On The Causes and Consequences of Divorce

Shilan Dargahi

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Department of Economics

University of Essex

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Abstract

This thesis consists of three papers that investigate the labour market activity of women following a divorce and discuss the possible causes of divorce from theoretical and empirical perspectives.

One of the consequences of divorce for women with dependent children who are not fully employed in labour market, is a major loss of income and decrease in their well-being. For the past decades more married women became active in labour market, however their employment choice remains an interesting question which has been broadly addressed in the literature.

With a focus on British Households during 1991 to 2008, the first chapter of this dissertation studies the employment rate among women who experience divorce. At the intensive margin, findings of this chapter suggest that labour supply increases after divorce. At the extensive margin the results suggest that probability of working part time decreases for women who do not hold a university degree whereas for women with a higher education degree, the probability of full time employment increases.

The second chapter studies causes of divorce by focusing on Search and Matching theoretical framework. Despite a number of studies that suggest re partnering is the driving force of divorce, the findings of this chapter do not agree with the

prediction of such models and instead argues that odds of separation are higher among couples in which both spouses have low productivity levels.

Continuing the discussion of previous chapter, chapter 3 reviews the welfare system of United Kingdom for the period of 1991 to 2008 and investigates the effect of tax and benefit system on probability of marital dissolution. The results of this chapter suggest that increase in benefit entitlement after divorce, to some extent explains the observed rate of marital dissolution specially among low productive households.

Dedication

To my parents

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Chapter 1

Transitions in Employment During and After Marital Dissolution

1.1 Introduction

This chapter is a descriptive study of labour supply of married women who experience a marital dissolution. The changes in labour supply of these women during separation period are studied at both intensive and extensive margins.

For a long period of time the dominant role for married women was to take care of children and household tasks, while married men were the bread winners. Over the past decades factors such as improvements in technology, introduction of contraceptive pills therefore decreasing the number of shut gun marriages (Greenwood and Guner, 2009), introduction of no fault or unilateral divorce (Parkman, 1992), drop in wage gap between men and women and increased educational opportunities played a role in changing the traditional way of sharing household responsibilities. During this transition more women; especially more married women became active

in labour market.

Despite the increased involvement of married women in labour market, there are still a considerable number of these women who specialise in home production and family care. Upon marriage failure, these women may suffer from less competitive advantages in labour market. Given that earned labour income is one of the secure ways of insuring against poverty it is important to understand the labour supply pattern of divorced women who compared with their male counterparts have lower marketable skills. Apart from labour market experience, investment in education is another path towards accumulating human capital. Therefore it would be interesting to know whether unexperienced but educated divorced women fare better compared with those who have lower educational qualifications.

There is a vast literature on the unidirectional causal relationship between divorce and labour force participation. For example Johnson and Skinner(1986) use the Panel Study of Income Dynamics to find out how much of the rise in labour supply of married women can be explained by observable changes in women's environment. They observe that hours of work and labour force participation rates start increasing from three years before separation while finding little evidence for a significant effect of labour force participation on divorce probabilities. They argue that the rise in frequency of divorce accounts for about one-third of the increase in women's postwar labour force participation. In a later study Papps (2006) uses National Longitudinal Survey of Youth (NLSY) for the period 1979 to 2004 and studies the effect of both marriage and divorce probabilities on labour supply. He finds the probability of marriage to increase number of working hours for those unmarried people who expect to marry someone with a lower wage rate and this case is more valid for men than for women. Among married people, an increase

in the likelihood of divorce has a positive effect on labour market participation of those who earn less per hour than their spouses. This case is more likely to happen for women than for men. Also Bremmer and Kesselring (2010) find strong statistical evidence that increased probability of divorce leads to increase in female labour force participation using a population survey which is conducted by the U.S. Census Bureau. Considering Granger causality test they state that rising divorce rates in the past decades caused increases in employment. Rather than defining a causal effect this paper looks at average transition rates in employment among women who experience a marital dissolution with a stress on the role of education.

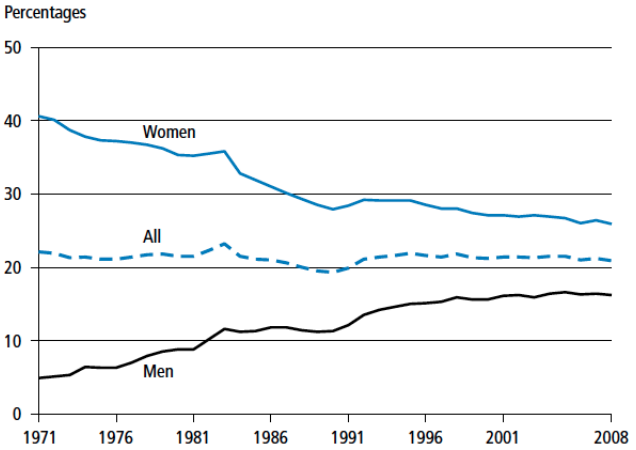
This chapter is organised as the following: the next section provides some stylised facts relevant to the discussion of the chapter. Data source and descriptive statistics are presented in sections 3 to 5. Estimation of labour supply at intensive and extensive margins are provided in section 6. The results are discussed in section 7 and section 8 concludes.

1.2 Stylised facts

Fact 1; There are three facts driven from the data to be highlighted in this section. Firstly, I will show that the percentage of women engaged in family care and home production exceeds that of men. The second point to be stressed is the importance of labour supply in reducing poverty of divorced women. The last point is a discussion on the importance of this study and shows to what extent the well being of children is linked to the labour supply of divorced women.

Figure 1.1 shows an overall picture of employment gender gap in the UK since 1971 and it can be seen that over time the inactivity gap between sexes has nar-

Figure 1.1: Economic Inactivity by Gender



1 Data are at Q2 each year and are seasonally adjusted. Men aged 16 to 64 and women aged 16 to 59. See Appendix, Part 4: Labour Force Survey.

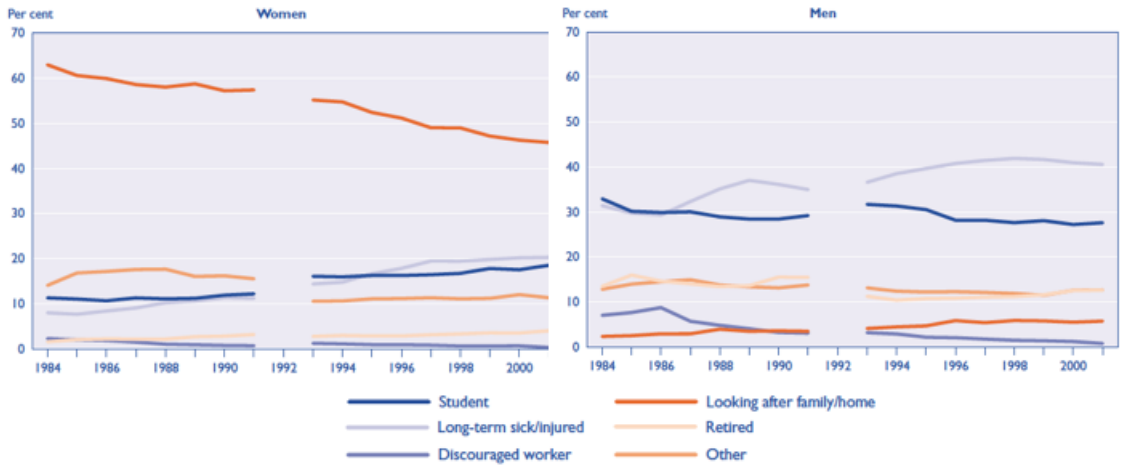
Source: Labour Force Survey, Office for National Statistics

rowed but has not disappeared. This figure is extracted from an ONS social trend report (ref) and compares the trend of inactivity among men and women aged 16 to 59, disregarding the reasons for inactivity. It would be interesting to break down these percentages by the reasons for economic inactivity.

Figure 1.2 also extracted from ONS report, breaks down the inactive individuals into 6 groups. As it is observed from the figures the main reason for economic inactivity among women is family care while among men is being in full time education. Since the long time sick, retired and full time students are not the concern of this study in figure 1.2 I focus on the two most relevant reasons for economic inactivity, these reasons are family care and unemployment.

Left hand side graphs in Figure 1.3 are based on a sub sample of British Household Panel Survey (BHPS). This sub sample represents men and women who live in the U.K. from 1991 to 2008 that have at one dependent child in their household.

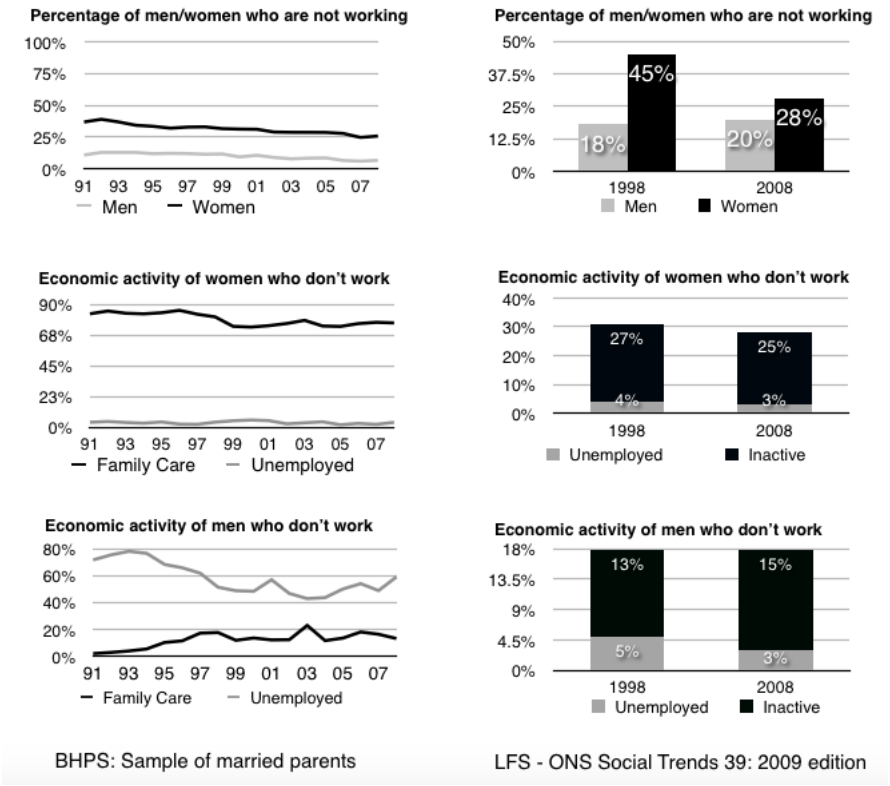
Figure 1.2: Breakdown of Economic Inactivity



Most of men who are not working are unemployed whereas the unemployment rate among women is very low, instead more than 70% of women who are not active in labour market are in family care. The percentage of men who are out of work because of family care has increased since 1991, but still is considerably lower than that of women. Thus it can be concluded that it is mostly women who dedicate their time to family care and consequently can suffer from low accumulation of marketable human capital.

The right hand side graphs in Figure 1.3 are derived from Office of National Statistic report. These graphs are presented to compare the sample of this study with the national statistics. ONS report does not provide detailed economic activities of married men and women who have or have not dependent children, nevertheless higher rates of family care among women than men is evident from both samples. For instance, according to the ONS report in 2008, among 25 to 34 year-old economically inactive women, 73% were engaged with family care whereas

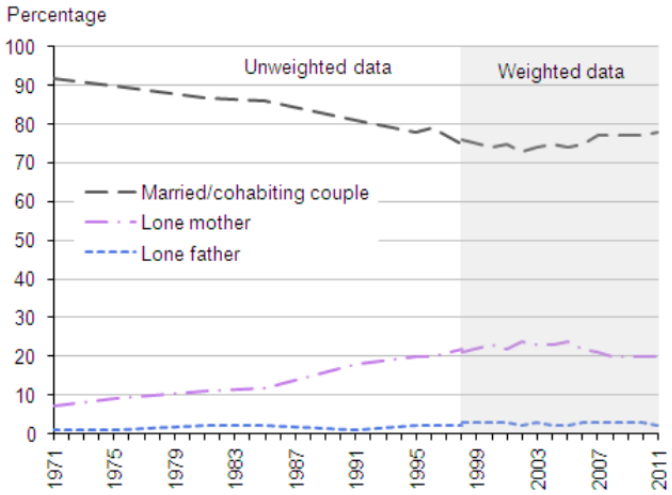
Figure 1.3: Comparison between BHPS and National Survey



only 9% of men reported family care as their reason for economic inactivity. These rates are 62% and 17% for women and men in 35 49 year-old age group.

Fact 2; Increase in employment is argued to be the most likely reason for reduction in poverty and improved well being after marital dissolution. The effect of employment on household income for United Kingdom is discussed in details by Jenkins (2008). He finds the reduction in adverse financial consequences of divorce among lone mothers to be due to the increased labour market participations, specially after the introduction of Working Family Tax Credit in 1999. The reduction in poverty rate due to higher labour supply is not only valid for divorced

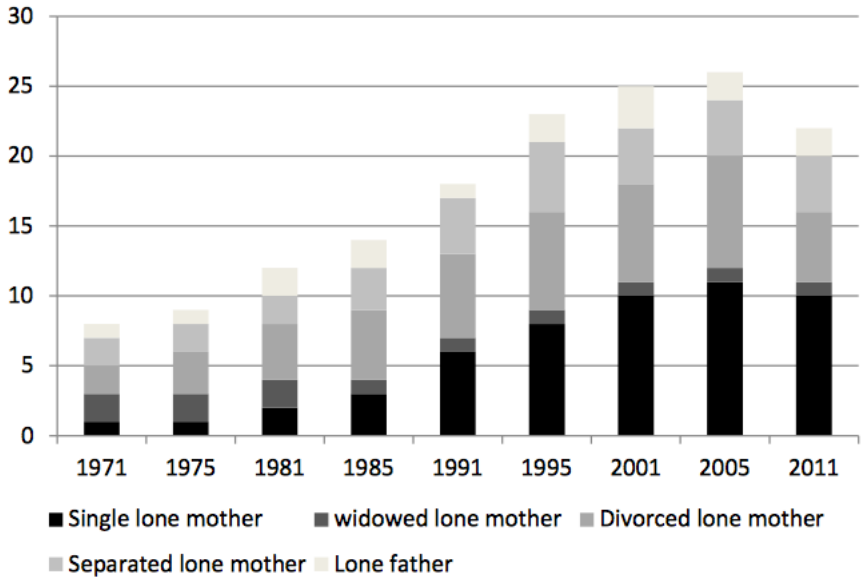
Figure 1.4: Families With Dependent Children



women. In Part of the ONS Poverty and Employment Transitions in the UK and EU, 2007-2012 Release, it is showed that the exit rate from poverty for people who move to employment, specially full time employment is on average 70%. Reforms in the UK that have been taking place since 1999 and specially the 2003 Working Tax credit reform are aimed at alleviating poverty by promoting paid work. Thus with decreased levels of out of work benefits and disregarding a minority group of separating women who can rely on inheritance or unearned income after divorce, for the rest of separating women labour income is the safest way of securing themselves against poverty.

Fact 3; Having discussed that economic well being of divorced women is directly linked to their labour supply, the final fact to be highlighted is that labour supply of divorced women is a determining factor in well being of children. This is due to the fact that a considerable proportion of children live with their separated mothers. In a report for Employment Research Institute, Graham (2014) compares the income

Figure 1.5: Transition to Lone Parenthood



level of lone parents with couple families who have dependent children in their household and she finds that lone parent families are more at risk of poverty. Moreover as seen in figure 1.4, which is taken from General Lifestyle Survey of Office for National Statistics around 20% of families with dependent children are lone mothers.

In their 2014 report (Berrington 2014), Centre for Population Change, provide a graph extracted from ONS General Lifestyle Survey 2011, that compares the number of separated or divorced lone mother with single lone mothers (this graph is presented in Figure 1.5). The data shows that during 1991 to 2008 about half of women entered single motherhood through marital dissolution.

These three stylised facts complete our discussion on why it is important to look at the labour supply of women following the marital dissolution. The next section is a description of the data and employment trends among separating women in

the U.K. between 1991 to 2008.

1.3 Data

The data for this study comes from British Household Panel Survey (BHPS), a government funded survey conducted at University of Essex, Institute of Social and Economic Research. The BHPS represents population of households living in the UK during 1991 and 2008. The survey is repeated annually for 18 years and each year of the survey is referred to as a wave. I have used all 18 waves of BHPS to investigate the role of divorce on labour market participation of women aged 23 to 60.

About 30% of women aged less than 23 are full time students, this number decreases to less than 2% for women aged more than 22. Therefore to have a homogeneous sample, women aged less than 23 are dropped out of the sample. Moreover the retirement age in UK is around 60 or 65, therefore in order to exclude retired individuals from the sample I leave out women aged 60 or more from the analysis.

Another criterion for selecting the sample of this study is marital status. Given that I am interested in labour supply of married and divorced women only I exclude women who are in none of the two states. Therefore the sample consists only of married women who may or may not separate. Should they separate they remain in the sample only if they don't remary. The single women will be observed only if they become married at some point during the panel and the observations of their singlehood state will be disregarded. The sample consists of first divorces only. Therefore if a woman remarries the information about her second marriage

will be disregarded.

In the original BHPS file there are eight categories to indicate marital status and there is a difference between legal and current marital status. To determine the marital status I focus on the current status as it is a better indication of the household composition. To make the distinction between legal and current states consider the case in which a woman is separated from her spouse and they no longer live together however her legal marital status is still reported as married. On the other hand there are women who re-partnered after a marital dissolution and cohabit with their new partner but their legal marital status is still divorced. Living with a new partner can provide new income sources, therefore the legal marital status is less indicative than the current one when it comes to economic situation of divorced women.

After applying the above filters, the final sample consists of married women who may or may not separate or divorce during the life of the panel. Should a woman divorce she still remains in the sample because I want to compare her labour supply before and after divorce. The data set is an unbalanced panel of 54,596 observations which consists of 7109 individuals who are observed for at most 18 years. Although the sample size and number of individuals are relatively large, when it comes to the number of women for whom I observe the transition from first marriage to first divorce, the number of divorces are narrowed down to 700 cases. For most parts of the analysis however, I look at the average behaviour across married or separated women and I don't limit the analysis to those 700 observed divorces. In the final discussion when I present the changes to labour supply during divorce years, I only look at those 700 women for whom I can observe the change in their marital status. The next section provides summary statistics

of the data set.

1.4 Descriptive Statistics

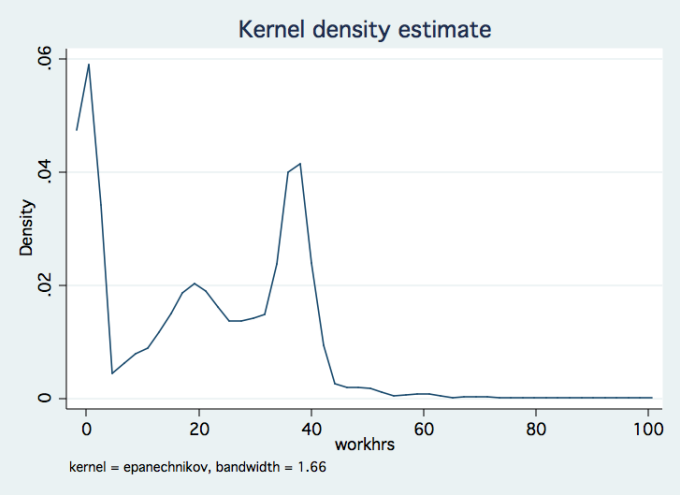
Table 1.1 presents some general descriptive statistics about age, labour market status and educational level of the selected sample of this study. As seen in this table observations are homogeneously spread across different age groups with the exception of 51 to 60 year-old groups. The average (as well as median) age of women is about 42. Women aged 23 to 30 are least represented in this sample compared to other age groups. This can be due to the average age of marriage during the 1991 to 2008 period which ranges from 29 to 34 years old. Therefore marriage is less common among the youngest cohort, thus they are under represented in this sample.

The variable indicating employment status is a derived variable which is composed of a number of other variables found in BHPS, such as the economic status, whether a person is in full time or part time employment, number of hours worked per week for employees and number of hours worked per week for the self employed. In BHPS full time work refers to 30 or more hours of work per week. Although there is no formal definition for full time or part time work, according to the UK government's website, a full time worker usually works 35 hours or more per week. I used both of these cut off points, i.e. 30 and 35 hours to distinguish between part time and full time work in the analysis but the results do not change significantly. For the rest of this analysis I use the BHPS definition of full time work which is working 30 or more hours per week. Thus I compare three main labour market states among individuals, full time, part time and not working. Non worker is

Table 1.1: Summary Statistics

	Frequency
Age	
23-30	12%
31-35	14%
36-40	16%
41-45	16%
46-50	16%
51-60	26%
Marital Status	
Married	85%
Married and divorced	85%
Sep/Divorced	15%
Labour market status	
Full-time	41%
Part-time	30%
Not employed	29%
Self-employed	0.4%
Maternity Leave	4%
Family Care	60%
Retired	11%
Sick or Disabled	14%
Unemployed	6%
Full time student	2%
Other or missing	2.6%
Education qualifications	
No Education	19%
Less than O-level	9%
GCE O-leves	22%
GCE A-levels	10%
Nursing Qualification	3%
Teaching Qualification	4%
College	20%
University First Degree	11%
University Higher Degree	2%
Sample Size	54,596

Figure 1.6: Kernel Estimate of Average Hours of Work per Week



some one who works zero hours per week, she can be out of labour market such as a family carer or unemployed.

The Kernel distribution of average hours worked per week is presented in Figure 1.6. As observed in the graph there are 3 peaks in the distribution. The first peak is at zero. The second peak starts at 20, and the third one is at 40 hour per week. Full time employment is the most observed state in this sample. Most of the women (60%) who are not working are taking care of their families. The rest of this table is self explanatory. Table 1.1 forms a general idea about sample's characteristics but it is more informative to break down these statistics by marital status. In this way, we can observe any differences in economic activity or education qualification among divorced and married women.

In Table 1.2 the education qualification of married women who at some point throughout the panel experience marital dissolution is compared with that of the the control group, which are married women who remain married throughout the

Table 1.2: Education by Marital Status

	Constantly married	Eventually Divorced
No Education/Qualification	17%	21%
Less than O-level	5%	5%
GCE O-leves	22%	27%
GCE A-levels	11%	11%
College	21%	21%
Nursing Qualification	3%	3%
Teaching Qualification	3%	2%
University First Degree	13%	8%
University Higher Degree	3%	2%
Number of Observations	47,991	3,536

sample. To minimise the bias from age gap and have a more homogeneous comparison, I have limited the observations represented in Table 1.2 to the women aged 26 to 50. The reason for doing so is that older cohorts tend to have lower levels of education, therefore I excluded those aged more than 50. By age of 26 most people have obtained their highest educational qualification, therefore those aged less than 26 are excluded from the comparisons in Table 1.2 as well. As observed from this table , there are no noticeable differences regarding education among these two groups.

Table 1.3 represents economic status conditional on marital status. Divorced women are compared with married women who have experienced a divorce and with married women who remained married throughout the sample. First column of this table describes women who tend to remain married at least as far as they are observed by the data collector. Second column corresponds to married women who experienced divorce at later stages of the survey and the last column corresponds to divorced women. It should be noted that almost all of the divorced women are

Table 1.3: Economic Status Conditioned on Marital Status

	Always Married	Married-Divorced	Divorced
Not working	29%	32%	32%
Part time	31%	30%	23%
Full time	40%	38%	45%
Number of Observations	47,991	3,536	4,559
Not working	Always Married	Married-Divorced	Divorced
Unemployed	5%	7%	15%
Family Care	61%	67%	48%
Sick/Disabled	13%	12%	23%
Maternity Leave	4%	8%	3%
Retired	13%	2%	4%
Other	4%	4%	7%

those who were observed to be married at earlier waves, therefore the average age of women in the second column of table 1.3 is lower than that of first and third columns of this table. The average age for the former is 36 while for the latter i.e. always married or divorced, is 43 - 44. Comparing second and third columns of table 1.3 gives us an idea about the possible changes to labour supply once women experience a marital dissolution.

Divorced women are 5% more likely to be working full time compared to women with stable marriages and the number rises to 7% when they are compared to married women with unstable marriages. This can imply that when women get divorced they are more likely to be working full time. However making such a claim needs more careful investigations.

Second part of Table 1.3 describes the economic activity of the 30% of women who do not work, in further details. It is interesting to see that the highest rate of unemployment is observed for divorced women. This can suggest that divorced

women move form economic inactivity to actively looking for a job. Given that tax benefit policies in the UK are designed to encourage single mothers to search of a job, this increase in unemployment rate seems to be justified.

Another noticeable difference among married and divorced women is the fraction of them who are occupied with family care. Due to the age gap between divorcees and currently married women it makes more sense to compare the percentage of family care among divorced women with that of constantly married women. As observed in this table the percentage of women in family care drops from 61% (among married women) to 48% (among divorced women).

The increase of 11% in long term sickness or disability among women who are divorced is also noticable. Given that most of these divorced women were observed to be married at an earlier stages in the panel, 11% change in health condition is a considerable fraction which needs further investigations, however the focus of this chapter is employment transition among women who are not suffering from disability therefore explaining the higher number of disability among divorced women is beyond the scope of the current research. I

n summary, what is learnt from Table 1.3 is that divorced women on average are expected to be more active in labour market. It should be noted however that once in part time or full time employment the average hours worked per week are the same among these three groups. The average hours worked per week is 17 among part time workers and 37 among full time workers. Having these results in mind it would be interesting to look at the average transition rates from one employment spell to another for these three marital groups.

1.5 Transitions in Labour Market

Blank (1994) uses the Panel Study of Income Dynamics (PSID) for women aged 18 to 50 who are in a position to make labour supply choices. She finds past activities in labour supply to have significant importance in predicting current labour supply choices. She states that women who are in full time employment or in unemployment are very persistent in their labour supply decisions whereas those who are in part time employment change their employment status more frequently. She finds little evidence that entering part time employment would increase the probability of gradually moving into full time employment.

Although the main purpose of Blank's work is not directly related to the objective of the current paper, her findings regarding instability of part time employment is consistent with the results of this chapter. Here I apply an approach similar to Blank (1994) and use the past labour supply information to explain current behaviour.

Transition rates are the probability of one employment state conditional on the previous year employment history. These probabilities can be good indication of the persistence of each group of women in their choice of labour supply and their tendency to move into or out of employment between any two year periods. I look into transitions in labour market between any two consecutive years among constantly married, temporarily married and divorced women, trying to answer questions such as: Do we observe more mobility in labour market for women who experience a divorce? Is the transition mostly towards higher or lower labour supply? Therefore I compare the average transition rates of divorced women with that of married women.

As mentioned earlier married women are put into two categories, those who are married at time t but become separated at a later point in the panel and those who remain married throughout the whole period that they have been observed. I refer to the former as temporarily married and to the later as constantly married. The transition rates among divorced women then, is compared with the rates among both types of married women, temporarily or constantly married. The temporarily married women are practically the same women who become divorced at some later point in time. Therefore divorced women in these tables are mostly the temporarily married ones observed at the divorcee state.

If labour income is one of the major income resources of divorced women, then temporarily married women who are not in paid work and foresee a marital dissolution should show higher rates of transitions into full time or part time employment compared to constantly married women. Moreover, once in full time employment do divorced women tend to remain in full time employment? Since these women do not have access to a partner's income, having a job can be the most trust able source of financial security. Having these questions in mind we can look at the average transition rates in labour market between any two consecutive years.

Transition rates are depicted in table 1.4. The row percentages in this table are the labour market status at current period conditional on last period's economic activity. The row and column totals respectively refer to unconditional economic activities for the previous and current periods.

The first point to be noticed from transition rates depicted in table 1.4 is that most of the people in this sample tend to remain in the labour market status of their choice between any two consecutive years. The lowest attachment is observed

Table 1.4: Average Transition Rates

Year $t-1$	Year t			Row Totals
	Not Working	Part-time	Full-time	
	Permanently Married			
Not working				
% of Row	85	11	4	
% of Total	24	3	1	28
Number of Observations	9,169	1,112	404	10,685
Part-time				
% of Row	8	77	15	
% of Total	3	25	5	33
Number of Observations	1,095	9,697	1,427	12,219
Full-time				
% of Row	5	7	88	
% of Total	2	3	34	39
Number of Observations	744	1,480	14,053	16,277
Column Totals	28	31	41	100
Total Observations	11,008	12,289	15,884	39,181
	Temporarily Married			
Not working				
% of Row	79	15	6	
% of Total	26	5	2	33
Number of Observations	819	145	55	1,019
Part-time				
% of Row	11	72	17	
% of Total	4	22	5	31
Number of Observations	100	681	127	908
Full-time				
% of Row	5	9	86	
% of Total	2	3	31	36
Column Totals	31	31	38	100
Number of Observations	6	121	1,000	1,177
	Divorced			
Not working				
% of Row	82	12	6	
% of Total	26	4	2	32
Number of Observations	1,074	152	73	1,299
Part-time				
% of Row	11	67	22	
% of Total	3	17	6	26
Number of Observations	119	690	162	971
Full-time				
% of Row	5	5	90	
% of Total	2	2	38	42
Column Totals	31	23	46	100
Number of Observations	85	112	1,608	1,805
Total Observations	1,278	954	1,843	4,075

to be to part time work. Regardless of the marital status, the attachment to full time work is highest compared to part time or unemployment.

As expected, divorced women appear to have the highest attachment to full time work, however the differences are small. The most frequent transition across all groups is transition from part time employment to full time employment. This shift is most pronounced among divorced women and is lowest among permanently married women.

The second most observed transition is from not working to part time work and the rate is highest for temporarily married women. One possible explanation is that married women who foresee a future divorce and are not active in labour market, start working while they are married and obtain some work experience which then gives them more chances to shift to full time employment by the time they are divorce. The lowest attachment to part time work is observed among divorced women while the highest attachment is observed among constantly married women, suggesting married women have access to a shared household income and therefore can afford lower level of labour supply. To summarise:

1. Temporarily married and divorced women are more mobile in labour market than constantly married women.

2. The transitions among divorced women is more towards higher rates of labour supply.

To highlight the second point mentioned above, we can define a total change in labour supply as all transitions into more labour supply (that is any shift from part-time to full-time, not working to part-time or not working to full-time) minus all transition into less labour supply (that is any movement from full time

Table 1.5: Average Transition Rates At Time of Divorce

Year $t-1$	Year t			Row Totals
	Not Working	Part-time	Full-time	
Not working				
% of Row	85	11	4	
% of Total	24	3	1	28
Part-time				
% of Row	8	77	15	
% of Total	3	25	5	33
Full-time				
% of Row	5	7	88	
% of Total	2	3	34	39
Column Totals	28	31	41	100
Number of Observations	248	176	299	723

to part time or not working and part time to not working) By looking at this difference we can have an estimate of whether on average the labour supply increases or decreases. The total change is positive for all three groups. Therefore the decrease in labour supply is more than compensated by the increase in labour supply and the highest increase is among divorced women. The numbers are as following: 19% increase in labour supply among divorced women, 13% increase among temporarily married women and 10% increase among constantly married women. These numbers suggest that divorce increases the portability of employment among women and the increase in labour supply from part time to full time among divorced women is noticeable.

Table 1.5 focuses on employment transitions of women at the time of divorce. Thus year $t-1$ refers to one year before separation. 15% of women who were working part time prior to separation switch to full time employment, and 15% of those who were out of labour market a year before separation move either to

Table 1.6: Average Transition Rates

Year $t-1$	Year t		
	Not Working	Part-time	Full-time
	Permanently Married		
NW, NW	91%	7%	2%
PT, PT	7%	84%	9%
FT, FT	4%	7%	89%
	Temporarily Married		
NW, NW	84%	12%	4%
PT, PT	8%	79%	13%
FT, FT	4%	7%	89%
	Divorced		
NW, NW	90%	7%	3%
PT, PT	7%	79%	14%
FT, FT	4%	4%	92%

full time or part time work. Whereas 12% of women who were full time employed decrease their labour supply following divorce and only 8% of women who were working part time before divorce, leave labour market following separation. These numbers verify the above observation that on average women tend to increase their labour supply after divorce.

In table 1.6, I look into transitions across three consecutive years. Therefore I condition the current labour market state on the two previous labour market states. To clarify the notations used in table 1.6, NW, NW refers to staying out of labour market for two consecutive years prior to the current state. PT, PT abbreviates two consecutive years in par time employment at times $t-2$ and $t-1$ and FT, FT refers to two consecutive years in full time employment. The labour market states at time t, refer to economic activity at the time of the observation, i.e. time t. The numbers presented in table 1.6 confirm the previous findings

Table 1.7: Employment Status By Education

	Not working	Part time	Full time
Married			
Uni Degree	23%	26%	51%
No Uni Degree	33%	31%	36%
Divorced			
Uni Degree	14%	20%	66%
No Uni Degree	35%	24%	41%
Always Married	Not working	Part time	Full time
Uni Degree	20%	25%	55%
No Uni Degree	31%	32%	37%

regarding transitions for women with different marital states.

It is well known that investment in education yields positive returns in labour market. Therefore we should expect the employment rate to increase with level of investment in educations. Table 1.7 compares the distribution of women in different employment states while making a distinction between women with and without universtiy qualification

It is well known that investment in education yields positive returns in labour market. Therefore we should expect the employment rate to increase with level of investment in educations. Table 1.7 compares the distribution of women in different employment states while making a distinction between women with and without university qualification. The first four rows in table 1.7 depicts the employment rate among women who are temporarily married and later become divorced. These numbers can be thought as the change in employment pattern of the same women who are observed at both married and divorced state.

As observed in this table 66% of divorced women who hold a teaching, first, or

higher university degree are in full time employment. This number decreases to 51% when we look at married women with the same educational qualifications. The gap between participation rate of married and divorced women gets smaller among women with lower levels of education. Women without a university degree are on average less active in labour market. The difference in full time employment of married and divorced women who do not hold a university degree is only 5% which is half of the number that is observed for women with higher level of education. In conclusion being divorced and having a university degree increases the probability of full time employment by 15% points, compared with being married and having a university degree. To summarise the observed patterns in this table it can be stated that having university education is associated with increase in labour supply upon divorce.

The bottom section of table 1.7 summarises the employment pattern of women who do not experience a divorce conditional on having a university degree. This group should be considered as a control group for the married women who eventually got separated or divorced. Comparing the employment rates indicates that there are not many differences among constantly married women and married women who separate from their partner later on.

The final table of this section is a comparison of employment rate among women with and without children. The purpose of this table is to see to what extent having dependent children affects employment patterns and whether or not women with different levels of eduaction respond differently to presence of dependent children in their household.

Table 1.8 depicts this trend among married women with or without dependent children. As the level of education increases the percentage of women who are

Table 1.8: Employment Rates Conditioned on Education and Dependent Children

	Women with Dependent Children			
	Not Working	Part-time	Full-time	Total
Less than O-level	57%	25%	18%	100%
GCE O-leves	35%	33%	32%	100%
GCE A-levels	36%	37%	27%	100%
College	24%	37%	39%	100%
Nursing Qualification	29 %	32%	39%	100%
Teaching Qualification	21%	18%	61%	100%
University First Degree	20%	28%	52%	100%
University Higher Degree	1%	31%	68%	100%
Total	37%	31%	32%	100%
	Women without Dependent Child			
	Not Working	Part-time	Full-time	Total
Less than O-level	42%	16%	42%	100%
GCE O-leves	21%	9%	70%	100%
GCE A-levels	17%	12%	71%	100%
College	15%	12%	73%	100%
Nursing Qualification	15 %	11%	74%	100%
Teaching Qualification	15%	11%	74%	100%
University First Degree	8%	10%	82%	100%
University Higher Degree	13%	15%	72%	100%
Total	23%	12%	65%	100%

not working decreases and the percentage who are working full time increases. This holds regardless of presence of children. However, the difference in full time employment rate between highly and lowly educated women is more pronounced in the presence of children. A married woman with university degree who has dependent children is 50% more likely to be working full time, compared with a woman has less than O-levels qualification. This difference narrows down for women without a dependent child.

1.6 Estimation Results

So far the descriptive statistics suggested that divorce is associated with an increase in women's labour supply. In this section I test this claim while controlling for

observable heterogeneities. The first step is looking at a simple OLS regression of average hours normally worked per week given characteristics such as age, education, age and number of children and non labour income and marital status which is either being married or being divorced. Therefore the pool of divorced women across all waves are compared with the pool of married women. The coefficient of divorce should indicate whether being divorced is associated with supplying more hours of labour.

The first set of estimations presented in table 1.9 are based on the sample of working and not working women. Regardless of current economic status, the results suggest that divorce increases number of hours normally worked per week by 65 minutes. The second set of estimates, presented in last column of table 1.9, show how hours of work is affected by divorce among employed women. In this case, the effect of divorce on labour supply is around 140 minutes per week.

Any level of educational qualification as opposed to no qualification increases the number of hours worked. Women with one dependent child work around 4 hours less per week compared with childless women. Having two or more children decreases labour supply up to 12 hours per week. More access to non labour income can decrease labour supply by as much as 12 hours per week. This effect narrows to around 3 hours per week if we look at the sample of employed women.

The OLS estimates provide an understanding on how the labour supply is affected by divorce on the intensive margin. What is more interesting than average increase in hours worked per week, is to understand how divorce affects the probabilities of part time and full time work conditional on some basic characteristics. To answer this question, I use a Multinomial Logit model to be able to distinguish the effect of divorce on extensive margins as well. Suppose $Y_i t$ denotes an observed

Table 1.9: OLS Regression Of Number of Hours Worked per Week

	All sample	Employed sample
Divorce	1.103**	2.379***
	(2.87)	(7.46)
Age	1.150	-0.767
	(1.66)	(-1.20)
Age squared	-0.00820	0.0250
	(-0.49)	(1.60)
Age cubed	-0.000111	-0.000270*
	(-0.84)	(-2.18)
Education		
Commercial Qualifications	3.443***	1.295*
	(5.47)	(2.04)
O-level	6.244***	2.646***
	(12.87)	(5.39)
A-level	7.298***	3.318***
	(12.74)	(5.88)
Other Higher Degree	9.363***	3.802***
	(21.14)	(8.32)
University Degree	11.75***	5.480***
	(21.51)	(10.69)
Dependent Children		
One Child	-4.182***	-4.514***
	(-11.49)	(-15.08)
Two Children	-7.504***	-7.409***
	(-17.77)	(-20.51)
Three or more Children	-10.93***	-9.528***
	(-20.42)	(-16.93)
Quartile 2 non-labour Income	-3.835***	-1.344***
	(-12.87)	(-5.49)
Quartile 3 non-labour Income	-7.787***	-2.033***
	(-23.50)	(-7.54)
Quartile 4 non-labour Income	-12.24***	-2.791***
	(-32.85)	(-8.10)
Constant	-0.579	38.34***
	(-0.06)	(4.57)
Time controls	Yes	Yes
Location controls	Yes	Yes
Number of Observations	54966	39201
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$		
t statistics in parentheses		

labour market status of individual i at time t. Y_i takes three values, full-time work, part-time work and not working. Let m be the alternative of interest, then the predicted probability that individual i chooses alternative m, i.e. one of the labour market states is given by:

$$Pr(Y_i t = m) = \frac{exp(x_i t \gamma_m)}{\sum_{k=1}^{M} exp(x_i t \gamma_k)}$$

Where $x_i t$ is a set of attributes of decision maker i. It is clear from the above expression that the predictors ($x_i t$'s) do not vary across different choices of labour market supply, but the parameters associated with them (γ's) do vary across alternatives. k refers to the two alternatives that are not chosen by a given individual at time t. To estimate the above multinomial logit model, apart from some time variant (X_{it}) characteristics such as marital state, number of children, age, level of education, and non labour income, the history of labour market choices are included as a predictor in the model. Therefore for each individual:

$$Pr(Y_{it} = m) = f(X_{it}, Y_{it-k})$$

where the dependent variable, Y_{it} is labour market status. Y_{it-k} denotes lagged values of labour market status of each individual ($k = 1, 2$).

The results of estimating the above model are presented in table 1.10. From this table we can observe how the probability of being in part-time or full-time employment changes with divorce, having controlled for some characteristics of each individual. The employment state that is set as base of comparison in 1.10 is unemployment or inactivity i.e., the probabilities of full time or part time em-

Table 1.10: Multinomial Logit Estimates

Predictor	Coefficient (S.D.)	Risk Ratio
Full-time		
Divorce	0.27* (0.11)	1.32
Age	-0.54*** (0.11)	0.58
Age squared	0.01*** (0.00)	1.01
Other qualification	0.12 (0.09)	1.13
O-levels	0.49*** (0.07)	1.63
A-levels	0.37*** (0.09)	1.45
Some College	0.64*** (0.07)	1.89
University Degree	0.90*** (0.09)	2.47
Child aged 0-6	-1.65*** (0.06)	0.19
L.Full time	3.58*** (0.05)	35.80
L.Part time	1.55*** (0.05)	4.70
L2.Full time	0.92*** (0.05)	2.50
L2.Part time	-0.02 (0.05)	0.98
L.Full time*Divorced	-0.02 (0.15)	0.98
L.Part time*Divorced	-0.21 (0.16)	0.81
L2.Full time*Divorced	0.33* (0.16)	1.39
L2.Part time*Divorced	0.66*** (0.17)	1.94
Part-time		
Divorce	-0.18* (0.096)	0.84
Age	-0.05 (0.10)	0.95
Age squared	0.00 (0.00)	1.00
Other qualification	0.11 (0.08)	1.11
O-levels	0.30*** (0.06)	1.34
A-levels	0.16* (0.08)	1.17
Some College	0.36*** (0.06)	1.43
University Degree	0.45*** (0.09)	1.57
Child aged 0-6	-0.52*** (0.04)	0.60
L.full time	1.75*** (0.06)	5.73
L.part time	2.95*** (0.05)	19.17
L2.Full time	0.21*** (0.06)	1.24
L2.Part time	0.89*** (0.05)	2.43
L.Full time*Divorced	-0.14 (0.19)*	0.87
L.Part time*Divorced	-0.37** (0.13)	0.69
L2.Full time*Divorced	0.24 (0.19)	1.28
L2.Part time*Divorced	0.52*** (0.14)	1.68
t statistics in parentheses		
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$		
Number of Obsevations	54,596	

ployment are compared with the probability of not working. Standard errors are clustered by individuals and most of the variables are self explanatory but there are a few points to be clarified.

Apart from age and squared value of age, the rest of the variables are binary. The interest is on the binary variable of divorce which takes value zero if a woman is married and value one if she is divorced. In table 9, both coefficients and likelihood ratios are presented. However the interpreting the coefficients of Multinomial Logit which are expressed in log format is not very straightforward, therefore we can use the relative risk ratios to interpret the results. L.full time, L.Part time, L2.Full time, and L2.Part time refer to first and second lagged values of full time and part time employment. For instance, L2.Full time indicates whether an individual has been in full time employment in period $t-2$. As it can be observed from table 1.10, being divorced increases the probability of full time work by 32%, compared to not working, and decreases the probability of part time work by 15%. Said in other words, the estimated model suggests that probability of being a part-time worker decreases with divorce or separation and odds of working full time increase by 32% for separated/divorced women.

Having young children who are aged less than 6 years old, decreases the probability of employment either part time or full time but the effect is more pronounced on full time employment. Education increases the chances of employment and the higher is the education level, the bigger is the effect on full time employment than on part time employment. A woman with a university degree is 2.5 times more likely to be working full time than not be working at all and 1.6 times more likely to be working part time than not working. The last four covariates in table 1.10 are interactions of lagged values of full time and part time work with divorced.

These variables can indicate how much being divorced and having labour market experience affects the chances of full time or part time work. The fist lagged values interacted with divorce are not significant but the second lagged values, i.e. the employment status 2 periods prior to the current year interacted with divorced provide meaningful information. Women who were in full time employment two years before the current observation and are divorced are almost 1.5 times more likely to be working full time at the current year.

1.7 Understanding the Role of Divorce

The prediction of the Multinomial Logit estimation that divorce increases the probability of full time employment is in line with the earlier statistical analysis. However the decrease in part time employment compared to not working may seem puzzling at first. The argument so far was that divorced women tend to increase labour supply to compensate for loss of income. Table 1.10 suggests that divorced women are more likely to be out of work than to be working part time.

I repeated the regressions presented in table 1.10 once for women with a university degree and once for women without a university degree. Therefore I isolate those women with high investment in education which are more likely to have more experience in labour market from the rest of observations and then compare the role of divorce on full time and part time employment among these two groups.

The results are presented in table 1.11. Among the highly educated group divorce has a bigger effect on odds of full time employment and it plays no significant role on the odds of part time work. The no university qualification group, are 18% more likely to be out of work than be in part time employment and they are 30%

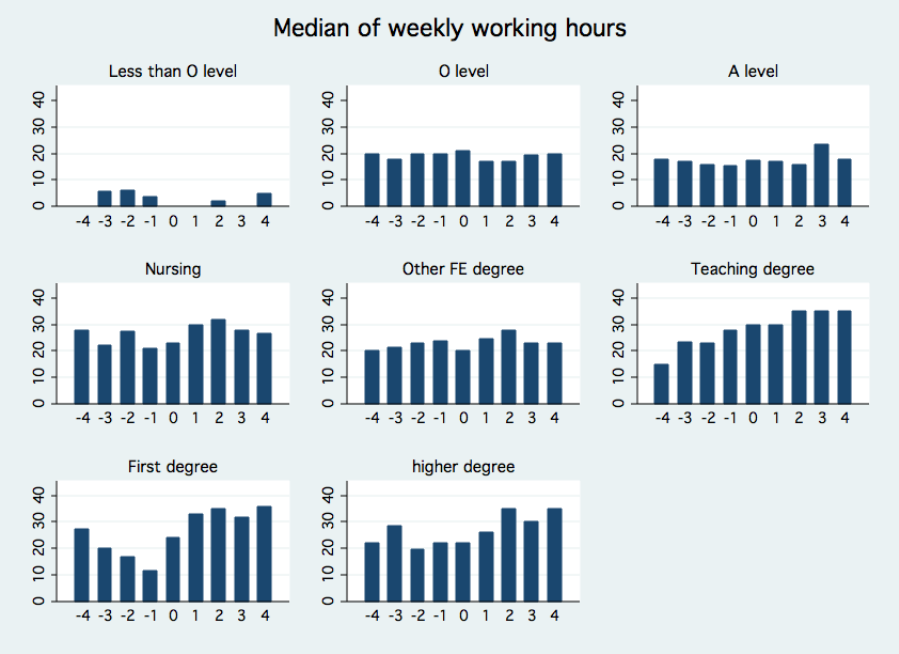
Table 1.11: Multinomial Logit by Education Groups

Predictor	Full-time (Odds Ratios)	Part-time (Odds Ratios)
With University Degree		
Divorce	2.63*	1.43
	(1.16)	(0.66)
Child 0-6	0.22***	0.70*
	(0.26)	(0.56)
L.Full time	18.27***	4.85***
	(2.70)	(0.75)
L.Part time	3.89***	19.37*
	(0.58)	(0.24)
L2.Full time	2.22***	1.54**
	(0.33)	(0.24)
L2.Part time	0.83	2.23***
	(0.12)	(0.33)
Sample Size	8,924	
Without University Degree		
Divorce	1.29*	0.82*
	(0.14)	(0.08)
Child 0-6	0.31***	0.81***
	(0.26)	(0.56)
L.Full time	39.32***	6.09***
	(2.3)	(0.39)
L.Part time	4.93***	19.55***
	(0.28)	(0.94)
L2.Full time	2.53***	1.17**
	(0.15)	(0.07)
L2.Part time	1.11*	2.55***
	(0.07)	(0.13)
Sample Size	47,228	

more likely to be working full time than not working at all. The role of divorce on part time employment is significant in the case of lower educated women.

So far it has been learnt that divorce has different effects on labour market activities of those women who have a university qualification and those women who do not. I find it informative to look at the mean and median of average working hours of women from four years before their divorce until four years after divorce. I separate women based on their education levels and denote the year that divorce has occurred by 0, so the year of divorce is the base year, the years before are denoted by negative numbers and the years after are denoted by positive numbers. Average working hours per week are shown on the vertical axis. Relative time to divorce is shown on horizontal axis. I should stress that these relative years are independent of calendar years. For example for one woman time zero happens

Figure 1.7: Women Labour Supply before and After Divorce by Education

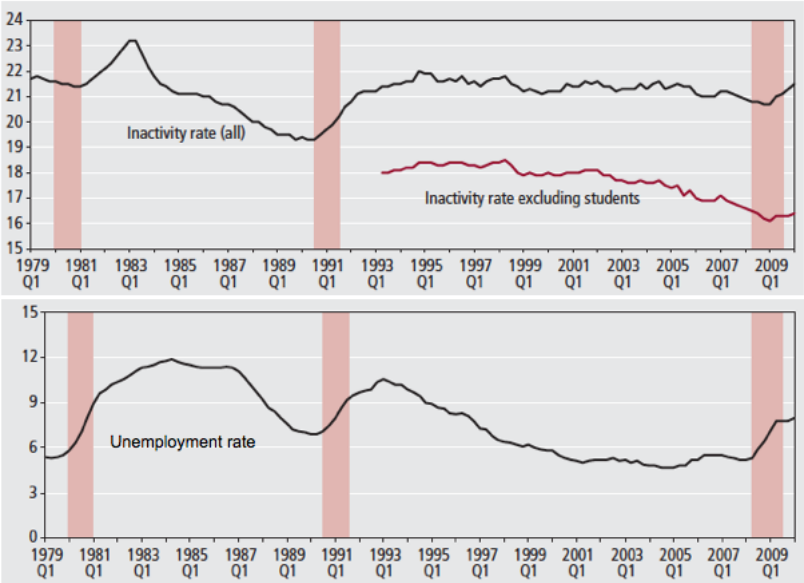


in 1998 and for another woman it can be in 2005. Therefore the median or mean of average weekly hours worked should be independent of calendar years.

Figer 1.7 summarises the median labour supply before and after divorce for women with different education levels. The medians are not conditioned on labour market status. It is observed that in consecutive years after divorce labour supply of women, specially those with a university degree increases. If the number of divorces increase during recessions, then the observed increase in labour supply after divorce can be attributed to the recovery of the economy rather than effect of divorce.

Figure 1.8 depicts a picture of unemployment rate in UK for the past few decades. The graphs in Figure 1.8 are taken from a labour market report by Office of National Statistics. As seen in the graph the two recessions during 1991 and

Figure 1.8: National Unemployment Rates-ONS Report



2008, coincide with the beginning and end of the survey used in this study. Unemployment has been falling since 1993 until 2008 without any big shifts throughout this period.

Figure 1.9 on the other hand, presents a picture of the divorce rates over the past decades. This graph is derived from the Population Trends report of National Statistics. According to this graph divorce rates have been declining from 1991 until around 2005. Since I limit the sample to those observations for which I can observe employment before and after divorce, the trends shown in Figure 1.7 correspond to divorces that took place no later than 2007 or 2006 (depending on timing of data collection). Eye-balling the national statistics of unemployment and divorce rates from 1991 to 2008, does not suggest that the divorce rates coincide with a recession period and thus the increase in labour supply after divorce cannot be attributed to recovery of the economy.

Figure 1.9: National Divorce Rates-National Statistics Report

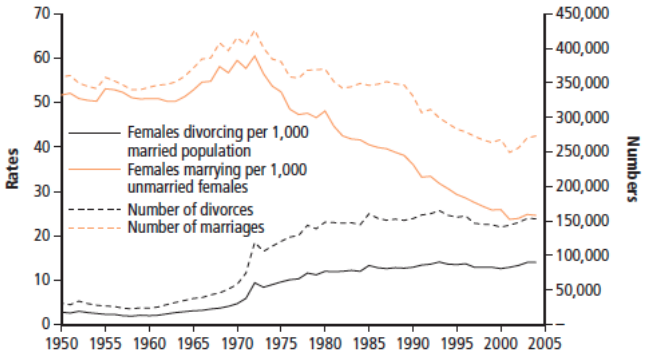


Figure 1.10: Average Divorce Rates in the BHPS Sample

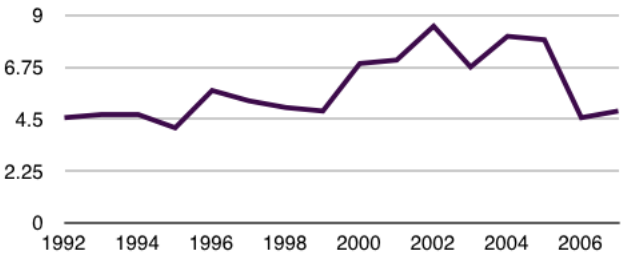
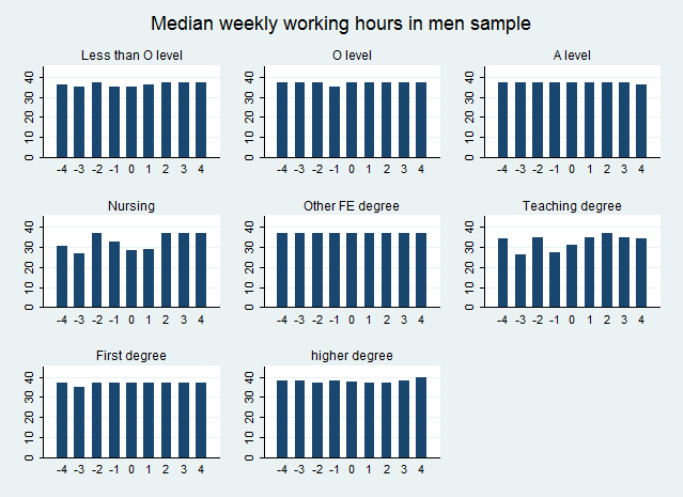


Figure 1.11: Men Labour Supply before and After Divorce by Education



In Figure 1.10 I present the average number of divorces at each wave of the panel and we can observe that there is no mass point at the beginning or at the end of the panel. Of course the discussion of cyclical divorce rates requires a much deeper investigation which can be a scope of future research for this paper.

Although the focus of this study is on the behaviour of married women, for the sake of comparison I have replicated the graph that depicts median hours of work before and after divorce using a sample of married men (graph 1.11). As seen in this graph, the labour supply of men does not vary much with a change in marital status. Specially For college graduates and above the labour supply stays relatively flat before and after divorce. This graph provides a further evidence that increase in labour supply of women after divorce is not the result of average increases in employment in the economy.

1.8 Conclusion

According to the findings of this study, divorce plays a significant role on behaviour of women in labour market. Women are observed to increase their labour supply following a divorce. Divorce increases labour supply at intensive and extensive margins. The labour supply of women after marital dissolution is heterogeneous in their level of investment in education. Among women without a university degree the rates of full time employment are relatively unchanged following divorce, however the odds of unemployment compared to part time work increase. In another word, women who do not hold a university degree seem to shift from part time work into actively looking for a job in labour market. Among university graduates, divorce increases the odds of full time employment whether the base of comparison is part time work or not working.

Given that the recent reforms in the U.K. are aimed at decreasing poverty by promoting in work benefits it is important to investigate how successful divorced women are in entering labour market. It would be interesting for a policy maker to take into account the challenges faced by divorced women who do not have accumulation of human capital either through work experience or through higher educational attainments in finding paid work. Understanding that women with low levels of education tend to be less active in labour market can help with alleviating some of barriers of finding jobs for women for instance by providing training to these women.

Chapter 2

An Empirical Test of On the Match Search in the Marriage Market

2.1 Introduction

Since the pioneering work of Becker (1974), economic literature has been studying how decisions to form partnerships or to dissolve them are formed within households. Household's decision-making processes have been analysed through various theoretical frameworks. The focus of this chapter is on the search and matching framework, specifically on the strand that assumes positive assortative matching in the marriage market.

According to search theory, heterogeneous agents engage in search to find a potential partner. Positive assortative sorting (hereafter called PAM) implies agents mate with their likes. With perfect information and no search frictions the market will be in equilibrium when men and women of similar traits are matched with each other and the matches are stable, i.e. no one is willing to deviate from the equilib-

rium outcome. With perfect information, search friction makes it costly to search long enough to find one's own type and therefore agents might accept a marriage offer even though that marriage is not their optimal match. Allowing divorce and re-partnership imply that agents can keep on searching for their perfect partner while matched with a less ideal mate. Equilibrium is reached when all agents are re-matched with their best potential partner. In this setting mismatched agents have the motivation to divorce to upgrade to a better partner.

If agents do not have ex-ante perfect information about traits of their potential partner, they engage in a partnership and form expectations about future payoffs. While matched they start learning about their partner's traits (and perhaps about their own traits too) and re-evaluate their marriage. If the new information is not favourable and the value of the match is below their expectations they separate. The decision to separate depends on value of outside options. In this case the outside option is remaining single or re-marriage.

Another way of looking at the problem is through imperfect information at the time of marriage. Imperfect information implies that some traits of spouses-to-be are not visible at the time of marriage. Positive assortative mating argues that agents prefer to be matched with their own type. PAM combined with imperfect information suggest that after the match is formed and partners learn about each other's characteristics they decide to separate if the realised characteristics of their partner are not matched with their own. In this case too, the mismatch is the cause of divorce and if the model allows re-partnership a potential better match provides motivation to divorce.

To complete the discussion about application of search framework to marriage market, I review a few papers that have contributed to this strand of literature.

Mortensen (1988) points out when the value of the match is initially unknown, a partnership may dissolve either because one of the partners receives an alternative offer with higher capital gain or because the realised value of the match once the partnership is formed is below expectation.Cornelius (2003) applies the on-the-job search theory of Burdett and Mortensen (1998) to the marriage market to explain divorce patterns. She divides people into good companions and bad companions (as seen in Burdett and Coles (1998)) and considers the good-good and bad-bad companionships stable matches whereas in any other match each party has a motivation to search for a better companion while already matched. Masters (2008) studies the marriage and divorce patterns with a matching model in which people age, and through ageing may lose their attractiveness. He finds marriages between equally attractive people stable but, mixed marriages are not stable in his framework. Goldmanis et al. (2013) state that matches are not be stable if the parties can search for a better partner while matched. They suggest divorce and remarriage continue until every one is matched to their own type. The reasons for divorce provided by search literature can be summarised in three groups:

1. Learning; In this strand of models divorce is the outcome of a matching process with ex-ante uncertaintly about quality of the match. The true value of the match is to be discovered ex-post. A poor draw from the set of match quality can result in divorce. Works of Brien et al. (2006), Chiappori et al. (2008), Bruze et al. (2015) fall in this group.

2. On the match search; In these models agents are impatient and search is costly. Thus even with perfect information agents accept a non-optimal offer

but continue to search while matched. Matches end in separation when one or both partners receive a better offer. Resorting can continue until all agents are matched to their optimal partner. Divorce can be an endogenous outcome and depends on the level of trust between spouses. Agents who believe their partner is searching while matched, start a search of their own thus partnerships formed in this environment will be less stable. (Mortensen (1988), Burdett and Coles (1998), Burdett et al. (2004), Cornelius (2003), Masters (2008), Goldmanis et al. (2013)

3. Idiosyncratic Match Value Shocks; Another way of modelling divorce is to assume that the only risks of dissolution for matches that seemed favourable at the time of formation are exogenous shocks to the idiosyncratic match values. These values can be considered as the love factor in a marriage (as seen in Fernandez et al. (2001)). Modelling divorce as an exogenous shock to the initial love draw is seen in Weiss and Willis (1997) and , Jacquemet and Robin (2013)).

Despite the rich theoretical framework under which one can study the potential causes of divorce, the empirical studies conducted to test these theories seems to be very limited. The most comprehensive empirical study in this literature is the Weiss and Willis (1997). Similarly to Mortensen (1988), Weiss and Willis (1997) argue that people meet randomly and thus there is the possibility that a matched person can find a better partner than his current match. They further argue that unanticipated changes in the characteristics of the partners can trigger divorce. Therefore probability of divorce should be lower amongst couples who are well matched. Weiss and Willis (1997) conduct an empirical study of whether the

unexpected changes to earning capacity can trigger divorce. The findings of their empirical study are discussed in the proceeding sections.

This chapter contributes to the literature by an empirical study of whether mismatch can increase the likelihood of divorce. In what follows I first describe a model of marriage and divorce with supermodular payoffs and positive sorting and then empirically test the predictions of the model. The purpose of this chapter is investigating to what extent re-sorting in marriage market can explain the decision to end a marital partnership.

2.2 A Model of Marriage and Divorce.

I consider equilibrium matching, divorce and re-matching in the context of a two-period model with ex-ante heterogeneous agents. Utility is transferable and all matches are heterosexual. Each individual is characterised by sex $s = f, m$ and a type $x \in \mathbb{R}$. The population distribution of x is the same for both sexes and the measure of males and females is also the same. Throughout the focus is on symmetric equilibria where men and women of the same type x adopt the same marriage and divorce strategies. I assume the payoff through remaining single is sufficiently negative that all form partnerships. If a male x matches with a female x' then family output is $F(x, x')$ where $F(.)$ is increasing, symmetric and strictly supermodular so that:

$$F(x_L, x_L) + F(x_H, x_H) > 2F(x_L, x_H) \text{ for all } x_L \neq x_H.$$

Matching is frictionless. In a one-period context a stable match allocation would correspond to a matching set $M(x)$ and terms of trade $V_f(.), V_m(.)$ such that:

$$\begin{aligned} V_m(x) + V_f(x') &= F(x, x') \text{ if } x' \in M(x), \\ V_m(x) + V_f(x') &\geq F(x, x') \text{ if } x' \notin M(x). \end{aligned}$$

A stable match allocation implies a matched pair enjoy corresponding equilibrium payoffs $V_f(.)$,$V_m(.)$ Stability requires should the male (or female) match with any other female (male) $x' \notin M(x)$ then, after compensating her with her equilibrium payoff $V_f(x')$, his residual payoff $F(x, x') - V_f(x') \leq V_m(x)$ and so is not better off. Hence, no one can identify an alternative match which strictly increases surplus. As it is well known, a symmetric environment and supermodular payoffs imply the unique stable matching outcome in that each male x marries a female with the same type; i.e. $M(x) = x$. Furthermore symmetry implies each partner enjoys the same equilibrium payoff $V_m(x) = V_f(x) = \frac{1}{2}F(x, x)$.

Here instead there are two periods. Suppose in the first period, a match (x, x') forms. In the second period there are individual specific type shocks, so that the male's second period type $x_m = x + \varepsilon$,the female's second period type $x_f = x' + \varepsilon'$. I assume each $(\varepsilon, \varepsilon')$ is an independent random draw from cumulative distribution function $G(\varepsilon, \varepsilon')$ which is symmetric. Given those realisations, the couple (x_m, x_f) then choose either to remain married or each pays a divorce cost c to separate. If they separate, both re-enter the divorcee market and rematch with a new partner.

Similar to Chiappori et al. (2008) and Jacquemet and Robin (2013) the types are defined by wages or productivities. Unlike their work, however, here it is assumed that shocks are given to individual types rather than to the match quali-

ties. Let $V_m^d(x_m) - c, V_f^d(x_f) - c$ denote their respective equilibrium payoffs through separation and equilibrium rematching in the divorcee market. As utility is transferable, the partners choose to divorce if and only if joint production is too small; i.e. when:

$$F(x_m, x_f) < V_m^d(x_m) + V_f^d(x_f) - 2c, \tag{2.1}$$

For completeness, though it plays no important part in what follows, I assume partners who do not divorce share the match surplus by symmetric Nash bargaining with threat points equal to each agent's payoff through divorce. Thus individual second period match payoffs are:

$$\begin{aligned} V_m^2(x_m, x_f) &= \max\left[V_m^d(x_m) + \frac{1}{2}[F(x_m, x_f) - V_m^d(x_m) - V_f^d(x_f)], V_m^d(x_m) - c\right] \\ V_f^2(x_m, x_f) &= \max\left[V_f^d(x_f) + \frac{1}{2}[F(x_m, x_f) - V_m^d(x_m) - V_f^d(x_f)], V_f^d(x_f) - c\right] \end{aligned}$$

where the first payoff applies if divorce is not jointly efficient (and match surplus is divided equally), otherwise they separate and obtain their respective divorce payoffs. More importantly, second-period joint surplus is:

$$V_m^2(x_m, x_f) + V_f^2(x_m, x_f) = \max\left[F(x_m, x_f), V_m^d(x_m) + V_f^d(x_f) - 2c\right].$$

I now formally define a stable match allocation in the first period.

Agents maximise expected discounted lifetime utility with discount factor $\beta \leq 1$. Let $\overline{V}_s(x)$ denote the expected equilibrium discounted payoff of an agent of type x with sex $s = m, f$. A stable match allocation is a first period matching set $M(x)$

and values $\overline{V}_s(x)$ with the property: $V_f(x')$

$$\overline{V}_m(x)+\overline{V}_f(x') = F(x,x')+\beta E \max\left[F(x_m,x_f), V_m^d(x_m)+V_f^d(x_f)-2c\right] \text{ if } x' \in M(x) \tag{2.2}$$

$$\overline{V}_m(x)+\overline{V}_f(x') \geq F(x,x')+\beta E \max\left[F(x_m,x_f), V_m^d(x_m)+V_f^d(x_f)-2c\right] \text{ otherwise,} \tag{2.3}$$

where divorce values $V_s^d(.)$ are consistent with a stable match allocation in the divorcee market.

For tractability, I restrict attention to the characterization and existence of symmetric stable match allocations. In such equilibria $M(x) = x$; i.e. males of type x marry females of the same type. Symmetry not only implies men and women enjoy the same payoffs $\overline{V}_m(x) = \overline{V}_f(x) \equiv \overline{V}(x)$, they also adopt the same divorce strategies. As the distribution of singles in the divorcee market must then be the same by sex, it immediately follows that a symmetric stable match allocation in the divorcee market yields payoffs:

$$V_m^d(x) = V_f^d(x) = \frac{1}{2}F(x,x)$$

as each divorcee x rematches with the same type. (2.1) now implies a couple with ex-post types (x_m, x_f) will divorce in the second period if and only if:

$$\frac{1}{2}F(x_m,x_m) + \frac{1}{2}F(x_f,x_f) - F(x_m,x_f) > 2c. \tag{2.4}$$

As payoffs are supermodular, this implies divorce occurs whenever ex-post types (x_m, x_f) are sufficiently "different". Note further that (2.2) implies equilibrium

payoffs:

$$\overline{V}(x) = \frac{1}{2}F(x,x)+\frac{1}{2}\beta E \max\left[F(x+\varepsilon, x+\varepsilon'), \frac{1}{2}F(x+\varepsilon, x+\varepsilon) + \frac{1}{2}F(x+\varepsilon', x+\varepsilon') - 2c\right] \tag{2.5}$$

where depending on type shocks (ε,ε'), the second-period divorce outcome maximises the joint surplus of the match. The above has thus established the following Proposition.

Proposition 1. If a symmetric stable match allocation exists, equilibrium payoffs $\overline{V}(x)$ are given by (2.5) and divorce occurs in any equilibrium match (x,x) when shocks $(\varepsilon, \varepsilon')$ imply:

$$\frac{1}{2}F(x+\varepsilon, x+\varepsilon) + \frac{1}{2}F(x'+\varepsilon', x'+\varepsilon') - F(x+\varepsilon, x'+\varepsilon') > 2c. \tag{2.6}$$

Below we consider in detail how the divorce outcome depends on the realised shocks $(\varepsilon, \varepsilon')$. First, however, we consider the existence of a symmetric stable match allocation. By (2.3) and Proposition 1, a symmetric stable match allocation exists if and only if:

$$\overline{V}(x)+\overline{V}(x') \geq F(x,x')+\beta E \max\left[F(x+\varepsilon, x'+\varepsilon'), \frac{1}{2}F(x+\varepsilon, x+\varepsilon) + \frac{1}{2}F(x+\varepsilon', x'+\varepsilon') - 2c\right]. \tag{2.7}$$

for all x, x' with $\overline{V}(x)$ given by (2.5). Substituting out $\overline{V}(x)$, (2.7) holds if and only if:

$$\frac{1}{2}F(x,x) + \frac{1}{2}F(x',x') - F(x,x') + \beta\Psi(x,x',c) \geq 0 \text{ for all } x, x', \tag{2.8}$$

where:

$$\Psi(x,x';c) = E\max\left[\frac{1}{2}F(x+\varepsilon,x+\varepsilon')\frac{1}{4}F(x+\varepsilon,x+\varepsilon)+\frac{1}{4}F(x+\varepsilon',x+\varepsilon')-c\right]$$
$$+E\max\left[\frac{1}{2}F(x'+\varepsilon,x'+\varepsilon'),\frac{1}{4}F(x'+\varepsilon,x'+\varepsilon)+\frac{1}{4}F(x'+\varepsilon',x'+\varepsilon')-c\right]$$
$$-E\max\left[F(x+\varepsilon,x'+\varepsilon'),\frac{1}{2}F(x+\varepsilon,x+\varepsilon)+\frac{1}{2}F(x'+\varepsilon',x'+\varepsilon')-2c\right] \quad (2.9)$$

As supermodularity implies $\frac{1}{2}F(x,x)+\frac{1}{2}F(x',x')F(x,x') \geq 0$, existence of a symmetric stablematch allocation is established if it can be shown that $\Psi(x,x';c) \geq 0$.

Consider now the divorce set:

$$D(x,x';c) = \{(\varepsilon,\varepsilon') : \frac{1}{2}F(x+\varepsilon,x+\varepsilon)+\frac{1}{2}F(x'+\varepsilon',x'+\varepsilon')-F(x+\varepsilon,x'+\varepsilon') > 2c\} \quad (2.10)$$

which is the set of shocks $(\varepsilon,\varepsilon')$ for which partners (x,x') will choose to divorce. The probability of divorce is then given by

$$P(x,x';c) = \int_{(\varepsilon,\varepsilon')\in D(x,x';c)} dG(\varepsilon,\varepsilon').$$

Proposition 2 establishes a useful relationship between the existence of symmetric stable match allocations and divorce probabilities.

Proposition 2. A sufficient condition for the existence of a symmetric stable match allocation is that divorce probabilities P(.) are submodular; i.e.

$$P(x,x;.)+P(x',x';.)-2P(x,x';.) \leq 0. \quad (2.11)$$

Proof. Direct inspection finds $\Psi(x,x';c) = 0$ when $c = 0$: when there is

no cost to divorce, all reallocate in the second period and the first period match allocation has no impact on second period surplus. Differentiating (2.9) with respect to c implies:

$$\frac{\partial \Psi}{\partial c} = -P(x, x; .) - P(x', x'; .) + 2P(x, x'; .). \tag{2.12}$$

As (2.11) implies $\Psi(x, x'; c)$ is increasing in c, then $\Psi(x, x'; c) = 0$ at $c = 0$ implies $\Psi(x, x'; c) \geq 0$ for all $c \geq 0$. As this establishes (2.8), this completes the proof of Proposition 2.

Submodular divorce probabilities would seem particularly intuitive: they simply say that un-like partners divorce with greater probability than do-like partners. Although this is a simple and intuitive criterion, however, it is not simple to establish general conditions under which it might hold.

For example suppose the standard production function $F(x, x') = xx'$. In a single period context with no divorce, it is well known this production function implies positive assortative matching. But this is not sufficient with type shocks and second-period divorce options. For example, this production function and (2.10) implies the divorce set:

$$D(x, x'; c) = \{(\varepsilon, \varepsilon') : [(x + \varepsilon) - (x' + \varepsilon')]^2 > 4c\};$$

i.e. divorce occurs whenever:

$$\begin{aligned} \varepsilon' &< \varepsilon + x - x' - 2c^{0.5} \\ \varepsilon' &> \varepsilon + x - x' + 2c^{0.5}. \end{aligned} \tag{2.13}$$

Figure 2.1: Divorce Set

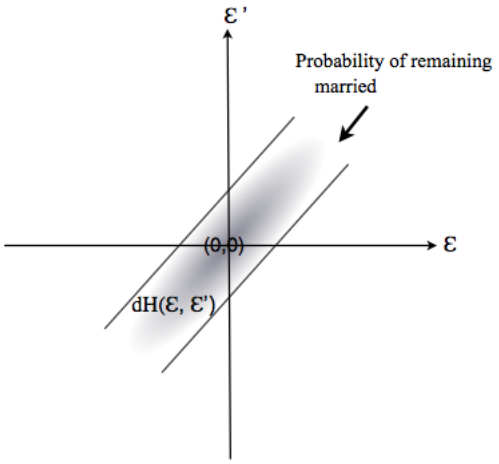


Figure 2.1 describes the divorce set when like partners match; i.e. $x' = x$. Partners remain married when the $(\varepsilon, \varepsilon')$ shocks lie in the band described in Figure 2.1. Thus when type shocks are positively correlated; i.e. both do better or both do worse, there is little value to resorting in the divorcee market and the partnership survives. Divorce instead occurs whenever $|\varepsilon' - \varepsilon|$ is sufficiently large; i.e. one does well, the other does relatively badly. The case when $x = x'$ is interesting for the "remain married" band is centered around (0,0). If most of the probability mass $G(\varepsilon, \varepsilon')$ is centered around (0,0), matching with one's own type would seem to maximise the probability of remaining married. Instead an increase in x' to, say, $x' = x + \Delta$ with $\Delta > 0$, shifts down the "remain married" band by Δ and it is no longer centered around (0,0). It would thus seem reasonable to presume that divorce probabilities are indeed submodular: an increase in Δ increases the probability of divorce. This is not, however, necessarily true.

For example, consider $(\varepsilon, \varepsilon')$ shocks which are perfectly negatively correlated, e.g. with probability one half $\varepsilon = \overline{\varepsilon}, \varepsilon' = -\overline{\varepsilon}$ and with probability one half $\varepsilon =$

$-\overline{\varepsilon}, \varepsilon' = \overline{\varepsilon}$ with $\overline{\varepsilon} > c^{0.5}$. In this case, divorce occurs with probability one when $x = x'$ but divorce only occurs with probability one half at $x - x' = 2\overline{\varepsilon}$. In this example the divorce probabilities are supermodular (like types are guaranteed to divorce) and asymmetric matching is instead potentially optimal. For instance, a male x may match with a female $x' < x$ on the gamble that she will have the favourable shock and they will remain married in the second period. That is not to say this is a particularly natural case, rather it demonstrates that assuming $F(.)$ is supermodular is no longer sufficient to guarantee positive assortative matching with type shocks and costly divorce.

Perhaps the most natural case to consider and is the one identified in the empirical section below, is that the type shocks $\varepsilon'\varepsilon$ are independent draws from $G(.)$. The divorce probabilities are then given by:

$$P(x, x'; c) = \int_{\varepsilon} [G(\varepsilon + x - x' - 2c^{0.5}) + 1 - G(\varepsilon + x - x' + 2c^{0.5})] g(\varepsilon) d\varepsilon$$

where, conditional on the male ε shock, which occurs with probability measure $g(\varepsilon)$, $G(\varepsilon + x - x' - 2c^{0.5})$ is the probability the ε' shock is sufficiently low the couple separate, while $1 - G$ is the probability the ε' shock is sufficiently high. Clearly the divorce probability only depends on the type gap $[x - x'] = \Delta$.Establishing submodularity on $P(.)$ now reduces to showing:

$$\int_{\varepsilon} \begin{bmatrix} G(\varepsilon + \Delta - 2c^{0.5}) - G(\varepsilon + \Delta + 2c^{0.5}) \\ -G(\varepsilon - 2c^{0.5}) + G(\varepsilon + 2c^{0.5}) \end{bmatrix} g(\varepsilon) d\varepsilon > 0 \qquad (2.14)$$

for any $\Delta > 0$. Unfortunately there is no natural restriction on $G(.)$ which guarantees (2.14). This condition does, however, describe the restriction on G which

ensures the existence of a symmetric stable match allocation.

Proposition 3. A symmetric stable match allocation exists for the case $F(.) = xx'$ and any shock structure G which satisfies (2.14)

2.3 An Empirical Implementation of the Model.

I use the above insights to identify a consistent model of marriage and divorce. For the case that $F(x, y) = xy$, partners (x, x') who marry will divorce if they have second period type shocks $(\varepsilon, \varepsilon')$ which satisfy (2.13). A stable, symmetric match allocation further implies $x' = x$ in any first-period marriage and thus divorce occurs in the second stage if and only if type shocks:

$$\varepsilon' - \varepsilon < -2c^{0.5} \tag{2.15}$$

$$\varepsilon' - \varepsilon > 2c^{0.5}. \tag{2.16}$$

In other words, a partnership dissolves when one partner receives a much more favourable shock than the other. In what follows I use Mincer wage equations to identify wage shocks. The estimation method is explained more extensively in the Econometric Method section. The prediction of the the theoretical framework discussed above, is that divorce is more likely if one partner receives a favourable wage shock while the other receives a more unfavourable shock. For when instead both partners receive favourable shocks, or both receive unfavourable shocks, the gain to resorting in the divorcee market is small and, as divorce is costly, partners remain matched. This prediction is tested with household data in the following sections.

2.4 Data and Method

2.4.1 Sample Selection and Descriptive Statistics

The data used in this study is derived from 18 years of British Household Panel Survey (BHPS), an annually repeated survey conducted in UK between 1991 and 2008. The sample of this study is an unbalanced panel of 26616 observations, consisting of 4202 married couples aged between 23 to 55. This age criterion eliminates most of the full-time students and the retired from the labour market. Both partners of selected couples are employed and/or have reported earned labour income. I excluded the entire history of those partnerships in which at least one spouse suffers from long-term sickness or disability. The event of interest is marital dissolution and is defined as either separation, divorce, or changing partner. Given the considerable rate of misreporting of hours and earnings among the self employed, and for the sake of having a homogeneous sample a common practice is to exclude the self-employed from the data set. This means excluding the whole history of those families for which, either or both partners have been at least once in self employment. I chose to keep the self employed in my sample as I believe they contribute valuable information to the regression model.

A summary of the economic activity of married men and women is presented in Table 2.1. As observed in this table, although the employment rate per se is not very different among men, women and couples with or without children, the difference in the average working hours per week among employed men and women is noticeable.

Table 2.2 compares a number of other characteristics of married couples who

Table 2.1: Summary of economic activities

	Women		Men	
	With Childern	Child-less	With Children	Child-less
Missing	0.08%	0.09%	0.29%	0.23%
Self-employed	5.94%	6.26%	18.13%	17.63%
Working < 16 hrs/week	23%	17%	2%	3%
Working 16 to 30 hrs/week	32%	28%	5%	9%
Working 30+ hrs/week	45%	55%	94%	88%
Employed	65.35%	76.76%	77.04%	72.60%
Working< 16 hrs/week	25%	11%	2%	3%
Working 16 to 30 hrs/week	41%	27%	3%	4%
Working 30+ hrs/week	34%	62%	95%	94%
Unemployed	1.21%	1.81%	3.01%	2.31%
Retired	0.06%	3.44%	0.39%	6.44%
Maternity leave	3.99%	0.98%	0.00%	0.00%
Family care	22.26%	9.72%	0.46%	0.07%
Full time student	0.79%	0.46%	0.35%	0.47%
Government training Scheme	0.03%	0.03%	0.11%	0.03%
Other	0.30%	0.45%	0.21%	0.22%
Number of observations	21642	17271	19,186	14829

experience divorce or separation with characteristics of married couples who remain married as long as they have been surveyed. For making the comparison easier I denote the former as currently-married (the terminology comes from Francesconi (2002)) and the latter as always-married. Thus the currently married couples are couples who are observed to be married to each other up to some point in the panel but their marriage is observed to end in separation. Always married couples are couples that have stayed together throughtout the survey years and thus are never observed to separate from each other.

It is highlighted in past empirical work (Becker et al. (1977a), Mott and Moore (1979) and Moore and Waite (1981)) that number of children, home ownership, high levels of investment in education, race, living in metropolitan areas and women's employment, are among determinant factors of marital dissolution. These

factors are measured by variables that are summarised in Table 2.2, where always-married couples are compared with currently-married ones.

Investment in education is measured by highest qualification achieved. The data suggests that the always-married group is slightly more educated than currently-married group. Given the negligible change in educational attainments throughout the panel it is reasonable to assume that educational qualification is fixed over time for the sample of this study.

Race is another fixed trait that is known to explain probability of divorce to some extent. Early works of Thornton (1985) and Moore and Waite (1981) find blacks to be more likely to divorce. This trend is also observable at a later work Stevenson and Wolfers (2007). Table 2.2 suggests that black females and males in this sample are slightly more likely to have an unstable marriage compared with non-blacks. However as evident in this table, non-whites are under represented in this sample (only about 3% of respondents for all 18 waves of the panel are non-whites). According to national statistics in years 1991 to 2001 about 7% - 9% of the total UK population were non-whites, this number increased to about 14% by 2011 (Source: 2013 briefing of ESRC Centre on Dynamics of Ethnicity)-.

Another factor that is found to be a determinant of marital dissolution is living in large metropolitan areas. Given the limited information provided by BHPS regarding metropolitan areas in the UK, I only distinguish between inhabitants of London with the rest of the UK. The statistic in Table 2.2 is consistent with previous studies that suggest living in large cities is associated with higher rate of marital instability.

A number of studies discuss that marriages tend to be less stable when wives are engaged in the labour market. Average working hours of women who experience

divorce are not considerably higher than those of married women who do not undergo a marital dissolution. The always-married men seem to be working longer hours per week, this evidence is consistent with the empirical evidence presented in the following sections.

Not surprisingly, women and men in stable marriages are on average older than the other group, which is an indication of longer duration of their marriage. Regarding the presence of dependent children in the household, at the first glance it seems that couples with stable marriages tend to have fewer number of children. This might seem surprising as children are usually considered as a marital investment commodity, couples in an unstable marriage should be less likely to make the investment. The number seems less controversial when the definition of dependent children is taken into account. BHPS only keeps a record of the number of dependent children who live in household and by definition these children are under 16 years old (or in full-time education). Given that always-married couples tend to be older than currently-married ones, it is likely that the children of the former group have left the household by the time of the interview. However the effect of children on marital dissolution requires deeper investigation.

Lastly, house ownership as another indicator of marriage specific investment is compared among two groups. The statistical evidence suggests that couples in more stable marriages tend to have higher rate of house ownership. It should be added that the difference between owned outright rates among two groups, can be partly attributed to the duration of the marriages. Given that the always-married group have been married for a longer period, it can be the case that some of these couples have paid off their mortgage by the time of the interview. Next chapter discusses to what extent the variables described in table 2.2 determine the

probability of divorce.

2.4.2 Econometric Method

As mentioned in section 3, I use Mincer wage equations to identify wage shocks. Income shocks are defined as an unexplained component of income after controlling for observable worker's ability. This choice of terminology for the residuals of mincer wage equation is to reflect the interpretation that is given to these residuals in this paper. This definition of income shock shall not be confused with the income shocks described in the vast literature of permanent income hypothesis.

According to permanent income hypothesis the observed income at each time period consists of observable time variant and time invariant characteristics as well as transitory and permanent shocks. In this literature the permanent component of income follows a martingale process and the transitory shocks are distributed i.i.d. (Hall and Mishkin (1982)). With this definition of income process one can then estimate the variance of transitory and permanent stochastic components. Apart from complication in estimating these shocks, this specification has another disadvantage that does not allow distinguishing between positive and negative convergences from income and thus it is not clear how one can identify a measure of sorting among couples using these income shocks. Additionally the shocks under this specification are computed using an expectation about future income. Each person's income shock is based on the deviation of their actual income from their own expectation of income and not from an average across identical individuals. For these reasons I choose the residual's of mincer wage equation as an indicator of income shocks. permanent shocks.

Mincer's pioneering transformation of human capital theory, as seen below, became the benchmark for estimating wages.

$$\log y_{it} = \alpha + \beta_1 X_{it} + \beta_2 X_{it}^2 + \sum_{i=1}^{k} \gamma D_{it} + \epsilon_{it} \tag{2.17}$$

I estimate equation (2.17) based on two sub-samples of married males and females. In the original Mincer's model, investment in education is measured by number of years spent in full-time education. Given that such specification imposes constant return of education on earnings, it has been suggested in the return to education literature; investment in education is better to be measured with multiple binary variables for each level of achieved qualification. The use of multiple variables relaxes the assumption that different levels of education have the same impact on earnings (Blundell et al., 2001).

It should be noted that in most recent panel surveys, including BHPS, individuals are asked of their highest educational qualification rather than completed years of schooling (Card, 1999). Therefore, the use of categorical variables instead of number of years spent in full-time education at times is dictated by the method of data collection. To be consistent with the advancements in the literature, I use categorical variables to quantify investment in education.

Earnings(y_i), are measured as annual labour income and include labour income from employment and self-employment -BHPS does not provide enough information for usage of hourly wages-. Variable X denotes potential years of work experience. Given unavailability of data regarding actual work experience, I use the potential labour market experience as a proxy for work experience (as suggested by Mincer, 1975). Lastly, dummy variables are included to control for year effects.

Having estimated equation (2.17), the income shocks are defined:

$$\varepsilon_{it} = \log y_{it} - \widehat{\log y_{it}} \tag{2.18}$$

Which are the residuals of estimation and indicate the unexplained component of income. Given that predicted earnings are defined by $\widehat{\log y_i} = \alpha + \beta_1 X + \beta_2 X^2 + \sum_{i=1}^{k} \gamma D_i$, the residuals can be interpreted as whether individual i's earning is below or above the average of a worker with similar education and potential experience.

According to the two-period model discussed in section (2), in second period, agents learn about their own and their partner's shock. After realisation of the shocks, partners reassess the value of their marriage. Those with large shock differences can gain by resorting. Therefore, keeping a set of control variables constant, spouses with big difference in shocks must be the most likely to divorce. Inequalities in (2.15) suggest that divorce is more likely when the absolute difference between shocks is larger than $2c^{0.5}$. To test this prediction with data, rather than estimating cost of divorce, c and defining the exact threshold as seen in (2.15), I focus on the difference between shocks to see whether increasing the difference can predict rate of divorce.

Having defined a measure of mismatch among couples the next step it to test whether these measures can partly explain the probability of divorce. Following the theoretical framework the most natural way of conducting this empirical test would be the following: At first show that at the time of marriage partners positively sort on their productivity type. This comes from the assumption made at the first period of the model where every one is matched to their own type. After evaluating the degree of positive assortative mating at the time of marriage then the degree of

divergence in types should be measured at the time of divorce. Finally, conditional on having positive assortative mating at the time of marriage, the probability of divorce can be estimated as a function of difference in shocks at the time of divorce.

Conducting the analysis in such a way requires rich information about productivities of both partners when they were forming their marriage which means limiting the sample to the marriages that their starting point is observed by the researcher. Unfortunately focusing on marriages for which the full spell is observed downgrades the sample size dramatically which makes any analysis based on such small sample size unattractive. The sample size in study is of great importance as there are four types of partnerships, and the separation rate must be compared among these four groups. Furthermore, the lack of information about starting point of the marriage prevents the use of a hazard function in estimating the probability of marital dissolution.

A less attractive but more practical way of estimating the effect of productivity mismatch on probability of divorce is to use this variable as an explanatory variable in a binary response model where the response variable is the event of divorce. The drawback of this method is that only the type differences at the time of divorce contribute to the probability of divorce and the initial sorting is not taken into account. Another drawback of this approach is that it is not possible to distinguish the persistent type shocks from occasional ones. One way of dealing with the latter issue is by grouping the ongoing marriages into stable and unstable marriages where the unstable marriages are those that at some point during the panel end in separation. Then estimating the probability of being in an unstable or stable marriage as a function of average type shocks. This approach is presented in the sensitivity analysis. In what follows I present the results from estimating

the probability of divorce using binary response functional forms. The likelihood function to be estimated is the following:

$$Log\theta_{it} = \sum_{i=1}^{n} \Big[y_{it} ln\Big(pr(y_i = 1|X_{it})\Big) + (1 - y_{it}) ln\Big(pr(y_i = 0|X_i)\Big)\Big] \qquad (2.19)$$

Where y_{it} is the conditional probability of divorce for couple i at time t and X_{it} are the set of covariates. The likelihood function is first estimated with a pooled probit/logit estimation and then with a random effect probit specification to model the serially correlated error terms. For additional checks the likelihood is also estimated using C-log-log specification which does not impose a symmetric shape on the likelihood function and is more adaptable to unequal number of zeros and ones in the dependent variable.

2.5 Empirical Evidence

2.5.1 Main results

In the first specification, I let $[\varepsilon_x - \varepsilon_y]^2$ to capture the degree of income shock mismatch between couples. According to the model we should expect a positive and significant coefficient of $[\varepsilon_x - \varepsilon_y]^2$ on probability of divorce.

Estimated parameters are presented in Table 2.3. As seen in Table 2.3, results do not support the prediction of the model; $[\varepsilon_x - \varepsilon_y]^2$ has an insignificant (and negative) coefficinet $[\varepsilon_x - \varepsilon_y]^2$. Specification 1 imposes two restrictions. Firstly it assumes all levels of difference have the same effect on the probability of divorce.

Secondly it treats the male and female shocks in a symmetric manner. There is no distinguishing which partner receives a positive shock and which partner receives a negative shock. As long as the magnitude of the shocks are the same, a couple in which $\varepsilon_x > 0$; $\varepsilon_y < 0$ is not different from a couple with $\varepsilon_x < 0$; $\varepsilon_y > 0$. Similarly a couple with $\varepsilon_x < 0$; $\varepsilon_y < 0$ is treated the same way as a couple with both shocks positive. To relax these assumptions I re-estimate the model using quantiles of $[\varepsilon_x - \varepsilon_y]$. If the difference in shocks is a cause of divorce, one would expect a positive and significant coefficient for the upper and lower quantiles and a zero coefficient for median points.

Table 2.2: Descriptive Statistics

	Always-married	Currently-married
Female's Education qualification		
No qualification	23.62%	20.45%
O-level	21.54%	28.85%
A-level	10.9%	11.83%
Higher vocational	28.15%	27.8%
Univeristy degree	15.79%	11.06%
Male's Education qualification		
No qualification	19.99%	19.82%
O-level	16.06%	21.34%
A-level	12.43%	13.24%
Higher vocational	33.27%	31.25%
Univeristy degree	18.25%	14.36%
Race		
White females	96.93%	96.68%
Black females	0.89%	1.29%
Other nonwhite females	2.72%	2.04%
White males	96.78%	96.23%
Black males	0.49%	1.64%
Other nonwhite males	2.73%	2.75%
London inhabitant	5.7%	6.9%
Female's Avg working hours/week		
less than 16 hours	14.49%	14.21%
between 16 to 30 hours	38.05%	36.79%
between 30 to 40 hours	42.25%	43.22%
More than 40 hours	5.2%	5.78%
Male's Avg working hours/week		
less than 16 hours	0.77%	0.54%
between 16 to 30 hours	3.98%	3.24%
between 30 to 40 hours	66.36%	63.3%
More than 40 hours	28.89%	32.92%
Average monthly labour income		
Female's	1066	1000
Male's	2027	1858
Average age		
Female's	42	37
Male's	44	38
Number of Dependent children		
None	46.27%	27.79%
One	21%	25%
Two	24%	32%
Three or more	9%	15%
Housing Tenure		
Owned outright	16.2%	6.47%
Owned with mortgage	70.57%	72.58%
In social housing	7%	13%
Privately rented	4%	6%

Table 2.3: Probability of divorce based on squared residual differences

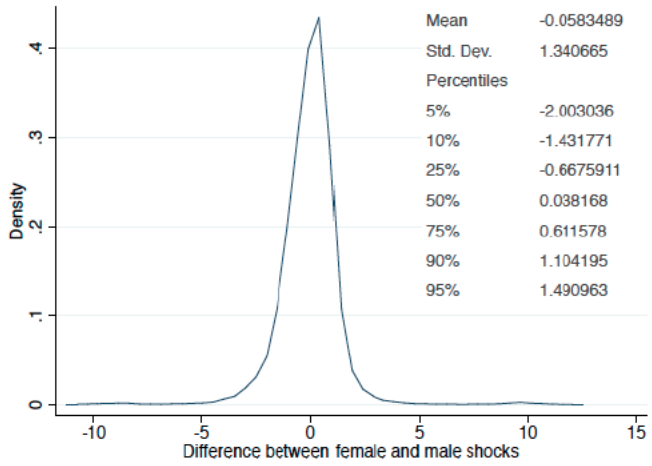
	Probit	Logit	Clog-log	RE Probit
$[\varepsilon_x - \varepsilon_y]^2$	-0.00162	-0.00361	-0.00354	-0.00175
	(-0.46)	(-0.40)	(-0.39)	(-0.46)
Pres school children	-0.170	-0.429	-0.424	-0.187
	(-1.92)	(-1.83)	(-1.82)	(-1.95)
Age (woman)	0.0165*	0.0439*	0.0434*	0.0201*
	(2.21)	(2.31)	(2.32)	(2.28)
Age (man)	-0.0423***	-0.113***	-0.112***	-0.0467***
	(-5.65)	(-5.89)	(-5.92)	(-5.31)
Owns outright	0.137	0.404	0.404	0.145
	(1.22)	(1.30)	(1.30)	(1.17)
Woman's education				
O-level	0.188*	0.527*	0.525*	0.211*
	(2.01)	(2.09)	(2.10)	(1.97)
A-level	-0.146	-0.378	-0.374	-0.163
	(-1.01)	(-0.94)	(-0.93)	(-1.03)
Some college	0.0507	0.160	0.161	0.0662
	(0.50)	(0.58)	(0.58)	(0.59)
University degree	-0.146	-0.365	-0.360	-0.150
	(-1.00)	(-0.90)	(-0.89)	(-0.93)
Man's education				
O-level	0.0973	0.219	0.216	0.115
	(0.97)	(0.81)	(0.80)	(1.02)
A-level	-0.0797	-0.196	-0.194	-0.0871
	(-0.69)	(-0.63)	(-0.62)	(-0.68)
Some college	0.0229	0.0500	0.0508	0.0348
	(0.25)	(0.20)	(0.20)	(0.34)
University degree	-0.0759	-0.262	-0.261	-0.0788
	(-0.57)	(-0.69)	(-0.69)	(-0.54)
Living in London	-0.0256	-0.0652	-0.0616	-0.0348
	(-0.20)	(-0.18)	(-0.17)	(-0.24)
Socio-economic class(women)				
Intermediate white collar	0.0223	0.0907	0.0910	0.0208
	(0.25)	(0.38)	(0.38)	(0.21)
Independents (Petty bourgeoisie)	-0.0777	-0.218	-0.218	-0.0916
	(-0.71)	(-0.72)	(-0.72)	(-0.76)
Intermediate blue collar	0.271	0.715	0.710	0.301
	(1.81)	(1.87)	(1.88)	(1.82)
Working class	0.128	0.358	0.355	0.137
	(1.19)	(1.25)	(1.25)	(1.16)
Socio-economic class(men)				
Intermediate white collar	-0.154	-0.396	-0.393	-0.180
(-1.04)	(-0.99)	(-0.98)	(-1.09)	
Independents (Petty bourgeoisie)	0.136	0.369	0.368	0.152
	(1.37)	(1.41)	(1.41)	(1.40)
Intermediate blue collar	-0.0606	-0.144	-0.141	-0.0722
	(-0.60)	(-0.54)	(-0.53)	(-0.64)
Working class	-0.182*	-0.477*	-0.470	-0.195*
	(-2.06)	(-1.97)	(-1.96)	(-2.02)
Black ethnic origin	0.537	1.361	1.341	0.566
	(1.24)	(1.31)	(1.32)	(1.20)
Woman's avg working hrs per week	0.00653**	0.0179**	0.0177**	0.00731*
	(2.60)	(2.67)	(2.67)	(2.57)
Man's avg working hrs per week	-0.00232	-0.00631	-0.00626	-0.00268
	(-0.74)	(-0.75)	(-0.75)	(-0.79)
Constant	-1.420***	-2.253***	-2.281***	-1.571***
	(-5.48)	(-3.37)	(-3.45)	(-5.11)
Logged Variance of R.E.				-1.784**
				(-2.86)
Number of observations	17683	17683	17683	17683

t statistics in parentheses
* p<0.05 ** p<0.01 *** p<0.001

Table 2.4: Probability of divorce conditioned on quantiles of shock differences

	Probit	Logit	Cloglog		Probit	Logit	Cloglog		Probit	Logit	Cloglog
	(1)	(2)	(3)		(4)	(5)	(6)		(7)	(8)	(9)
Tercile 1st	0.0470	0.159	0.158	Quintile 1st	0.0930	0.287	0.286	Decile 1st	0.0812	0.230	0.228
	(0.54)	(0.67)	(0.67)		(0.86)	(0.98)	(0.98)		(0.54)	(0.56)	(0.56)
Tercile 3rd	-0.00456	-0.0108	-0.0110	Quintile 2nd	-0.0390	-0.0865	-0.0869	Decile 2nd	0.186	0.520	0.517
	(-0.06)	(-0.05)	(-0.05)		(-0.39)	(-0.32)	(-0.32)		(1.40)	(1.44)	(1.44)
				Quintile 4th	-0.0414	-0.126	-0.126	Decile 3rd	0.0168	0.0522	0.0487
					(-0.44)	(-0.50)	(-0.51)		(0.12)	(0.13)	(0.12)
				Quintile 5th	-0.0408	-0.138	-0.140	Decile 5th	0.141	0.350	0.347
					(-0.41)	(-0.53)	(-0.54)		(1.04)	(0.96)	(0.96)
								Decile 6th	-0.0627	-0.157	-0.156
									(-0.44)	(-0.40)	(-0.40)
								Decile 7th	-0.137	-0.442	-0.443
									(-0.86)	(-1.00)	(-1.01)
								Decile 8th	0.103	0.255	0.251
									(0.75)	(0.69)	(0.68)
								Decile 9th	0.0464	0.0729	0.0688
									(0.32)	(0.18)	(0.17)
								Decile 10th	-0.0493	-0.163	-0.163
									(-0.30)	(-0.37)	(-0.37)
Constant	-1.444***	-2.319***	-2.345***		-1.439***	-2.296***	-2.321***		-1.499***	-2.404***	-2.426***
	(-5.57)	(-3.48)	(-3.56)		(-5.45)	(-3.37)	(-3.45)		(-5.42)	(-3.32)	(-3.39)
Number of Observations	17683	17683	17683		17683	17683	17683	17683	17683	17683	17683
t statistics in parentheses											

Figure 2.2: Kernel estimate of female's shock minus male's shock



The estimates based on tercile, quintiles, and deciles of $[\varepsilon_x - \varepsilon_y]$ with the middle percentiles being the reference category are presented in Table 2.4. The set of control variables is the same as specification 1. Figure provides the kernel density estimates of $[\varepsilon_x - \varepsilon_y]$. None of the sepecifications discussed so far find the difference in shocks as a determinant of divorce. In the next step I focus more on ranking of partners according to their income shock. Suppose there are only two ex-post types. i.e. $x = \{good, bad\}$, and

$$x = \begin{cases} good & \text{if } \varepsilon_{it} \geq 0 \\ bad & \text{if } \varepsilon_{it} < 0 \end{cases}$$

The terminology for ranking couples in this way is borrowed from Burdett, Coles 1999 and Cornelius 2003. The types here merely indicates the sign of income shocks. Assuming positive shocks are favourable, a partner who receifves a favourable

income shock is referred to as a partner with good shock or simply a partner of good type, likewise for negative shocks. Therefore, we have the following couple types:

$$\begin{cases} \text{G-G} & \text{if} \quad \varepsilon_{it}^{f} \geq 0 \text{ and } \varepsilon_{it}^{m} \geq 0 \\ \text{G-B} & \text{if} \quad \varepsilon_{it}^{f} \geq 0 \text{ and } \varepsilon_{it}^{m} < 0 \\ \text{B-G} & \text{if} \quad \varepsilon_{it}^{f} < 0 \text{ and } \varepsilon_{it}^{m} \geq 0 \\ \text{B-B} & \text{if} \quad \varepsilon_{it}^{f} < 0 \text{ and } \varepsilon_{it}^{m} < 0 \end{cases}$$

Where ε_{it}^{f} refers to women's income shock at any wave and ε_{it}^{m} refers to men's shock. The first character in couple types indicates women's residuals and the second indicates their spouse's residual. According to the predictions of the model G-G and B-B Matches are more stable than B-G and G-B matches. The log-likelihood function in (2.19) is estiamted again, using the couple types as covariates that capture the degree of mismatch between partners.

As seen in Table 2.5 among couples with identical levels of education, socio-economic class and average working hours per week, those who are in the B-B group have the highest probability of divorce. The rate of divorce among B-B couples is higher than G-B and B-G couples who are not matched with their own type. The application of search theory to marriage market implies the cause of divorce is re-sorting in order to rematch with someone's own type. If that was true, we should have observed higher divorce rates among G-B and B-G couples. However, the findings in this chapter do not support the scenario that resorting is a motivation for divorce.

The rest of the covariates are included in the model to gain robust estimates of effect of difference in shocks and, therefore, are not the interest of this analysis

Table 2.5: Couple's type and Probability of Divorce

	Probit	Logit	Clog-log	RE Probit
Couple's type				
G-B	0.0740	0.175	0.173	0.0768
	(0.88)	(0.78)	(0.78)	(0.85)
B-G	0.103	0.298	0.295	0.112
	(1.04)	(1.10)	(1.10)	(1.06)
B-B	0.233*	0.590*	0.584*	0.242*
	(2.22)	(2.09)	(2.09)	(2.14)
Pres school children	-0.174	-0.450	-0.447	-0.189*
	(-1.96)	(-1.91)	(-1.91)	(-1.99)
Age (woman)	0.0169*	0.0450*	0.0445*	0.0201*
	(2.28)	(2.38)	(2.39)	(2.33)
Age (man)	-0.0425***	-0.114***	-0.113***	-0.0465***
	(-5.68)	(-5.91)	(-5.96)	(-5.34)
Owns outright	0.130	0.390	0.389	0.138
	(1.15)	(1.25)	(1.26)	(1.12)
Woman's education				
O-level	0.191*	0.525*	0.523*	0.212*
	(2.06)	(2.10)	(2.11)	(2.02)
A-level	-0.143	-0.375	-0.371	-0.157
	(-0.99)	(-0.93)	(-0.93)	(-1.01)
Some college	0.0554	0.167	0.167	0.0697
	(0.55)	(0.61)	(0.61)	(0.63)
University degree	-0.149	-0.372	-0.365	-0.152
	(-1.03)	(-0.92)	(-0.91)	(-0.95)
Man's education				
O-level	0.0984	0.218	0.214	0.114
	(0.98)	(0.80)	(0.79)	(1.03)
A-level	-0.0738	-0.184	-0.181	-0.0791
	(-0.64)	(-0.59)	(-0.58)	(-0.63)
Some college	0.0309	0.0669	0.0670	0.0415
	(0.33)	(0.26)	(0.26)	(0.41)
University degree	-0.0598	-0.228	-0.229	-0.0616
	(-0.44)	(-0.59)	(-0.60)	(-0.42)
Living in London	-0.00474	-0.00793	-0.00519	-0.0124
	(-0.04)	(-0.02)	(-0.01)	(-0.09)
Socio-economic class(women)				
Intermediate white collar	0.00939	0.0668	0.0687	0.00728
	(0.11)	(0.28)	(0.29)	(0.07)
Independents (Petty bourgeoisie)	-0.136	-0.376	-0.373	-0.151
	(-1.17)	(-1.18)	(-1.18)	(-1.21)
Intermediate blue collar	0.241	0.636	0.633	0.267
	(1.60)	(1.65)	(1.66)	(1.62)
Working class	0.0779	0.216	0.213	0.0860
	(0.70)	(0.71)	(0.71)	(0.71)
Socio-economic class(women)				
Intermediate white collar	-0.173	-0.440	-0.435	-0.195
	(-1.16)	(-1.08)	(-1.08)	(-1.18)
Independents (Petty bourgeoisie)	0.0936	0.267	0.269	0.107
	(0.90)	(0.98)	(0.99)	(0.96)
Intermediate blue collar	-0.0803	-0.179	-0.174	-0.0909
	(-0.80)	(-0.68)	(-0.66)	(-0.82)
Working class	-0.209*	-0.533*	-0.526*	-0.221*
	(-2.38)	(-2.23)	(-2.21)	(-2.31)
Black ethnic origin	0.526	1.320	1.299	0.555
	(1.20)	(1.25)	(1.26)	(1.17)
Woman's avg working hrs per week	0.00827**	0.0225**	0.0223**	0.00907**
	(3.08)	(3.23)	(3.24)	(3.01)
Men's avg working hrs per week	-0.00218	-0.00630	-0.00629	-0.00249
	(-0.72)	(-0.78)	(-0.78)	(-0.76)
Constant	-1.536***	-2.525***	-2.547***	-1.679***
	(-5.88)	(-3.78)	(-3.86)	(-5.44)
Logged Variance of R.E.				-1.904**
				(-2.83)
Number of observations	17683	17683	17683	17683
t statistics in parentheses				
	* p<0.05	** p<0.01	*** p<0.001	

per se. Nevertheless, it can be seen that the socio-economic class of women does not play any role in the probability of divorce. Working class men are less likely to divorce compared with the salarist. The reference group for socio-economic class are the salarists or service classes. Professionals, administrative and managerial employees are in this group. Men's average working hours per week does not have an effect on divorce rate whereas longer working hours of women increase the probability of divorce. Marital specific capitals, namely home ownership and dependent children, do not have an effect on the probability of divorce. I controlled for number of children in various ways, such as number of dependent children in total, number of depenedent children at different age groups, the age of youngest child. The overall result is that existence of children, at least among couples who both are active in labour market, does not play a role in divorce probabilities.

Table 2.6: Additional Couple's type and Probability of Divorce

	Probit (1)	Logit(1)	Cloglog(1)	Probit(2)	Logit(2)	Cloglog(2)	Probit(3)	Logit(3)	Cloglog(3)
B-B	Ref.	Ref.	Ref.	0.260	0.621	0.612	0.425**	1.026**	1.007**
				(1.72)	(1.65)	(1.66)	(3.01)	(2.88)	(2.90)
B-Avg	-0.254	-0.570	-0.553	0.00560	0.0510	0.0593	0.171*	0.456*	0.454*
	(-1.69)	(-1.48)	(-1.46)	(0.05)	(0.17)	(0.19)	(2.30)	(2.23)	(2.22)
B-G	-0.250	-0.537	-0.516	0.00914	0.0839	0.0960	0.174	0.489	0.491
	(-1.43)	(-1.19)	(-1.15)	(0.06)	(0.21)	(0.24)	(1.41)	(1.48)	(1.48)
Avg-B	-0.260	-0.621	-0.612	Ref.	Ref.	Ref.	0.165	0.405	0.395
	(-1.72)	(-1.65)	(-1.66)				(1.70)	(1.54)	(1.51)
Avg-Avg	-0.425**	-1.026**	-1.007**	-0.165	-0.405	-0.395	Ref.	Ref.	Ref.
	(-3.01)	(-2.88)	(-2.90)	(-1.70)	(-1.54)	(-1.51)			
Avg-G	-0.426**	-0.971*	-0.948*	-0.166	-0.350	-0.336	-0.000865	0.0550	0.0585
	(-2.81)	(-2.49)	(-2.47)	(-1.47)	(-1.13)	(-1.09)	(-0.01)	(0.27)	(0.28)
G-B	-0.476*	-1.086*	-1.057*	-0.216	-0.465	-0.445	-0.0509	-0.0600	-0.0498
	(-2.44)	(-2.15)	(-2.11)	(-1.27)	(-1.01)	(-0.96)	(-0.34)	(-0.15)	(-0.12)
G-Avg	-0.547***	-1.321***	-1.295***	-0.288**	-0.700**	-0.684*	-0.122*	-0.295	-0.289
	(-3.69)	(-3.54)	(-3.55)	(-2.85)	(-2.59)	(-2.54)	(-2.12)	(-1.92)	(-1.89)
G-G	-0.667***	-1.599***	-1.572***	-0.407**	-0.978*	-0.960*	-0.242*	-0.573	-0.565
	(-3.83)	(-3.42)	(-3.41)	(-2.89)	(-2.42)	(-2.38)	(-2.11)	(-1.68)	(-1.66)
Constant	0	0	0	0.260	0.621	0.612	0.425**	1.026**	1.007**
	(.)	(.)	(.)	(1.72)	(1.65)	(1.66)	(3.01)	(2.88)	(2.90)
Number of observations	-0.254	-0.570	-0.553	0.00560	0.0510	0.0593	0.171*	0.456*	0.454*
t statistics in parentheses									
	* p<0.05	** p<0.01	*** p<0.001						

2.5.2 Sensitivity Analysis

Changing the cut off point of shocks

I conducted a few robustness checks for the results. As discussed in previous sections, an agent will fall into a good category if her income shock is bigger than or equal to zero. The ideal analysis will distinguish between those whose residual is positive but close to zero and those whose residuals are at the extreme right tail of the residual distribution. If having a positive shock is a proxy for relative success in the labour market, then those with big positive shocks are relatively very successful. On the other hand, someone with a negative shock close to zero is considered as unsuccessful as an agent with a very negative shock furthesr from zero. In other words, agents with shocks at minimal distance from zero can be considered alike.

Unfortunately, the small sample size does not allow a fine division of shocks into separate categories. I, however, have grouped those with a shock that is half a standard deviation away from the mean into a new category called *average*. The new type set is thus {good, average, bad} which results in 9 types of partnerships. The partnership types set is {B-B, B-Avg, B-G, Avg-B, Avg-Avg, Avg-G, G-B, G-Avg, G-G}. As before, the first character in the couple type pair indicates women's type of shock and the second character indicates the shock type of their spouse. The probability of divorce is estimated using these 9 types and the results are presented in Table 2.6.

The rest of the control variables not shown in Table 2.6 are the same as previous specifications. According to the re-sorting theory, if we take B-B as the reference group, probability of divorce among B-Avg, B-G, Avg-B, Avg-G, G-B and G-

Avg must be higher than the reference category. This is due to the fact that compared with B-B all those mentioned types are partnerships in which men and women are not matched with their own type. However, first three columns of Table 2.6, indicate the opposite. Compared with B-B group, the probability of divorce among all other groups is lower. In specifications 4-6, the reference group is Avg-B. As seen in Table 2.6, the highest probability is still observed among B-B types. Specifications 7-9 confirm the findings. Depending on the reference category, coefficient of B-B is significantly different from 0 at the 0.05 or 0.1 level.

A different measure of unstable marriages and Cloglog estimations

An unstable marriage is a marriage that is observed to end in separation or divorce. The married couples can be divided into two groups: a group of unstable marriages and a group of stable marriages. In the latter case, as long as the couple have been surveyed they did not exit their partnership. Rather than estimating the probability of divorce, the probability of belonging to one the two groups can be estimated. Log-likelihood function is now defined in the following way:

$$Log\theta = \sum_{i=1}^{n} \Big[MD_i ln\Big(pr(MD_i = 1|X_i)\Big) + (1 - MD_i) ln\Big(pr(MD_i = 0|X_i)\Big)\Big]$$

Where MD denotes a marriage that ends in divorce. Replicating the assumption of the model, income shocks are realised in the second period and couples adjust their divorce strategies according to the realisation of their own and their partner's income shock. Thus defining the dependent variable as unstable marriage rather than event of divorce should not change the results.

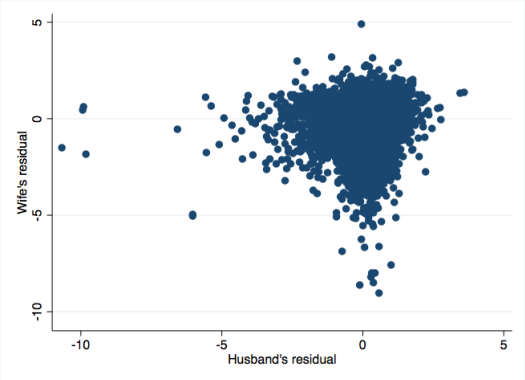
It should be stressed again that the limited data at hand does not allow for duration analysis. There is not enough information about the start of the marriages of all the married, active in labour market couples who experience divorce. Currently, the number of marital dissolutions in the sample is about 8% which means 206 divorces or separations for 2354 households. After deriving the duration of marriage for the existing couples, the number of divorces dropped by more than half. Given that these couples are then grouped into 4 categories and the divorce behaviour is compared across the four groups, there was not enough data points to conduct a duration analysis.

Rather than estimating a hazard model I estimate equation (2.19) with complementary log-log which capture asymmetry in dependent variable better than logit and probit models. Clog-log coefficients are presented alongside probit and logit coefficients in all the tables. Setting unstable marriage as dependent variable increases the frequency of positive outcome in dependent variable. As seen in Table 2.7, the final results remain robust under this specification.

2.5.3 Discussion

The purpose of this study was to investigate whether resorting is a valid explanation for marital dissolution. The application of search and matching theory with positive assortative matching to marriage market suggests that given set of imperfect information at the time of marriage, once the match is formed and partners learn about ex-ante unobservable characteristics they end their marriage if the ex-post realised characteristics are not compatible. The option outside marriage for those couples who don't have similar characteristics, is separation and

Figure 2.3: Joint distribution of couple's income shocks



re-partnering with someone of their own type. Thus, divorce rate must be higher among couples who are not matched with their like. This implication is tested with a sample of British households between 1991 and 2008. I assumed that after forming the partnerships, agents receive type shocks. These shocks are not observable at the time of marriage or else, with frictionless matching, agents would have been sorted on the shock types in the first period as well. I estimate the type shocks with the residuals of Mincer wage model.

Figure 2.3 presents a joint distribution of men and women residuals or said otherwise the joint distribution of type shocks. It is clear from the dot plot in Figure 2.3 , that these residuals are not correlated and, therefore, there is no systematic sorting among couples with respect to the residuals.

Having the difference between residuals as a regressor to predict the probability of divorce did not support the hypothesis that a mismatch between couples is the driving force for divorce. To make the analysis clearer I ranked agents according to the type of their shock. I consider positive shocks favourable because positive shocks indicate earnings higher than average. Similarly, negative shocks are con-

sidered unfavourable. Following these two type of shocks there are four types of partnerships. Partnerships in which both partners have favourable or both have unfavourable shocks are matching of likes. Partners with opposite shocks are mismatched. I then compared the divorce rate across these four groups and found the matches when both partners have negative shocks to be most likely to break down. The results are robust to various specifications and controls.

I have not found a similar study in the literature that empirically tests the predictions of on the match search models in marriage market. Nevertheless, there is a number of studies that investigate the relationship between labour market outcomes or shocks to earnings and quality of marriage. Weiss and Willis define shocks according to permanent income. In their framework, each party forms an expectation about their own and their partner's lifetime income at the time of marriage. These expectations are updated each period given a new set of information. They define yearly income shocks as the difference between predicted permanent (lifetime) income at the time of marriage and the predicted income evaluated after each year of marriage. They find that an unexpected increase in the husband's earning capacity reduces the divorce hazard while an unexpected increase in the wife's earning capacity raises the divorce hazard. Up to the point that unexpected decreases in husband's earnings increases probability of divorce, their findings are in line with my results. Regarding the positive correlation between wives income shock and the probability of divorce, I only find such effect when I exclude a number of control variables such as socio-economic class of husbands and wives.

In another strand of research, unemployment is considered as an unfavourable shock and the effect of this shock on divorce rate is investigated. There is a vast literature from different countries on this matter. To name a few, Jensen and

Smith (1990) use sample of married couples in Denmark, between 1979 and 1985 and find that only the unemployment of the husband to have a negative effect on marriage stability. Boheim and Ermisch (2001) find unexpected improvements in finances to substantially reduce the risk of dissolution. They also find evidence that the risk of breakdown is higher for couples who experience negative financial surprises. Also, Blekesaune (2008), finds any form of unemployment to predict partnership dissolution. He uses BHPS between 1991 to 2005. What can be learnt from the studies that investigate effect of unemployment on divorce is that financial constraints put pressure on marriages and increase the probability of dissolution. In this sense, my findings are comparable with the mentioned studies as both approaches predict adverse financial circumstances to increase the risk of divorce. In the next chapter, I propose that one possible explanation for the higher rate of divorce among financially less advantaged couples is their higher access to state benefits.

2.6 Conclusion

The purpose of this chapter was to investigate how effectively the search and matching models, in particular on the match search models, are able to explain the divorce behaviour among couples. I focused my analysis on couples where both members are employed or self-employed and I used a sample of British Household Panel Survey between 1991 and 2008 to estimate the probabilities of divorce. My findings suggest that the application of on the match search to marriage market, although theoretically convenient is not empirically supported. The decision to divorce is not best explained by mismatch and motivation to find a better com-

panion.

Table 2.7: Probability of Unstable Marriage

	Probit	Logit	Cloglog
Dependent variable:	md	md	md
G-B	0.0661	0.127	0.0661
	(1.02)	(0.99)	(1.02)
B-G	0.0825	0.155	0.0825
	(1.19)	(1.12)	(1.19)
B-B	0.157*	0.305*	0.157*
	(2.26)	(2.24)	(2.26)
Pres school children	0.0935	0.180	0.0935
	(1.47)	(1.47)	(1.47)
Age (woman)	0.0183	0.0405	0.0183
	(1.63)	(1.79)	(1.63)
Age (man)	-0.0342**	-0.0712**	-0.0342**
	(-3.10)	(-3.23)	(-3.10)
Owns outright	-0.314*	-0.667*	-0.314*
	(-2.52)	(-2.41)	(-2.52)
London inhabitant	-0.0143	-0.0411	-0.0143
	(-0.10)	(-0.14)	(-0.10)
Intermediate white collar	0.0955	0.199	0.0955
	(1.30)	(1.40)	(1.30)
Independents (Petty bourgeoisie)	-0.0671	-0.112	-0.0671
	(-0.73)	(-0.60)	(-0.73)
Intermediate blue collar	-0.0606	-0.0995	-0.0606
	(-0.49)	(-0.40)	(-0.49)
Working class	-0.0395	-0.0720	-0.0395
	(-0.39)	(-0.36)	(-0.39)
Intermediate white collar	0.148	0.284	0.148
	(1.29)	(1.31)	(1.29)
Independents (Petty bourgeoisie)	0.0336	0.0558	0.0336
	(0.32)	(0.26)	(0.32)
Intermediate blue collar	0.122	0.233	0.122
	(1.33)	(1.32)	(1.33)
Working class	-0.0425	-0.0918	-0.0425
	(-0.51)	(-0.55)	(-0.51)
Black ethnic origin	0.545	1.001	0.545
	(1.54)	(1.56)	(1.54)
Woman's avg working hrs per week	0.00364	0.00652	0.00364
	(1.54)	(1.37)	(1.54)
Man's avg working hrs per week	0.00309	0.00607	0.00309
	(1.36)	(1.30)	(1.36)
Constant	-1.090***	-1.835***	-1.090***
	(-4.82)	(-4.09)	(-4.82)
Number of observations	16115	16115	16115
t statistics in parentheses			
	* p<0.05	** p<0.01	*** p<0.001

Chapter 3

Benefit System and Marriage Dissolution Among Working Families

3.1 Introduction

The traditional economic model of marriage implies that falling male earnings, rising female earnings, and increasing public support for unmarried mothers will generally reduce marriage rates and increase the prevalence of single-headed households (Becker, 1973, 1974). The previous chapter discussed that among married men and women who both are active in labour market; the chance of separation is highest for those couples that both spouses have earnings below the average of their cohort. In this chapter I argue that a possible explanation for this observed phenomenon is the availability of social benefits. Therefore I test to what extent eligibility for more public support after divorce can explain the divorce decision among working families, specifically families in which both partners have a below average labour market productivity and thus are likely to be more economically

disadvantaged.

In traditional families, women and children were financially dependent on men's earnings. With increased rate of employment among married mothers this dependency has weakened but still is existent. Financial constraints can discourage couples from separating even if the quality of their marriage is below expectation. If the benefit system alleviates the financial difficulties following a divorce then we can expect an increase in the probability of divorce among unhappily married couples. The benefit system can improve the expected value of single-hood either through an increase in non-labour income or through an increase in tax credits, which effectively increases the real wages. Among married women who specialise in home production, the financial insecurity in the case of divorce is higher given their lack of marketable skills and experiences. Married women who are full time or part time active in labour market, do not face the challenges of inactive women for entering labour force upon divorce. However their challenge in splitting their time between market and home production in case of divorce can create a barrier for marital dissolution. Therefore availability of child care support, housing benefit, and tax credits can smooth the transition from partnership to single-hood.

The benefit system can create an incentive for marital dissolution by providing at least a partial level of financial security after divorce. Looking at receipt of benefits after divorce to understand the effect of social benefits on marital dissolution creates endogeneity (reverse causality) problem. A common practice to deal with this endogeneity problem is to estimate the benefit entitlements using instruments such as a tax simulator. With the help of the tax simulator, one can estimate the counter factual, and study how benefit entitlements change if a couple were to divorce. The difference in entitlements before and after divorce provides an

estimate of the role of welfare system on marital dissolution.

This chapter focuses on families where both partners are active in labour market and investigates whether the benefit system can provide an explanation for the divorce patterns that have been observed among working families in chapter two. In what follows, firstly I provide a review of the UK tax and benefit system during 1991 to 2008 and discuss how tax and benefit system can create incentives for divorce. Section 3 describes the data set used for this study. Section 4 sets out the empirical strategy, and explains use of the tax simulator to calculate counter factual entitlement in case of divorce. Findings are presented in section 5, and section 6 concludes.

3.2 Review of UK Tax-Benefit System from 1991 to 2008

The tax and benefit system in the UK is not marriage neutral [1]. In their 2002 report (Civitas, 2002), The Institute for the Study of Civil Society (Civitas) point out that welfare system has subsidised the lone parenthood which in turn discourages parents to share the child care responsibility through marriage. Whether the system is advantageous or disadvantageous to the society is beyond the scope of this study. Nevertheless the Civitas' discussion about marriage penalties created by UK tax and benefit system is in line with the findings of this study.

Figure 3.1, illustrates how much total benefits entitlement of a married couple changes if they were to divorce. Entitlements are calculated using the entitledto, which is one of the major on-line benefit calculators in the UK. I picked two families from the sample of this study- the sample will be described in details

[1] It is dependent on marital status.

Figure 3.1: Two Examples Based on entitledto

Example 1	Example 2
. Both partners aged below 50 . 2 dependent children under 12 . Rent of private house £104 per week . No other income apart from wages	. Both partners aged below 50 . 2 dependent children under 12 . Rent of private house £265 per week . No other income apart from wages
Husband: . Employed . Works 40 hours per week . Earns £270 per week (£240 after deductions)	Husband: . Self employed . Works 30 hours or more per week . Earns £120 per week (Net of deductions)
Wife: . Employed . Works 8 hours per week . Earns £84 per week (£84 after deductions)	Wife: . Employed . Works below 15 hours per week . Earns £81 per week (Net of deductions)
Total benefits of the married couple: £154 -£112 Child Tax Credit -£8 Housing Benefit -£34 Child Care Cost Benefit	Total benefits of the married couple: £154 -£107 Child Tax Credit -£254 Housing Benefit -£34 Child Care Cost Benefit
Total benefits of the single mother assuming her rent and wages remains as above: £278 -£116 Child Tax Credit -£24 Council Tax Support -£103 Housing Benefit -£34 Child Care Cost Benefit	Total benefits of the single mother assuming her rent and wages remains as above: £278 -£107 Child Tax Credit -£26 Council Tax Support -£265 Housing Benefit -£34 Child Care Cost Benefit
Total benefits of the divorced husband, assuming children stay with their mum, his rent reduces to £80 per week and his wage remains as above: £0	Total benefits of the divorced husband, assuming children stay with their mum, his rent reduces to £150 per week and his wage remains as above: £152 -£52 Working Tax Credit -£99 Housing Benefit
The difference in benefits between married and divorced states: **£124** per week	The difference in benefits between married and divorced states: **£190** per week

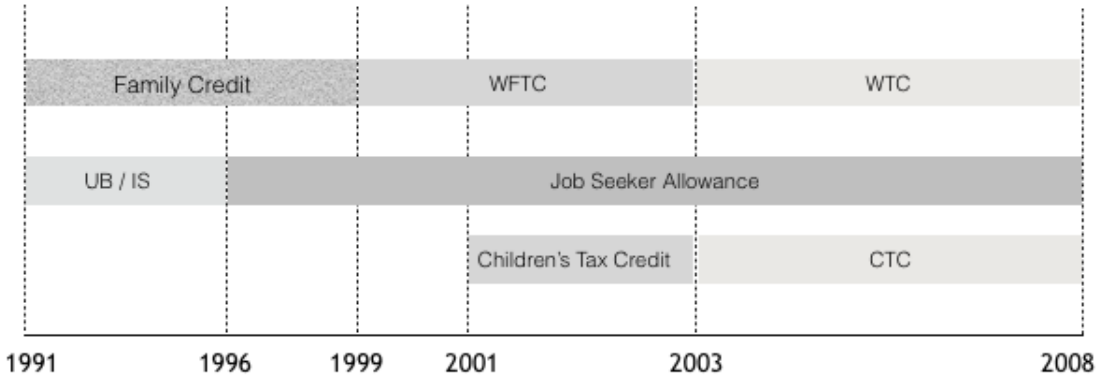
in the following section-. In the two selected households, partners earn labour income, they have dependent children under 12 years old and they live in privately rented houses. As far as the data allowed I used actual numbers to obtain the estimated benefits. As seen in Figure 3.1, the entitlement to benefits is greater if the two partners claim for benefits as two divorcees and the gain is higher for the couple with lower labour income.

Depending on the objective the the study, this difference is referred to in the literature as bonus or penalty. The most commonly used term in the literature is marriage penalty (as seen in Adam and Brewer (2010), Francesconi et al. (2009)). Throughout this chapter I refer to this difference as divorce premium to stress the importance of gain from social benefits caused by marital dissolution. Adam and Brewer (2010) explain that the tax and benefit system will be completely marriage neutral if all the taxes and benefits are assessed individually. They provide the following causes for marriage penalties created by UK tax and benefit system:

- When the benefits are provided to adults with no income but will be taken away for couples based on their combined income.
- The benefit cap for the couple is smaller than twice the cap for the single adults. The benefit cap is usually applicable to means-tested benefits.
- Benefits are aimed to help families with certain living costs, such as housing cost. In this case couples living together, who benefit from economies to scale in living costs, face a couple penalty.

The tax and benefit system in the UK has undergone a number of reforms over the past few decades. Given that the sample of this study covers years 1991 to

Figure 3.2: A Brief Time line of Tax and Benefit Reforms 1991-2008



2008 I briefly review the major reforms that took place during this period and discuss whether or not those reforms are marriage neutral. It should be noted that since I am interested in working and married couples, I ignore the reforms aimed at elderly people, sick and disabled people and bereaved people.

Figure 3.2 presents a time-line of the reforms that took place during the period under investigation. Family Credit (FC) was in place from 1988 to 1999. Family credit was a means-tested benefit designed to help families with low income. Families with children needed to have at least one adult working at least 16 hours per week to be eligible for this benefit. Household's maximum credit consisted of a basic adult rate, credits for each child and childcare credits if applicable. There was a bonus for working 30 hours or more per week.

From 1999, Working Family Tax Credit (WFTC) replaced FC and lasted until 2003. WFTC was a more generous in-work support compared with FC; it provided more credits for younger children, increased the threshold of income eligibility and decreased the tapper rate and increased the help with childcare costs. In the 1998

HM treasury report, it is stated that one of the advantages of WFTC in principle was improving work incentives by increasing potential in work benefits.

In April 2003 the WFTC was replaced by the Working Tax Credit and Child Tax Credit. WTC and CTC are subject to joint means-test. WTC provides in work support for families on low wages but no employment conditions are required to be eligible for CTC. The new feature of WTC was that families without children could also claim WTC conditional on having at least one adult working 30 hours or more per week. The CTC separated out the child premium that was provided under WFTC and merged it with the child premium provided under the income support (IS) programme. CTC replaced Children's Tax Credit in 2003. Children's Tax credit existed for a short period of time from 2001 to 2003 and it was not based on family's income. The Children's tax credit was introduced to increase the amount of help that goes to families with children regardless of their marital status. Prior to Children's tax credit, married couples and single or married parents were entitled to married couple's allowance (MCA) and an additional personal allowance (APA), respectively. Overall the welfare system progressed towards a system more considerate about children's right (Ridge, 2003).

The Job Seeker's Allowance (JSA) replaced the previous system of Unemployment Benefit and Income Support in 1996. JSA has two components, Contributory and Income-based. JSA was intended to promote finding job among the unemployed and is different from previous system in two main aspects; The duration of Contributory JSA which replaced the Unemployment Benefit was reduced from one year to six months and the claimants were required to sign a job seeker's agreement in which they agree to actively look for work (Manning (2009), Petrongolo (2009)). Only one partner in a couple can claim income-based JSA, and the partner of the

claimant cannot be working more than 24 hours per week (James Browne (2012)).

Having reviewed the reforms and pointing out the general purpose of each we can now look at the the potential sources of marital penalties created by these reforms. The two key personal income taxes in the UK are income tax and National Insurance contributions. Independent taxation was introduced in 1990, after which people have been taxed as individual persons. A fully individual taxation is marriage neutral. Until 1990, the income of a married woman was regarded as her husband's for tax purposes. In an attempt to establish a system that treats men and women neutrally it was suggested to move towards a system of transferable allowances. In 1990 a reform took place to tax husbands and wives separately, based on their individual income.

The new system allowed transfer of any unconsumed personal allowances between spouses, regardless of their gender. In addition to the personal allowance that were common to all individuals, married couples and non married divorced or widowed parents could claim married couple's allowance (MCA) or additional personal allowance (APA), respectively. Given that the MCA and APA were equal in value, they were not a source marriage penalty among married or divorced parents, but childless couples would face marriage penalty. Although the new income tax reform was designed to be gender neutral, effectively the transferable allowances were creating disincentive for women to work. The system created many debates and went under two additional reforms in 1994 and 1999. In 1994 reform, MCA and APA were reduced to a flat rate of 20%. They were further reduced to 10% in 1999 and ultimately abolished by 2000 (Parliament briefings SN/BT/315 and SN4392 Seely (2009),Seely (2014)).

The tax credits summarised in 3.1, all depend on joint household income. Thus

Table 3.1: Marriage Neutrality of Tax Benefit System during 1991-2008

Tax Credit/Benefit	Effective Period	Marriage Neutral
National Insurance	Effective during 1991-2008. Changes to the upper limit	Yes - Paid by employee if income increases a certain level.
Income Tax	Effective during 1991-2008. Major reforms took place during this period	Not until 2000.
Child Benefit	Effective during the whole period (1991-2008)	Yes - Independent of marital status or income of parents.
Family Credit	Effective until 1999	No- means tested
Working Family Tax Credit	From 1999 to 2003	No- means tested
Working Tax Credit	2003 onwards	No- means tested
Child Tax Credit	2003 onwards	No- means tested
Income Support	Migrated to JSA in 2006 and went through some reforms.	No- means tested
Housing Benefit	Effective during the whole period (1991-2008)	No- means tested
Council Tax Benefit	1990-1993	No- means tested
Community Charge Benefit	1993 onwards	No- means tested

they can be source of marriage penalties if the married couple's joint income exceeds the threshold above which the family element is withdrawn. Council Tax Benefit and Community Charge Benefit also depend on household income, and in the case of married couples the household income is assessed as the joint income of both partners.

3.3 Data and Descriptive Statistics

The data used in this study are taken from BHPS. I use all the 18 waves of this annually repeated survey which has been conducted from 1991 to 2008. The sample

consists of married couples where both spouses are active in labour market, even if their labour supply is as low as 5 hours per week, and are aged 23 to 59. Thus for a couple to be part of the analysis both husband and wife should have a report of their earned labour income. Both men and women remain in the sample up to one year after divorce or separation. Therefore their characteristics during the time that their marital status is changed to separated or divorced is accounted for. Given this selection criteria, the sample size consists of 17000 observations for 2700 households.

Demographic characteristics of the sample are presented in table 3.2. For the sake of statistical comparison I included those households in which either of the partners may not be working. The summary statistics indicate that there is no difference in employment rate among married men, whether they have dependent children present in their household or not. The percentage of economic inactivity among married women with dependent children is around 15% higher compared with married women without a dependent child.

There is no systematic gender difference in educational qualification among men and women with or without children. Couples with dependent child are on average 4 to 5 years younger than childless couples. Couples with dependent child have lower income and this difference is persistent even after rescaling the income for the family size. The rescaling factor is the household equivalence scale before housing costs, provided in BHPS. Households with dependent children, on average have more access to benefit income.

The socio-economic class is defined based on a class specification that is common between Goldthorpe schema and the NS-SEC as seen in Goldthorpe and McKnight (2006). These classifications are presented in table 3.3. Looking at

Table 3.2: Summary Statistics

	With Children	Without Child
Number of Dependent Children		
One	39%	-
Two	43%	-
Three or more	18%	-
Economic activity		
Male:		
Working (employed/self employed)	95%	93%
Fmaily Care	1%	less than 1%
Other	4%	7%
Female:		
Working (employed/self employed)	71%	85%
Fmaily Care	23%	8%
Other	6%	7%
Education		
Male:		
No qualification/less than O level	18%	19%
O level/GCSE	19%	15%
A level	13%	13%
1emHigher vocational qualification	31%	34%
University degree	19%	19%
Female:		
No qualification/less than O level	20%	25%
O level/GCSE	25%	19%
A level	12%	11%
Higher vocational qualification	29%	28%
University degree	16%	17%
Average weekly hours of work		
Male	32(19)	28(20)
Female	18(15)	27(16)
Age		
Male	39 (7)	43 (11)
Female	37(7)	44(11)
Household level Incomes		
Annual Labour Income	28611(23667)	32631(23384)
Annual Non labour Income	3956(6445)	3396(7322)
Annual Benefit Income	2590(3717)	833 (3452)
Monthly Equvalised Income	2078(1517)	2802(1890)
Socio Economic Class		
Male		
Salarist	46%	45%
Intermediate white collar	5%	5%
Independents	15%	14%
Intermediate blue collar	11%	9%
Working class	24%	26%
Female		
Salarist	37%	44%
Intermediate white collar	23%	23%
Independents	22%	16%
Intermediate blue collar	3%	3%
Working class	15%	13%
Sample Size	21114 (46%)	24737 (54%)

summary statistics of table 3.2, it is evident that there is no difference in socio economic class of men with or without children. Childless women are more likely to be small employers or self-employed compared to married women with dependent children. Moreover having children is observed to be associated with fewer hours of work among women, whereas for men the opposite is true.

Table 3.3: Combined Goldthorpe schema and the NS-SEC

Salariat (or service class)	Higher and lower grade professional, administrative and managerial employees; higher grade technicians
Intermediate white-collar	Routine non-manual employees, higher grade
Independents	Small employers and self-employed workers
Intermediate blue-collar	Supervisors of manual workers, lower grade technicians
Working class	Skilled manual worker; Routine non-manual workers; Semi and unskilled manual workers

3.4 Methodology

3.4.1 Calculation of Marriage Penalties

As mentioned in the introduction, to answer the question of whether the welfare system plays any role in marital dissolution one needs to deal with endogeneity of dissolution decisions. Using benefit entitlements after divorce as a predictor of divorce ignores the selection problem. With the help of a tax simulator it is

possible to impute the counter-factual effect of divorce on benefit entitlement and use this imputed estimator as an explanatory variable for divorce decision.

As Becker et al (1977) discuss, the probability of divorce depends on expected gain and the variance of unanticipated gains from marriage. Following this argument, we should expect higher divorce rates if benefit system creates higher gain after marital dissolution. Dickert-Conlin (1999) and Fisher (2013) are examples of research on the effect of marriage penalties on marital status. The two mentioned studies are based on the U.S. welfare system. A similar research based on UK welfare system is the work of Adam and Brewer (2010), in which they analyse sources of couple penalties and premiums under 2010-2011 UK tax and benefit system. They don't however relate couple penalties to marital dissolution decisions. The effect of couple penalties on household formation is mostly studied under a single policy evaluation such as Francesconi et al. (2009). Although they are primarily interested in the impact of WFTC on work incentives, they provide a detailed discussion on how the reform can impact divorce.

The usefulness of focusing on one policy is the possibility of finding a relibale evidence for the analysis of causal effect of the policy on the event of interest. However focusing on one policy limits the analysis to one period and more importantly to either a tex credit reform or a benefit reform. Rather than exploiting a causal effect, this chapter is concerned with average association between marriage penalties and probability of divorce. There seems to be a gap in the literature regarding the combined effect of UK benefit and income tax system on marital dissolutions. Anderberg (2008) studies the impact of WFTC, WTC and CTC reforms on partnership rates. He is interested in the effect of welfare system on the probability of having a partner but his main focus is on the three mentioned

reforms that took place during 1999 and 2003.

I calculate divorce premiums for the working couples in my sample using a microsimulation tax library called FORTAX that implements the UK tax and benefit system from 1990 to 2010. The other two tax-benefit microsimulation models applicable to UK system are EUROMOD and TAXBEN. EUROMOD is not limited to UK system, however it is limited to specific data sources and the available data source for UK that is compatible with EUROMOD starts from 2005. TAXBEN is another simulator designed by Institute for Fiscal Studies for UK system since 1983, however it is not open to public use. FORTAX performs many of the same functions as TAXBEN (Adam and Brewer, 2010). All of the reforms summarised in table 3.1 are modelled by FORTAX. To estimate the difference in benefit entitlements before and after divorce, I need to simulate a divorce among married couples. To simplify the analysis a few assumptions must be made regarding tax liabilities of married couple if they separate. I assume the following hold after a married couple separate:

1. Children will live with their mother after separation.

2. labour supply of both partners remains unchanged.

3. Housing tenure remains unchanged unless the couple were renting. In the case of renters, the rent paid by single mothers remains at the same level prior to divorce and the rent paid by separated men is halved.

4. There is 100% participation in both tax payment and benefit receipts.

5. Alimony payments are ignored.

Most of these assumptions are derived from previous work in this literature. Assumption (1) is the same as seen in Dickert-Conlin (1999), Eissa and Hoynes (2000b), Adam and Brewer (2010), and Fisher (2013). The basis of this assumption is the observed behaviour of splitting couples where in the majority of cases (dependent) children if any, stay with their mother after a marital dissolution.

The second assumption of no change in labour supply, though may be unrealistic, but helps to isolate the effect of a change in marital status on benefit entitlements. Taking into account the change in labour supply following separation is not only technically complicated, but has the disadvantage that will not allow disentangling the effect of merely a change in marital status on marriage penalties. The second assumption is commonly made in the literature and can be seen in Dickert-Conlin (1999), Adam and Brewer (2010), and Fisher (2013). Although Fisher (2013) only points out that the actual earnings rather than labour supplies are assumed to remain constant following a separation.

The third assumption has the same benefit as the second one in helping to isolate the effect of change in marital status on divorce premiums. I have adopted an approach somewhat similar to Adam and Brewer (2010) where they assume that the housing cost of a single household is at least half those of the couple's. With the help of a Propensity Score Matching technique and comparing households of similar characteristics, one can obtain a more precise way of predicting the housing costs of both partners in the case of divorce. Applying the Propensity Score Matching technique in this case implies generating hypothetical couples. Given that the interest of this chapter is to explore how the benefit entitlements coupled with a measurement of mismatch (as discussed in previous chapter) can predict probability of divorce, I will use the simplistic assumption that the housing

cost of renters will be halved for the partner who forms a single household following the divorce and remains the same for the partner who lives with children. The major drawback of this assumption is that it takes for granted that the housing cost of home owners remains unchanged. Given that owning a house requires a secure level of income, this assumption can be justified by arguing that the home owners who benefit from higher levels of household income are less likely to be eligible for housing benefits even if they separate.

The forth and fifth assumptions are embeded in FORTAX calculations and their only purpose is to make the calculations tractable.

The net divorce premium for each couple is then defined as: $\Delta P_i = (P_i^f + P_i^m) - P_i^c$. Where P_i^f and P_i^m are net benefits that the man and woman are separately entitled to and P_i^c denotes couple's net benefit entitlement. The net benefits are defined as the following:

- Net benefits = Total Benefits - total taxes.
- Total Benefits = child benefit + poll tax benefit + council tax benefit + family care + working family tax credit + child tax credit + income support + housing benefit
- Total taxes = National insurance + income tax + council tax + poll tax

3.4.2 Empirical Strategy

The calculated divorce premiums are used as the main regressor in a reduced form model to estimate the probability of marital dissolution. Analysis of the findings are based on random effect probit estimation, however the results are robust to

the choice of non-linear functional form (such as logit or c-log-log). The vector of covariates includes the measure of positive assortative sorting between couples which has been discussed in the previous chapter. At first I only look at the effect of divorce premium generated by welfare system on the probability of divorce and the effect of sorting will be added to the discussion shortly.

$$Pr(D_{it}) = f(X_{it}, \Delta P_{it}, \eta_{it})$$

Where $Pr(D_{it})$ is the probability of divorce for each household at each point in time. X_{it} is the vector of observable heterogeneity at individual and household level; this includes age, education, socio economic class, housing tenure, average hours of work per week, number of children and race. ΔP_{it} is the measure of divorce premium which itself is a function of childcare expenditure, number of dependent children in the household, housing tenure type, rent, region, council tax band, interview date, both spouses' age and earnings and a dummy for self employment. η_{it} indicates the four couple types discussed in chapter two which are functions of age, education, age at time of leaving full time education, time and region fixed effects. The set of variables used to define $Pr(D_{it})$ is different from the sets that define η_{it} and ΔP_{it}. This makes sure that the effect of divorce premium on divorce probability is not merely stemming from a nonlinear relationship among variables in the set of of X_{it} and η_{it}.

3.5 Findings

3.5.1 Main Results

Table 3.4: Estimated Effect of Divorce premium on Partnership Dissolution

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Probit	Marginal Effect	Logit	Probit	Marginal Effect	Logit	Probit	Marginal Effect	Logit	Probit	Marginal Effect	Logit	RE Probit	Marginal Effect
Divorce premium	0.00141***	0.0000460***	0.00350***	0.000930*	0.0000250*	0.00243*	0.00273***	0.0000675***	0.00695***	0.00277***	0.00006S7***	0.00277***	0.00314***	0.00005***
	(3.82)	(3.74)	(3.90)	(2.11)	(2.10)	(2.23)	(4.58)	(4.37)	(4.77)	(4.60)	(4.39)	(4.60)	(4.47)	(3.79)
Dependent Child				-0.197**	-0.00530**	-0.453**	-0.175*	-0.00433*	-0.425	-0.178*	-0.00442*	-0.178*	-0.206*	-0.003*
				(-3.22)	(-3.18)	(-2.93)	(-2.03)	(-2.02)	(-1.89)	(-2.07)	(-2.05)	(-2.07)	(-2.18)	(-2.03)
Age (wife)				0.00619	0.000167	0.0153	0.00435	0.000108	0.0103	0.00429	0.000106	0.00429	0.00783	0.0001
				(0.94)	(0.94)	(0.91)	(0.55)	(0.55)	(0.52)	(0.54)	(0.54)	(0.54)	(0.85)	(0.88)
Age (husband)				-0.0351***	-0.000945***	-0.0867***	-0.0321***	-0.000793***	-0.0813***	-0.0321***	-0.000795***	-0.0321***	-0.0368***	-0.0006***
				(-5.52)	(-5.30)	(-5.32)	(-4.05)	(-3.91)	(-4.10)	(-4.05)	(-3.90)	(-4.05)	(-3.97)	(-3.56)
Housing Tenure														
Own outright				-0.573***	-0.0303***	-1.343***	-0.392**	-0.0212**	-0.853*	-0.392**	-0.0213**	-0.392**	-0.454**	-0.0187**
				(-5.13)	(-4.72)	(-4.50)	(-2.77)	(-2.64)	(-2.29)	(-2.76)	(-2.63)	(-2.76)	(-2.75)	(-2.54)
Own with mortgage				-0.714***	-0.0337***	-1.681***	-0.679***	-0.0289***	-1.611***	-0.681***	-0.0291***	-0.681***	-0.774***	-0.024***
				(-9.58)	(-5.76)	(-9.78)	(-6.76)	(-4.12)	(-6.68)	(-6.76)	(-4.12)	(-6.76)	(-6.18)	(-3.57)
Council Housing				-0.322***	-0.0210**	-0.707**	-0.314*	-0.0182*	-0.754*	-0.313*	-0.0182*	-0.313*	-0.362*	-0.0162*
				(-3.39)	(-3.17)	(-3.29)	(-2.16)	(-2.14)	(-2.15)	(-2.15)	(-2.13)	(-2.15)	(-2.12)	(-2.09)
London inhabitant				-0.0133	-0.000359	-0.0451	-0.0286	-0.000708	0.00715	-0.0260	-0.000643	-0.0260	-0.0357	-0.0005
				(-0.14)	(-0.14)	(-0.18)	(-0.22)	(-0.22)	(0.02)	(-0.20)	(-0.20)	(-0.20)	(-0.25)	(-0.25)
Black ethnicity				0.468	0.0126	1.060*	0.375	0.00928	0.799	0.373	0.00925	0.373	0.401	0.006
				(1.95)	(1.94)	(2.04)	(0.85)	(0.85)	(0.72)	(0.85)	(0.85)	(0.85)	(0.82)	(0.82)
Highest qualification (wife)														
O level/GCSE							0.161	0.00437	0.423	0.162	0.00440	0.162	0.189	0.0034
							(1.71)	(1.75)	(1.71)	(1.72)	(1.76)	(1.72)	(1.74)	(1.82)
A level							-0.0771	-0.00161	-0.226	-0.0775	-0.00162	-0.0775	-0.0748	-0.001
							(-0.58)	(-0.59)	(-0.64)	(-0.58)	(-0.59)	(-0.58)	(-0.50)	(-0.50)
Higher vocational qualification							0.0900	0.00226	0.239	0.0918	0.00231	0.0918	0.113	0.002
							(0.91)	(0.94)	(0.91)	(0.93)	(0.96)	(0.93)	(1.01)	(1.04)
University degree							-0.206	-0.00374	-0.582	-0.205	-0.00373	-0.205	-0.217	-0.002
							(-1.35)	(-1.41)	(-1.42)	(-1.34)	(-1.40)	(-1.34)	(-1.25)	(-1.25)
Highest qualification (husband)														
O level/GCSE							0.102	0.00279	0.184	0.101	0.00279	0.101	0.118	0.002
							(1.03)	(1.03)	(0.71)	(1.02)	(1.03)	(1.02)	(1.06)	(1.06)
A level							-0.0484	-0.00113	-0.160	-0.0489	-0.00114	-0.0489	-0.0540	-0.0008
							(-0.42)	(-0.42)	(-0.52)	(-0.42)	(-0.42)	(-0.42)	(-0.42)	(-0.42)
Higher vocational qualification							-0.000367	-0.00000902	-0.0976	0.000686	0.0000169	0.000686	0.0147	0.0002
							(-0.00)	(-0.00)	(-0.38)	(0.01)	(0.01)	(0.01)	(0.14)	(0.14)
University degree							-0.0844	-0.00190	-0.346	-0.0825	-0.00186	-0.0825	-0.0839	-0.0012
							(-0.61)	(-0.62)	(-0.92)	(-0.60)	(-0.61)	(-0.60)	(-0.54)	(-0.55)
Socio Economic Class(wife)														
Salarist							0.0210	0.000538	0.0651	0.0242	0.000622	0.0242	0.0286	0.0005
							(0.19)	(0.20)	(0.23)	(0.22)	(0.23)	(0.22)	(0.24)	(0.24)
Intermediate white collar							0.0167	0.000424	0.0771	0.0171	0.000436	0.0171	0.0133	0.0002
							(0.16)	(0.16)	(0.29)	(0.17)	(0.17)	(0.17)	(0.12)	(0.12)
Independents							-0.151	-0.00322	-0.381	-0.152	-0.00323	-0.152	-0.174	-0.002
							(-1.39)	(-1.35)	(-1.33)	(-1.40)	(-1.36)	(-1.40)	(-1.44)	(-1.35)
Intermediate blue collar							0.282	0.00960	0.728*	0.285	0.00971	0.285	0.320*	0.007*
							(1.91)	(1.62)	(1.99)	(1.92)	(1.64)	(1.92)	(1.96)	(1.58)
Socio Economic Class														
Salarist							0.0952	0.00219	0.220	0.0959	0.00221	0.0959	0.0989	0.0015
							(1.09)	(1.10)	(0.95)	(1.09)	(1.11)	(1.09)	(1.01)	(1.00)
Intermediate white collar							-0.0198	-0.000401	-0.0711	-0.0201	-0.000408	-0.0201	-0.0361	-0.0004
							(-0.12)	(-0.12)	(-0.16)	(-0.12)	(-0.12)	(-0.12)	(-0.20)	(-0.20)
Independents							0.244*	0.00665*	0.565*	0.244*	0.00667*	0.244*	0.275*	0.005*
							(2.33)	(2.12)	(2.10)	(2.33)	(2.12)	(2.33)	(2.37)	(2.02)
Intermediate blue collar							0.0377	0.000814	0.109	0.0386	0.000835	0.0386	0.0275	0.0004
							(0.36)	(0.35)	(0.40)	(0.37)	(0.36)	(0.37)	(0.24)	(0.23)
Average hours weekly work (wife)							0.00494*	0.000122*	0.0132*	0.00485*	0.000120*	0.00485*	0.00561*	0.0001*
							(2.03)	(2.01)	(2.15)	(1.99)	(1.98)	(1.99)	(2.03)	(1.99)
Average hours weekly work (husband)							-0.00145	-0.0000358	-0.00465	-0.00140	-0.0000347	-0.00140	-0.00171	-0.00002
							(-0.44)	(-0.44)	(-0.55)	(-0.43)	(-0.43)	(-0.43)	(-0.48)	(-0.48)
Household equivalised labour income										7.03e-08	-1.74e-09	-7.03e-08	3.10e-08	3.10e-08
										(-0.08)	(-0.08)	(-0.08)	(0.03)	(0.03)
Constant	-2.285***		-4.478***	-0.528***		-0.896***		-0.991	-0.892***		-0.892***	-0.996***	-0.996***	
	(-90.72)		(-68.21)	(-3.97)		(-3.41)		(-1.50)	(-3.40)		(-3.40)	(-3.30)	(-3.30)	
Number of observations	28881	28881	28881	25466	25466	25466	16959	16959	16959	16918	16918	16918	16918	16918
Number of groups	3660	3660	3660	3320	3320	3320	2645	2645	2645	2637	2637	2637	2637	2637
t-statistics in parentheses														
* p<0.05 **p<0.01 ***p<0.001														

Estimations of effect of divorce premium on partnership dissolution are presented in Table 3.4. The dependent variable equals 1 if a marriage terminates in separation or divorce. Table 3.4 presents estimation of the model firstly with pooled probit and logit functions along with probit marginal effects. To take into account the time dimension of the data and control for serial correlation the model is then estimated using a random effect probit model with clustered standard errors at individual level. The final column of table 3.4 presents the marginal effects from random effect probit estimation. A more accurate method of estimating the divorce probabilities would be by descrete hazard function that conditions the probability of failure, in this case divorce, on survival rate and takes into account the duration of survival. Unfortunately the lack of data does not allow calculation of marriage durations which are an essential component of hazard function analysis. In order to calculate accurate marriage durations I a considerable proportion of the sample would be lost and given the currenlty limited cases of observed divorce I refrain from using duration analysis at this stage. However this study can be enriched by using the recently published data of British Household survey (Understanding the Society survey). With a bigger sample size one can have richer data set without compromising the size of the sample.

Divorce premium is found to have significant but small effect on probability of divorce in all the specifications. Models 1 to 3, show the effect of divorce premium on marital dissolution without controlling for observable characteristics. A unit increase in the premium is associated with 0.0000460 increase in probability of divorce or 0.0046 percentage points increase. The premium is expressed in pound sterling. Thus a unit increase in premium means one pound more of weekly transfer to the household. Given the observed divorce rate of 5% in the data, £100 weekly

increase in premium increases the probability of divorce by around 1%.

Specifications 4 to 12 include controls for observable heterogeneity. Columns 5 to 7 present the results controlling for age of both partners, the presence of dependent children in the household, whether the couple live in London, race and housing tenure. The housing tenures presented in the table are compared with private renting. In specifications 7 to 9 education, socio economic class and average working hours per week of both partners are controlled for. Adding these controls has a slight effect on the estimated coefficient of interest i.e. divorce premium.

The additional controls increase the effect of premium on probability of separation to 1.5%. In the last three specifications equivalised labour income is also included in the model. The use of random effect models does not increase the magnitude of the effect of premium and as it can be seen from the last column of table 3.4, the random effect estimates suggest a similar measure of effect of divorce premium on the likelihood of divorce. The closest evidence in the literature to these findings is found in Anderberg (2008). However Anderberg (2008) finds a stronger effect for premium. He reports that £100 per week of partnership penalty reduces the probability of having a partner for women by about 7% percentage points .

Anderberg's measures of labour supply are more adjusted to the marital status. He imputes the counterfactual labour supply of women by artificially matching all the women in the sample with a potential partner. Given that with the current benefit system working more hours per week makes a person entitled to more generous benefits or tax reductions, allowing the labour supply to be flexible with the changes in marital status could potentially increase the magnitude of divorce premiums which could in turn increase their effect on probability of divorce.

3.5.2 Results by Partnership Heterogeneity

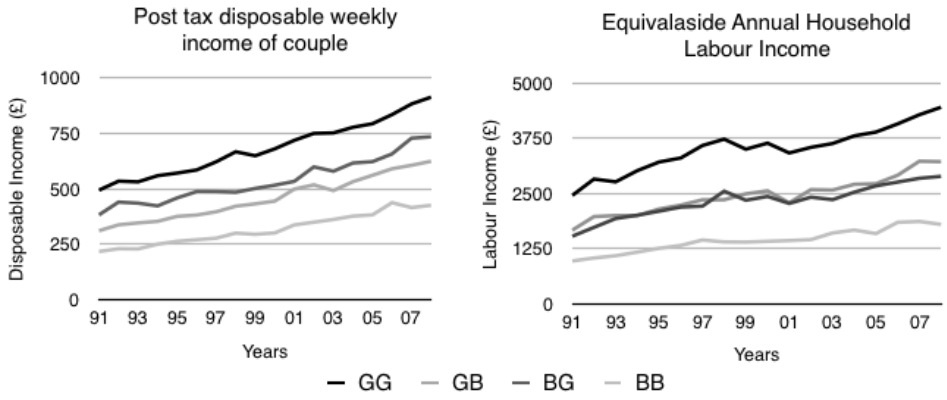
As discussed in chapter 2, I assumed that the only dimension of assortative sorting among spouses is their labour market productivity. After the marriage is formed people receive productivity shocks. According to prediction of on the match search literature, if the productivity shocks of the spouses are different then they have a higher motivation for divorce, as they can be rematched with a new partner similar to their type. Being matched with one's own type yields higher payoffs as the household production is an increasing function of both partner's productivities. The empirical test conducted in previous chapter did not find enough supportive evidence for this theoretical prediction. In what follows, I test to what extent the observed separation rate among married couples with low productivity can be explained with divorce premiums generated by welfare system.

As seen in the previous chapter, partnerships in which both spouses are low productive type are more prone to dissolution. By grouping agents into high and low productivity type and I defined four types of partnerships according to relative productivity of males and females. I replicate those types below:

- GG; if both female and male partner is of high productivity type
- GB; if female is high and male is low productivity type
- BG; if female is low and male is high productivity type
- BB; if both the female and male partner is of low productivity type

Given that productivities determine household income, BB couples are financially worse off compared with the other three groups. The average monthly labour income of four partnership types depicted in Figure 3.3 indicates that BB couples

Figure 3.3: Household Income by Couple Type



have lower labour income compared with three other groups. The left hand side graph in Figure 3.3 depicts that BB group have the lowest post tax weekly disposable income. The right hand side graph verifies similar trend based on equivalised annual labour income These trends are observed from 1991 to 2008, in the graphs x-axis indicates the number of years throughout this period.

Additionally, given that most of the benefits in the UK are means tested, households with lower income might have access to more benefit when they divorce. This is depicted in Figure 3.4. It can be observed that divorce premium is higher among households at lowest quantiles of labour income. Thus families with lower income level have more to gain from benefit transfers if they separate.

According to the assumptions made earlier, children will reside with their mother in case their parents separate. Thus it would be interesting to know whether the benefit system provides more support to women after divorce, especially if they have dependent children. The first graph in Figure 3.5 depicts the distribution of weekly divorce premiums by female's type. From this graph we can observe that should a high productivity woman divorce, she has less access to

Figure 3.4: Divorce Premium by Income Quantiles

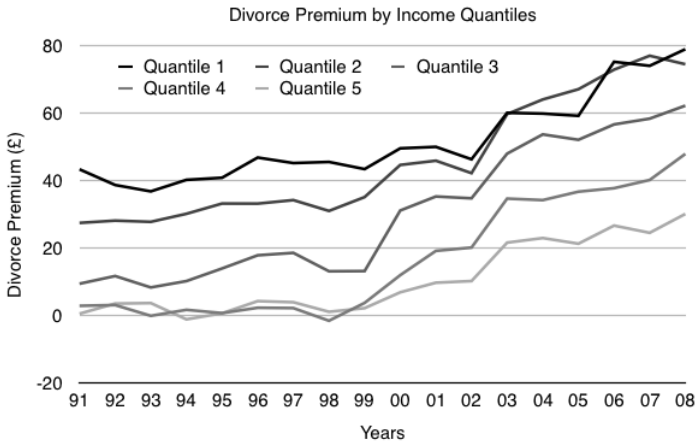
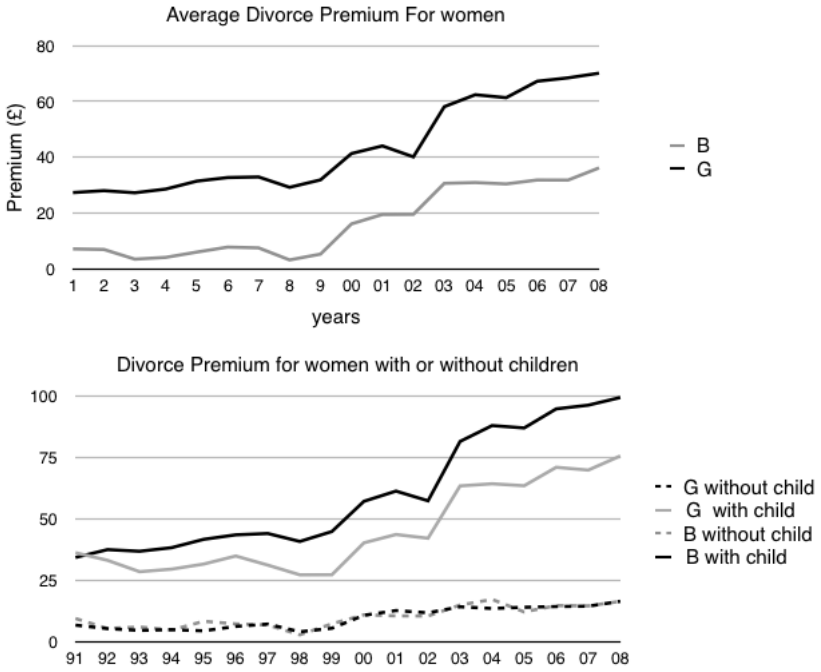


Figure 3.5: Divorce Premium for Women



benefits than a low productivity type woman.

The second graph of figure 3.5 separates the distribution of weekly premiums of high and low type women in the presence of dependent children in the household. High type women gain less support from welfare system if they separate. Separated with children earn more from benefit transfers than separated childless women. Single mothers with low income have the highest gain from welfare system after separation.

In all the graphs that depict divorce premium, a shift in the divorce premium is observed at about wave 9. Wave 9 refers to calendar year 1999 which coincides with the introduction of WFTC. Looking at bottom graph in figure 5, the average premium for a good type woman has been around £10 per week from 1991 to 1999. After the implementation of WFTC the average gain increased to about £25 per week and has not decreased since then. The same holds for bad type women. Distinguishing between single mothers and divorced women without dependent child, it seems that the benefit entitlement of childless women remains unchanged after divorce throughout all the 18 waves of the panel, whereas women with dependent children experience the rise in benefit after WFTC was introduced.

Following the discussion made at the end of chapter 2, it is interesting to investigate whether benefit system increases the gain from divorce for the BB couples and hence explains the observed higher separation rate among these couples. This exercise is done by adding the divorce premium as an explanatory variable to the probability of divorce model and check how the inclusion of this factor in the model affects the magnitude and significance of coefficients of productivity types.

Table 3.5 presents the estimated effect of benefit system when the couple type is controlled for. The first column of Table 3.5, shows the effect of couple type

Table 3.5: Estimated Probability of Divorce

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Probit	Marginal Effect	Logit	Probit	Marginal Effect	Logit	RE Probit	Marginal Effect
Divorce premium				0.00266***	0.0000672***	0.00706***	0.0036***	0.000035*
				(3.44)	(3.32)	(3.71)	(3.29)	(2.47)
Couple's Type								
G-B	0.0134	0.000297	0.0223	0.0134	0.000312	0.0229	0.0083	0.00007
	(0.15)	(0.15)	(0.10)	(0.15)	(0.15)	(0.10)	(0.08)	(0.08)
B-G	0.150	0.00388	0.392	0.0689	0.00170	0.165	0.095	0.0009
	(1.65)	(1.53)	(1.63)	(0.72)	(0.69)	(0.65)	(0.81)	(0.73)
B-B	0.201*	0.00550*	0.500*	0.166*	0.00455	0.385	0.18	0.002
	(2.48)	(2.20)	(2.33)	(2.02)	(1.84)	(1.79)	(1.75)	(1.34)
Dependent Child	-0.180	-0.00458	-0.424	-0.239*	-0.00604*	-0.583*	-0.318**	-0.003*
	(-1.87)	(-1.85)	(-1.71)	(-2.45)	(-2.41)	(-2.33)	(-2.51)	(-1.96)
Age (wife)	0.00816	0.000207	0.0193	0.00846	0.000214	0.0204	0.018	0.0001
	(1.00)	(1.00)	(0.95)	(1.03)	(1.02)	(0.98)	(1.42)	(1.61)
Age (Husband)	-0.0406***	-0.00103***	-0.100***	-0.0406***	-0.00103***	-0.101***	-0.055***	-0.0005***
	(-4.86)	(-4.54)	(-4.84)	(-4.81)	(-4.51)	(-4.81)	(-3.97)	)(-2.71)
Housing Tenure								
Own outright	-0.434**	-0.0251*	-0.886*	-0.421*	-0.0249*	-0.888*	-0.588**	-0.019*
	(-2.64)	(-2.40)	(-2.07)	(-2.55)	(-2.35)	(-2.09)	(-2.40)	(-2.14)
Own with mortgage	-0.717***	-0.0331***	-1.628***	-0.730***	-0.0338***	-1.682***	-1.00***	-0.023**
	(-5.95)	(-3.53)	(-5.70)	(-6.03)	(-3.58)	(-5.88)	(-4.51)	(-2.69)
Council Housing	-0.361*	-0.0222*	-0.779*	-0.386*	-0.0235*	-0.862*	-0.577*	-0.019*
	(-2.21)	(-2.11)	(-2.00)	(-2.35)	(-2.23)	(-2.21)	(-2.27)	(-2.20)
London	-0.0294	-0.000748	0.0183	0.000685	0.0000173	0.104	-0.023	-0.0002
	(-0.20)	(-0.20)	(0.05)	(0.00)	(0.00)	(0.27)	(0.90)	(-0.12)
Black ethnicity	0.736	0.0187	1.725	0.740	0.0187	1.759	0.894	0.008
	(1.51)	(1.50)	(1.56)	(1.53)	(1.52)	(1.60)	(1.42)	(1.25)
Constant	-0.361		0.127	-0.358		0.190	-0.45	
	(-1.12)		(0.17)	(-1.09)		(0.24)	(-1.04)	
Education dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Socio-economic class dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average weekly hours	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household labour income	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	13640	13640	13640	13640	13640	13640	13640	
t-statistics in parentheses								
* p<0.05 **p<0.01 ***p<0.001								

on probability of divorce. This is replicated from the previous chapter to make the comparison more tractable. It has already been discussed that being in a BB couple significantly increases the probability of divorce compared with being in a GG couple. According to pooled probit specification, inclusion of divorce premium in the model decreases the coefficient of BB from 0.2 to 0.16. In the logit specification, including divorce premiums wipes out the effect of couple type and makes the coefficient of BB insignificant. The last two columns are estimations using a random effect probit which acknowledges the possible serial correlation of error term across observed waves. The RE probit estimation gives similar result to that of logit specification and it is observed that after inclusion of divorce premium couple type does not have a significant marginal effect on probability of divorce. According to this observation, divorce premium can at least to some extent explain the difference in separation rate among the four couple types. This result can suggest that under the setting and assumptions of this paper, access

to benefits transfers after divorce rather provides a better explanation for marital dissolution compared with the motivation for re-sorting.

3.6 Conclusion

This chapter explored how and to what extent the welfare system in the UK generates incentives for marital dissolution. This has been done by looking at a sample of around 3000 households in the UK, most of which are married and are active in labour market. For the existing married couples a separation has been simulated and with the help of a tax and benefit calculator the tax or benefit entitlements of these couples is calculated before and after divorce. This difference is then used as an explanatory variable to predict the probability of divorce. My findings suggest that £100 weekly increase in premium increases the probability of divorce by around 5%. Furthermore, a measure of assortative matching based on spouse's productivity is introduced to the model and it is observed that couples with both spouses at lower levels of productivity are most likely to separate. This can be explained partly by the availability of benefits to these couples in case they divorce.

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