

IZA DP No. 1855

Gender, Time Use and Public Policy over the Life Cycle

Patricia Apps
Ray Rees

November 2005

Gender, Time Use and Public Policy over the Life Cycle

Patricia Apps

*University of Sydney, Australian National University
and IZA Bonn*

Ray Rees

University of Munich

Discussion Paper No. 1855
November 2005

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0

Fax: +49-228-3894-180

Email: iza@iza.org

Any opinions expressed here are those of the author(s) and not those of the institute. Research disseminated by IZA may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit company supported by Deutsche Post World Net. The center is associated with the University of Bonn and offers a stimulating research environment through its research networks, research support, and visitors and doctoral programs. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ABSTRACT

Gender, Time Use and Public Policy over the Life Cycle^{*}

In this paper we compare gender differences in the allocation of time to market work, domestic work, child care, and leisure over the life cycle. Time use profiles for these activity categories are constructed on survey data for three countries: Australia, the UK and Germany. We discuss the extent to which gender differences and life cycle variation in time use can be explained by public policy, focusing on the tax treatment of the female partner and on access to high quality, affordable child care. Profiles of time use, earnings and taxes are compared over the life cycle defined on age as well as on phases that represent the key transitions in the life cycle of a typical household. Our contention is that, given the decision to have children, life cycle time use and consumption decisions of households are determined by them and by public policy. Before children arrive, the adult members of the household have high labour supplies and plenty of leisure. The presence of pre-school children, in combination with the tax treatment of the second earner's income and the cost of bought-in child care, dramatically change the pattern of time use, leading to large falls in female labour supply. We also highlight the fact that, in the three countries we study, female labour supply exhibits a very high degree of heterogeneity after the arrival of children, and we show that this has important implications for public policy.

JEL Classification: J16, J22, H31, D91

Keywords: gender, time allocation, labour supply, household taxation, life cycle

Corresponding author:

Patricia Apps
Faculty of Law
University of Sydney
173-175 Phillip Street
Sydney NSW 2000
Australia
Email: pfapps@law.usyd.edu.au

^{*} We would like to thank Margi Wood for her very considerable contribution to programming and data management for this study. The research was supported by an Australian Research Council DP Grant.

I. Introduction

The inverse association between female labour force participation (FLP) and the total fertility rate (TFR) appears to be a strong empirical regularity.¹ Increasing wages and job opportunities for women seem to have led to growth in participation rates and declining family size in virtually all developed countries.² In this paper we use time use survey data for three countries, Australia, Germany and the UK, to look in greater depth at female labour supply, and at the allocation of time between market work, household work and child care over the life cycle. Our concern is that while participation and fertility rates in these countries appear to be strongly negatively associated over time, on average the increase in the time women supply to the labour market does not appear to have matched the fall in the demand for domestic labour that might be expected to follow the large falls in fertility. Why, given the significant falls in fertility, has female labour supply not risen to much higher levels? It should also be emphasized that these movements in data averages conceal very high variation in female labour supply changes across households, with a large proportion of women continuing to work virtually full time while a similarly large proportion leave the labour force. How do we explain this heterogeneity and what are its policy implications?

The explanation we suggest is that the design of public policy in the areas of taxation, social security and child care creates serious disincentives to female market work, particularly when the children are young. The tax treatment of the family effectively penalises the female partner as, typically, the second earner, and this, together with certain types of market failure that we discuss in the paper, has the result that many women supply little or no time to the market while others work full time. We believe that it is quite possible to change policy in a given country in such a way as to increase both female labour supply and fertility, thus reversing the historically negative association.

¹ For recent empirical studies confirming the negative time-series association between the TFR and FLP, see Engelhardt, Kögel and Prskawetz (2004) and Kögel (2004).

² For a theoretical model linking an inverse association between the FLP and TFR to a rising female wage, see Galor and Weil (1996).

The paper is organised as follows. Section II begins with cross-country comparisons of TFRs and participation and employment rates from 1970 to 2000, based on aggregate OECD data. One aim of the paper is to use the more detailed time use data to deepen considerably our understanding of the relationship between female labour supply and fertility. We then describe the time use and other survey data we use in the remainder of the paper, and set out the theoretical framework underlying the main aspects of our empirical approach. Section III goes on to analyse detailed evidence on the age profiles of female and male time allocations for each of the three countries. Separate profiles are presented for households with and without children, in order to identify the time use effects of children.

Section IV presents labour supply profiles for couples and shows first that the fall in female labour supply is associated with an increase in female time allocated to household production, in particular to child care. To bring out more clearly the full effect of children on market versus domestic time allocation decisions, we then define the life cycle³ on the presence and ages of children, rather than simply on the age of the male partner, as is usual in the life cycle literature. This allows us to capture more effectively the key transitions in the life cycle of the typical household and to bring out more clearly how the demands of children affect the allocation of female time under existing government policies. We then examine the contribution of female earnings to private household incomes over the life cycle and the effects of taxes and benefits for two of the three countries, Australia and the UK, using household expenditure survey data.

In section V we emphasise the importance of the heterogeneity of households in respect of the female's allocation of time to market and household work. To help explain the data, we classify households into two groups: those with low and those with relatively high female market labour supplies. We show how the tax and benefit policies in the countries concerned can result in a substantial redistribution of income from the latter to

³ We should make clear that in the empirical work, because we have only cross section data, our "life cycle" is a synthetic construct, based on data for households at different points in their own life cycles at a given point in time. We thus ignore cohort effects. However, for the comparisons we wish to make in this

the former, which explains, at least in part, why female labour supplies are markedly low on average, once the household has children. We conclude the paper in Section VI with a discussion of the implications of our findings for public policy.

II Time allocation and fertility: evidence and theory

(i) Fertility, labour supply and public policy

Table 1 shows that Australia, the UK and Germany experienced steadily declining fertility rates from 1970 to 2000, and sharply increasing female labour force participation rates, particularly in the first two decades. However unemployment rates also rose over the period, giving lower employment rates. More importantly, the female part-time employment rate increased more rapidly than the full-time rate, which has remained

Table 1: Fertility, participation and employment rates*, 1970-2000

Year	1970	1980	1990	1997	2000
Australia					
TFR ^a	2.86	1.90	1.91	1.78	1.75
Female participation rate %	46.50	52.70	62.10	63.60	66.10
Female employment rate %	44.20	45.20	55.00	55.50	60.20
Female full-time employment rate %	**	29.43	33.83	32.74	35.70
Male participation rate %	93.70	87.60	85.80	83.90	84.70
Male full-time employment rate %	**	76.18	69.98	64.31	66.63
UK					
TFR ^a	2.43	1.90	1.83	1.72	1.64
Female participation rate %	50.70	58.30	66.50	67.10	67.70
Female employment rate	49.80	54.10	60.00	61.40	62.90
Female full-time employment rate %	**	32.41 ^b	36.30	36.23	37.24
Male participation rate %	94.40	90.50	87.20	83.20	82.80
Male full-time employment rate %	**	81.04 ^b	75.85	68.85	69.46
Germany					
TFR ^a	2.03	1.56	1.45	1.37	1.36
Female participation rate %	48.10	52.80	56.70	62.50	63.70
Female employment rate	47.50	48.50	50.90	51.90	55.60
Female full-time employment rate %	**	33.37 ^b	35.73	35.60	36.75
Male participation rate %	92.50	84.30	82.20	80.30	79.80
Male full-time employment rate %	**	79.98 ^b	76.30	67.99	68.73

*% of population aged 15-64 years. ** Data not available.

(a) TFR: Average number of children a woman would expect to have if she were to experience all of the age-specific birth rates occurring in that year. (b) 1983 full-time employment rate (1980 not available).

Source: OECD Labour Force Statistics.

paper, we do not believe that these effects are so strong as to invalidate the conclusions we draw. This is further discussed below.

around half the male rate in each country. These figures suggest that female labour supply has not risen at a rate that comes near to matching the rate of decline in the TFR.

Though the inverse association between fertility and female participation within a country seems quite marked, across the countries the relationship tends to be positive, and indeed this is very much the case for the whole group of OECD countries.⁴ For example, Denmark, France and Sweden now have substantially higher FLPs and TFRs than Germany, Italy, Spain and the Netherlands. Nevertheless, as recent empirical studies show,⁵ the time-series association within the OECD countries has remained negative.⁶

The persistence of a negative time-series correlation within countries does not, however, prove that the trade-off between the choices of fertility and female labour supply is inevitably negative. A result of this kind can, of course, be derived from a model that imposes conventional gender roles within the family. For example, Galor and Weil (1996) assume that the only source of child care is the mother's time, to obtain this result. However, when bought-in child care is also an input and can substitute for parental time, as in Apps and Rees (2004), the TFR and FLP can vary positively with each other under quite plausible assumptions. In particular, we show that policies that reduce the price of bought-in quality child care and raise the female net wage can lead to an increase in both fertility and female labour supply.

More specifically, we would argue that factors such as: the structure of the tax and social security systems, as they impact on working women of child bearing age; the availability of good quality and affordable child care; and organisation of the school system, have an important effect on the terms of the trade-off between allocating time to the market and to domestic child care.

⁴ See Apps and Rees (2004) and Kögel (2004).

⁵ See Engelhardt and Prskawetz (2002), Engelhardt, Kögel and Prskawetz (2004) and Kögel (2004).

⁶ An exception is the US, which draws heavily on low wage, unskilled workers as a source of labour supply for child care. See Martinez and Iza (2004).

To give some indication of the possible effects of these factors, in what follows we first construct female and male life cycle profiles of labour supply, domestic work and child care. The profiles highlight the very dramatic substitution of domestic for market work by the female partner that still prevails after the arrival of children, despite declining family size, and the high degree of heterogeneity in female market hours across seemingly similar households. Using household expenditure survey data, we then go on to identify the way in which tax and social security policies can effectively tax the income of a working mother (as second earner) at a much higher rate than that of a single individual.

Since Boskin and Sheshinski (1983) it has been recognised that basing a progressive tax on the joint income of couples has the effect of taxing the first dollar of the second earner at the same rate as the last dollar of the primary earner and, therefore, that individual taxation is superior on efficiency grounds, given available wage elasticity estimates. Less well understood are the policy implications of female labour supply heterogeneity across families in similar circumstances. As we show in Apps and Rees (1999), an income tax is, in effect, a tax on market trade that a couple can partly avoid by having one partner switch from market work to the home production of substitutes, such as child care. A key problem that arises is that, among two-parent families with the same wage rates, non-labour incomes and demographics, mothers (and occasionally fathers) make very different market/domestic work decisions. Consequently, even under a flat rate income tax and a universal child benefit system, mothers of young children who work in the market effectively subsidise those in similar circumstances who withdraw from it. Under these conditions, individual taxation has the further advantage that the tax rate on working mothers can be reduced by increasing the progressivity of the marginal rate schedule.⁷

Of the three countries we study, only Germany has an income tax that is formally a system of joint taxation. Australia has a personal income tax that is nominally based on

⁷ In a discussion of family taxation, the OECD (2004) cites the “the principle of equal taxation of equal [household] income” as support for joint taxation on equity grounds. However, as shown in Apps and Rees (1999), this kind of argument ignores the policy implications of female labour supply heterogeneity and the

individual incomes. In the UK, independent taxation was introduced in 1990, primarily in response to the view that it was inappropriate to treat a woman's income as part of her husband's income.⁸ However, neither Australia nor the UK can be said to have retained systems of independent taxation, broadly defined to include levies, tax credits and tax/cash benefits for dependent children. Through a succession of reforms since the 1980s, Australia has moved to a family tax-benefit system that imposes very high effective rates on the incomes of married mothers as second earners. This has been achieved by replacing universal family allowances with an expanding system of tax benefits that are withdrawn on the basis of joint income or the income of the second earner. The UK is in the process of moving in the same direction, with the introduction of tax credits based on family income and employment status.⁹ These reforms have effectively shifted a greater share of the tax burden to working mothers. Moreover, there has been no commensurate increase in relief for the high cost of child care for working mothers and, in the case of Germany, no major change in the restrictive schedule of school hours that also imposes a constraint on female labour supply and domestic work choices.

(ii) Data

Our construction of life cycle profiles of labour supply, domestic work and child care in the sections to follow draws on data from time use surveys for each of the three countries: the Australian Bureau of Statistics (ABS) 1997 Time Use Survey (TUS); the UK Office

fact that households in which the mother withdraws from work avoids tax by substituting domestic for market output.

⁸ For these arguments in support of independent taxation in the UK, and for a brief history of recent changes, see Adam (2004).

⁹ Jaumotte (2003) ranks OECD countries according to the ratio of the effective tax rate faced by a second earner and the rate she would face as a single individual, for female earnings levels of 67 per cent and 100 per cent of Average Production Worker earnings (APW) and the male level held at 100 per cent of APW, in 2000-2001. However, the ratios for these APWs may be unrepresentative because they may miss the high effective tax rates on second earners at lower earnings levels. The result for Australia of 1.4, for example, is likely to be too low because in 2000 family tax benefits were withdrawn at 30 cents in the dollar, mostly at lower income levels. Using unit record data for in-work families during 1999-2000, Apps (2002) finds that second earners in quintiles 1 and 2 of primary income faced the highest average tax rates. More recent results show that average tax rates on second earners have since risen quite dramatically, to give ratios of 2.5 and higher across almost the entire distribution of primary income.

of National Statistics (ONS) 2000 Time Use Survey; and the special topic module with questions on time use included in the German Socio-Economic Panel Study (GSOEP) 2000. To obtain information on incomes and the tax treatment of couples, we select matching samples of couples from the ABS 1998 Household Expenditure Survey (HES) and the 2000-01 UK Family Expenditure Survey (FES). While the GSOEP 2000 includes information on incomes before and after tax, the data do not provide sufficient detail to allow the construction of life cycle tax profiles.

The ABS 1997 TUS collected time use data by diary for ten activity episode classifications comprising market employment activities as a single category and nine non-market activity categories,¹⁰ for two diary days. We compute market hours of work as the sum of time allocations to all subcategories of employment activities, including associated travel, job search and work breaks. Domestic work (including child care) is computed as the sum of time allocations to three non-market categories: domestic activities, purchasing goods and services and child care/minding.¹¹ For each episode, information is recorded for a primary and, if relevant, a secondary activity. Where both are recorded, a weighting of 0.6:0.4 is applied to satisfy the time constraint. We select non-dependent adult records excluding only those with missing information for both diary days and a small number of difficult to classify records in complex households. This *full sample* of non-dependent adults contains 6160 records of which 2180 represent single persons and single parents.

The ONS 2000 TUS collected time use data by diary for two diary days (one week day and one weekend day) and recorded primary and secondary activities for market and non-market activity categories that closely match those of the Australian survey. For consistency, UK market hours of work are computed as total time allocated to all employment activities, including travel to work, job search and breaks at work. Domestic work is calculated as the sum of time allocations to household tasks (including shopping),

¹⁰ The nine non-market activity episode classifications are: sleep and personal care, education, domestic activities, child care, purchasing goods and services, voluntary work and care, social and community interaction, active leisure and passive leisure. Associated travel is included within each category.

¹¹ In the ABS 1997 TUS, the activity categories include associated travel.

child care and associated travel, and we weight primary and secondary activities as above to satisfy the time constraint. We select a *full sample* of 7061 non-dependent adult records that matches as closely as possible the sample selected from the ABS TUS. The sample includes 2129 records representing single persons and lone parents.

The GSOEP 2000 module collected information by questionnaire on usual hours of work and time spent on the following activities: employment (including travel to and from work), shopping for goods and services, housework, child care, education or further training, maintenance of house, garden or car repairs and hobbies and other free time activities. The data were collected for a week day, a Saturday and a Sunday. We compute time allocations to activities that match as far as possible those included in the categories of market work and domestic work in the ABS and ONS surveys. The *full sample* contains 9716 non-dependent adults, of which 2074 represent single persons and lone parents.

The information on time use collected by questionnaire in the GSOEP 2000 is not as reliable as the diary data in the ABS 1997 and ONS 2000 surveys. One limitation, which is common to questionnaire data, is the overstatement of hours of work. Both market and domestic hours of work appear to be overstated in the GSOEP. A second problem is missing information on the primary/secondary status of activities. This means that simultaneous activities cannot be identified and appropriately weighted to ensure the time constraint is satisfied. As a consequence, an activity that is predominantly secondary, such as child care, can be seriously overstated. To reduce this problem, we have set the time constraint conservatively to 18 hours per day and scaled nonmarket activities to satisfy this constraint. Nevertheless, it is clear that domestic work, and especially child care, remains overstated. Thus caution needs to be exercised in making cross-country comparisons with Germany.

(iii) Implicit Model

The theoretical framework on which the empirical work presented in this paper is based draws primarily on the literature on the life cycle model, which can be interpreted in general terms as saying that the household chooses time paths of labour supply, consumption and saving over its entire lifetime, given its preferences and the prices, wages and interest rates it expects to face.¹² Since the central concern of the paper is the comparison of female and male time allocations, and of how they change over time with family circumstances, it is important to extend the standard model to the case of two-adult households in which time not spent in market work is not simply “leisure”, but rather is devoted to production of domestic goods and services, in particular, to child care. Briefly, we propose a model in which household choices of saving and consumption over time are driven by decisions on female labour supply, which in turn are strongly influenced by the number and ages of children in the household, given that child care and market work are close substitutes.¹³ While we extend the model in these respects, we nevertheless continue to use the convention of treating fertility as an exogenous variable, fully recognising of course the limitations of this assumption.

The life cycle is necessarily dynamic: it refers to a process unfolding over time. Empirical observations would then ideally track a given set of households over time. However, for the purposes of this study we have available only cross-section data. To interpret a sequence of data values for households of increasing ages as depicting a “life cycle” then obviously encounters the difficulty that the characteristics of individuals born at different times, or of households first set up at different points of time, may differ significantly. Such “cohort effects” are obviously missing in a data set constructed at one point in time. However, we would suggest that the available evidence on cohort effects does not indicate that they are so strong, or that significant changes occur so rapidly, that all use of cross section data to draw inferences about life cycle behaviour is to be ruled out.¹⁴ Moreover, the focus of this study is not on comparisons between households whose

¹² For surveys see Deaton (1992), Browning and Lusardi (1996) and Browning and Crossley (2001).

¹³ For a formal treatment and further discussion of this model see Apps and Rees (2001).

¹⁴ It is true that the percentage increases in the female hours of work of recent cohorts reported in some studies, especially those for the US, can appear to be quite large (see, for example, Pencavel, 1998, and Attanasio, Low and Sanchez-Marcos, 2003). However, as we emphasise in this paper, the changes in absolute hours are often far less impressive, especially in the countries we consider here.

members are in their 20's and 30's and those in their 50's and 60's. That females in the former group for example may have larger market labour supplies than those in the latter when they arrive at age 50 is not the central issue. Rather, our main concerns are with households whose members are in their late 20's to early 40's, and here we would argue that cohort effects are far less likely to invalidate the conclusions we draw.

III Life Cycle Labour Supplies – All Adults

(i) Female and Male Labour Supplies by Age

Table 2 presents data means for annual market hours of work and full-time employment rates by age and gender using the full samples for each of the three countries.¹⁵ The profiles are plotted in Figure 1. A common pattern is evident across the countries in the relationship between male and female hours of market work and the way in which these vary over the life cycle, defined on the individual's age. The results show a very large gap between female and male labour supplies, with the shape of the female profiles showing clearly the impact of the presence of children in each age category. As the percentage of households with children present declines, the differences between the labour supplies decrease, essentially because male hours fall more rapidly than female hours, until retirement age is reached. The ratio of female to male hours of work at each age of work reflects very strongly the ratio of the female to male full-time employment rates. Overall, women under 65 years work around half the market hours of men under 65 and they have a full-time employment rate that is also around half the male rate, which shows again that the gap between full-time employment rates, rather than participation rates, provides a more reliable indicator of gender differences in labour supply.

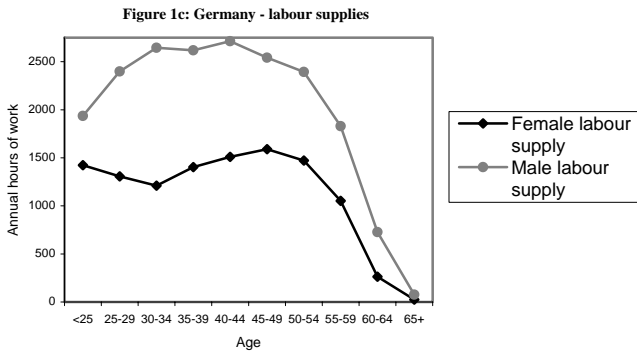
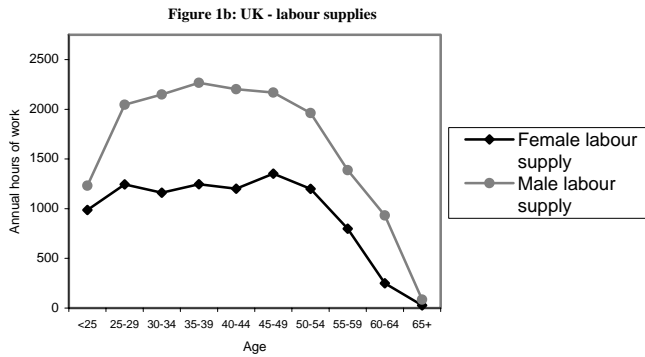
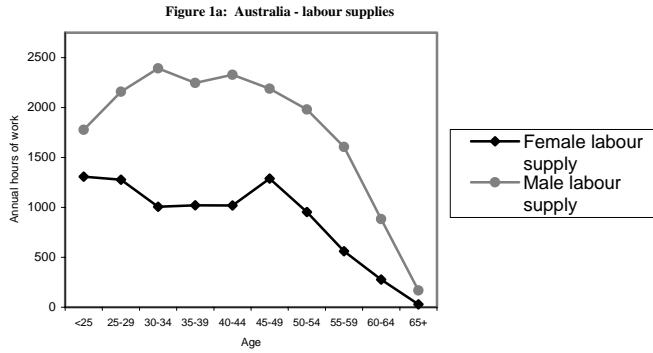
In terms of cross-country comparisons, Australia has a more strongly U-shaped profile of female labour supply across the child rearing years than the UK and, of the three countries, the UK exhibits the smallest gap between male and female hours profiles. This

¹⁵ The data on time use are converted to an annual basis by weighting for the number of diary days and multiplying by days per year.

would seem to be consistent with the cross-country policy differences noted in the preceding section, and discussed in more detail in later sections.

Table 2 Labour supplies and full-time employment rates

Australia								
Age	Females				Males			
	Market hours pa	FT emp %	% with children	Cell size	Market hours pa	FT emp %	% with children	Cell size
<25	1307	55.2	14.9	341	1777	72.8	4.6	368
25-29	1278	45.6	41.3	334	2159	76.0	21.6	307
30-34	1007	36.0	71.8	347	2392	78.5	52.2	317
35-39	1021	32.4	81.2	334	2247	77.6	64.8	329
40-44	1020	33.9	72.2	333	2329	81.3	69.3	304
45-49	1289	42.4	50.2	314	2189	84.5	55.3	324
50-54	954	35.2	23.6	267	1981	74.9	40.1	225
55-59	561	15.7	9.6	207	1605	61.8	17.1	188
60-64	277	7.7	3.1	190	883	31.7	8.0	213
65+	29	4.4	2.0	496	169	6.8	2.0	422
<65	1021	36.1	44.3	2667	1989	72.8	37.6	2575
UK								
Age	Females				Males			
	Market hours pa	FT emp %	% with children	Cell size	Market hours pa	FT emp %	% with children	Cell size
<25	987	31.8	23.7	320	1232	40.8	12.4	194
25-29	1244	51.3	47.9	295	2046	82.1	25.8	250
30-34	1161	49.8	66.9	438	2149	89.0	53.9	345
35-39	1246	36.5	72.6	412	2267	86.7	63.1	368
40-44	1201	41.0	69.6	364	2203	86.1	62.6	306
45-49	1353	43.1	45.0	377	2169	86.0	51.1	323
50-54	1199	44.1	17.1	356	1963	77.3	25.7	359
55-59	798	19.8	5.0	291	1388	57.4	13.0	258
60-64	249	5.1	2.1	231	932	32.7	3.3	222
65+	28	0.6	0.2	764	86	3.0	0.9	584
<65	1079	35.4	41.7	3084	1886	74.0	37.7	2625
Germany								
Age	Females				Males			
	Market hours pa	FT emp %	% with children	Cell size	Market hours pa	FT emp %	% with children	Cell size
<25	1424	48.1	33.3	162	1936	69.1	14.8	81
25-29	1307	42.0	54.1	383	2399	79.5	40.6	254
30-34	1211	37.7	76.7	600	2645	88.9	66.3	524
35-39	1404	45.3	87.7	610	2618	89.0	79.5	589
40-44	1510	41.2	71.4	583	2713	90.4	74.6	541
45-49	1589	50.4	38.1	516	2542	88.2	50.0	451
50-54	1472	47.2	14.1	405	2394	83.5	27.9	423
55-59	1052	33.2	3.9	476	1830	64.4	11.5	477
60-64	263	7.8	1.9	447	727	24.5	2.3	461
65+	25	0.4	0	1013	76	1.7	0.3	720
<65	1250	39.9	47.6	4182	2244	77.3	46.8	3801



(ii) Female and Male Labour Supplies by Family Status

While the profiles in Table 2 and Figure 1 suggest that the presence of young children has a very dramatic effect on female labour supply, nevertheless they do not isolate the effect very sharply, due to averaging over women in a particular age group, some of whom have

children and some who have not yet had children and are therefore continuing to work full time. To control for this, we compare female and male labour supply profiles across households with and without children. Table 3 reports hours of work for females and males with and without children, up to the 50-54 age category. Beyond this age there are very few households with children. Figure 2 depicts the separate profiles to this age category, for each country, and shows graphically the very large gap between the labour supply of mothers and both of younger women without children and of men with and without children.

Table 3: Female and male labour supplies by family status

Age	With children				Without children	
	Female		Male		Female	Male
	# deps	Hours pa	# deps	Hours pa	Hours pa	Hours pa
Australia						
<25	1.47	421	1.21	1943	1498	1720
25-29	1.68	556	1.46	2222	1787	2132
30-34	2.11	636	1.93	2382	1955	2403
35-39	2.25	865	2.25	2296	1689	2101
40-44	2.00	899	2.26	2394	1360	2184
45-49	1.63	1259	1.80	2214	1318	2158
50-54	1.47	1120	1.65	1916	903	2024
<65	1.90	870	1.91	2203	1159	1833
UK						
<25	1.37	492	1.18	1568	1327	1157
25-29	1.67	700	1.51	2236	1839	1942
30-34	1.97	856	1.75	2178	1775	2117
35-39	2.06	1086	2.05	2382	1671	2069
40-44	1.86	1093	2.03	2293	1450	2051
45-49	1.52	1319	1.68	2134	1382	2207
50-54	1.25	1298	1.48	2075	1179	1924
<65	1.80	968	1.80	2148	1166	1712
Germany						
<25	1.24	292	1.23	2108	2005	1903
25-29	1.48	686	1.45	2626	2259	2234
30-34	1.81	882	1.71	2678	2270	2587
35-39	1.91	1264	1.94	2614	2410	2632
40-44	1.72	1369	1.83	2736	1917	2639
45-49	1.35	1323	1.60	2642	1770	2419
50-54	1.27	1111	1.40	2484	1540	2357
<65	1.70	1106	1.73	2621	1382	1912

Figure 2a: Australia - labour supplies by family status

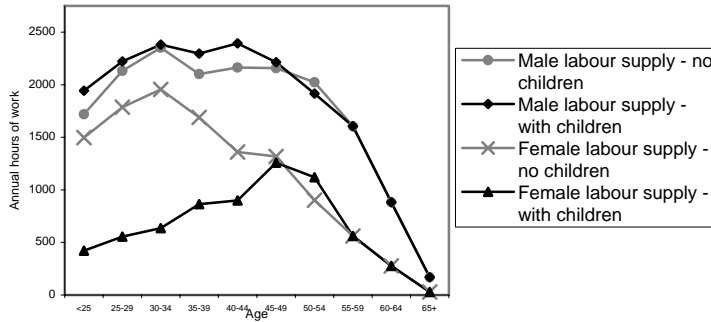


Figure 2b: UK - labour supplies by family status

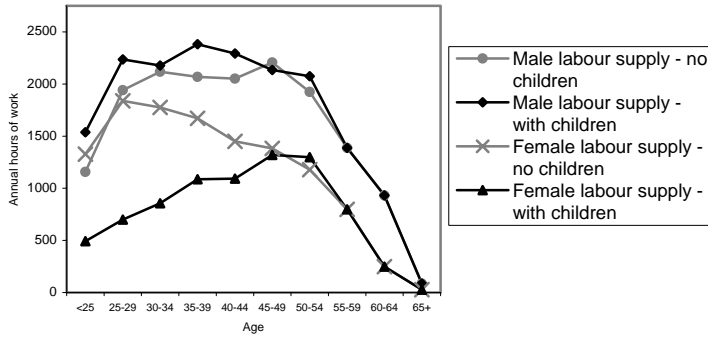
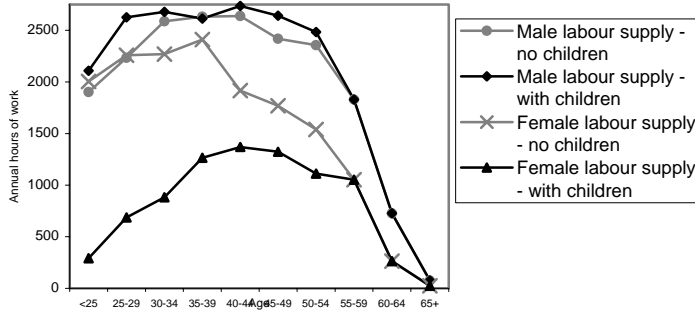


Figure 2c: Germany - labour supplies by family status



It is clear that the presence of children has on average a much larger effect on female labour supply in the early age groups. In the younger age groups, women without children work a much higher percentage of male hours than women with children, especially in Germany. In all three countries, the percentage of females with children reaches a maximum in the 35-39 age category. From this point on, we cannot distinguish

between women whose children have left home and those who have never had children, although the large majority will of course have had children.

Comparing Figures 1 and 2 we can see the extent to which the fall in female labour supply associated with the arrival of children is masked by age profiles that average across the two households groups, as in the life cycle literature. Although Figure 1 shows a large gap between male and female labour supply profiles, the relevant gap from a policy perspective is that between females and males with children, which we can see from figure 2 is much larger. Figure 2 also gives some indication of the extent to which the rise in the female participation rate is partly due to an increase in the proportion of women without children in the early age groups. This is a result of the postponement of the first child, especially in Australia, which may be driven to some extent by the anticipation of the high cost and poor availability of child care.

IV Couples – Time Use and Incomes

(i) Time Allocation by Age

In the preceding tables, the data are averaged separately over the sample of women and the sample of men respectively. From the point of view of behaviour however, clearly the decision taking unit is the household, which typically contains a couple. We now analyse the time allocation decisions of couples and the effects of children. Following convention, we begin by presenting life cycle labour supply profiles defined on the age of the male partner. Since there are very few male partners under 25, the first age category comprises the under 30 year-olds.

Table 4 presents data means for the labour supplies of the household members, together with full-time employment rates and the percentage of couples with children in each age category. Figure 3 plots the labour supply profiles. Because the percentage of couples with children is higher than the percentage of the whole population with children, the gap between the female and male labour supply profiles is larger than in Figure 1. Again the

size of the difference is largest in the age groups in which the children are very young. In both the UK and Australia there is a noticeable dip in female labour supply after age 30, while in Germany, where there is a far higher percentage of the relatively small sample in the under 30 age group who have children, there is no dip, but labour supply starts off lower, before increasing as the children get older.

Table 4: Labour supplies and employment rates of couples

Male age	Female		Male		% with children	Cell size
	Mkt hours	FT %	Mkt hours	FT %		
Australia						
<30	1295	50.0	2305	90.8	39.6	186
30-34	993	33.2	2448	89.6	73.0	224
35-39	853	27.8	2365	84.0	86.0	252
40-44	1093	33.5	2426	88.3	87.7	233
45-49	1097	37.7	2241	88.4	64.7	269
50-54	977	34.5	2037	79.0	46.6	188
55-59	771	27.8	1770	68.7	21.9	144
60-64	468	14.0	912	31.8	8.8	183
65+	80	1.9	183	6.4	1.7	311
<65	956	32.6	2098	78.9	56.9	1679
UK						
<30	1395	52.6	2194	86.4	44.3	211
30-34	1117	41.1	2176	92.4	68.9	288
35-39	1116	37.4	2418	92.0	79.8	303
40-44	1281	31.8	2331	91.0	78.0	251
45-49	1336	41.8	2189	89.5	59.1	282
50-54	1364	42.7	2106	83.2	30.7	296
55-59	1058	28.1	1498	59.4	15.7	220
60-64	513	16.0	1001	34.6	3.5	185
65+	70	2.8	117	3.6	1.2	430
<65	1163	36.9	2029	80.3	49.9	2036
Germany						
<30	1102	34.4	2466	84.1	61.5	195
30-34	1040	33.3	2708	92.4	79.3	420
35-39	1135	32.8	2640	91.7	89.7	503
40-44	1360	43.1	2758	92.5	86.4	469
45-49	1374	38.4	2589	90.4	60.6	406
50-54	1439	47.0	2465	85.1	33.2	370
55-59	1131	33.4	1844	64.9	14.4	425
60-64	710	22.1	745	24.7	2.6	416
65+	231	6.6	68	1.5	0.3	617
<65	1148	35.5	2277	78.3	54.6	3204

Figure 3a: Australia - Labour supplies of couples

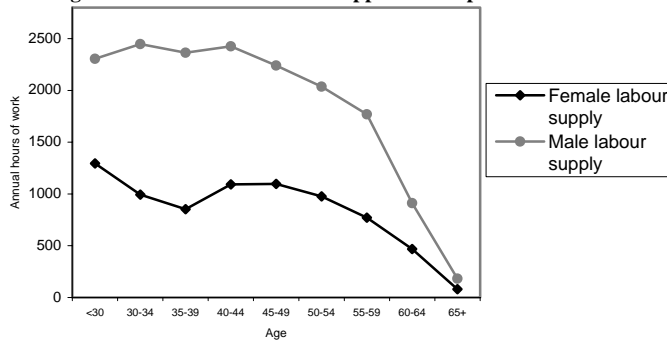


Figure 3b: UK - Labour supplies of couples

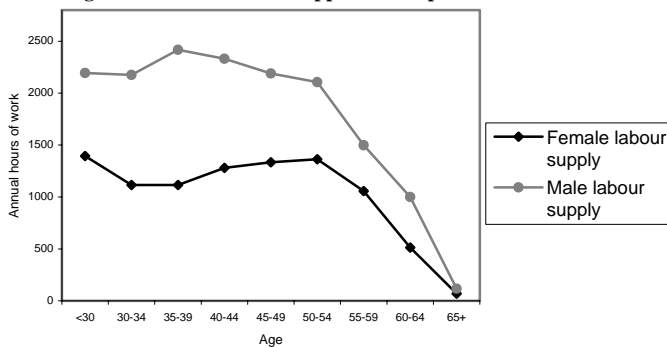
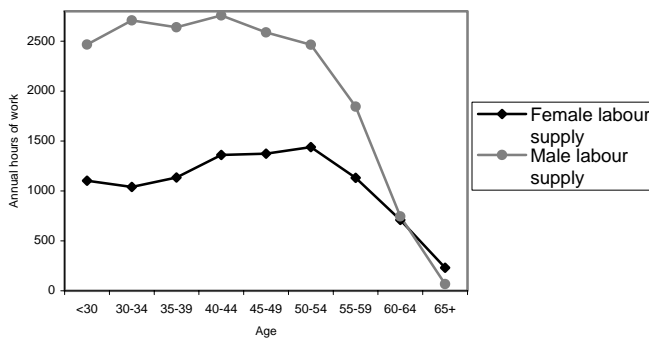


Figure 3c: Germany - Labour supplies of couples



Again we can see that the ratio of female to male market hours tracks the ratio of full time employment rates, in all three countries. For couples in which the male partner is under 65 years, the female full-time employment rate is less than half the male rate and, apart from the UK, female market hours are less than 50 per cent of male hours. In contrast, the ratio of female to male employment rates (full and part time) varies from around 70 to over 80 per cent. Australia records the lowest female full time employment rate and the lowest average female labour supply.

The fall in female labour supply after the arrival of children reflects, of course, the fact that home production becomes a close substitute for market production, especially in countries with poorly developed child care sectors. Unfortunately, much of the theoretical and empirical work on labour supply and household decision taking over the life cycle has been based on the conventional model of the single individual consumer, who divides time solely between market work and leisure. This simple dichotomisation of time is not empirically relevant for the household with children, since the fall in female labour supply after the first child represents the substitution of domestic production, especially child care, for market output. To show this, Table 5 presents age profiles of female and male domestic hours of work and child care. The table also reports total hours of work.

All three countries show hump-shaped profiles of time allocated to household production and child care, although there are dramatic differences, due primarily to differences in child care hours. If we look at domestic work excluding child care, we can see that the Australian and UK profiles are very similar for both females and males. They tend to rise with age, the female profile being around twice the height of the male profile in the early and middle age group. The German profiles for both males and females are flatter, and the female profile is almost twice as high in the early and middle children years as the profiles for her counterparts in the UK and Australia. We suggest this reflects the effect of collecting the data by questionnaire, and failing to account for the secondary status of at least some of the time reported as domestic work activity. If we assume that male domestic hours are also overstated, then cross-country comparisons of the gap between the two profiles would suggest that men in Germany work fewer hours in the household than in the other two countries.

The dramatic cross-country differences between child care hours appear to be due to variation in survey design and reporting. While the ABS and ONS diaries are very similar in design, Australian and UK respondents appear to vary in their reporting of child care, especially as a secondary activity. The data indicate that UK respondents report child care less frequently as a secondary activity when a child is present and in the care of the

respondent even when the primary activity is, for example, travel or various home activities and the child is under 2 years of age. This seems to account for the lower UK profiles for both partners, in comparison with the Australian profiles. In contrast, German respondents tend to report child care as an activity whenever a child is present. Consequently, the child care profiles for Germany would appear to be far too high, especially for the female partner, and missing data on the primary/secondary status of activities exacerbates the problem, as already noted.

Table 5 Domestic work and child care hours of couples

Male Age	Female hours			Male hours		
	Domestic + c'care	Child care	Total hrs of work	Domestic + c'care	Child care	Total hrs of work
Australia						
<30	1741	748	3036	801	245	3151
30-34	2767	1546	3760	1281	624	3729
35-39	2881	1486	3734	1313	662	3618
40-44	2498	1057	3591	1253	515	3679
45-49	2002	477	3098	1007	236	3249
50-54	1882	279	2859	941	119	2978
55-59	1922	177	2693	1001	42	2770
60-64	1793	132	2087	1176	72	2261
65+	1732	63	1812	1364	26	1547
<65	2219	779	3176	1107	337	3205
UK						
<30	1690	706	3085	876	299	3069
30-34	2180	1076	3297	1109	490	3286
35-39	2252	993	3368	1027	454	3445
40-44	2024	710	3306	1048	332	3379
45-49	1770	406	3106	897	160	3086
50-54	1533	146	2898	825	95	2931
55-59	1588	150	2646	1002	104	2501
60-64	1743	150	2256	1204	92	2204
65+	1774	67	1844	1345	40	1464
<65	1866	565	3028	996	264	3025
Germany						
<30	3713	2042	4815	1404	767	3869
30-34	3961	2354	5001	1492	943	4201
35-39	3558	1899	4694	1528	960	4168
40-44	2949	1176	4323	1187	609	3945
45-49	2500	642	3778	861	252	3451
50-54	2187	388	3626	675	105	3140
55-59	2152	238	3283	707	65	2550
60-64	2150	215	2860	792	56	1537
65+	2303	152	2303	830	44	898
<65	2869	1089	4017	1078	470	3353

Figure 4a: Australia - domestic work and child care hours

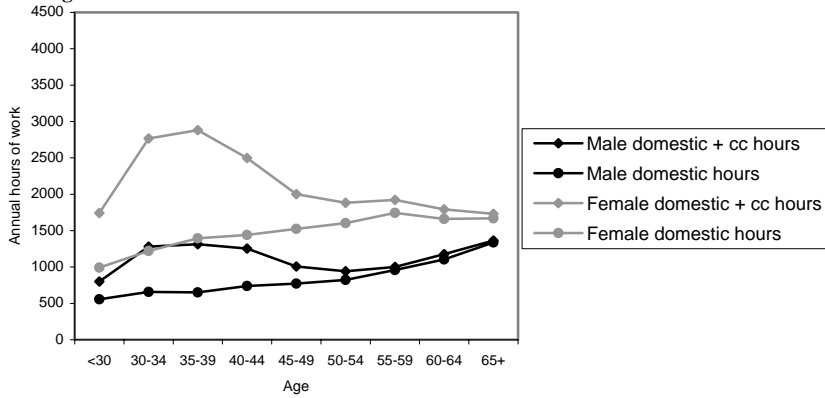


Figure 4b: UK - domestic work and child care hours

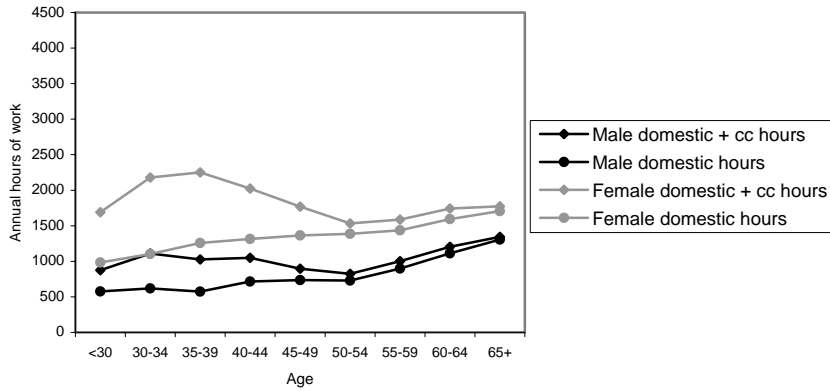
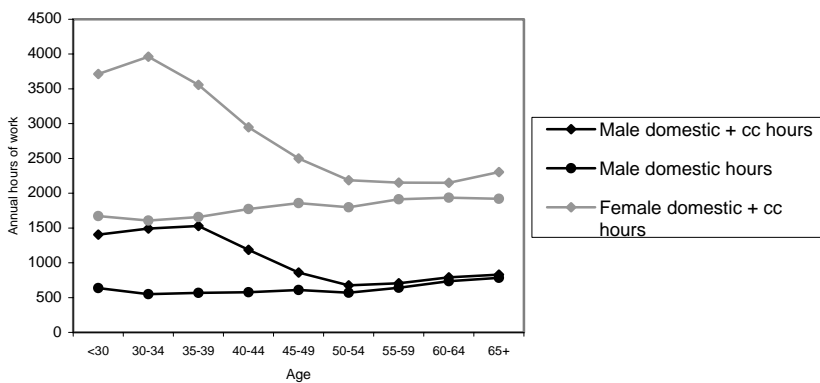


Figure 4c: Germany - domestic hours and child care



The profiles of total time allocated to work in the market and at home exhibit an inverted U-shape. Thus if we subtract hours of work from the time constraint, we obtain a U-

shaped profile of leisure for both partners, due to higher hours of work during the child-rearing years.

(ii) Time Allocation by Life Cycle Phase

Again, as in Table 2, averaging across women who have children and those who have not conceals the full effect of children on female labour supply. Here, however, rather than splitting the sample for each country into couples with and without children and presenting separate age profiles as in Table 3, we partition the sample for each country into life cycle phases defined on the presence and age of children, and on criteria that capture the later transition of their parents from work to retirement. We also differentiate between younger women who are unlikely to have had children and older women whose children may have left home. Thus, we split the sample into the following mutually exclusive phases:

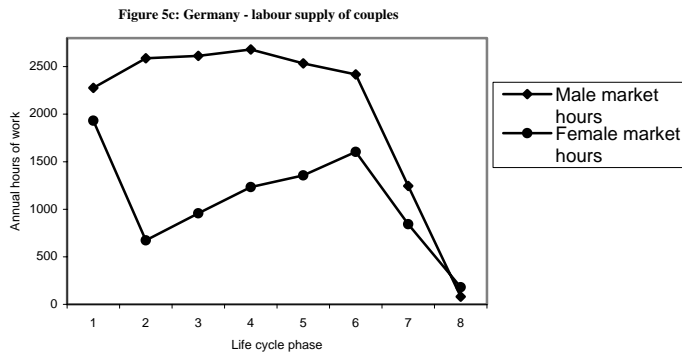
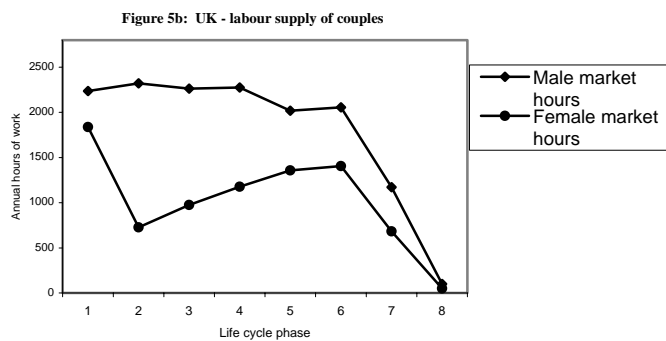
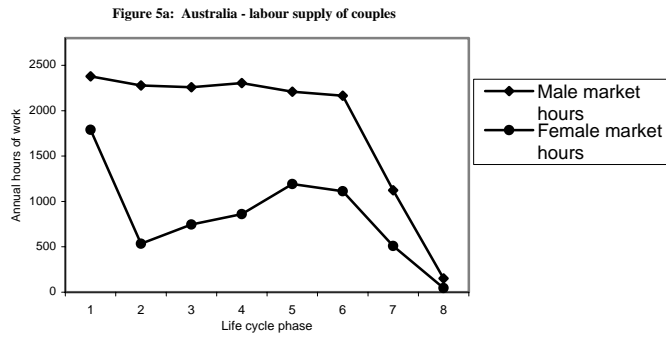
- Phase 1: couples of child-bearing age who do not yet have children;
- Phase 2: couples with children of pre-school age;
- Phase 3: couples with children of primary school age;
- Phase 4: couples with children predominantly in the age range 13-15;
- Phase 5: couples with children aged 15 and over and living at home;
- Phase 6: couples of working age where the children have left home;
- Phase 7: couples approaching retirement age;
- Phase 8: couples of retirement age.

Phase 1 contains couples with no dependent children and the female partner is aged under 40 years. Phase 2 represents families with children under 5 and no teenage children present. Phase 3 families have at least one child aged 5 to 9 years. In phase 4 the children are predominantly in the 12 to 14 year age group. In phase 5 families have high school and older dependent children still living at home. There are no children present in phases 6 to 8. Phase 6 is defined to include couples in which a partner is aged under 55 years or the male partner is under 60 and has a significant workforce attachment. Phase 7 is pre-retirement, and represents couples in which the male partner is aged under 65, or at least one partner is not fully retired. In phase 8 both partners are retired.

Table 6 and Figure 5 present the profiles of market and domestic hours of work, and full time employment rates, defined on these phases. On the arrival of children, in the move between phases 1 and 2, female labour supply and the percentage of women employed full time fall far more dramatically than in the preceding tables, while the proportion of women who supply no labour rises sharply, in all three countries. Female domestic hours of work more than triple, male domestic hours more than double, and both partners have a substantial reduction in leisure time in the early child rearing phases.

Table 6: Life cycle labour supplies and employment rates of couples

Life cycle phase	Female Market hours	FT %	Male market hours	FT %	Female Domestic hours	Male Domestic hours	# deps	Cell size
Australia								
1	1789	69.5	2379	90.7	983	596	-	213
2	535	21.8	2278	88.9	3548	1571	1.66	229
3	745	17.7	2258	83.4	3185	1491	2.22	256
4	861	27.4	2304	85.3	2724	1307	2.28	242
5	1192	37.8	2209	81.1	1777	866	1.75	253
6	1112	39.1	2166	41.5	15932	831	-	233
7	509	17.2	1123	43.2	1801	1116	-	290
8	46	1.1	152	5.1	1720	1380	-	276
UK								
1	1842	75.4	2227	90.1	1032	673	-	259
2	722	19.0	2335	89.8	2974	1351	1.56	257
3	973	22.7	2262	91.0	2604	1263	2.10	285
4	1174	27.7	2274	87.5	2185	1001	2.28	255
5	1349	44.7	2018	83.6	1554	940	1.40	289
6	1388	45.9	2055	83.3	1394	764	-	363
7	676	20.1	1183	44.0	1681	1076	-	368
8	50	1.8	99	2.6	1756	1357	-	390
Germany								
1	1932	70.3	2277	78.0	1612	713	-	278
2	673	18.9	2588	88.2	4887	1853	1.65	473
3	957	27.1	2614	90.7	4199	1724	2.11	426
4	1233	34.4	2681	92.9	3157	1252	1.82	425
5	1356	40.5	2534	87.1	2293	768	1.37	428
6	1604	54.5	2418	82.6	1763	611	-	499
7	843	25.4	1246	42.9	1855	650	-	625
8	180	4.9	81	1.9	1879	745	-	667



In all three countries, male market hours and full time employment change very little until the pre-retirement age. As the children reach school age and beyond, female market hours gradually increase and domestic hours fall, and leisure also increases. The female full-time employment rate rises steadily over these phases, but remains far below the male rate. In both the UK and Australia, female market hours and female full time employment are much higher in phase 1 than at any later phase.

(iii) Life cycle Income and Taxes

The impact of children on the allocation of female time may obviously have, as an important corollary, significant effects on household income. Again, these can be somewhat masked when we take the conventional definition of the life cycle in terms of male partner's age, because of the averaging over households with very different compositions, but emerge very sharply when we adopt the phase definition above.

Drawing on data for matching samples of couples from ABS 1997 Household Expenditure Survey (HES) and the 2000-01 UK Family Expenditure Survey (FES), Table 7 presents life cycle profiles of household private income,¹⁶ female earnings, net household income, and taxes and benefits for Australia and the UK.¹⁷ The profiles show the large drop in female earnings and, in turn, in household private income that accompanies the switch of female time from the market to the household, from phase 1 to phase 2.¹⁸ In Australia, household private income falls by over 25 per cent, due to a drop in female earnings of almost two-thirds. The fall in net income is less, at around 20 per cent, due to family cash benefits, which have the effect of reducing direct taxes net of cash benefits by almost 50 per cent from phase 1 to phase 2. In the UK household private income falls by a little over 21 per cent, due to a fall in female earnings of over 50 per cent, and direct taxes net of cash benefits fall by over 40 per cent. In both countries, private household income tends to recover in the later phases with the rise in female employment and earnings as the children grow up.

The ABS HES 1998 provides detailed estimates of indirect taxes and indirect benefits, which allow the computation of an overall profile of all taxes net of benefits.¹⁹ It is striking that in phases 3 and 4, when the children are at school, education and child care

¹⁶ Private income is defined as income from all non-government sources such as wages and salaries, profits, investment income and superannuation.

¹⁷ Results for Germany are omitted due to data limitations.

¹⁸ The fall in household income following the arrival of children is missed in UK studies that define the life cycle solely on the age of head of household. See, for example, Blundell et al (1994).

benefits significantly exceed taxes paid, and even in phase 5, when the children are in their teens and many have left home, the excess of taxes over benefits is small. However in phase 2, there is a substantial excess of taxes over benefits.²⁰ This is due to a very low level of spending on child care and education for children under school age.

Table 7: Life cycle incomes, earnings, taxes and benefits

Life cycle phase	Household private income	Female earnings	Household net income	Direct taxes less benefits	All taxes less all benefits	Cell size
Australia AUD\$1998						
1	66353	27589	50890	15463	16208	449
2	48720	9846	40894	7826	2569	508
3	51605	12367	43643	7962	-2841	512
4	54103	14137	46601	7503	-6081	516
5	69547	18548	56594	12953	573	518
6	63391	16867	50613	12778	13335	538
7	38597	9608	35594	3003	820	531
8	13291	574	22243	-8951	-17730	546
All	49537	13247	42763	6774	303	4118
UK GB£2000						
1	38169	14756	29800	8370	-	354
2	29942	6935	25101	4842	-	342
3	31327	6711	27074	4253	-	338
4	31974	7826	27622	4352	-	349
5	35319	8914	30229	5091	-	346
6	33125	9347	27249	5876	-	484
7	18088	3587	19293	-1205	-	513
8	11196	851	16452	-5256	-	638
All	27478	7032	24680	2799	-	3900

Overall, we can see that the effects of government policy, whether intended or not, are to transfer income predominantly from phases 1 and 6 to phases 3, 4 and 8. It is arguable that the time of the household's greatest need, when gross market income is lowest and the adults are, in terms of both household and market labour supply, working their hardest, is phase 2, which receives relatively little net support. It is interesting to speculate on the extent to which this may play a part in the fertility decline and its differential impact across countries.

¹⁹ The HES estimates of indirect government benefits cover non-cash benefits and services for education, health, housing and social security and welfare.

²⁰ The excess would be considerably greater if indirect health benefits associated with childbirth were excluded.

V Across-Household Heterogeneity

(i) Labour Supply and Heterogeneity

A striking feature of the data on female labour supply is the large degree of variation across households in female hours worked, after controlling for wage rates and demographics. It is therefore interesting to present the data on life cycle time allocation, income, taxes and benefits differentiated by household type defined on the hours worked by the female partner. Ideally, we would like to differentiate between households in which female labour supply is just about zero, and those in which it is large, over the entire life cycle. This would however require panel data. Since we only have cross-section data, we present life cycle profiles for a sample of households partitioned into two groups of equal size, according to the female partner's usual hours of work. The sample is selected on the criterion that the male partner is employed in phases 1 to 7. "Type I" consists of households in which the female partner is a non-participant or supplies very little market labour. "Type II" are those in which she is employed full time or works relatively long part time hours.²¹ We do not split phase 1, since significant heterogeneity appears only after the arrival of children, nor do we split phase 8, in which few households are employed.

Table 8 shows the high degree of polarisation of female labour supply across phases 2 to 6, reflecting the fact that in the majority of Type I households the female partner is a non-participant or has minimal market hours, and in Type II households a large proportion is employed full time. Figure 6 depicts the profiles graphically. As we would expect, females in Type I households supply significantly more time to household production than those in Type II households across these phases. However, the difference is well below the market labour supply of the latter, and so overall women in the Type II household are working longer hours and consuming significantly less leisure. They are

²¹ In presenting life cycle profiles for these types we are assuming that transitions between types over time do not invalidate our results. In other words, we are assuming that "persistence" dominates. For evidence in support this hypothesis, see Shaw (1994).

also working longer hours than their male partners in all three countries. The profiles of male market hours tend to be similar across both types of households, although there are differences across countries.

Table 8: Labour supply and domestic work by household type

H'hold Type	Life cycle phase	<u>Female hours of work</u>			<u>Male hours of work</u>			# kids
		Market	Domestic	Total	Market	Domestic	Total	
Australia								
I	2	23	3953	3976	2495	1369	3864	1.74
	3	91	3646	3737	2535	1258	3793	2.33
	4	230	3125	3355	2605	1102	3707	2.17
	5	454	2393	2847	2403	817	3220	1.72
	6	616	1846	2462	2427	755	3182	-
II	2	1132	2908	4040	2357	1571	3928	1.53
	3	1536	2679	4215	2439	1497	3936	2.05
	4	1640	2285	3925	2518	1225	3743	1.96
	5	1993	1753	3746	2627	856	3483	1.72
	6	1915	1568	3483	2569	858	3427	-
UK								
I	2	197	3397	3594	2405	1325	3730	1.56
	3	466	3091	3558	2447	1145	3592	2.63
	4	615	2502	3117	2399	914	3314	2.17
	5	961	1739	2701	2254	850	3104	1.85
	6	824	1606	2430	2292	732	3024	-
II	2	1348	2589	3937	2337	1428	3765	1.28
	3	1573	2223	3700	2223	1432	3655	2.02
	4	1888	1778	3666	2478	1033	3511	2.00
	5	1866	1393	3258	2215	963	3178	1.70
	6	2016	1176	3192	2430	677	3107	-
Germany								
I	2	0	5063	5063	2861	1523	4384	1.37
	3	5	4844	4849	2770	1430	4200	2.27
	4	287	3715	4002	2810	1234	4044	1.82
	5	288	2842	3130	2785	671	3456	1.64
	6	619	2094	2713	2713	552	3265	-
II	2	1126	3911	5130	2699	1692	4459	1.28
	3	1891	3258	5149	2794	1728	4391	1.91
	4	2195	2650	4845	2814	1370	4148	1.55
	5	2365	2039	4401	2811	847	3658	1.49
	6	2593	1661	4254	2845	682	3527	-

Figure 6a: Australia - labour supply by household type

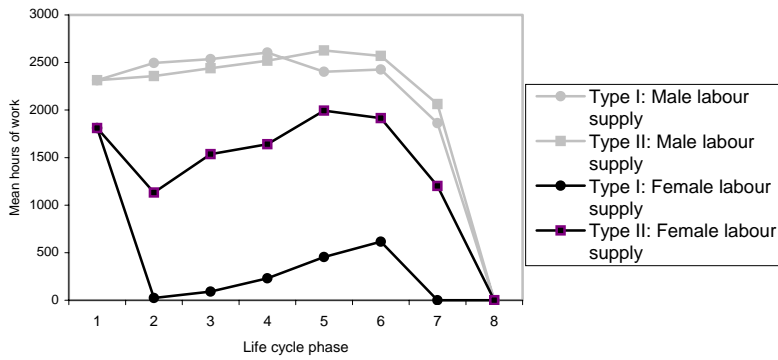


Figure 6b: UK - labour supply by household type

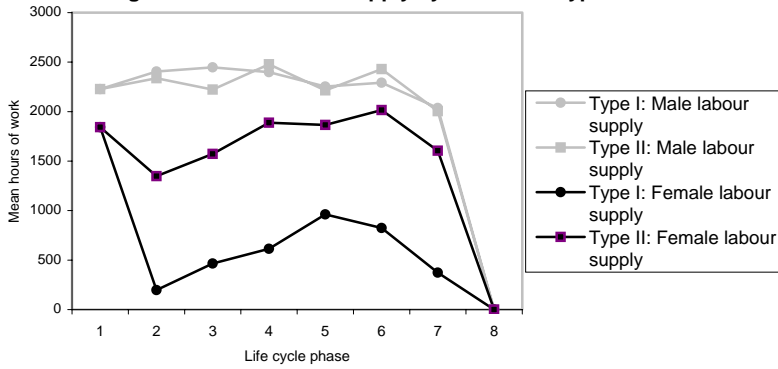


Figure 6c: Germany - labour supply by household type

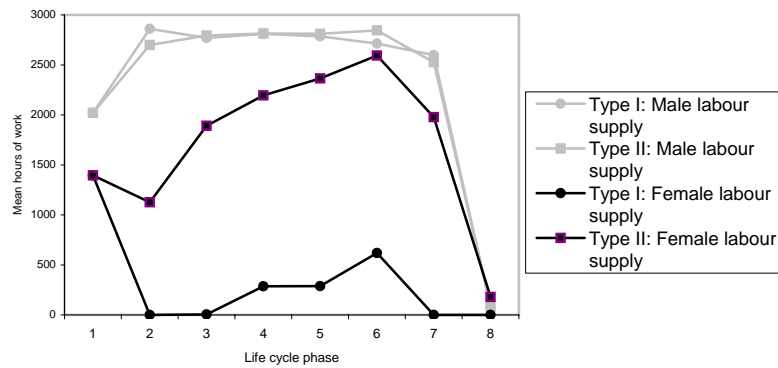


Table 9 presents income and tax profiles by household type, using the ABS HES and UK FES data. Male earnings are quite similar across household types, which, since working hours are also similar, suggests there is little variation in average male wage rates across types. The substantial differences in household private incomes by household type are due to female earnings, as we would expect. The interesting point is that the effect of the tax-benefit system is to bring about much smaller differences in household net income across types. Moreover, we see that Type II households are still major net contributors to taxation in phase 2, as well as in all other phases. Type I households on the other hand benefit considerably in all phases in which there are children present in the household, although the difference declines in later phases in the UK, possibly because, unlike Australia, not all benefits are withdrawn on joint income or the income of the second earner.

Table 9 Incomes and taxes by household type

H'hold type	Life cycle phase	Household private income	Female earnings	Household net income	Direct taxes less benefits	All taxes less all benefits
Australia AUS\$1998						
I	2	43074	426	36719	6355	710
	3	47713	2759	40344	7369	-3639
	4	51685	6530	44167	7518	-6810
	5	66753	9197	59013	12741	209
	6	64264	6279	50559	13705	14474
II	2	63667	21905	50127	13540	9619
	3	68410	25314	53613	14797	5561
	4	69766	26094	55443	14323	3272
	5	88160	31053	67965	20195	9393
	6	77901	30452	59748	18154	19844
UK GB£2000						
I	2	26973	1909	22347	4626	-
	3	28297	1500	24098	4199	-
	4	30032	3411	24881	5151	-
	5	36239	3263	29310	6929	-
	6	33632	2928	26784	6848	-
II	2	39656	12357	31729	7927	-
	3	40441	13806	32171	8270	-
	4	40868	15638	32727	8141	-
	5	44854	16170	35291	9563	-
	6	40049	16015	31085	8964	-

Note that differences in the average numbers of children by household type are relatively small in each phase, especially in the case of Australia, and therefore cannot offer an adequate explanation for the much higher taxation of the Type II household, although it is clearly a contributing factor in some phases, especially in the UK. The main cause of the large gap between direct taxes, net of benefits, is the withdrawal of family assistance and/or tax credits on the basis of joint incomes. Effective average tax rates on the incomes of second earners in Australian families with dependent children are now in the order of 30 to 40 per cent across the distribution of the primary income, with the highest rates applying towards the lower end of the distribution. In both countries, we can see that the net effect of shifting towards a tax-benefit system designed to tax second earners at high effective rates is to bring about a substantial redistribution of income from Type II to Type I households, which cannot be justified in terms of family size or male earning capacity. A similar result can be expected to hold for Germany, given its system of joint taxation.

VI Discussion and Conclusions

Our analysis of the data in the previous two sections suggests to us three points for further discussion, each of which is relevant for public policy.

(i) Female Labour Supply and Fertility Decline

The aggregate data examined in Table 1 suggested a negative correlation between fertility and female labour supply within countries over time. This would seem to bear out the simple intuition that market work and child care are substitutes, as well as confirming more sophisticated models of economic growth and fertility.²² However, when we compare the data for Type I and Type II households, we see that there are relatively small, if statistically significant, differences in family size, although there are very large differences in female labour supply. If households in which the woman quits work when children arrive have only slightly more children on average than those in which she goes

²² See for example Galor and Weil (1996)

on working close to full time, how can growth in female labour supply explain fertility decline?

One possible answer to that puzzle is provided by the life cycle perspective emphasised in this paper. Once the children reach school age there is a steady rate of return to the labour force, which increases as the children get older. Thus, even women who do not work when the children are small may well be anticipating a return to the labour force later, and as a result limit their family size. In that case the choice of family size is still restricted by the perceived possibilities of combining family and market work, and we would expect that a policy-induced improvement in these possibilities would increase both family size and the rate of re-entry to the labour force. It would also tend to increase family size among women who choose to go on working in the early phases.

(ii) Phase 2: The Impact of Children

We view the time allocations we have considered in this paper as the outcomes of rational choices couples make, in the light of values of exogenous variables - wage rates, job characteristics,²³ interest rates, availability of unsecured credit, price and availability of good quality child care, expectations of future wages and job opportunities, tax rates, government benefits - that they face. A striking feature of the data is the change in female time allocation between phases 1 and 2, and the resulting fall in household income and leisure of both partners. In terms of income level and total hours worked, phase 2 is the hardest time of the couple's life.

We would argue that such an abrupt and costly reallocation is the result of two kinds of market failure. First, there is a failure in the child care market to provide affordable child care of sufficiently high quality, hence it is rational for the female partner to reallocate her time from labour market to household, since she typically faces a lower wage, and for both partners to forego leisure, since the shadow price of household production has increased. There are two sources of market failure here. There is a non-convexity arising

²³ For example working hours, flexibility.

from economies of scale in the provision of child care. Child care has the typical characteristics of a local public good. Secondly there is a huge tax distortion: market child care must be bought out of taxed income, and the main factor of production in child care, labour, is also heavily taxed. Therefore there is a large gap between the marginal value product and the marginal social cost of child care. For both these reasons, there is a strong case for public intervention in the supply of child care.

Secondly, there is a capital market failure. Couples who want to maintain their consumption standard and buy in child care face the problem that the interest rate on non-collateralised borrowing, such as bank overdrafts, credit cards and consumer credit, is high and rising with the amount borrowed. A rational response therefore is to work harder and cut consumption and saving in this phase of the life cycle. We can regard government provision of benefits for older children, in phases 3 to 5, as to some extent compensating for this capital market failure, particularly in the provision of education. As we have seen however, this does not extend to phase 2. Instead, a mother who opts to remain at work in this phase may find that her net-of-tax income is not sufficient to cover the cost of private sector child care,²⁴ even in cases where she qualifies for a child care benefit. Under these conditions it is not surprising to observe a dramatic decline in female labour supply after the arrival of children and a high degree of heterogeneity in female hours across seemingly identical families, who are making different assessments of the gains and losses associated with the choice between working at home and in the market.

(iii) Heterogeneity of Female Labour Supply

We have seen that family demographics and the male partner's wage do not differ sufficiently to provide an explanation for the observed large degree of heterogeneity in female labour supply. Clearly, as noted, varying assessments of the risk associated with

²⁴ The limitations of a privatised, for-profit child care sector employing low-skilled labour become obvious when we consider the impact that government support, centralised planning and regulation have had on ensuring that children after age 4 have access to an affordable primary school education from trained teachers.

future net-of-tax earnings and the ease with which a woman can become re-employed after a spell out of the labour market,²⁵ are contributing factors. In addition, we would expect productivity in household production and the price and availability of quality child care to be important determinants of variations in female labour supply.

The explanation of the across-household variation in female labour supply is central to the evaluation of tax and benefit policies. As we have seen, existing policies imply substantial redistributions from households with high, to households with low female labour supply. This will always be characteristic of tax and transfer systems that are based on household market income. The extent to which this represents on balance a socially desirable redistribution, especially when the efficiency effects are taken into account, depends on the relationship between household utility possibilities and market income. Holding constant the female wage, re-employment possibilities and price and availability of child care, if female labour supply is inversely associated with productivity in household production, as would be the case for example if women worked where they had a comparative productivity advantage, then along this dimension there is a negative correlation between female labour supply and market income, on the one side, and household utility possibilities on the other. Thus the observed redistribution could be regressive. More generally, we would need to know much more about the determinants of female labour supply to be able to assess the equity implications of the existing tax/transfer system and to be able to set these against the efficiency costs. Needless to say, existing systems presuppose an answer to this question.

(iv) Conclusion

Three decades ago, Germany and the UK on the one hand, and Australia on the other, were regarded as having fundamentally different tax and social security contribution systems. Germany had, and still has, a system of joint taxation or income splitting, which essentially equalizes marginal tax rates of husband and wife, with the result that a family

²⁵ This will depend on the rate of human capital depreciation when out of the labour market, and of course, if anticipated, can have an important effect *ex ante*, on the decision whether to go on working when the children are young, as well as *ex post*. For more on this, see Attanasio et al (2003).

in which the mother works in the market rather than at home faces a higher effective tax rate. Australia had, from the outset, independent taxation and the UK switched to independent taxation in 1990. Under this system the marginal tax rate depended only on the income of the individual. Since the early 1980's, as a result of introducing a system of family benefits based on joint income, the Australian system has become more like that of Germany, but with a difference: the highest marginal rates can now apply to average family incomes. The UK is in the process of moving in a similar direction, with the introduction of working family tax credits. The three countries are also not dissimilar in having rather poor systems of child care. It is not therefore too surprising that all three countries have similar profiles, as reported in this paper. It would be interesting to extend the approach of this paper to the Scandinavian countries and France, where the tax and/or the child care systems would be expected to produce substantially different results.

References

- Adam, S. (2004), 'A Survey of the UK Tax System', The Institute of Fiscal Studies, Briefing Note No. 9.
- Apps, P.F. (2002), 'Why an Earned Income Tax Credit Program is a Mistake for Australia', *Australian Journal of Labour Economics* 5, 549-568.
- Apps, P.F., and Rees, R. (2001), 'Household Saving and Full Consumption over the Life Cycle', Discussion Paper 280, IZA, Bonn.
- Apps, P.F., and Rees, R. (2004), 'Fertility, Female Labour Supply and Public Policy', *Scandinavian Journal of Economics*, 106, 745-763.
- Apps, P. F., and Rees, R. (1999), 'On the Taxation of Trade Within and Between Households', *Journal of Public Economics*, 73, 241-263.
- Attanasio, O. P., Low, H., and Sanchez-Marcos, V. (2003), 'Explaining Changes in Female Labour Supply in a Life-Cycle Model', paper presented at the NBER Summer Institute session: *Aggregate Implications of Microeconomic Consumption Behavior*, Boston, July 21-25.
- Boskin, M.J., and Sheshinski, E. (1983), 'Optimal Tax Treatment of the Family', *Journal of Public Economics*, 4, 1-25.

Browning, M., and Crossley, T.F. (2001), 'The Life-cycle Model of Consumption and Saving', *Journal of Economic Perspectives*, 15, 3-22.

Blundell, R., Browning, B., and Meghir, C. (1994), 'Consumer Demand and the Life-Cycle Allocation of Household Expenditures', *Review of Economic Studies*, 61, 57-80.

Browning, M., and Lusardi, A. (1996), 'Household Saving: Micro theories and Micro Facts', *Journal of Economic Literature*, XXXIV, 1797-1855.

Deaton, A. (1992), *Understanding Consumption*, Clarendon Press, Oxford.

Engelhardt, H., Kögel, T., and Prskawetz, A. (2004), 'Fertility and Women's Employment Reconsidered: a Macro-Level Time-series Analysis for Developed countries, 1960-2000', *Population Studies*, 1, 58, 109-129.

Engelhardt, H., and Prskawetz, A. (2002), 'On the Changing Correlation between Fertility and Female Employment over Space and Time', WP 52, Max Planck Institute for Demographic Research, Rostock, Germany.

Galor, O., and Weil, D. N. (1996), 'The Gender Gap, Fertility and Growth', *American Economic Review*, 3, 86, 374-387.

Jaumotte, F. (2003), 'Female Labour Force Participation: Past Trends and Main Determinants in OECD Countries', *OECD Economic Studies*, 37, 51-108.

Kögel, T. (2004), 'Did the Association between Fertility and Female Employment within OECD Countries Really Change Its Sign?' *Journal of Population Economics*, 1, 17, 45-65.

Martinez, D.F., and Iza, A. (2004), 'Skill Premium Effects on Fertility and Female Labor Force Supply', *Journal of Population Economics*, 1, 16, 1-43.

OECD (2004), Economics Dept. (<http://www.oecd.org/dataoecd/25/5/31743836.pdf>)

Pencavel, J., (1998), 'The Market Work Behavior and Wages of Women: 1975-94', *Journal of Human Resources*, 4, 33, 771-804.

Shaw, K., (1994), 'The Persistence of Female Labor Supply: Empirical Evidence and Implications', *Journal of Human Resources*, 29, 348-378.