Research in Applied Economics - EC331

Can the Economic Theories of Comparative Advantage and Diminishing Marginal Productivity Explain Patterns of Household Production: Evidence from the UK

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Contents

Section 1

1.1: Introduction

Value added production in the household corresponds to a significant, yet unaccounted for, area of production within the economy. Value added intra-household transfers were estimated at $300 million in the US in 2005, compared to the $90 million transferred from the state to households in the same year.

This paper investigates how household production is allocated between two individuals according to economic theory. Understanding the factors that influence how production is allocated can have larger budgetary implications for the state; so understanding if theory and efficiency influence household decisions is imperative. Because this paper only utilises data from the UK there may be limitations of external validity. On a larger international scale social norms and preferences may vary in influence and type from country to country.

Using data from the UK national time use survey from ONS, this paper evaluates household production allocation according to the theories of comparative advantage and diminishing marginal productivity; isolating potential differences between households with and without children[1].

Section 2

2.1: Conceptual Framework

Within the theories of comparative advantage and diminishing marginal productivity my basic assumptions are as follows:

- Individuals may have differing levels of efficiency in the labour market dependent upon levels of education, experience and gender[2].
- The levels of efficiency within the labour market can be effectively proxied by an individual's wage[3].
- Both individuals are equally effective at household production, however, women may be more efficient at childcare and child related household production[4].
- Within a household, time spent in the labour market is the most important production element and is prioritised accordingly, however, as the primary activity is subjected to diminishing marginal productivity.

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1 For the purposes of this paper, childcare is included in household production.

2 Gary S. Becker (1964, 1993, 3rd ed.). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. Chicago, University of Chicago Press.

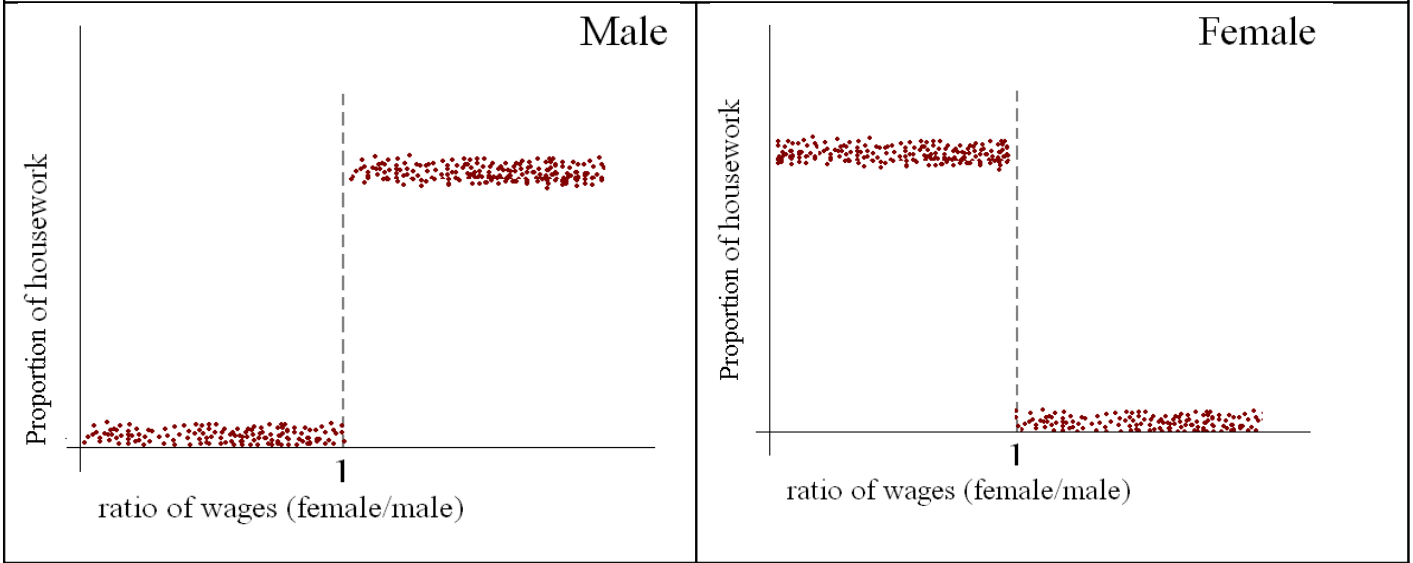
3 This is my own assumption, at the very least we can say that the individual with the higher hourly wage is more efficient at bringing home wages, even if they may actually be less efficient at their job.

4 Brown, J.K., (1970), "A Note on the Division of Labour by Sex", American Anthropologist pp 1073-8.

2.2: Econometric description of theory

The relationship between the wage ratio and the proportion of household production are outlined for each theory in figures 2.1 and 2.2 below.

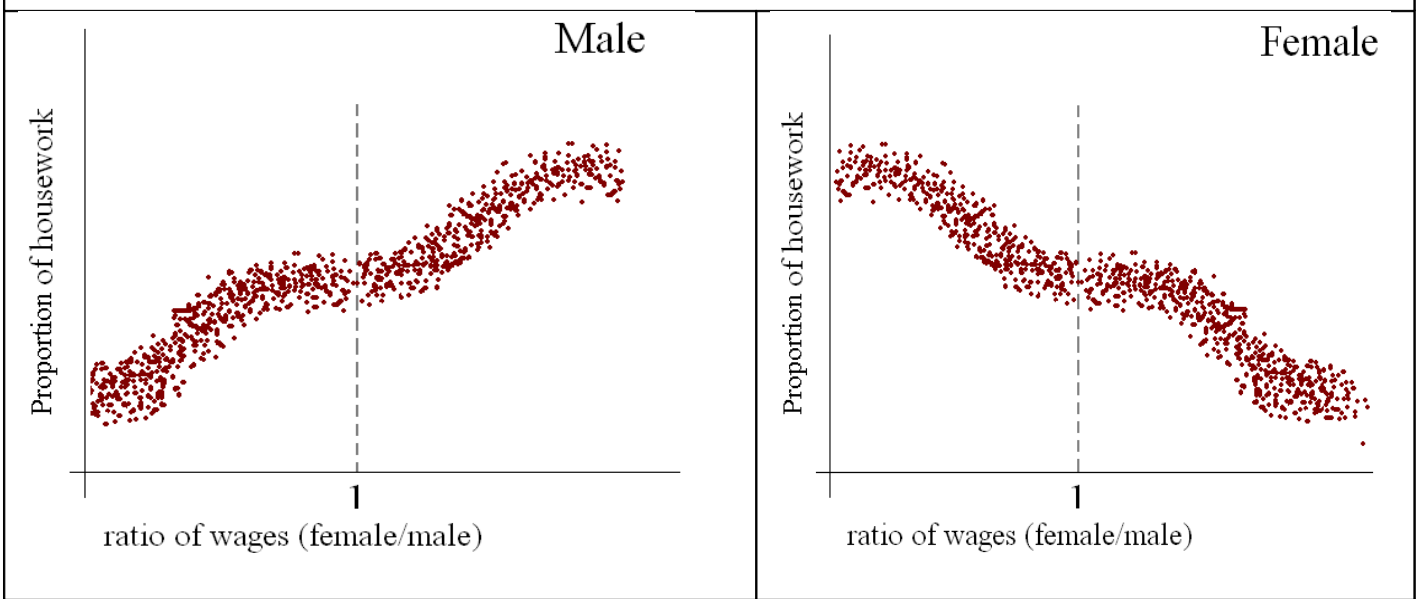
Comparative Advantage Theory



The theory of comparative advantage suggests a marked jump in the relative proportions of household production between the genders as the wage ratio passes one.

Figure 2.1

Diminishing Marginal Productivity



The theory of diminishing marginal productivity suggests a non-linear relationship between the wage ratio and proportion of household production such that, as wages converge the household activities are shared more equally.

Figure 2.2

2.3: Predictions taken from theory

1. Differences in allocations occur as the absolute volume of household production changes[5].
2. In households without children the theory of diminishing marginal productivity will hold because as there is less *absolute* household production there is no need for one individual to produce solely within the household and therefore sharing tasks, avoiding diminishing marginal productivity is more efficient than comparative advantage.
3. In households with children considering the higher absolute volume of household production that needs undertaking diminishing marginal productivity would not be the most efficient method of household production, there would probably be greater gains from specialisation especially where one individual is more efficient than the other in the labour market.

Section 3

3.1: Literature Review

There are two main empirical methods used regarding time allocation of production within households, which are well represented in the literature and of which I will now provide an overview.

The first approach specifies a specific functional form for household production to derive time allocation equations. Graham and Green[6] (1984) use a Cobb-Douglas specification for the household production function, and data from the ninth wave (1976) of the "Panel Study of Income Dynamics" generated by the Institute for Social Research at the University of Michigan. They investigate jointness[7] between home production time and leisure, the degree of which is greater for wives than for husbands. Alternative papers use different forms which are more flexible but where household production is a linear function of time spent on household activities by husband and wife. This suggests the importance of female preferences and how the definitions of work may impact upon research in this field.

The second approach is used to find specific functional forms for the equilibrium conditions of the household production model. This approach is taken in Gronau[8] (1980) and in Kiker and Mendes de Oliveira[9] (1992). Gronau (1980) specifies a functional form for the household production function, which

[5] This seems intuitive, households with only one hour of household production required per week may allocate that production equally or all to one individual, however, as the absolute volume of household production rises, there is a need to improve the efficiency of those allocations.

[6] Graham, John W. and Green, Carole A., (1984), "*Estimating the Parameters of a Household Production Function with Joint Products*", The Review of Economics and Statistics, Vol. 66, No. 2, pp. 277-282

[7] Jointness is the concept developed in the Graham and Green paper where household production simultaneously serves as leisure time.

[8] Gronau, R., (1980), "Home Production: a forgotten industry", The Review of Economics and Statistics, Vol. 62, No. 3, pp. 408-416

[9] Kiker, B.F. and M. Mendes de Oliveira. 1992. "Optimal Allocation of Time and Estimation of Market Wage Functions." *Journal of Human Resources* 27(3):445-471

then derives the equation for work at home. The Gronau paper was the first in its field and although drawing some interesting and useful conclusions it has been critiqued for three reasons. Firstly, response selectivity biases in the data set are largely ignored and may play a more important role in the household production functions than previously identified. Secondly, the strictly limited data set, focusing exclusively on white, married households limits the relevance of the model. Finally, Gronau focuses on parameter estimation of the wife's marginal productivity, and not estimation of the underlying production function itself, as such it is unable to answer questions about the relative inputs of the wife's time relative to the Husband's; an element central to this research project. By using a strong and large dataset developed by ONS this paper has attempted to minimise the impact of response selectivity bias. Between the two methods discussed above, I feel that the first is preferable as it allows for the incorporation of theoretical frameworks that I'm investigating.

Another issue identified in the literature includes difficulties defining work. Reid[10] (1934) defines work as "An activity [that] is of such character that it might be delegated to a paid worker", however this definition is flawed; many individuals pay for childcare services but also derive great pleasure from looking after their children. Gortz[11] provides some useful insights into what constitutes work or pleasure in the context of household production but highlights the difficulty drawing distinctions between preferences and efficiencies.

An empirical challenge identified in the literature is individual market wage, which is unobservable for individuals not engaged in labour market activities. As one of the first empirical papers to deal with the subject Gronau (1980) provides a method for estimating the wages which depends upon; the educational of the individual, their spouse's education, the number of years experience in the labour market gained since their 18th birthday and the experience variable squared. The estimation method used can be seen below:

$$\begin{aligned} \ln W = & \underset{(3.83)}{-.4237} + \underset{(8.34)}{.0827}\, EDUCW \\ & + \underset{(2.25)}{.0186}\, EDUCH + \underset{(5.48)}{.0331}\, EXPRNW \\ & - \underset{(3.39)}{.0006}(EXPRNW)^2 \\ & R^2 = .16 \end{aligned}$$

Perhaps the most interesting element of this solution is the inclusion of a variable for spouse's education, they justify this element in terms of selective breeding factors, that an individual is more likely to marry someone of a similar educational level, however, the link between spouses education and that individuals wage is necessarily apparent. I believe they may have been attempting to compensate for the omitted variable of aspirations which could influence wage, although this is not explained in the paper.

[10] Reid, M., (1934), "*Economics of Household Production",* Wiley & Sons
[11] Gortz, M., (work in progress), "*Household Production in the Family – Work or Pleasure?*"

An alternative method used by Maasen Van Den Brink and Groot[12] was the use of a Mincerian[13], semi logarithmic specification, as shown below. In this situation, Y_w is a collection of human capital variables not expressed in the paper and β_w is the coefficient on those variables. Maasen Van Den Brink and Groot did not include a variable for spouse's education in their empirical solution to this problem.

$$LogW = \mathbf{Y}_w \boldsymbol{\beta}_w + \epsilon_w$$

These models have formed the basis of the Mincerian regression used to derive the wage variables throughout this paper.

In contrast to the existing literature, this paper offers an investigation of the direct relationships between economic theory and empirical reality focusing on evaluation of the wage ratio within the household as the trigger for economic decisions. Previous investigations typically focus on one individuals production function within the household and its components whereas this paper examines more the role of allocation within the household as a unit. The final result of this paper is an analysis of how theory fits to reality and whether households are influenced by efficiency of social norms.

3.2: Dataset

The data used in this paper is taken from the 2000 National Time Use Survey by ONS. The Time Use Survey was designed, where possible, to provide results comparable with other European studies as part of a wider Harmonised European Time Use Study.

Data was collected via phone interviews and time use diaries at household level for all household members over the age of 8 years. Two one-day diaries and a one week work and education time sheet were completed per individual. For the purpose of my analysis I have excluded all diary extracts from those under 18. This restricts my sample size from 20981 to 11792. This is still a large and important sample size to evaluate. Data has been collected in such a way that all time-use diaries add-up to 24 hours in a day. The diaries include information on the primary and secondary activities of each individual during each period of the day, but for the purposes of this paper the regressions focus on the self reported primary activities.

Within my dataset, the average age of respondents to the ONS survey was 40.6 years of age, however, after excluding individuals under the age of 18 from the dataset, the average age rose to 46.6. After restricting the dataset to married individuals only, the sample size fell to 4093 with a mean age of 30.5, a maximum age of 92 and a minimum age of 18.

[12] Maasen Van Den Brink and Groot, (1997), "*A Household Production Model of Paid Labour, Household Work and Childcare*", De Economist

[13] The semi-logarithmic earnings function, also known as the Mincerian earnings function (Mincer, 1974), is the commonly accepted functional form for the earnings function. Mincer, J, (1974) "*Schooling, Experience and Earnings*", National Bureau of Economic Research .

The gender distribution of respondent within the survey was reasonably equal within the restricted dataset as can be seen in figure 3.2 below, before restricting the dataset there was notably more variation in the gender of respondents, females accounted for 57% of the dataset.

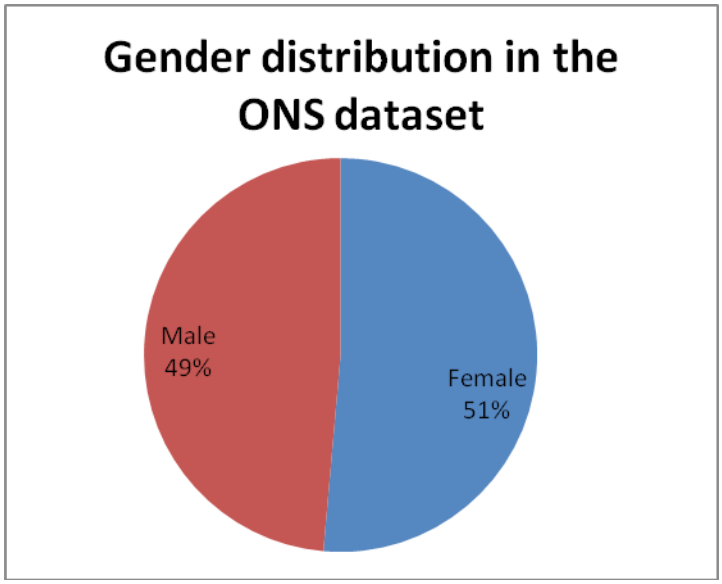


Figure 3.2

Variable	No. of observations	Mean	Standard deviation	Min	Max
Age	4093	30.5	13.4	18	92
Gender	4093	0.514	0.49	0	1
Dml1_3	3744	140.7	147.6	0	830
Wage ratio	921	0.7	0.144	0.133	1.433

Table 3.2

Above in table 3.2 the summary statistics for the key variables in this study can be seen. In the mean household the female partner will earn only 70% of her husband's wage and within this dataset, the highest wage ratio is 1.433; there are no women which earn more than 43.3% more than their male partners. This sample size is still large enough for any results drawn to be deemed representative of the UK population.

3.3: Methodology

Regression analysis is used to assess the relationship between the wage ratio and proportion of household production undertaken by two married individuals within a household. As the proportion of housework undertaken can take a range of values from 0 to 1, all proportions are expressed as decimals, OLS regression has been used.

Two different regressions have been developed in order to isolate the influences of the different theories within the data.

The following regressions demonstrate the basic econometric forms that the theory takes.

$$Production=\beta_0+\beta_1 Wage\ Ratio+\beta_2 Wage\ ratio^2+\varepsilon \qquad (1)$$

Equation 1 demonstrates the form of the OLS regression testing for the theory of diminishing marginal productivity.

$$Production=\beta_0+\beta_1 Wage\ Ratio\ Dummy+\varepsilon \qquad (2)$$

Equation 2 demonstrates the form of the OLS regression form testing for the theory of comparative advantage. The dependant variable production takes a values between 0 and 1 representing the proportion of household production that an individual within a given household will undertake. The independant variable wage ratio is the ratio of wage of the female partner in the household to the male partner's wage and the variable wage ratio dummy is a dummy variable taking the value 1 when the wage ratio is greater than 1 for a given household, in other words when the female wage is greater than the male wage within a given household. Within this context household production encompasses elements such as childcare, cooking and cleaning, however a full description can be found in the appendix section 1.

These regressions don't control for any additional factors which may influence the relationships within the household therefore further regressions were run to limit OVB and improve the regression estimates[14]. These variables allow for differences between geographies, household incomes and demographic characteristics. For a full description of these variables please refer to appendix section 5.

$$Production=\beta_0+\beta_1 WageRatio+\beta_2 Wageratio^2+\beta_3 age^2+\beta_4 England+\beta_5 Wales+\beta_6 Scotland+\beta_7 White+\beta_8 BlackCar+\beta_9 BlackAfr+\beta_{10} Indian+\beta_{11} Pakistani+\beta_{12} Bangladeshi+\beta_{13} Chinese+\beta_{14} Inc<2610+\beta_{15} Inc2610\text{-}5210+\beta_{16} Inc5210\text{-}10430+\beta_{17} Inc10430\text{-}15640+\beta_{18} Inc15640\text{-}20860+\beta_{19} Inc20860\text{-}33800+\beta_{20} Inc33800\text{-}41000+\beta_{21} Inc41000\text{-}46000+\beta_{22} Inc46000\text{-}55000+\beta_{23} Inc55000\text{-}80000+\beta_{24} Inc>80000+\beta_{25} Care+\varepsilon \qquad (3)$$

$$Production=\beta_0+\beta_1 WageRatioDummy+\beta_2 age^2+\beta_3 England+\beta_4 Wales+\beta_5 Scotland+\beta_6 White+\beta_7 BlackCar+\beta_8 BlackAfr+\beta_9 Indian+\beta_{10} Pakistani+\beta_{11} Bangladeshi+\beta_{12} Chinese+\beta_{13} Inc<2610+\beta_{14} Inc\ 2610\text{-}5210+\beta_{15} Inc5210\text{-}10430+\beta_{16} Inc10430\text{-}15640$$

[14] Stock and Watson, (2003), "An Introduction to Econometrics", Pearson Education.

$+\beta_{17}Inc15640\text{-}20860 +\beta_{18}Inc20860\text{-}33800 +\beta_{19}Inc33800\text{-}41000 +\beta_{20}Inc41000\text{-}46000 +\beta_{21}Inc46000\text{-}55000 +\beta_{22}Inc55000\text{-}80000 +\beta_{23}Inc >80000 +\beta_{24}Care+ \varepsilon$ (4)

Regressions 3 and 4 were run for households with and without children separatly, including variables for the number and age of children where appropriate, these regression results can be seen in appendix sections 2 and 3 respectively.

Throughout this paper all reasonable attempts have been made to reduce the threats to the internal validity of the model; OVB[15] has been limited by including a range of demographic and geographic regressors; all care has been taken to reduce the probability of misspecification or errors in variables bias.

Unfortunately my data may suffer from sample selection bias; the nature of the ONS study was that cooperation in completing questionnaires and time use diaries was option for each individual, this in itself doesn't necessarily threaten the internal validity of my study, however there may be a tendency for enthusiastic or hard working individuals to respond more frequently, as such the time spent dedicated to housework, childcare or labour market work may be skewed in this study and not truly represent the population of the UK.

This study has also restricted effects from reverse causality. The constructed variable wage is independent from the number of hours of housework performed, as are all its component parts. In construction of the wage variable all efforts were taken to ensure that the causality only acted in once direction.

The variables of wage, wage ratio and wage ratio dummy have been developed from the dataset in order to overcome the problem of missing wage observations for individuals who do not work. The wage for individuals who worked within the dataset was regresed on various educational and experience variables as well as gender, according to equation 5 below. For a full explanation of variables please refer to appendix section 5.

$Income=\beta_0+\beta_1age+\beta_2age^2+\beta_3degree+\beta_4hi\_edu+\beta_5alevel+\beta_6gcse+\beta_7ageleft1518+\beta_8ageleft1925+ \beta_9ageleft26 +\beta_{10}gender + \varepsilon$ (5)

The regression coefficients were then used to develop the wage variable used throughout the paper. Please refer to the limitations and extensions section for a discussion of this methodology.

[15] Omitted Variable Bias

Section 4

4.1: Empirical analysis

The regression results for each theory according to whether children are present in the household are laid out below by gender in tables 4.1 and 4.2. By evaluating the effects of each economic theory separately by gender the significance that each theory may have on gender may become more apparent.

Households without children	Diminishing marginal productivity		Comparative advantage	
Variable	Male	Female	Male	Female
Wage ratio	0.140	-0.280*	-	-
	[0.194]	[0.152]		
Wage ratio^2	0.087**	0.001	-	-
	[0.042]	[0.001]		
Wage dummy	-	-	-0.012	-0.001
			[0.031]	[0.028]

Table 4.1

Table 4.1 illustrates the regression results for households in the survey without children. It demonstrates that, on average, a rise in ratio of female to male wage is met with a statistically significant decline in the proportion of household production that the female partner undertakes. This relationship is linear and statistically significant at the 10% level. This result is consistent with the theory of diminishing marginal productivity. For men, there is a statistically significant non-linear relationship; suggesting, on average, as a women's efficiency in the labour market increases relative to a man, as she takes home an increasing proportion of the household income there is an associated non linear relationship, such that the man increases his proportion of the household production by an increasing factor.

The table below outlines the level of household production that, on average, we would anticipate from both partners based upon regression results.

Proportion of Household Production Undertaken at Different Wage Ratios		
Wage ratio	Male	Female
0.6	0.12	-0.17
0.7	0.14	-0.20
0.8	0.17	-0.22
0.9	0.20	-0.25
1	0.23	-0.28
1.1	0.26	-0.31
1.2	0.29	-0.34
1.3	0.33	-0.36
1.4	0.37	-0.39

Table 4.11

In table 4.11 above, the linear relationship has also been included, although not statistically significant from the regression results, I believe that it is of economic significance and therefore warrants evaluation.

The theory of comparative advantage isn't statistically significant in households without children; this may be because the absolute level of household production is too low. The comparative advantage model is based on the trade off between one individual remaining in the household and one working cannot be justified if the absolute level of household production is too low.

Table 4.2 below demonstrates the regression results for households with children. Interestingly, none of the results are significant. This seems contrary to theory as in a household requiring high levels of production there is no statistically significant, economically efficient behaviour.

Households with children				
	Diminishing marginal productivity		Comparative advantage	
Variable	Male	Female	Male	Female
Wage ratio	0.744	-0.356	-	-
	[3.810]	[3.950]		
Wage ratio^2	-0.463	0.256	-	-
	[2.404]	[2.505]		
Wage dummy	-	-	-0.038	-0.001
			[0.339]	[0.338]

Table 4.2

Of course the assumption from the theory of comparative advantage that the jump in production at a level where the wage ratio is equal to one may be flawed in a household with children. Brown (1970)[16] suggests that the wage ratio jump may occur above one if women have an absolute advantage in childcare.

The results of trying to identify this step change can be seen in table 4.21 below, where the basic regression was repeated using dummies for a number of different wage ratios.

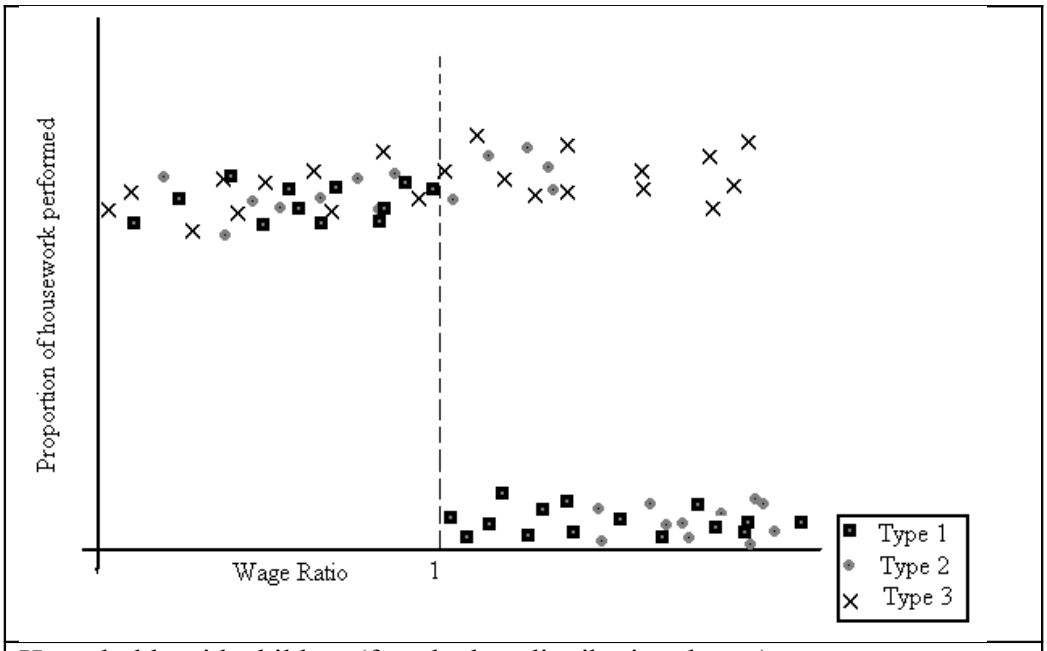
Variable	Diminishing marginal productivity		Comparative advantage	
	Male	Female	Male	Female
Wage ratio	0.744	-0.365	-	-
	[3.810]	[3.950]		
Wage ratio ^2	-0.463	0.256	-	-
	[2.404]	[2.505]		
Wage dummy 1	-	-	-0.308	-0.001
			[0.339]	[0.338]
Wage dummy 1.025	-	-	-0.009	-0.001
			[0.050]	[0.049]
Wage dummy 1.05	-	-	-0.050	0.035
			[0.056]	[0.055]
Wage dummy 1.075	-	-	-0.040	0.027
			[0.061]	[0.059]
Wage dummy 1.1	-	-	0.006	-0.020
			[0.066]	[0.065]
Wage dummy 1.125	-	-	-0.099	0.074
			[0.086]	[0.084]
Wage dummy 1.15	-	-	-0.050	0.025
			[0.118]	[0.115]
Wage dummy 1.175	-	-	-0.050	0.025
			[0.118]	[0.115]
Wage dummy 1.2	-	-	-0.050	0.025
			[0.118]	[0.115]
Wage dummy 1.25	-	-	-0.021	-0.007
			[0.152]	[0.149]
Wage dummy 1.3	-	-	-0.187	0.164
			[0.179]	[0.176]
Wage dummy 1.35	-	-	-0.187	0.164
			[0.179]	[0.176]
Wage dummy 1.4	-	-	-0.138	0.102
			[0.249]	[0.246]

Table 4.21 - Additional regressions for higher wage ratios can be found in the appendix section 4.

As we can see from the table above, the additional dummy variables for wage ratio dummies, have failed to identify any significant step changes within the data. The range of these wage ratio dummies has been increased up to 2.0 and the regressions were re-performed with more precise wage ratios, neither

[16] Brown, J.K., (1970), "A Note on the Division of Labour by Sex", American Anthropologist pp 1073-8.

produced statistically significant results, please refer to appendix section 4 for more details. Of course, given that there are few observations of a wage ratio in the dataset above 1.2 and none above 1.433 it is unsurprising that these results are limiting – it suggests that if a step change has occurred then we probably haven't observed it in this dataset.



Households with children (female data distribution theory)

Figure 4.3

There are several potential explanations for the inability to identify a significant step change in the data for households with children and a number of conclusions may be drawn from these explanations.

The role of preferences may play a more significant role than acknowledged in theory. As highlighted by Graham and Green[17] (1984) women have a higher level of jointness than men for activities relating to household production, that is, women derive greater utility from performing household production tasks than men, up to the level where the utility derived is equal to that of leisure rather than work. In a situation where preferences hold a greater importance than theory in household production then even when women have no distinct advantage in childcare, then it is possible that women within households will demonstrate the characteristics of type two or even type three in the diagram 4.3 above. Where the trade off between the opportunity cost of wage ratio and household production becomes significantly shifted, to a level above one.

My analysis cannot take into account allocating production to individuals outside of the household such as grandparents or nannys. In this situation individuals may be classified as within type 1 (figure 4.3 above) where no additional household production is required, and household allocate as before children.

[17] Graham, John W. and Green, Carole A., (1984), "*Estimating the Parameters of a Household Production Function with Joint Products*", The Review of Economics and Statistics, Vol. 66, No. 2, pp. 277-282

The final influence upon my results is the presence of maternity leave laws in the UK[18]. Certainly for women during their maternity leave period then we would see behaviour more of type three, where they undertake all household production and childcare regardless of their wage ratio because they continue being paid a certain amount. During maternity leave there is no opportunity cost to not working.

Assuming the three types of individuals discussed act more according to preferences than theory then without separating them in the dataset, then as in figure 4.3 above, econometrically identifying a step change in the data would be near impossible. Overall the existence of preferences within the dataset means than this study has been unable to identify evidence of theoretical efficiencies.

Regressions were re-performed for households at a lower level of income where preferences may have less of an impact upon household allocations and efficiency might take priority. Once again, none of these regression results were significant, strengthening the argument that efficiency isn't a priority in households with children but rather that different groups of individuals choose their levels of production relative to different characteristics.

[18] UK Maternity Laws - Within the UK, upon meeting certain criteria Women are granted 39 weeks of maternity leave paid at 90% of their full salary. This element may have a significant impact upon the results presented within this paper. If any gains of learning by doing occur through experience caring for children then in 2000, given that women were granted paid statutory leave, then it is sensible to suggest that this may have introduced a rigidity into the dataset and economic theory. As whomever started caring for the children after their birth would have greater efficiencies in childcare than the other partner. In the year 2000 men were not entitled to paternity leave in the UK; since 2003 men have been entitled to 2 week paternity leave, in 2000 women were entitled to 18 weeks paid maternity leave, perhaps this would impact if we were to compare the differences across datasets. Of course in the model used here no elements of learning by doing have been included, although the elements visable in the law may help us understand why pure economic theory is not applicable in this situation.

4.2: Conclusion

From the UK time use data survey we can draw the following conclusions about the intra-household allocation of production according to the theories of diminishing marginal productivity and comparative advantage.

1. In households with no children, diminishing marginal productivity prevails, demonstrating a significant, linear relationship between the wage ratio and the proportion of total household production undertaken. For male household members there is also a significant non linear term demonstrating an increasing willingness to perform household production activities as the female wage rises relative to the male wage.
2. In households with children, neither theory has a statistically significant basis. In my opinion, the theory of comparative advantage may be the most significant within this scenario given that from experience we know that in households with younger children, one partner often takes on all the production and childcare activities as the other partner works, so in my opinion, what we have failed to identify is the wage ratio at which this relationship switches. However, as different groups of individuals place different weights on spending time with their children and efficiency the econometric analysis is unable to identify any step changes in the data, as demonstrated in figure 4.3.

In relation to pre-existing literature, these results, although not conclusively have demonstrated some important relationships and built upon the foundations of analysis regarding econometric methods and difficulties investigating household production and time allocation. The focus of this paper is quite different from existing literature and as such my results are not comparable, however, still valid and stand well alone due to their foundation in previous papers, namely Maassen, Van Den Brink and Groot.

4.3: Limitations and extensions

The limitations within this paper are grouped under three main areas. Firstly; issues with using wage as a proxy for efficiency in the labour market; secondly, problems derived from the dataset itself; and finally, issues associated with applying pure economic theory to a real dataset.

A number of individuals in the dataset didn't have a variable for wage as these individuals are not employed in the labour market. As such, constructing the wage variable used in this investigation may have introduced error. Error has been limited by following methods from papers econometrically recognised as sound and following important rules limiting the potential impact of threats to internal validity. Allowing for this margin of error within the paper has allowed the investigation of this phenomenon which otherwise may have been impossible.

Wage may also have efficiency elements associated with it, for instance at higher levels of income, individuals may purchase labour saving devices such as washing machines, dishwashers or hire help around

the home. This may exaggerate within the study the rigidity within the labour market, where individuals may choose to purchase labour saving devices over working part time or not at all. Of course, rigidities in the labour market have an impact upon the amount of free time that individuals within households may have to perform household activities.

In the context of this paper I have used wage to proxy efficiency in the labour market and although, hourly wage could be taken as a measure of efficiency gaining money, it is important to recognise that a wage rate may be determined by factors external to demographic, geographic and educational characteristics that have been used in this paper. Many individuals earn a higher income by working less amiable hours in more difficult conditions; such individuals are anomalous in this study.

Gender has been included in the regression because it is a significant determinant of wage. In reality, omitting it from the wage regression would introduce error into this investigation. According to economic theory if gender is used in wage it has little impact upon my interpretation it simply means that the theory is more likely to fit the reality in the dataset.

Within the dataset there are a number of issues that I have already discussed, including sample selection bias and a self reporting bias. In the future improving the dataset to include additional variables such as parental wage, parental social class would allow for the examination of the effect of social aspirations on the level of household production. Social class and aspirations may be one method of separating the preferences of individuals as described in figure 4.3

Finally, applying pure economic theory to realistic data will never reveal perfect results; individuals are influenced by perceptions, social norms and preferences.

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Appendix
Section 1

Section 2a – Households without children diminishing marginal productivity

Male

Source	ss	df	ms	number of obs	1289
Model	2.597	24	0.108	Prob	0.008
Residual	74.335	1264	0.059	Rsqu	0.034
Total	76.932	1288	0.060	Adj R squ	0.015
				Root MSE	0.243

Variable	Coefficient	Standard Error	
Wage ratio	0.140	0.194	
Wage ratio^2	0.087	0.042	**
Age	0.003	0.002	
Wage ratio*age	-0.004	0.003	*
England	0.130	0.130	**
Wales	0.119	0.062	*
Scotland	0.098	0.059	*
White	0.057	0.100	
Black Car	0.294	0.263	
Black Afr	dropped		
Indian	-0.085	0.136	
Pakistani	-0.063	0.200	
Bangladeshi	dropped		
Chinese	0.185	0.199	
Inc< 2610	0.126	0.061	**
Inc 2610- 5210	0.030	0.032	
Inc 5210- 10430	0.042	0.024	*
Inc 10430-15640	0.046	0.025	*
Inc 15640-20860	0.028	0.025	
Inc 20860-33800	0.046	0.022	*
Inc 33800-41000	0.039	0.034	
Inc 41000-46000	0.029	0.041	
Inc 46000-55000	0.070	0.046	
Inc 55000-80000	0.043	0.039	
Inc> 80000	0.007	0.040	
Care	-0.054	0.018	***
Cons	0.128	0.182	

Significance	
	10%*
	5%**
	1%***

Female

Source	ss	df	ms	number of obs	1320
Model	0.158	25	0.104	Prob	0.011
Residual	75.648	1294	0.058	Rsqu	0.033
Total	78.245	1319	0.059	Adj R squ	0.015
				Root MSE	0.242

Variable	Coefficient	Standard Error	
Wage ratio	-0.280	0.152	*
Wage ratio^2	0.001	0.001	
Age	-0.004	0.002	**
Wage ratio*age	0.004	0.002	*
England	-0.160	0.051	**
Wales	-0.141	-0.141	*
Scotland	-0.127	-0.127	**
White	0.109	0.100	
Black Car	-0.064	0.199	
Black Afr	-0.026	0.262	
Indian	0.331	0.142	**
Pakistani	0.249	0.199	
Bangladeshi	dropped		
Chinese	-0.319	0.262	

Significance	
	10%*
	5%**
	1%***

Inc< 2610	-0.106	0.056	*
Inc 2610- 5210	-0.040	0.031	
Inc 5210- 10430	-0.035	0.023	
Inc 10430-15640	0.023	0.025	*
Inc 15640-20860	-0.020	0.025	
Inc 20860-33800	-0.038	0.022	*
Inc 33800-41000	-0.034	0.034	
Inc 41000-46000	-0.017	0.041	
Inc 46000-55000	-0.065	0.046	
Inc 55000-80000	-0.056	0.039	
Inc> 80000	0.021	0.040	
Care	-0.030	0.016	*
Cons	0.984	0.158	*

Section2b – Households without children comparative advantage

Male

Source	**ss**	**df**	**ms**	**number of obs**	1289
Model	1.978	22	0.090	**Prob**	0.059
Residual	74.954	1266	0.059	**Rsqu**	0.026
Total	76.932	1288	0.060	**Adj R squ**	0.009
				Root MSE	0.243

Variable	**Coefficient**	**Standard Error**	
Wage Dummy	-0.012	0.031	
Age	0.000	0.001	
England	0.131	0.055	**
Wales	0.120	0.062	*
Scotland	0.098	0.059	*
White	0.055	0.101	
Black Car	0.279	0.264	
Black Afr	dropped		
Indian	-0.091	0.136	
Pakistani	-0.073	0.200	
Bangladeshi	dropped		
Chinese	0.182	0.199	
Inc< 2610	0.131	0.061	**
Inc 2610- 5210	0.033	0.032	
Inc 5210- 10430	0.042	0.024	*
Inc 10430-15640	0.045	0.025	*
Inc 15640-20860	0.024	0.025	
Inc 20860-33800	0.043	0.022	*
Inc 33800-41000	0.036	0.034	
Inc 41000-46000	0.026	0.041	
Inc 46000-55000	0.075	0.046	
Inc 55000-80000	0.044	0.040	
Inc> 80000	0.002	0.040	
Care	-0.056	0.018	***
Cons	0.252	0.123	**

Significance
10%*
5%**
1%***

Female

Source	**ss**	**df**	**ms**	**number of obs**	1320
Model	2.377	23	0.103	**Prob**	0.014
Residual	75.868	1296	0.059	**Rsqu**	0.030
Total	78.245	1319	0.059	**Adj R squ**	0.013
				Root MSE	0.242

Variable	**Coefficient**	**Standard Error**	
Wage Dummy	-0.001	0.029	
Age	-0.001	0.001	
England	-0.158	0.051	***

Significance
10%*
5%**

Wales	-0.140	0.058	**
Scotland	-0.125	0.055	**
White	0.104	0.100	
Black Car	-0.066	0.199	
Black Afr	-0.017	0.262	
Indian	0.341	0.135	**
Pakistani	0.250	0.199	
Bangladeshi	dropped		
Chinese	-0.314	0.262	
Inc< 2610	-0.113	0.056	**
Inc 2610- 5210	-0.043	0.030	
Inc 5210- 10430	-0.038	0.023	
Inc 10430-15640	-0.044	0.025	*
Inc 15640-20860	-0.019	0.025	
Inc 20860-33800	-0.039	0.022	*
Inc 33800-41000	-0.034	0.034	
Inc 41000-46000	-0.016	0.041	
Inc 46000-55000	-0.071	0.046	
Inc 55000-80000	-0.057	0.039	
Inc> 80000	0.022	0.040	
Care	-0.032	0.016	**
Cons	0.799	0.120	***

1%***

Section 3a – households with children diminishing marginal productivity

Male

Source	ss	df	ms	number of obs	931
Model	3.466	44	0.079	Prob	0.079
Residual	52.612	886	0.059	Rsqu	0.062
Total	56.078	930	0.060	Adj R squ	0.015
				Root MSE	0.244

Variable	Coefficient	Standard Error	
Wage ratio	0.744	3.815	
Wage ratio^2	-0.463	2.404	
Age	0.006	0.007	
Num 0-2	-0.111	0.889	
Num 3-4	0.468	0.509	
Num 5-9	0.010	0.368	
Num 10-15	0.662	0.277	*
Num 16-17	-0.241	0.659	
Age youngest	-0.159	0.406	
England	0.095	0.048	**
Wales	0.019	0.060	
Scotland	0.079	0.053	
White	0.045	0.064	
Black Car	0.147	0.120	
Black Afr	0.045	0.156	
Indian	0.156	0.093	
Pakistani	-0.096	0.092	
Bangladeshi	-0.044	0.139	
Chinese	-0.140	0.127	
Inc< 2610	0.064	0.151	
Inc 2610- 5210	-0.005	0.050	
Inc 5210- 10430	0.030	0.041	
Inc 10430-15640	-0.010	0.032	
Inc 15640-20860	-0.016	0.030	
Inc 20860-33800	0.009	0.026	
Inc 33800-41000	-0.033	0.034	

Significance
10%*
5%**
1%***

Inc 41000-46000	0.055	0.042
Inc 46000-55000	0.006	0.052
Inc 55000-80000	-0.066	0.044
Inc> 80000	0.062	0.046
Care	-0.030	0.026
Cons	-0.048	1.493

Female

Source	ss	df	ms	number of obs	931
Model	3.383	44	0.077	**Prob**	0.095
Residual	52.413	886	0.059	**Rsqu**	0.061
Total	55.796	930	0.060	**Adj R squ**	0.014
				Root MSE	0.243

Variable	Coefficient	Standard Error	
Wage ratio	-0.356	3.950	
Wage ratio^2	0.256	2.505	
Age	-0.004	0.008	
Num 0-2	0.124	0.940	
Num 3-4	-0.538	0.524	
Num 5-9	0.063	0.368	
Num 10-15	-0.698	0.274	
Num 16-17	0.115	0.662	
Age youngest	0.216	0.430	
England	-0.097	0.048	
Wales	-0.022	0.060	
Scotland	-0.081	0.053	
White	-0.120	0.080	
Black Car	-0.205	0.129	
Black Afr	-0.233	0.164	
Indian	-0.142	0.100	
Pakistani	0.009	0.113	
Bangladeshi	-0.032	0.145	
Chinese	0.037	0.135	
Inc< 2610	-0.071	0.151	
Inc 2610- 5210	-0.011	0.050	
Inc 5210- 10430	-0.041	0.041	
Inc 10430-15640	0.005	0.032	
Inc 15640-20860	0.013	0.030	
Inc 20860-33800	-0.014	0.025	
Inc 33800-41000	0.031	0.034	
Inc 41000-46000	-0.056	0.042	
Inc 46000-55000	0.002	0.052	
Inc 55000-80000	0.072	0.044	
Inc> 80000	-0.082	0.046	*
Care	0.008	0.023	
Cons	1.017	1.540	

Significance
10%*
5%**
1%***

Section 3b – households with children comparative advantage

Male

Source	ss	df	ms	number of obs	931
Model	2.912	36	0.081	Prob	0.079
Residual	53.166	894	0.059	Rsqu	0.052
Total	56.078	930	0.060	Adj R squ	0.014
				Root MSE	0.244

Variable	Coefficient	Standard Error

Wage dummy	0.038	0.339	
Age	0.001	0.001	
Num 0-2	-0.008	0.038	
Num 3-4	-0.030	0.026	
Num 5-9	-0.026	0.014	*
Num 10-15	-0.022	0.013	*
Num 16-17	-0.034	0.026	
Age youngest	0.007	0.019	
England	0.090	0.046	*
Wales	0.012	0.059	
Scotland	0.076	0.052	
White	0.056	0.063	
Black Car	0.166	0.119	
Black Afr	0.069	0.155	
Indian	0.155	0.092	
Pakistani	-0.094	0.091	
Bangladeshi	0.012	0.134	
Chinese	-0.140	0.126	
Inc< 2610	0.034	0.151	
Inc 2610- 5210	0.000	0.050	
Inc 5210- 10430	0.029	0.041	
Inc 10430-15640	-0.018	0.032	
Inc 15640-20860	-0.018	0.030	
Inc 20860-33800	0.008	0.026	
Inc 33800-41000	-0.031	0.034	
Inc 41000-46000	0.057	0.042	
Inc 46000-55000	0.015	0.052	
Inc 55000-80000	-0.059	0.044	
Inc> 80000	0.062	0.046	
Care	-0.029	0.026	
Cons	0.236	0.121	*

Significance
10% *
5% **
1% ***

Female

Source	ss	df	ms	number of obs	931
Model	2.829	36	0.079	Prob	0.097
Residual	52.967	894	0.059	Rsqu	0.051
Total	55.796	930	0.060	Adj R squ	0.013
				Root MSE	0.243

Variable	Coefficient	Standard Error	
Wage dummy	-0.001	0.338	
Age	-0.002	0.001	
Num 0-2	0.005	0.039	
Num 3-4	0.025	0.026	
Num 5-9	0.023	0.014	
Num 10-15	0.022	0.013	*
Num 16-17	0.033	0.026	
Age youngest	-0.005	0.019	
England	-0.094	0.046	**
Wales	-0.015	0.059	
Scotland	-0.080	0.052	
White	-0.145	0.080	*
Black Car	-0.239	0.129	*
Black Afr	-0.260	0.164	
Indian	-0.181	0.100	*
Pakistani	-0.007	0.111	
Bangladeshi	-0.104	0.141	
Chinese	0.028	0.135	
Inc< 2610	-0.046	0.150	
Inc 2610- 5210	-0.019	0.050	
Inc 5210- 10430	-0.043	0.041	
Inc 10430-15640	0.011	0.032	
Inc 15640-20860	0.013	0.030	

Significance
10%*
5%**
1%***

Inc 20860-33800	-0.012	0.026	
Inc 33800-41000	0.029	0.034	
Inc 41000-46000	-0.058	0.043	
Inc 46000-55000	-0.008	0.052	
Inc 55000-80000	0.066	0.044	
Inc> 80000	-0.080	0.046	
Care	0.008	0.023	
Cons	0.934	0.132	***

Section 4 – Additional regression results from wage ratio dummies

Variable	Comparative advantage	
	Male	Female
Wage ratio 1.5	-0.138	0.102
	[0.249]	[0.246]
Wage ratio 1.55	-0.138	0.102
	[0.249]	[0.246]
Wage ratio 1.6	-0.138	0.102
	[0.249]	[0.246]
Wage ratio 1.65	-0.138	0.102
	[0.249]	[0.246]
Wage ratio 1.7	-0.138	0.102
	[0.249]	[0.246]

Section 5 - Variable list

Variable Name	Description of variable
Wage dummy	A dummy variable which takes the value of one if the wage ratio is above 1. This variable was created from the generated variable wage.
Wage ratio	The ratio of the female wage over the male wage for a married couple within a household. This variable was created from the generated variable wage.
Wage ratio^2	The ratio of the female wage over the male wage for a married couple within a household squared. This variable was created from the generated variable wage.
Age	The age of the individual at the time the survey was conducted.
Num 0-2	The number of children in the household between the ages of 0 and 2 years old.
Num 3-4	The number of children in the household between the ages of 3 and 4 years old.
Num 5-9	The number of children in the household between the ages of 5 and 9 years old.
Num 10-15	The number of children in the household between the ages of 10 and 15 years old.
Num 16-17	The number of children in the household between the ages of 16 and 17 years old.
Age youngest	The age of the youngest child within the household.
England	A dummy variable for the location of the household. This variable takes the value 1 when the household is in England and 0 at all other times.
Wales	A dummy variable for the location of the household. This variable takes the value 1 when the household is in Wales and 0 at all other times.
Scotland	A dummy variable for the location of the household. This variable takes the value 1 when the household is in Scotland and 0 at all other times.
White	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is white and 0 at all other times.
Black Car	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is black (caribbean) and 0 at all other times.
Black Afr	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is black (african) and 0 at all other times.
Indian	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is Indian and 0 at all other times.

Pakistani	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is Pakistani and 0 at all other times.
Bangladeshi	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is Bangladeshi and 0 at all other times.
Chinese	A dummy variable for the ethnicity of the individual within the study. This variable takes the value 1 when the individual is Chinese and 0 at all other times.
Inc<2610	This is a dummy variable for household income. It takes the value 1 when household income is less than £2610 p.a. and 0 at all other times.
Inc 2610- 5210	This is a dummy variable for household income. It takes the value 1 when household income is between £2610 and £5210 p.a. and 0 at all other times.
Inc 5210- 10430	This is a dummy variable for household income. It takes the value 1 when household income is between £5210 and £10430 p.a. and 0 at all other times.
Inc 10430-15640	This is a dummy variable for household income. It takes the value 1 when household income is between £10430 and £15640 p.a. and 0 at all other times.
Inc 15640-20860	This is a dummy variable for household income. It takes the value 1 when household income is between £15640 and £20860p.a. and 0 at all other times.
Inc 20860-33800	This is a dummy variable for household income. It takes the value 1 when household income is between £20860 and £33800p.a. and 0 at all other times.
Inc 33800-41000	This is a dummy variable for household income. It takes the value 1 when household income is between £33800 and £41000 p.a. and 0 at all other times.
Inc 41000-46000	This is a dummy variable for household income. It takes the value 1 when household income is between £41000 and £46000 p.a. and 0 at all other times.
Inc 46000-55000	This is a dummy variable for household income. It takes the value 1 when household income is between £46000 and £55000p.a. and 0 at all other times.
Inc 55000-80000	This is a dummy variable for household income. It takes the value 1 when household income is between £55000 and £80000 p.a. and 0 at all other times.
Inc >80000	This is a dummy variable for household income. It takes the value 1 when household income is greater than £80000 p.a. and 0 at all other times.
Care	This is a dummy variable which takes the value 1 if the individual in the study spends more than an hour per week providing care for another individual.
Dml1_3ratio	This is a variable for the proportion of housework performed by an individual.
Degree	This is a dummy variable for the educational level of an individual. It takes the value 1 where the individual has been educated up to degree level and 0 at all other times.
Hi_edu	This is a dummy variable for the educational level of an individual. It takes the value 1 where the individual has been educated past the age of 16 in vocational training and 0 at all other times.
Alevel	This is a dummy variable for the educational level of an individual. It takes the value 1 where the individual has been educated up to A level and 0 at all other times.
Gcse	This is a dummy variable for the educational level of an individual. It takes the value 1 where the individual has been educated up to GCSE level and 0 at all other times.
Ageleft 1518	This is a dummy variable for the age left full time education. This variable takes the value 1 where and individual left between the ages of 15 and 18, 0 at all other times.
Ageleft 1925	This is a dummy variable for the age left full time education. This variable takes the value 1 where and individual left between the ages of 18 and 25, 0 at all other times.
Ageleft 26	This is a dummy variable for the age left full time education. This variable takes the value 1 where and individual left over the age of 26, 0 at all other times.
Gender	This is a dummy variable for gender which takes the value 1 for females and 0 for males.