ANALYSIS OF THE ADDED WORKER EFFECT AND THE DISCOURAGED WORKER EFFECT FOR MARRIED WOMEN IN AUSTRALIA

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Abstract

This paper investigates both the added worker (the labour supply responses of women to the partner's job losses) and the discouraged worker effect (workers withdrawing from the labour market because of failed searches) for married women in Australia, with the emphasis on the former. We focus on the partners' displacement experiences, and analyse women's labour supply and its change in the periods before and after their partners' displacement. By estimating fixed effect labour supply equations using the first seven waves of the HILDA data, we find a significant added worker effect in terms of increased full time employment and working hours. The findings suggest that it is harder for the female partners of displaced males to enter the labour market than for those already working to increase their working hours to compensate for lost income incurred by their partners' displacement. We also find a longer term effect in that, after one year of the partners' displacements, more of those women would still like to work longer hours than they actually could. By investigating the relationship between self-assessed job-finding probability on job-seekers' subsequent labour force participation and by studying the relationship between labour force participation of all married women and the regional unemployment rate, we also find a substantial discouraged worker effect.

* The views expressed are those of the author, and not necessarily those of the Australian Treasury.

Executive Summary

- To assess the full impact of rising unemployment, it is important to understand how households respond to the income shock incurred by one member losing their job and to understand how individuals' labour supply behaviour is affected by the changing market conditions.

- Using panel data from the first 7 waves of the HILDA survey, both the 'added worker effect' (AWE) and the 'discouraged worker effect' (DWE) are studied for married women in Australia.

- AWE predicts that individuals respond to the negative income shock in the case of another family member losing their job by increasing their own labour supply, or become 'added workers'.

- DWE suggests that job-seekers tend to withdraw from the labour market after repeated failure in job-searching or when facing unfavourable labour market conditions.

- The AWE is studied by modelling the effect of husbands' displacement experiences on the wives' labour force participation, full time employment, increases in hours worked and wishes to work more.

- It is not appropriate to study the AWE using partners' unemployment status, because being unemployed does not necessarily mean a job or income loss to the family and the wives of the unemployed may be as likely to be not employed as their partners due to assortative matching in the marriage market.

- A significant added worker effect is found, not in terms of increased participation, but in terms of increased full time employment and hours worked, which may

suggest that it is harder to compensate the income loss through entering the market than through increasing working hours of the existing workers. To be specific,

- the *ceteris paribus* effects of husbands' displacement experiences on wives'
  - participation: positive but not significant;
  - full time employment: women with partners experiencing displacements are 2.8 percentage points more likely to be working full time than their counterparts with non-displaced partners;
  - increasing in hours worked: women with partners experiencing displacements are 4.3 percentage points more likely to be working more hours than before, compared with their counterparts with non-displaced partners;
  - preferring to work more hours: women with partners experiencing displacements are 4.5 percentage points more likely to want to work more hours than their counterparts with non-displaced partners would.

- The AWE appears to be a long term effect — after one year of the partners' displacement, women are about 4.9 percentage points more likely to want to work longer, while the likelihood of working hours longer was no different from those with non-displaced partners. This may also suggest that rigidity in the labour market prevents those women from increasing their working hours.

- A significant DWE is also found for these women, which implies that in economic downturn, more women would drop out of the labour force.
  - For every percentage point increase in the unemployment rate, the likelihood of participating in the labour force by these married women decreases by 1.2 percentage points.
  - For every percentage point decrease in the self-assessed job-finding probability, the likelihood of participating in the labour force subsequently by the job-seeker decreases by 0.4 percentage points.

1. Introduction

As the effects of the unprecedented financial crisis on the real economy unfold, unemployment rates around the globe keep rising sharply on daily bases. As we speak, the unemployment rate in the US has reached its peak in 26 years. In Australia, the seasonally-adjusted unemployment rate has risen from the historical low of 3.9% in February of 2008 to 4.8% in January 2009 and it is projected to be over 7% by mid-2010. Policy makers are trying to figure out its consequences on households and on the economy as a whole. In addition to the direct income and human capital loss to the displaced individuals,[1] the families involved will also suffer from the adverse income shocks and may respond to it, which has further implications on the labour market. The extent to which those responses materialize depends upon the market conditions. Thus to evaluate the full-scale impact of the rising unemployment it is important taking into account its repercussion effects. Do other family members respond to a layoff of their partners by increasing their own labour supply, if so, what is the magnitude? Also, what are the implications of the worsening market conditions on individuals' labour market attachment in the short and long run? The answers to theses questions are keys to understand the full impact of welfare consequences on households with such experiences. Economic models of family utility maximization predict that to compensate the income losses due to their partners' displacements, individuals may choose to increase their own labour supply, or become an 'added worker'. This labour supply response is a transitory way of smoothing family inter-temporal income and consumption, and is often called the 'Added Worker Effect' (AWE). In the context of a dynamic family labour supply model, the added worker effect may also be affected by employment uncertainty and households' liquidity constraints (see more theoretical discussions in, for example, Mincer 1962, 1966; Ashenfelter 1980; Killingsworth and Heckman 1986; Rosen 1992; Lundberg 1985; and so on). The issue has been of interest to both economists and policy-makers who are concerned with the labour force participation of married women over the business cycle. In the short run, AWE may put more pressure on the already stressed labour market in an

[1] In US, the annual earning losses of the displaced workers are estimated to be between about 25% and 40% in the year of displacement (see Topel 1990 and Stevens 1997).

economic downturn if most of these added workers could not find a job, but more people keep at least attached to the labour market might not be a bad thing in the long term. In addition to AWE, also predicted by economic theories and often empirically confirmed is the 'discouraged worker effect' (DWE), which hypothesizes that after failed job searches or facing gloomy prospect of finding jobs, individuals may give up looking for jobs and withdraw from the labour market all together. The DWE works in the opposite direction as the AWE. Especially during economic downturns, the existence of the discouraged worker effect will surely hinder the recovery of the households from the income loss.

This paper investigates the added worker effect and the discouraged worker effect for married women[2] in Australia using panel data drawn from the seven waves of the longitudinal Household Income, and Labour Dynamics in Australia (HILDA) Survey. The focus is mainly on the added worker effect which is less researched in the literature. In studying the AWE, functions based upon life-cycle labour supply models are estimated using fix and random effect panel data techniques to identify the immediate and long term effects of the partners' displacements on women's labour supply. In this paper, labour supply behaviour of married women with long term unemployed partners is distinguished from that of those with partners experiencing job losses. The effects on labour supply are measured not only by changes in the likelihood of labour force participation and full time employment, but also by changes in the likelihood of working longer hours and of preferring to work more hours. To our knowledge, similar analysis has not been done for Australia before.

To get a more comprehensive assessment of the effects of rising unemployment on labour supply of the married women, the DWE is investigated by analysing the impact of unemployment rate on all women's participation. It is also studied by evaluating the impact of the self-assessed job-finding probability on subsequent labour force participation of job-seekers.

[2] Through out the paper, the term 'married women' refers to all legally married and cohabitated women. They are also referred as 'the wives', and their partners are referred to as 'the partners' or 'the husbands'.

The economic literature studying the added worker effect can be dated back to as early as 1940s (Woytinsky, 1940). Despite it is unambiguously predicted by the theoretical models, empirical work has yet to reach a consensus regarding its magnitude, or even its existence. While some early studies do discover some small but significant added worker effect (for example, Mincer 1962; Bowen and Finegan 1968; Heckman and MaCurdy 1982; Lundberg 1985; Gruber and Cullen 1996; and Spletzer 1997), some other studies of the similar period fail to find any such effect (for example, Layard, Barton, and Zabalza 1980; Pencavel 1982; and Maloney 1987, 1991).

Nevertheless, as discussed by Stephens (2002), the results of these early studies may not be readily applicable to the understanding of the added worker effect due to a few issues in the methodological approaches used. First of all, these studies focus upon labour force participation of individuals with unemployed partners and do not distinguish partners who experience job losses from those who are observed to be unemployed. In the HILDA data used in this analysis, only about 32% of the married men who reported being displaced were not employed at the time of the interview. Meanwhile, not all unemployed individuals experienced job losses or income reductions. Some of the unemployment may be of long term or was anticipated by the families. As stressed by Lundberg (1985), such an anticipated unemployment does not induce AWE unless the families face credit constraints. And, the individuals with long-term unemployed partners may well be likely to have a similar low labour supply pattern as their partners due to assortative matching in the marriage market. Thus, on the one hand, a substantial portion of job losers may be excluded from the 'treatment group' in previous estimates. On the other hand, the inclusion of the long-term unemployed individuals in the 'treatment group' may disguise the added worker effect.

Secondly, when the partner loses his job, it takes time or is even impossible for the woman to adjust her labour supply behaviour. Thus, the effect may take time to materialize and be difficult to be identified at least in the short run. In fact, the responses may also be in the form of hour increases, and/or in the form of willingness to work more hours by the existing workers, so the effect measured in terms of realized labour force participation may also just be the lower bound of the true effects.

Indeed, Stephens (2002), using the Panel Study of Income Dynamics (PSID), did find a small but significant and persistent added worker effect for US by singling out the displaced workers and addressing the long-term effects. He finds that the effect could last as long as five years. Some recent studies, using similar approaches, also get findings consistent with those in Stephens (2002) (for example, Morisserre and Ostrovsky 2008 for Canada).

For Australia, a couple of studies examined the issue using approaches different from majority of the international literature. Bradbury (1995), by describing the patterns of unemployment for married men and women using 1991 Labour Force Survey data and the administrative data from the former Department of Social Security, concluded that the employment gap between women married to unemployed partners and those to employed partners were mainly due to the differences in characteristics. The added worker effect co-exists with the discouraged effect but the net effects contribute only a little to the observed differences in the employment patterns. Again, he does not distinguish unemployment and displacement, and, no formal analysis was conducted in the paper.

Lenten (2000) attempts to identify the effect by investigating the relationship between the time series of the aggregate labour force participation rates of partnered individuals and the unemployment rates. The author finds that the higher the unemployment rate is, the lower is the rate of labour force participation, and concluded that there is no added worker effect but discouraged worker effect. Yet, again, labour force participation of partnered individuals is not the same as that of the individuals with displaced partners. The negative relationship between the participation rate of married people and the unemployment rate is a result of multiple effects including both the AWE and the DWE, so the two could not be identified separately using those aggregated series.

We find that the nominal disposable income of families with the male partners experiencing displacement is on average 11% lower than that of the other families. A significant added worker effect for Australian married women is found in terms of increased likelihood of full time employment and in terms of increased likelihood of working longer hours. Compared to those with partners not having been displaced and

not about to be displaced, with everything else being the same, women with partners being displaced are about 2.8 percentage points more likely to participate in the labour force, are 4.3 percentage more likely to increase their labour supply, and are 4.5 percentage points more likely to want to work more hours if they could. We did not find a significant added worker effect in terms of increased likelihood of labour force participation, although it was positive. The findings seem to suggest that increasing working hours by the existing workers is easier than entering the labour market by the non-participants. We also find the effect to be of long term in that one year after the partners' displacements, the women were about 4.9 percentage points more likely to wish to increase hours than their counterparts with non-displaced partners. This may again imply the constraints they face in increasing labour supply.

We also find a significant DWE for married women in Australia. The magnitude of the effect is pretty large — the probability of participating in the labour force subsequently by the job-seekers would drop by 0.4 percentage points for every percentage point decrease in the self-assessed job-finding probability. And, for every percentage increase of the unemployment rate, the labour force participation likelihood of married women would decrease by 1.2 percentage points.

The rest of the paper is arranged as follows. The next section describes the data. In Section 3, the added worker effect is investigated, where the methodology and empirical findings are presented and discussed. In the short Section 4, the discouraged worker effect is estimated and discussed. Conclusions are drawn in Section 5.

2. Data and initial analysis

The data used for the analysis are drawn from the available seven waves of the HILDA surveys (2001-2007). The survey collects extensive information on individuals' current labour market status, working hours, labour market history, income and earnings, and demographic characteristics of both households and individuals. Around 8,000 households across Australia are randomly selected and followed over time. We focus

upon married women (both legally married and cohabitated) who as well as their partners were aged between 22 and 59 in each wave. Also excluded are the ones who or whose partners were unable to work due to a long term health condition. The resulted sample consists of 18,448 observations with about 2,500 to 3,000 married women in each wave. Summary statistics of the sample are presented in Table A of the Appendix. From the table, we can see that on average and at each point in time, 74% of women were employed (of which, around half were working full-time), about 2% of them were looking for jobs and the rest 26% did not participate, while 91% and 2% of their partners were employed and unemployed, respectively. As expected, both the participation and employment rates for this group are higher than the Australian average during the same period.

As discussed above, labour force status of the partner is not appropriate for identifying the added worker effect. Not all of them were displaced, and not all displaced workers are observed as unemployed. The key variables used to identify the added worker effect are the variables indicating the displacement experiences of the partners. In the survey, each individual is asked whether he/she lost or changed jobs during the last 12 months and if so, the reasons. From these questions, we construct the displacement variables at various time points — the individual is regarded as displaced if he/she lost or changed jobs because "Got laid off/No work available/Retrenched/Made redundant/Emp" (for the employees) or "Self employed Business closed down for economic reasons" (for the self-employed individuals). On average, about 3.1% of the men have been displaced within one year and another 2.2% experienced displacement between 24 and 12 months before the interview.

Displacement brings about income shocks to the families involved. To see this, in Figures 1 and 2 families with displaced male partners and those without are compared on their average disposable income and its yearly growth over the years. Figure 1 shows that the average nominal disposable income of the families with displaced partners are always lower than those without. The average gap varies from as large as more than 20% to

about 3% but on average it is around 11%.[3] Note that these results are for a period of continuous economic boom when the majority of the displaced workers were able to find jobs rather quickly (see discussions below). It would be a different picture for periods in economic crisis such as the current one. From Figure 2, it can be seen that on average, the nominal income of families with displaced workers decreased for the years until 2004, and only end up in the positive territory from 2005, when the economy was booming dramatically and the labour markets were tight enough for many people to be able to find alternative jobs in short time periods. In contrast, the families without displaced partners always enjoyed positive and much larger income growth.

To illustrate the difference between unemployment and displacement, the two variables are cross-tabulated in Table 1. It is obvious from the table that the majority of the displaced men were observed working, and only half percent of men were displaced and unemployed. This happens because of the favourable economic environment which enabled the displaced finding jobs quickly. Meanwhile, most of the 2.2% unemployed men (about 1.7%) were not displaced within the year leading to it.

Table 1. Male partners' labour force status vs. displacement experiences (%)

	Labour force status			
Displacement over the last year	Employed	Unemployed	Non-participation	Total
No	88.3	1.7	6.9	96.9
Yes	2.2	0.5	0.4	3.1
Total	90.5	2.2	7.3	100

To explore its implications on the analysis of the AWE, we present the rates of labour force participation, full-time employment, and the rate of increase in hours worked against both the employment status and the displacement experiences of their partners in Figures 3 and 4. As discussed in the introduction, the labour force participation rate can only capture the effect on the movements of in and out of the labour market and the

[3] The large variation may be due to the small number of displaced workers in each wave of the sample.

movements within the market of changing hours by the existing workers are ignored. To see this, we create a variable indicating whether the individual increased her working hours from the previous wave. Besides the usual labour market variables, also asked in the survey is whether the worker wishes to increase, decrease, or keep the working hours. This variable enables us to analyze the potential rather than the realized added worker effect.

From Figure 3, it is clear that, by all four measures, labour supply of women with employed partners is much larger than their counterparts with not-working partners. The labour force participation rate of the former group was about 32 percentage points more than the latter. And the percentage of women working full time was about 13 percentage points more for those with employed partners than for those with not-employed partners. Meanwhile, about 28% women with employed partners worked more than a year ago, which is 13 percentage points more than the other group. There is also a gap of the proportions of people preferring to increase their hours between the two groups, but the difference is not large. Thus, a study using employment status is not expected to find any added worker effect if not the opposite. Figure 4 is a similar graph except that the rates are of women with partners just lost their jobs and of those with partners not having such an experience. It reveals a completely different pattern. The proportions of women who participated or worked more hours across waves are roughly the same between those with partners experiencing displacements across waves and those with non-displaced partners, but about 6 percentage points more of the first group worked full time and 5 percentage points more preferred to work more hours if they could. The patterns seem to reflect that women move into full time jobs when their spouses were displaced rather than entering the labour market from non-participation, and that more women would like to increase working hours than those managed to do so. When women with partners being displaced between the previous 24 and 12 months were compared with those with non-displaced partners, similar patterns hold. For the sake of conciseness, the results are not presented but available on request.

When the discouraged worker effect exists, one would expect to observe a negative relationship between labour force participation and the unemployment rate. The negative relation between the two can be seen by a simple division of women in states with high and low unemployment rates. Over the sample period in which the economy was booming continuously, the average state unemployment rate was about 5.5%. The average participation rate of women in the states with the unemployment rate above that level was 72%, which was 5% lower than in the other states (77%). The discouraged worker effect can also be examined through analysing the subsequent labour supply behaviour of women who searched for jobs. In the HILDA, unemployed individuals are asked to assess the probability of finding a job in the following 12 months. From the first to the sixth wave (when women's subsequent labour supply could be observed), 396 women were searching for jobs and provided answers for the question. In Table 2, the labour force participation rate and the self-assessed job-finding probabilities of these women are summarized. On average, the prior predictions and the participation rates a year later matched pretty well with each other, although the realized employment rates must be lower. For example, on average, these women predicted their chances of finding a job in a year to be 64%. At the same time, about 65% of those women participated in the labour force a year later. If the discouraged worker effect is at work, one would expect that those with lower self-assessed job-finding probabilities withdraw from the labour market more often than otherwise. The raw data show that it is indeed the case — the subsequent participation rate for women with the self-assessed probability larger than half is 76%, compared with the rate of 51% for those with it lower than half.

Table 2. Self-assessed job finding probability and labour force participation

Prob. of getting a job in a year	Participation a year later	Avg. prob. of finding a job in a year
>50%	76%	87%
≤ 50%	51%	33%
Total	65%	64%

3. The added worker effect

Theoretical background of the added worker effect

We take a similar approach as Stephens (2002), which is based upon a family life-cycle labour supply model with uncertainty and is an extension of the single worker model by MaCurdy (1985). According to the model, at any point in time, the household is assumed to maximize a utility on leisure of both partners' and the total household consumption over the rest of its lifetime with the expectation of the utility updated with any new information available since the early period. In each period, the wife's labour supply depends on both partners' wages and the marginal utility of wealth that is determined by the expectations of the future variables (including wage offers of both partners) and the evolutions in their distributions. Both the realizations of past variables such as job losses, and the change in beliefs about future distribution, such as the probabilities of losing and finding jobs affect those expectations and evolutions in the distributions and thus enter her labour supply function. The model implies that the added worker effect works through two channels. The main channel is through the reduction of the expected lifetime wealth due to partner's displacement. The loss in lifetime wealth increases the marginal utility of wealth in all periods so the individual works more in every future period to compensate.

The other channel is through the cross-wage effect. As discussed by Stephens (2002), the direction of the displacement effect through this channel is unclear because it depends upon whether the couples' leisure times are substitute or complements. Nevertheless, this effect is believed to be small and secondary and confined within each period. Most of the empirical literature finds that the cross-wage effect is indeed very small.

The magnitude of the added worker effect depends upon the size of the permanent wealth loss. The larger is the wealth loss, the larger the effect is. In addition, it also depends upon how sudden the displacement is. If the partner's displacement comes as a shock to the family, the woman will increase her labour supply accordingly. If it is well anticipated, the individual may have adjusted to it long before the displacement occurs

and will only change her labour supply slightly when it realizes. See MaCurdy (1985) and discussions in Stephens (2002) for formal presentation and more detailed discussion of the model.

Empirical Specification

The life-cycle labour supply model discussed above implies that a woman's labour supply (H_{it}) in family i at time t is in general a function of family's marginal utility of wealth (λ_{it}), parameters reflecting the marginal utility of her leisure time (ω_i), her wage offer ($\ln w_{it}^f$), and 'taste modifiers' of the female's leisure (x_{it}) [4],

$$H_{it} = g(\lambda_{it}, \omega_i, \ln w_{it}^f, x_{it}). \tag{1}$$

Using similar reasoning as MaCurdy (1985), suppose λ_{it} is a function of the initial marginal utility of wealth and the subsequent forecast errors which are functions of displacements, the probabilities of labour force participation $\Pr^p$ and full time employment $\Pr^f$, which are all functions of the arguments in Equation (1), can be specified as follows,

$$\Pr^m{}_{it} = P(\alpha_{i0} + \sum_{s=-1}^{1} \eta_s D_{it}^s + \gamma \ln w_{it} + \beta x_{it}), \text{ where } m = p,\ f \tag{2}$$

where α_{i0} is a household specific effect reflecting the initial marginal utility of wealth, the marginal utility of the female's leisure time, and so on. D_{it}'s are mutually exclusive dummy variables indicating partners' displacement experiences, with D_{it}^{-1} for being displaced in the previous but not the current period, D_{it}^0 for being displaced in the current period;[5] and D_{it}^1 for being displaced in the future period only.[6] The reference group is the

[4] Stephens (2002) derives an empirical equation by specifying an inter-temporal utility function which assumes inter-temporal separability between partners' leisure times in addition to those assumptions in the standard life-cycle labour supply models.

[5] Those who were also displaced in the past and in the future are included in D_{it}^0 as well, so that its coefficient indicates the accumulative effect.

individuals with partners not having displacement experiences in any of the three periods. Because of the relative short panel we have, we are not able to take into account the longer term effects as in Stephens (2002). The added worker effects are captured by η_s, the coefficients of these dummies. η_{-1} refers to the effect of the partner being displaced in the previous period and part of the future displacement effect; η_0 refers to the cumulative added worker effects as long as the partners are displaced in the current period; and η_1 refers to the pure future displacement effect. The ability for individuals to vary their labour supply is often constrained at least in the short run. The coefficients may also reflect these constraints. When the functional form of P is specified as linear, Equation (2) becomes a linear probability model, and can be estimated by the usual linear fixed or random effect techniques. However, random effect models may be inconsistent because the time invariant household effect reflects the initial assets, the interest rate, and wages in all periods which are all correlated with the other explanatory variables. When it is specified as normal, the model becomes a panel data probit model. The baseline estimates are obtained using a standard linear fixed effect estimator, which is asymptotically consistent.

Included in x_{it} are the typical demographic variables such as number of children in each age group, partner's age and education, and housing status. Following the majority of such models, the wage rate is assumed to be a function of and replaced by variables indicating her human capital stocks such as her labour market experience and its square, education, indicators for birth place and languages other than English, and so on.[7]

To peel out the displacement effect, we also estimated reduced-form models for probabilities of increases in labour supply — of increasing in hours worked and of

[6]The way how these variables are defined is to make them mutually exclusive and the interpretation of these coefficients as meaningful as possible. Defining these variables to be indicators of displacement in each period without making them mutually exclusive (such as in Stephens, 2002) makes it more difficult to interpret the parameters, because the reference group for each of the dummies changes so the meaning of the coefficients also changes and the coefficients cannot be explained as the differences with the designated reference group — those who are not displaced in the previous, the current, or the future period.

[7] In the linear fixed effect model, however, those time-invariant variable will drop out because of the differencing.

preferring to increase hours. The specifications are similar to that in Equation (2), except for the left hand-side probabilities, which refer to those of increasing in hours worked, and of preferring to increase hours. Loosely speaking, the coefficients of displacement can then be seen as estimated by difference-in-difference methods.

Estimation Results

The estimated coefficients of the partners' displacement for labour force participation, full-time employment, increasing in hours worked and preferring to hours equations are presented in Table 3. The coefficients are explained as the *ceteris paribus* marginal effects of the corresponding variable on the explained probability. The estimates are based upon the fixed effect linear probability model. First of all, the added worker effect on participation is not significant — the displacement effect in the participation equation is positive but not significant. However, the accumulative added worker effects (η_0) are all significantly positive at least at 10% level for all the other three measures. It seems that compared with those with partners of not having displacement experiences, the individuals with partners being displaced in the current period are 2.8 percentage points more likely to be full-time employed, 4.3 and 4.5 percentage points more likely to work more hours or to wish to work more hours, respectively. This implies that the increased labour supply comes from increases in hours worked especially from increases in full time employment, but not from increases in participation. This may reflect the constraints in the labour market — it may be easier to increase the working hours than to enter the labour market.

Secondly, all but one η_{-1} are insignificant, but the significant one is in the equation of preferring to increase hours. It means that the probability of wishing to increase hours is 4.9 percentage points more for women of partners with previous displacement experiences compared to those of partners without displacement experiences. This seems to suggest that in case of partners being displaced, all the ones who could do so did it immediately and that after one year, significant proportion of them would still like to increase their working hours but were possibly not able to do so at least in the short run (as reflected by the insignificant parameter in the other equations). The finding indicates

a long term AWE effect. This may also reflect the rigidity in the labour market and that individuals' ability of increasing labour supply is constrained.

Thirdly, unlike in Stephen (2002), the anticipated (future) displacement effect is not found to be significant in any of the four equations, although all of them are positive. This may be due to the small sample size problem and may be because of the way the variables are defined. Some of the future displacement effects are already picked up in the previous and current displacement coefficients and only a few individuals are observed to be displaced in the future only.

Table 3. Coefficient estimates of partners' displacement (in %-points)

	Coefficients of partner's displacement experiences		
Equation	The previous but not current period (η_{-1})	Current period (η_0)	The future period only (η_{-1})
Participation	0.7	2.1	-1.1
Full-time employment	-0.8	2.8**	1.7
hours-worked increased	2.2	4.3*	3.1
Prefer to increase hours	4.9**	4.5**	0.4

* Significant at 10% level; ** significant at 5% level. The reference group comprises women with partners who have no displacement experiences in any of the three periods.

Although OLS and random effect models are inconsistent, the estimated displacement effects using these alternative models are presented as comparison in Table B of the Appendix. What can be picked up there is that the displacement effects especially for the full time employment equation and for the preferring to increase hours equation are quite robust to the model specifications.

In Table C of the Appendix, coefficient estimates of the other variables are presented for the fixed effect model. The coefficients of both the participation equation and the full time employment equation are largely consistent with previous labour supply literature. For example, more of young children tend to discourage women to work. It is worth

noting that for the two increase-in-hours equations, except for the displacement variables, the rest did not have much explaining power. This result is expected and confirms that the increases in labour supply are indeed coming out of the displacement of the partners.

4. The discouraged worker effect

The discouraged worker effect is analyzed by estimating a reduced form Probit model of labour force participation for all married women and a model of labour force participation in the subsequent year for the job-seekers. Included in the models are the state level unemployment rates together with the demographic variables usually found in such models. For the job-seekers, the self-assessed job-finding probability is also included.[8] The full list of the explanatory variables and their estimated marginal effects of the two models are presented in Table D of the Appendix. The marginal effects are calculated at the sample mean and are interpreted as the change in the participation probability for a unit change in the corresponding explanatory variable, *ceteris paribus*. For example, for the job-seekers, the value of 0.004 corresponding to the self-assessed job-finding probability means that every percentage point increase in the self-asses job-finding probability would increase the likelihood of subsequent participation by 0.4 percentage points. In another words, with everything else being the same, the more pessimistic is the job-seeker, the less likely she is participating in the labour force a year later. For this group of job-seekers, the aggregate unemployment rate appears to have insignificant impact on their labour force participation. However, the marginal effect of the unemployment rate on contemporary labour force participation is negatively significant for all women. Its magnitude is found to be -0.012, which means for every percentage point increase in the unemployment rate, the likelihood of labour force participation of the averaged married women drop by 1.2 percentage points.The general findings for the other variables are consistent with the literature. For example, the labour force participation increases with the educational level, decreases with the number of young children, and so on.

[8] The participation equation for all women is estimated without the self-assessed job-finding probability because the information is missing for those who are not in the labour force.

5. Conclusions

Using seven waves of the HILDA data, this paper first examined the added worker effect by studying the labour supply responses by married women to their partners' job displacement. As in Stephens (2002), we argue that unemployment status of the partners is not appropriate for studying the added worker effect. Instead, we investigate the added worker effect in the context of the family life-cycle labour supply model focusing on partners' displacement effects.

Displacement of the family members brings income shocks to the families. We find that the nominal disposable income of families with the male partners experiencing displacement is on average 11% lower than that of other families. Economic theories predict that in the cases of such adverse shocks, other family members would increase their labour supply to compensate the income loss. Our empirical analysis confirmed the predictions and found a significant added worker effect for Australian women in terms of increases in full time employment and in terms of increased working hours. The findings are also consistent with the results of previous literature. The results show that the added worker effect mainly comes from the increases in working hours especially in terms of full time employment and it implies that it is harder for women entering the labour market than increasing the working hours. Compared to those with partners having not been displaced and not about to be displaced, the likelihood of labour force participation of women with partners being displaced is about 2.8 percentage points higher, they are 4.3 percentage points more likely to increase their hours worked, and are 4.5 percentage points more likely to wish to increase hours. The results also show that one year after the partners' displacement, more women would like to work longer hours than those of partners without displacement experiences, indicating a long term effect, one that is also predicted by the theory. The result also suggests the rigidity in the labour market and that the ability of these women to increase labour supply is limited. It is important to note that the AWE is only one side of the coin. To get a full account of the rising unemployment on women's labour supply, the discouraged worker effect has to be taken into account.

By estimating reduce-form labour force participation equations separately for all married women and the job-seekers only, we find that for every percentage point increase in the unemployment rate, the married women's labour force participation would drop by 1.2 percentage points. We also find that the job-seekers are quite clear about their chance of getting a job, and that the job-seekers' subsequent participation is significantly affected by the assessment, with the likelihood of participation dropping by 0.4 percentage points for every one percentage point drop in the self-assessed job-finding probability. The results suggest that in economic downturn, it is much less likely for either the job-losers to find jobs again or for their partners to compensate the lost income by increasing their working hours. With such a large discouraged worker effect, the financial impact of displacement is surely to be much larger than in the booming period of this analysis.

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Appendix

Table A. Summary Statistics

Variable definition	Mean	Standard Deviation
Age	39.7	9.2
Speaks languages other than English (%)	10.9	
Born in Australia (%)	58.9	
Born in main English speaking countries (%)	28.9	
Born in other countries (%)	12.2	
Received higher education (%)	27.5	
Received vocational education (%)	25.3	
Finished Year 12 (%)	15.6	
Did not finish Year 12 (%)	31.6	
No. of children between 0 and 5	0.43	0.7
No. of children between 6 and 12	0.51	0.8
No. of children between 13 and 15	0.22	0.5
No. of children between 16 and 17	0.12	0.3
No. of children between 18 and 20	0.11	0.3
Hours increased (%)	27.1	
Wish to increase hours	15.3	
Participation rate	74.3	
Working full-time	37.6	
Unemployed	2.2	
Non-participation	25.7	
Partner's age	41.9	9.5
Partner received higher education (%)	25.8	
Partner received vocational education (%)	41.9	
Partner finished Year 12 (%)	10.7	
Partner did not finish Year 12 (%)	22.0	
Partner has been displaced during the last 12 months (%)	3.1	
Partner has been displaced a year ago but not during the last 12 months (%)	2.2	
Partner is not working (%)	9.5	
Renting the house (%)	20.3	
Paying off the mortgage (%)	51.4	
State level unemployment rate[9]	5.7	1.2
Obs. (individuals and waves)	18,448	

[9] Obtained from ABS (2001, 2004, and 2008)

Table B. Coefficient estimates of partners' displacement from alternative models

Equation	Coef. of partner's displacement experiences (%-points)		
	The previous but not current period (η_{-1})	Current period (η_0)	The future period only (η_{-1})
	OLS		
Participation	-1.6	0.6	-1.2
Full-time employment	1.4	5.6**	3.2*
hours-worked increased	3.0	1.9	3.0
Prefer to increase hours	5.0**	4.4**	1.8
	Random effect Probit model		
Participation	0.3	1.5	-1.2
Full-time employment	-2.1	5.7**	3.6
hours-worked increased	3.0	1.9	3.2*
Prefer to increase hours	3.7**	4.1**	0.9
	Linear random effect model		
Participation	0.1	1.5	-1.1
Full-time employment	-0.2	3.5**	1.9
hours-worked increased	3.0	1.9	3.0
Prefer to increase hours	5.0**	4.4**	1.1

* Significant at 10% level; ** significant at 5% level. The reference group comprises the women with partners having no displacement experiences in any of the three periods.

Table C. Estimated coefficients of demographic variables in the linear fixed effect model

	Equations			
Variables	Hours increased	Prefer to increase hours	Participation	Full-time employment
No. of children 0-5	-0.011	0.005	-0.137**	-0.204**
No. of children 6-12	0.010	0.018**	-0.021**	-0.105**
No. of children 13-15	-0.001	0.005	-0.009	-0.061**
No. of children 16-27	-0.012	0.007	0.011	-0.033**
No. of children 18-20	0.003	-0.001	-0.001	-0.022**
partner's age	0.023**	0.003	-0.004	-0.010**
experience	-0.065	0.084	0.954**	0.769**
experience-sq	-0.001	0.001	0.010**	0.008**
renting home	-0.005	-0.004	0.014	0.034**
paying mortgage	0.022	0.004	0.023**	0.023**
constant	-0.678**	-0.079	0.743**	0.789**
Obs.	18,448			

*Significant at 10% level; ** significant at 5% level.

Table D. Estimated marginal effects on participation of married women (based upon Probit models)

	Job-seekers at t-1		*All*	
Variables	Effect	*t*-value	Effect	*t*-value
Prob. of getting a job at *t-1*	0.004**	4.68	-	
State unemployment rate	0.006	0.25	-0.012**	-3.87
No. of children 0-5	-0.067*	-1.69	-0.148**	-31.8
No. of children 6-12	-0.032	-0.91	-0.006	-1.56
No. of children 13-15	-0.043	-0.71	0.011	1.54
No. of children 16-27	0.060	0.72	0.049**	4.61
No. of children 18-20	-0.022	-0.25	0.042**	4.00
partner's age	-0.004	-0.90	-0.014**	-28.92
Experience/100	0.691	0.69	1.879**	39.47
renting home	0.095	1.31	-0.009	-0.84
paying mortgage	0.089	1.34	0.052**	6.42
Birthplace: Eng-speaking	-0.055	-0.90	-0.002	-0.25
Birthplace: non-Eng-speaking	-0.002	-0.03	-0.047**	-4.23
Received higher education	0.166**	2.31	0.134**	15.72
Received vocational education	0.160**	2.26	0.018*	1.83
Not finishing Year 12	0.039	0.50	-0.090**	-8.57
Partner being displaced	0.180*	1.62	0.013	0.74
Obs	396		18,448	

* Significant at 10% level; ** significant at 5% level.

Figures

Figure 1. Nominal financial year family disposable income by the male partners' displacement experiences

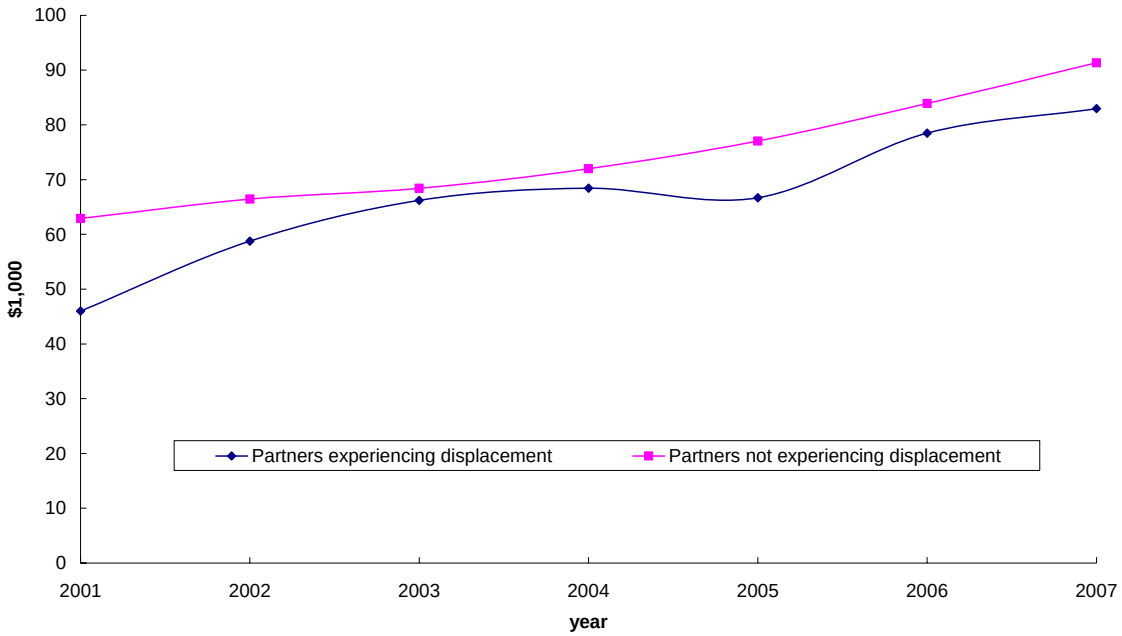

Figure 2. Changes in nominal financial year family disposable income by the male partners' displacement experiences

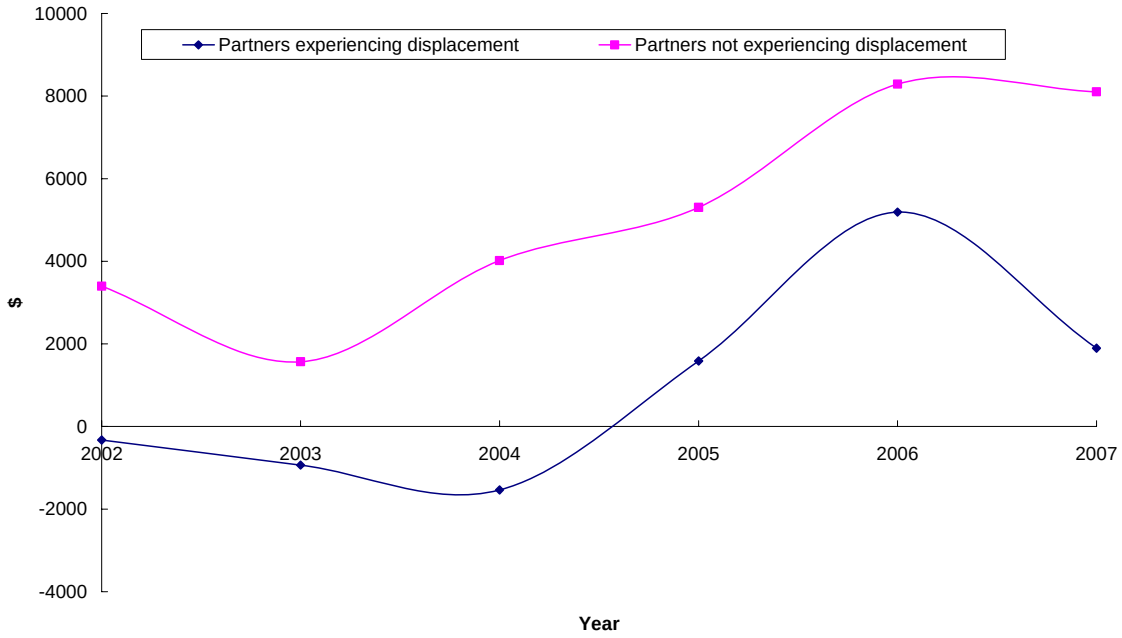

Figure 3. Females' labour supply and its changes by partners' employment status

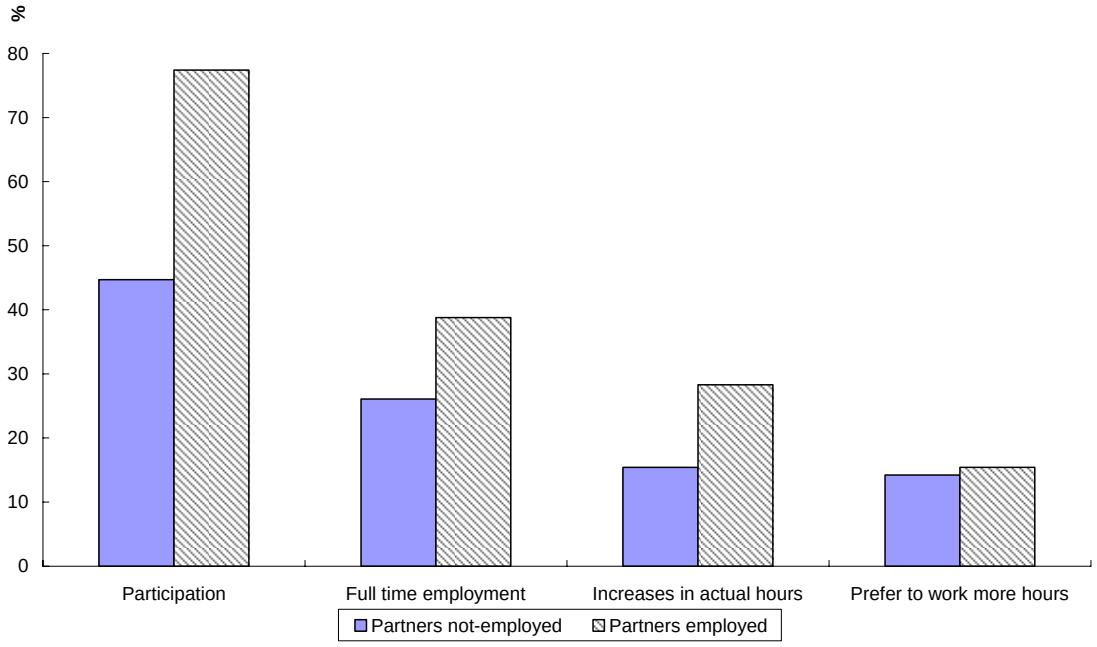

Figure 4. Females' labour supply and the changes by partners' displacement experiences