our estimates, because the participation statuses are highly and positively correlated between consecutive periods, and participation of wives has a positive effect on that of their husbands. Without controlling for the persistence of the participation of husbands, the effect of the participation of the wives is likely to be overstated. In this section, we report the results when the persistence of husbands' participation is also included in the estimation.

Table 5: Probit Model Estimates with State Dependence

	(3)		(4)	
	Coefficient	Marginal effect	Coefficient	Marginal effect
Wife in labour force	0.599	0.191	0.650	0.079
	(0.048)	(0.016)	(0.051)	(0.017)
Lagged husband participation	2.346	0.736	2.228	0.605
	(0.052)	(0.018)	(0.056)	(0.039)
Age	–0.073	–0.010	–0.081	–0.005
	(0.011)	(0.002)	(0.012)	(0.002)
Education:				
Year 12 and below				
Certificate or diploma	0.079	0.011	0.055	0.004
	(0.044)	(0.006)	(0.047)	(0.004)
University degree	0.205	0.023	0.148	0.009
	(0.064)	(0.007)	(0.069)	(0.004)
Number of children	–0.012	–0.002	0.022	0.001
	(0.038)	(0.005)	(0.041)	(0.003)
Not born in English–speaking country			–0.213 (0.079)	–0.018 (0.009)
Long–term health condition			–0.577 (0.060)	–0.066 (0.013)
Wife age			0.010	0.001
			(0.007)	(0.001)
Major city			0.095	0.007
			(0.055)	(0.005)
Constant	2.947		3.116	
	(0.680)		(0.650)	
State dummy	NO		YES	
Year dummy	YES		YES	

Note: The dependent variable is husband's participation in labour force. Standard errors are in parentheses. Sample included married men aged 55–64 in 2001–2011. Marginal effects are evaluated for men with the following characteristics: wife in labour force; participation in the labour force in the previous year; 60 years old; with certificate or diploma; no children at home; born in an English–speaking country; no long–term health condition; wife aged 55; living in a major city in Victoria and in wave 2006.

Table 5 reports the probit estimation results when we include the lag of the labour force participation variable as an additional control. As expected, the coefficient estimate of this variable turns out to be very significant and sizeable. Using our baseline (shorter) specification in Model (3) shows that participating in the previous period will increase the participation propensity in the current period by 73.6 percentage points. Correspondingly, the effect of the participation of wives on the participation of husbands has substantially decreased from 32.6 per cent (in Table 3) to 19.1 per cent in Table 5. Model (4) in Table 5 reports the results when the additional controls are used. The marginal effect of wives' participation is even smaller, decreasing from 21.4 per cent (in Table 3) to only 7.9 per cent (in Model (4), Table 5).

Table 6 displays the bivariate probit estimation results with persistence in men's participation being taken account. The estimate of the correlation between the unobservable variables in the two equations becomes statistically insignificant in both of the specifications, after controlling for the persistence in the participation of husbands. The instrumental variable is not weak and has sufficient power in our specifications (F- statistic = 17.19, 10.94 respectively). The bivariate probit models also show that participation in the previous period has a large and significant impact on the current period's participation in the labour force. The marginal effects of a wife in the labour force are considerably smaller than those reported in Table 4, although they are still slightly larger than the corresponding probit estimates reported in Table 5. Model (3) shows that a husband is 24 per cent more likely to participate in the labour market if his wife also participates; and Model (4) shows that the magnitude of the marginal effect is much smaller (only 10 per cent) when including additional controls in the estimation.

5.3 Summing up the Regression Results

Our probit estimation results have shown that the labour market participation of a wife is positively associated with the participation of the husband. That is, mature age husbands with wives who work are more likely to be working themselves. Our bivariate probit estimation went further, and tested the proposition that part of the correlation between the work of a husband and wife may be due to the causal impact of the labour force participation of the wife on the participation of the husband. The bivariate probit results clearly suggest that the decision of a wife to work has a (positive) causal effect on the decision of the husband to work. Our further analysis on the persistence of participation showed that employment is indeed a persistent labour market state, in that people who

Table 6: Bivariate Probit Model Estimates with State Dependence

	(3)				(4)			
	Husband		Wife		Husband		Wife	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Wife in labour force	1.071	0.240			0.773	0.099		
	(0.466)	(0.139)			(0.368)	(0.060)		
Lagged husband participation	2.123	0.641	0.940	0.360	2.182	0.578	0.962	0.356
	(0.279)	(0.122)	(0.032)	(0.012)	(0.161)	(0.085)	(0.036)	(0.018)
Age	–0.058	–0.006	–0.077	–0.026	–0.080	–0.005	–0.011	–0.003
	(0.020)	(0.003)	(0.011)	(0.003)	(0.012)	(0.002)	(0.010)	(0.003)
Education:								
Year 12 and below								
Certificate or diploma	0.067	0.008	0.048	0.017	0.053	0.004	0.045	0.014
	(0.045)	(0.006)	(0.039)	(0.013)	(0.049)	(0.004)	(0.042)	(0.012)
University degree	0.195	0.018	0.022	0.007	0.147	0.008	0.027	0.008
	(0.065)	(0.007)	(0.049)	(0.007)	(0.069)	(0.004)	(0.050)	(0.014)
Number of children	–0.031	–0.003	0.128	0.043	0.022	0.001	0.017	0.005
	(0.036)	(0.004)	(0.029)	(0.010)	(0.040)	(0.003)	(0.030)	(0.009)
Not born in English–speaking country					–0.206	–0.016	–0.163	–0.052
					(0.078)	(0.008)	(0.055)	(0.018)
Long–term health condition					–0.575	–0.062	–0.032	–0.010
					(0.061)	(0.014)	(0.045)	(0.014)
Wife age					0.013	0.001	–0.080	–0.024
					(0.012)	(0.001)	(0.005)	(0.002)
Major city					0.097	0.007	–0.076	–0.022
					(0.055)	(0.005)	(0.053)	(0.016)
Wife's mother was employed when wife was 14			0.213	0.076			0.192	0.061
			(0.051)	(0.018)			(0.058)	(0.018)
Constant	1.931		4.060		2.838		4.826	
	(1.284)		(0.469)		(1.116)		(0.470)	
State dummy	NO		NO		YES		YES	
Year dummy	YES		YES		YES		YES	
ρ	–0.289				–0.074			
	(0.282)				(0.213)			

Note: The dependent variable is husband's participation in labour force. Standard errors are in parentheses. Sample included married men aged 55–64 in 2001–2011. Marginal effects are evaluated for men with the following characteristics (where applicable): wife in labour force; participation in the labour force in the previous year; 60 years old; with certificate or diploma; no children at home; born in an English–speaking country; no long–term health condition; wife aged 55; living in a major city in Victoria and in wave 2006.

are employed today are more likely to be employed tomorrow, the difference in the participation probability being present over and above the difference that can be explained by the conventionally observed characteristics of those who work and those who do not work.

The next section takes these results and develops them in the context of one of the most important labour market trends of our times, namely the continually increasing female labour force participation rate. The objective is to form an understanding of the degree to which increasing female labour force participation may have had a beneficial effect on the participation of males through the workings of couples' joint decision-making.

5.4 Decomposition Results

This section focuses on the trend in labour force participation of mature age husbands and how this relates to the labour force participation of their wives. We apply the methodology proposed by DiNardo et al. (1996) to decompose observed changes between two points in time into several parts. More specifically, we take the estimated change in the participation of mature age husbands between 2002 and 2011 (from about 63 per cent to 73 per cent) and decompose it into the part attributed to (i) the change in the labour force participation of their wives, (ii) the change in their characteristics measured by our data, and (iii) the change in all remaining factors that are not observed in our data.

Table 7 presents two sets of estimates. The upper panel is based on the simple probit model which assumes the independence of the participation decision. The second set of estimates is based on the bivariate probit model estimates and these form our main results.

We separately report the decomposition results corresponding to the four different sets of controls that were presented in tables 3, 4, 5, and 6. We first look at the decomposition results based on the probit estimates with model specification (1). The result shows that men's participation rates would have been 6.7 points lower in 2011 had their wives' participation rates not increased by 15 percentage points during the last decade; this means that about 56 per cent of the total rise in mature age men's participation rates observed between 2001 and 2011 can be explained by the effects of the increasing participation of their wives.

Table 7: DiNardo et al. (1996) Decomposition Results

Based on Probit Estimates	Without State Dependence		With State Dependence	
	(1)	(2)	(3)	(4)
Predicted participation rate, 2002	0.602	0.603	0.605	0.608
Predicted participation rate, 2011	0.721	0.718	0.720	0.719
Total Change	0.119	0.115	0.115	0.112
Effect of:				
Change in wives' participation	0.067	0.068	0.041	0.043
	(56.3%)	(59.1%)	(36.7%)	(38.4%)
Change in men's characteristics	0.006	0.007	0.065	0.063
	(5.0%)	(6.1%)	(56.5%)	(56.3%)
Unexplained effects	0.046	0.040	0.009	0.006
	(38.7%)	(34.8%)	(7.8%)	(5.44%)
Based on Bivariate Probit Estimates	Without State Dependence		With State Dependence	
	(1)	(2)	(3)	(4)
Predicted participation rate, 2002	0.577	0.571	0.599	0.601
Predicted participation rate, 2011	0.689	0.688	0.714	0.717
Total Change	0.112	0.117	0.115	0.116
Effect of:				
Change in wives' participation	0.097	0.094	0.040	0.044
	(86.6%)	(80.3%)	(34.8%)	(37.9%)
Change in men's characteristics	0.007	0.015	0.075	0.072
	(6.3%)	(12.8%)	(64.3%)	(57.8%)
Unexplained effects	0.008	0.008	–0.001	–0.005
	(7.1%)	(6.8%)	(–0.9%)	(–4.3%)

Note: Figures in parentheses are percentages of total change explained by the change in the factor.
Specification (1): wife in labour force, men's age, education, number of children and year dummies;
Specification (2): variables in specification (1), not born in an English–speaking country, with long–term health condition, wife age, living in a major city and year dummies;
Specification (3): variables in specification (1) and lagged husband labour force participation;
Specification (4): variables in specification (2) and lagged husband labour force participation.

Men's participation rate would have been 0.6 percentage points lower if men's characteristics in 2011 were the same as they were in 2002. This only explains 5 per cent of the increase in participation rates from 2002 to 2011, which is small but expected. Table 1 indicates that mature age men are slightly older in 2011 than in 2002, and the probit estimation results show that older men are less likely to be in the labour force. As a result, we expect that the change in age structure between 2002 and 2011 would be in part responsible for the lower participation rate of men in 2011. However, Table 1 also reveals that men in 2011 are better educated. Better educated people are more likely to participate in the labour force, so the change in education levels has helped to drive up the labour force participation rate over time. The negative effect from the change in age structure and the positive effect from the better educated men in 2011 combine to produce a positive effect of 0.6 percentage points in total. In addition, the unexplained effects, which estimate the contribution of factors omitted from the model account for 39 per cent of the increase in the participation rates of men. The decomposition results using specification (2), in which more controls are used, closely resemble the results from specification (1).

When the lagged labour force participation of the husband is included in the estimation, the decomposition results for specifications (3) and (4) show that the participation status of their wives accounts for only 37 to 38 per cent of the observed increase in men's participation. Interestingly, the contribution made by the change in the characteristics of men increased from 0.6 percentage points to over 6.3 percentage points. The effect of the participation of the husband in the previous period, which was a major component of the unexplained effects for specifications (1) and (2) (and also a component in wives' contribution because of the correlation between the past participation of husbands and the current participation of wives) is now primarily driven by the contribution of the change in men's characteristics for specifications (3) and (4).[2]

[2] We know that husbands' past and current participation are highly correlated (in the decomposition sample, 0.762) and wives' participation are also correlated with husbands' participation (0.406), so statistically, there is a correlation between husband's past participation and wives' current participation. The decomposition sample shows a correlation coefficient of 0.374 between husbands' past participation and wives' current participation. As a result, part of the contribution of wives' participation to mean's increase in participation in the past decade was due to the effect of the lagged husband participation, when using specification (1) and (2).

We now turn to the discussion of the results based on our bivariate probit estimates. The counterfactual decomposition results change dramatically when we use the estimates from the bivariate probit model in which the joint decision of labour force participation among older couples is part of the estimation. We show that the contribution of the change in the participation of wives accounts for over 80 per cent of the increase in the participation rates of their mature age husbands, much larger than the proportion obtained from the decomposition based on probit estimates. This is consistent with, and probably driven by, the regression results in Table 3, where the estimated effect of the participation of the wives is much larger when we use the bivariate probit model estimation. The effects of the change in the characteristics of husbands are also slightly larger. Notably, the proportion due to unobservable factors has declined substantially to around 7 per cent when the decomposition is based on bivariate probit model estimates, presumably because this model is more flexible and accounts for the joint decision-making of couples in a better and more realistic manner.

As the participation of a husband in the previous Wave is positively correlated to both wife's current participation and husband's current participation, we expect a decrease in the contribution of wives' participation when taking into consideration the effect of the persistence in the participation of mature age husbands. When we consider the effect of the persistence of participation status over time using the bivariate probit model, the increase in the participation of wives between 2002 and 2011 accounts only for 35 to 38 per cent of the total increase in the participation of their mature age husbands in that period. This means that if the participation of women had not increased during the last decade, the participation rate of their mature age husbands would have ended up being 4.0 to 4.4 percentage points lower in 2011. It should be noted that as the coefficient estimates are similar for the dynamic probit model and the dynamic bivariate probit model, and the decomposition results are also very similar. These changes in the results from whether or not we are controlling for the effect of husbands' participation in the previous period show that Schirle (2008) may have overstated the role of labour force participation of wives in driving up the participation rates of husbands since the mid-1990s in the United States, the United Kingdom, and Canada.

6 Conclusion

In this paper we investigated the relationship between the labour force participation of a mature age husband and a wife. We used longitudinal data from the HILDA survey covering the period from 2001 to 2011. We estimated the participation relationship in several ways, and we tested which one was best-supported by the data. We first assumed that the participation decisions of a husband and a wife are independent. We then carried out the same estimation allowing for the decisions to be interdependent. Estimations suggested strongly that the decisions are interdependent. Further estimations found that the decision of the wife to participate influences positively and in a causal fashion the decision of her husband to participate. We also investigated the interrelated decisions of the husband and the wife, allowing for the possibility that the decision of mature age husbands to work or not may be persistent over time. We found that some of the estimated effect of the participation decision of the wife on the participation decision of her husband is absorbed by the estimated persistence of the husband, but not all. We conclude that there is sufficient and robust evidence to support the proposition that the participation decisions of wives influence positively those of their husbands.

Having established the effect of the participation of wives on the participation of husbands, we carried out further analysis to examine the effect that the increasing female labour force participation experienced in recent decades in Australia may have had on male labour force participation. We used decomposition and counterfactual analysis to address these questions. A decomposition of the relationship between the decision of the wife and that of her husband showed that the continually increasing participation of wives between 2002 and 2011 has been responsible for maintaining higher participation rates of their husbands. The results of this research have considerable policy implications in two main directions. First, they illustrate the need to base our policy thinking on the joint modelling of labour force participation decisions within couples. This is a modelling choice that adds complexity and places higher demands on the data requirements for evidence-based policy. In this paper we show in a convincing way that choosing the simpler model, which assumes choice independence, is simply assuming the problem away and is bound to generate misleading policy recommendations. Second, the we illustrate that policies that influence the participation of the wife in a couple will have both direct and indirect effects. We show that one such indirect effect will manifest itself through effects on the participation of the husband. In particular, policies that influence family benefits and pension reform ought to consider explicitly the (joint) couple nature of the participation decisions and their outcomes.

The results of this research have considerable policy implications in two main directions. First, they illustrate the need to base our policy thinking on the joint modelling of labour force participation decisions within couples. This is a modelling choice that adds complexity and places higher demands on the data requirements for evidence-based policy. In this paper we show in a convincing way that choosing the simpler model, which assumes choice independence, is simply assuming the problem away and is bound to generate misleading policy recommendations. Second, we illustrate that policies that influence the participation of the wife in a couple will have both direct and indirect effects. We show that one such indirect effect will manifest itself through effects on the participation of the husband. In particular, policies that influence family benefits and pension reform ought to consider explicitly the (joint) couple nature of the participation decisions and their outcomes.

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