C The impact of income on fertility

This appendix considers a sample of the empirical results on the effect of male and female wages and income on fertility. Many of the studies surveyed here include government policy variables and are discussed in greater detail in appendix E. However, two general points about the literature should be noted:

- The underlying models of fertility behaviour are subject to almost all of the uncertainties and inherent methodological difficulties described in appendix E.
- One mitigating factor is that income is easier to measure than government policy, and is measured more consistently between studies. This allows for greater comparability of results.

The literature on wages and fertility contains a number of common features:

- Women's wages are generally found to be negative and significant. A one per cent increase in women's wages is usually found to decrease fertility by between one and three per cent.[1]
- Men's wages/income is generally positive and significant. A one per cent increase in men's wages/income generally increases fertility by between 0.5 and 2.0 per cent.
- When men's and women's wages are included in the same model, the estimated coefficient on women's wages is usually larger (in absolute value) than the coefficient on men's wages.
- Several studies find that relative earnings are important. That is, fertility tends to fall when women's wages rise relative to men's.

However, there are discrepancies and confounding results in some studies:

- Many studies fail to find a significant effect of men's and women's wages on fertility, or find a significant effect but an unexpected sign (Gauthier and Hatzius 1997, Tasiran 1996, Zhang, Quan and Meerbergen 1994, Del Boca 2002).
- Results often differ by parity. For example, Ronsen (2004) finds a negative effect of women's wages on the probability of having a first and second child, but finds no effect on having a third.

[1] 'Fertility' here usually refers to the TFR. In some studies, it refers to completed fertility.

- Results differ by country. Using Swedish data, Heckman and Walker (1990) find a negative effect of women's wages on fertility. Tasiran (1996), following Heckman and Walkers methodology but using U.S. data, finds that women's wages have a positive and significant effect on fertility.

A sample of literature is presented in table C.1

Table C.1 **Econometric estimates of the effect of wages and income on fertility**

Authors	*Data and Methods*	*Variables included*	*Findings*
Gauthier and Hatzius (1997)	International A fixed effect panel estimator was used on aggregate data from 22 OECD countries for the period 1970–1990.	The dependent variable was the TFR. The independent variables were men's and women's wages, changes in the unemployment rate, maternity leave entitlements and the ratio of family payments to average weekly earnings. Time dummies were used to exclude missing time-varying variables.	A one per cent increase in women's average wages was found to increase the total fertility rate by 0.22 per cent in the short run. In the long run, a one per cent increase in women's average wages was found to increase the total fertility rate by around 1.7 per cent (PC calculation based on table 2). Men's wages were found to be insignificant.
Ehrlich and Kim (2007)	International A fixed effect panel estimator was used on aggregate data from 57 countries.	The dependent variable was the TFR. The independent variables were GDP per capita, social security benefits as a share of GDP, the marriage rate, government spending as a share of GDP, the probability of surviving until the age of 24, the female labour force participation rate, and ratio of average schooling years of females to males.	A one per cent increase in GDP per capita was found to decrease the total fertility rate by between 0.17 and 0.31 per cent.
d'Addio and d'Ercole (2005)	International Aggregate panel data from 16 OECD countries was used. The preferred model (out of the three presented) used a pooled mean group (PMG) estimator. (The two other models used a generalised method of moments and a pooled OLS estimator).	The dependent variable was the TFR. The independent variables were lagged TFR, female employment rate, ratio of women's to men's wages, share of female workers in part-time employment, unemployment rate, length of parental leave, parental leave benefits, and public spending on leave benefits and the difference in effective tax rates for families with and without children.	Increasing women's wages relative to men's was found to have a negative and significant effect in the preferred model (the effect was insignificant in the other models presented).

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Heckman and Walker (1990)	Sweden A hazard model of life-cycle fertility was used on individual level data from the 1981 Swedish Fertility Survey. This model essentially estimates how transitional probabilities (that is, progressing from parity 1 to parity 2) changes through time and according to various characteristics. The authors estimated 148 different specifications to find the best fitting model and to test for robustness.	The dependent variable was the transition from one parity to another. As individual wage data were not collected in the Swedish Fertility Survey, summary tax return statistics were used to calculate average wages by sex and age. Other independent variables included: employment, education, marital status, cohabitation status and social background.	Female wages were consistently found to be a significant and negative determinant of fertility across the various specifications. Likewise male wages were consistently found to be positive and significant. In the preferred model: • A one per cent increase in female wages decreases the predicted number of children a women will have by the age of 40 by 0.55%. • A one per cent increase in male wages, increases the predicted number of children his spouse will have by the age of 40 by 0.21%.
Merrigan and St.-Pierre (1998)	Canada The methodology followed Heckman and Walken (see above).	The dependent variable was the transition from one parity to another. The independent variables included: female wage and male income, religion, region, cohort and education.	A 12.5 per cent increase in women's wages was found to decrease the predicted number of children at age 40 by between 6.5 and 15.6 per cent. A 12.5 per cent increase in men's wages was found to increase the predicted number children at age 40 by between 0.12 and 1.8 per cent.
Tasiran	Sweden and the U.S.A. The methodology followed Heckman and Walken (see above).	The dependent variable was the transition from one parity to another. The independent variables included, age, education, male and female wages, benefits.	The effect of wages differed between parities and between countries. Parameter values were not reported. In Sweden: • Increasing women's wages was found to have a positive effect on the first birth, an insignificant effect on the second birth and a negative effect on the third birth. • Increasing wages was found to have a positive effect on first and second birth but an insignificant effect on third births. In the USA • Increasing women's wages was found to have a positive effect on first second and third births • Increasing men's income was found to have a negative effect on first, second and third births.

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Butz and Ward (1979)	U.S.A. An OLS estimator was used on aggregate data. Regressions were run on the different ages groups separately, as well as all age groups together.	The dependent variables were the age specific fertility rates and the TFR. The independent variables were: female hourly earnings, male annual earnings, cohort and the fraction of families with employed wives.	A one per cent increase in women's hourly earnings was found to decrease the TFR by between 1.59 and 1.85 per cent (depending on the cohort). A one per cent increase in men's annual earnings was found to increase the TFR by around 1.3 per cent (table 2, page 322).
Jackson (1995)	Australia An OLS estimator was used on aggregate data.	The dependent variable was the TFR. The independent variables were the ratio of the number of women to men in the workforce, the male annual income and female hourly wages.	In the preferred model, a one per cent increase in women's hourly wage was found to decrease the TFR by 1.45 per cent. A one per cent increase in men's annual wages increased the TFR by 1.27 per cent.
Hyatt and Milne (1991)	Canada An OLS estimator was used on aggregate time series data from 1948-1986.	The dependent variable was the TFR. The independent variables were male income and female wage rates, the proportion of households in which the wife is employed and variables relating to family payments and maternity benefits.	In the preferred model (model 2, pp. 83) a one per cent increase in female wages was found to decrease the TFR by 1.1 per cent. A one per cent increase in male wages was found to increase the TFR by 0.5 per cent.
Zhang, Quan and Meerbergen (1994)	Canada An OLS estimator was used on aggregate time series data from 1921-1983.	The dependent variable was the TFR. The independent variables were: female wage and male income, family payments, tax deductions for dependent children, maternity leave, the immigration rate, the unemployment rate, infant mortality, female education and dummy variables for World War 2 and the introduction the contraceptive pill.	Female wages and male income were both found to be insignificant in this model.

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Ermisch 1998	UK The study used a 'two-step' error correction model on aggregate time series data (at the cohort and parity level) from 1952 to 1983. The study determined that the dependent fertility variable and the independent variables were non-stationary and co-integrated	The dependent variable was the logit of the conditional birth rate for a particular cohort of women by age group and parity. Independent variables included: relative cohort size, ratio of men and women's wages, men's real after tax earnings, the male unemployment rate, the inflation rate, the parity-specific child allowance, real house prices, and a constructed 'permanent lifetime employment propensity' variable.	Increasing women's wages relative to men's was found to have a large effect on fertility. A 35 per cent increase in this ratio was simulated, which yielded a decline in average family size of 0.3 children. Increasing both women's and men's wages simultaneously was found to have only a small effect. A 45 per cent increase in men's earnings (holding the ratio of men and women's earnings constant) was found to decrease the average family size by 0.05 children.
McNown and Ridao and Cristobal (2004)	Canada An OLS estimator was used on aggregate data for the period 1947–1999. A co-integrating relationship was found and the estimation was done in levels, which yields long-run estimates.	The dependent variable was the TFR. The independent variables were: women's wages, male incomes, labour force participation, female education, child benefits, and dummy variables controlling for the availability of the birth control pill and the provision of publicly-funded maternity benefits.	Increasing women's wages by one per cent was found to decrease the total fertility rate by 2.7 per cent. Increasing men's income by one per cent was found to increase the TFR by 3.7 per cent.
Milligan 2004	Canada A probit estimator was used on individual level data.	The dependent variable was whether a birth had occurred. In some specifications over 20 control variables were included. These variables related to education, family income, ethnicity, age and the macro-economic environment.	An increase in family income of $10 000 was found to increase the probability of having a child by 1.75 percentage points.
Blacklow (2006)	Australia OLS, poisson, multinomial logit and sequential logit estimators were used on individual level data.	The dependent variable was the number of children ever had and expected to have. A large number of independent variables were used including: male and female wages; health; education; work force attachment; country of origin; sector; and work force experience.	Women's wages were generally found to have a significant and negative effect on fertility.

Table C.1 continued

Authors	*Data and Methods*	*Variables included*	*Findings*
Barmby and Cigno (1990)	UK A maximum likelihood estimator was used on a large random sample of British women aged between 16 and 59, undertaken in 1980. Only women who were married for ten years were included in the analysis.	The dependent variable was 'completed' fertility (births after ten years of marriage). The independent variables were: the ratio of female to male wages, the age of the mother, the year the mother was born, the year the mother was married, years of post-compulsory education, years of work experience, and an index of child benefits.	The study found that increasing women's earnings relative to men's had a negative impact on fertility
Del Boca (2002)	Italy A fixed effect logit estimator was used on individual level panel data collected between 1991 and 1995.	The dependent variable was whether a birth had occurred in the last 2 years. The independent variables were: the proportion of children aged 1–3 in childcare for each of the Italian regions; the proportion of women in part-time work for each of the Italian regions;, mother's age at first birth; household income; family transfers (from relatives); schooling; and whether grandparents were still alive.	Family income was found to be insignificant in both models
Ronsen (2004)	Norway and Finland A maximum likelihood estimator was used on individual level data. Each parity was estimated separately.	The dependent variable was whether a birth occurs (for a woman of a given parity). There were a large number of independent variables relating to birth cohort; social background; marital status; education; wage; and experience.	Women's wages was found to have a negative and significant effect on the probability of having a baby for women of parity zero and one (but not two).
Risse (2006)	Australia. A probit estimator was used on individual level data. The modelling technique also corrected for potential sample selection biases.	The dependent variable was whether the respondent had fallen pregnant in the last year. A large number of independent variables were used including: personal weekly gross wage; workforce attachment; industry of employment; education; age; region; and remoteness.	Women's wages were found to have a negative and significant effect on the probability of having fallen pregnant in the last year.