E International studies of the impacts of family policies on fertility

This appendix describes a representative sample of the econometric literature relating to fertility and family policy. The summary provided here (tables E.1 to E.4) is narrower, but more detailed, than that found in Sleebos (2003) and Gauthier's (2007) broad and useful meta-studies. Nevertheless, the evidence presented here supports Sleebos (2003) and Gauthier's (2007) qualitative assessment that while family policy is positively related to fertility, the magnitude of the effect is likely to be small and subject to a great deal of uncertainty.

It is difficult to pin down the effects of family policy due to the diversity of findings and methods employed in the literature, as well as the inherent methodological difficulties involved in modelling fertility decisions. The most obvious point of distinction is the level of aggregation. Studies range from country level (macro) to individual level (micro) data.

E.1 Macro-level studies

Macro-level studies typically model the effects of country-wide variables on a period measure of fertility — usually the TFR. While there are some time series studies for single countries (for example Gabos, Gal and Kezdi 2007), in general, panel data involving many countries and periods is preferable. This allows the estimation to exploit the variation that occurs between countries, as well as through time. The main difficulty for macro-level studies is that it is hard to measure policy in a way that is both meaningful and comparable between countries. Family policy differs not just by generosity, but also by type. Some countries have a strong redistributive element to their policy (benefits differ by the income of recipients), some favour flat payments (benefits are the same for all), and others have pronatalist elements (benefits differ by parity, bonuses to big families, etc). To overcome this problem, an index of family payments is usually constructed, based on an assumed family type. For example, d'Addio and d'Ecole (2005) use the difference, for a given level of family earnings, in effective tax rates between families with two children and childless families.

Macro-level studies consistently find a small effect of government policy on fertility. The categorisation of 'small' stems from the size of the change in TFR that could be expected from feasible changes in the index of family policy used. This is usually in the range of 0.02 to 0.04 children per woman.

E.2 Micro-level studies

Micro-level studies generally use discrete response models to estimate the impact of various factors on the probability of having a child over a given period. One advantage of these studies is that fertility decisions are modelled according to the mix of attributes and opportunities actually encountered by individuals (as opposed to country-wide averages). As variations in benefits usually only occur through time or regionally, the difficulty lies in identifying the effect of family policy. This problem is acute in 'difference-in-difference' or 'treatment/effects' type models. The reliability of estimates from these models depends crucially on the adequacy of the 'control' group (those not exposed to new or increased family policy). An ideal control group is identical in their traits to the 'treatment' group except that they have not received the treatment. Or, if achievement of this ideal is not feasible, the differences in the traits of the control and treatment groups should be unrelated to people's fertility decisions.

Unfortunately, the implicit 'control' groups used in these studies fall short of these standards — reflecting the inherent difficulty of observing all the relevant characteristics of the control and treatment groups.

Accordingly, while these studies yield the largest policy coefficients in the literature, it is difficult to predict how much of the estimated policy effect merely reflects the influence of unobserved factors. Studies that attempt to model policy as continuous variables (such as Barmby and Cigno (1990) and Laroque and Salanie 2004) tend to find a more modest effect.

Micro-level studies tend to suggest a larger effect of family policy on fertility than macro-level studies, although there is also more variation in the findings. Studies differ not just in the estimated magnitude, but also in relation to the parities most sensitive to policy.

E.3 Common issues

Both macro-level and micro-level studies face a number of common challenges. Most of these studies are subject to a 'tempo' bias that overstates the impact of family policy. This occurs because the introduction of new or more generous family

policy prompts some families to bring childbearing forward, but does not change their completed fertility. Typical specifications (that specify the TFR or the probability of having given birth as the dependent variable) will spuriously construe these tempo effects as an increase in lifetime fertility.

The most basic difficulty is specifying the complex and heterogeneous process that underlies fertility behaviour. While it is not obvious what a 'complete' model would even look like, ideally panel models should control for variations in individuals' traits (such as men's and women's wages, family income, and educational attainment) and economy-wide factors (such as unemployment, availability of child care and the cost of children). Lack of data frequently constrain such richly specified models. Moreover, there are several unobservable, even undefinable, factors that are likely to play a powerful role in childbearing decisions. These include a tapestry of evolving cultural norms and social institutions pertaining to the role of women, family structure, working habits, materialism and the value placed on children.

Given the profound challenges involved, the discordant approaches to (and outcomes from) modelling fertility behaviour are unsurprising. In addition to preventing easy generalisation about the results, specification issues make it difficult to assess the reliability of individual studies. It is probable that the estimated coefficient of the effect of family policy is highly sensitive to sample selection, econometric technique and the inclusion or exclusion of other variables. When multiple models are presented, the effect of family policy often appears to be unstable, with coefficients changing sign and/or losing significance.

The implication of this is that any one study result needs to be interpreted with caution. Nevertheless, the shared qualitative finding of a small, but significant, positive link between family policy and fertility is both sound and intuitively plausible.

Table E.1 **Micro-level data studies**

Authors	*Methods*	*Variables included*	*Findings*
Laroque and Salanie (2004)	France The study was based on three years of individual level data from the French labour surveys of 1997, 1998 and 1999, with a total of 23 000 observations. A Full Information Maximum Likelihood (FIML) estimator was used to examine the impact of the 1994 extension to maternity benefits. The study assumes women decide whether to have a child in the current year by incorporating expectations of next year's income. This expectation is determined by their potential wage and whether they are employed in the next year. The above approach then allows anticipated income to be controlled for when estimating the impact of additional income on fertility choices. The coefficients from the income-fertility model were then used to model the effects of increasing or decreasing maternity benefits.	The dependent variable was whether a birth had occurred or not. Explanatory variables included women's income, partner's income, non-wage income, education attainment, work experience, matrimonial status and employment status. The study also incorporated a large number of other controls (more than 70). The estimated coefficients were then used to model the removal of the *Allocation Parentale d'Education* (APE) for second children. (The APE provides around 465 euros per year for three years for a parent who stops work to care for a child. The parent must have worked in two years out of the previous five. Prior to 1994 it was only available for children of parity three or above.)	The impacts of the 1994 reform to extend the maternity benefit (APE) to second children were estimated to be: • no affect on the probability of having a first child • a 5.0 per cent increase in the probability of having a second child • a 2.1 per cent decrease in the probability of having a third child • a 1.3 per cent net increase in total births (this was around one fifth of the overall increase in fertility observed between 1995 and 2000) • the APE could reduce participation by 2.0 per cent. The study also modelled an increase in family benefits of 240 euros per month (equivalent to an approximately 50 per cent increase in family benefits) and found this would result in an 8.9 per cent increase in the TFR (see page 27).

Table E.1 continued

Authors	*Methods*	*Variables included*	*Findings*
Milligan (2004)	Canada This study used the introduction of generous maternity benefits in the province of Quebec as a natural experiment. A probit regression and a difference-in-difference estimator were used. The study measured the impact of the increase in Quebec's allowance for newborn children, which was increased in 1991 from C$375 for first and second children and C$3000 for third or later children to C$500 and C$8000.	The dependent variable was whether a birth had occurred or not. Living in Quebec during the introduction of the maternity benefit was the proxy for the effect of policy. In some specifications over 20 control variables were included. These variables related to education, income, ethnicity, age and the macro-economic environment.	The difference-in-difference estimate of the additional rise in fertility in Quebec compared with the Rest of Canada (ROC) over the study period was 5.5 per cent. The study presented two estimates of impacts. One measured the rise in TFR one year after the policy was introduced. This rise comes after only a portion of entitled benefits have been paid (since the entitled benefits were paid quarterly over five years). Because the one-year estimate measures the TFR response to only a fifth of the benefit increase, the impact of an increase in benefits by C$1000 measured after one year is equivalent to the impact from a C$5000 increase in overall benefits. The one-year estimate found an additional C$1000 (per year) was associated with an increase in the TFR of 16.9 per cent (see Milligan 2004, table 8). The other measure of impacts included the total additional family payments made over the five years from birth. This measure was considered to be the more reliable. Using the five-year estimate of maternity benefits, additional maternity payments of C$1000 were related to an increase in the TFR of 2.6 per cent.
Barmby and Cigno (1990)	UK The study used a maximum likelihood estimator. The data originated from a large random sample of British women aged between 16 and 59 years undertaken in 1980. Only women who were married for 10 years were included in the analysis.	The dependent variable was completed fertility (births after 10 years of marriage). An index of child benefits for first and second children from 1954 to 1980 was used as the policy variable (recipients' benefits differ according to the year in which they had children). Other variables include 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 at marriage, and annual earnings.	The study found: • increasing child benefits increased completed fertility and reduced the time to the first birth • a higher ratio of female-to-male earnings reduced fertility • older age at first birth reduced completed fertility.

Table E.2 **Multi-country studies with macro-level data**

Authors	*Methods*	*Variables included*	*Findings*
d'Addio and d'Ercole (2005)	The modelling covered 16 OECD countries. Aggregate data were used. The preferred model (out of the three presented) employed a Pooled Mean Group (PMG) estimator. This estimator assumes a common long-run effect of policy but allows different short-run coefficients for each country. The model was dynamic so it allowed for different short and long-run effects. (The two other models used a generalised method of moments and a pooled OLS estimator).	The dependent variable was the TFR (as a log). The policy variable was the difference between average effective tax rates for families with two children and singles without children. The representative married couple had two children (aged 4 to 6) and earned 100 per cent of the income of an Average Production Worker (APW). The representative single person without children also earned 100 per cent of the income of an APW. The average effective tax rate included both income taxes and social security contributions paid by households, less cash benefits received from governments. Other variables included in the models were the: 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.	Using the pooled mean group dynamic model, the authors found that a 25 per cent increase in the tax rate difference would increase the TFR by 0.05 births per woman (see d'Addio and d'Ercole 2005, p. 65, footnote no. 52).
Blanchet and Ekert-Jaffe (1994)	The study examined 11 countries in Western Europe. It used aggregate data for the period 1969 to 1983. The model did not differentiate between short and long-run effects. Time dummies were used to exclude missing time-varying variables.	The dependent variable was the TFR by parity. Family policy was measured by an index (FPI) that accounted for both the generosity of family payments as well as the degree of pronatalism. Pronatalism was defined by the extent to which payments increased with parity. Women's wages were also included. These wages were converted to purchasing power parity amounts in a common currency.	A one unit increase in the FPI would generate an increase the TFR of between 0.00475 and 0.00940 (OLS regression results from table 4.5 and 4.6). As an indicative example, France and the United Kingdom were compared in 1981. At this time France had a FPI of 60 and England had a FPI of 25. France's more generous policies were estimated to have contributed between 0.17 and 0.31 births per woman.

Table E.2 continued

Authors	*Methods*	*Variables included*	*Findings*
Gauthier and Hatzius (1997)	OECD countries The study analyses 22 countries, using aggregate data for the period 1970 to 1990. The study uses a fixed-effects estimator with a lagged dependent variable (TFR). The study analysed the impact of family expenditures and maternity leave. As family payments often differ by parity, three separate regressions were run for the payments received by families with one, two or three children. Time dummies were used to try and exclude missing time-varying variables.	The dependent variable was the TFR as a log. The policy variable was the ratio of family payments to average weekly earnings for male manufacturing workers. The maternity leave variables were: 1) weeks of leave offered by country 2) maternity leave payments as a percentage of wages. Other variables included in the model were men's wages, women's wages (as logs) and the change in the unemployment rate.	Maternity leave and pay was not found to have a significant effect. A 25 per cent increase in the family payment to wages ratio for a family with two children was estimated to increase fertility by 0.07 children per woman in the long run (for a country with an average TFR of 1.71). The short-run effect was found to be smaller, being 0.01 children per woman. The effect was also found to vary across countries. • No effects were found in the English-speaking countries. • Large positive effects were found in the Scandinavian countries. • Intermediate effects were found in the continental West-European countries and in the Southern-European countries. • For the Southern-European countries only benefits for the first child were significant.

Table E.3 **Single country studies with macro-level data**

Authors	*Methods*	*Variables included*	*Findings*
Gabos, Gal and Kezdi (2007)	Hungary Found TFRs and family benefits to be non-stationary but not cointegrated. In order to overcome problems of spurious significance with non-stationary variables, the dependent variables were included in differenced form (in this case as the differences of logs).	The dependent variable was the change in the log of the TFR (which is equivalent to dependent variable being the percentage change in the TFR). The policy variables were changes in logs of: • family benefits as a percentage of GDP • pensions as a percentage of GDP. (This is equivalent to including the percentage changes in these variables as the explanatory variables.) Other variables included in the model were the participation rate, the infant mortality rate, the marriage rate and dummies to control for periods of stringent abortion policy in the early 1950s and early 1970s.	The study finds that a one per cent increase in the ratio of family benefits to GDP increased the TFR by 0.25 per cent.
Duclos, Lefebvre and Merrigan (2001)	Canada The regression was a linear probability model. The study undertook parity-specific regressions for parities of one, two and three. The data covered the period from 1982 to 1997. The study analysed the impact of policies introduced in Quebec in 1988. Only women under the age of 35 years were included in the sample.	The dependent variable was the probability of transitioning from one parity to another (for example, a women with one child giving birth to a second). The transition probabilities were compared between Quebec and Canada in 1987 to obtain an initial difference. Another difference was found by comparing between Quebec and the ROC in 1989 (1990 for third births). The difference between these (the difference-in-difference estimate) was then ascribed to the impact of the introduction of the additional family policy expenditures in Quebec. No other factors were controlled for.	The study found the additional family benefits introduced in Quebec had positive effects on the probability of first, second and third births. The initial impacts found were: • a 21 per cent increase in the transitional probability of first births • a 15 per cent increase in the transitional probability of second births • a 26 to 35 per cent increase in the transitional probability of third births.

Table E.3 continued

Authors	*Methods*	*Variables included*	*Findings*
Zhang, Quan and Meerbergen (1994)	Canada The study used an ordinary least square regression on aggregate data from 1921 to 1983.	The dependent variable was the TFR. The study examined the impacts of three family expenditure programs: the tax deduction for dependent children; the family allowance; and the child tax credit. These variables were measured as real dollar amounts and were examined individually and as combined total benefits. The study also examined the impacts of maternity leave. Other variables included in the model were the immigration rate, the unemployment rate, female wage and male income, infant mortality, female education and dummy variables for World War 2 and the introduction of the contraceptive pill.	The study found a positive and statistically significant effect of total benefits on fertility. A one per cent increase in total benefits was estimated to increase the TFR by between 0.05 to 0.11 per cent.
Hyatt and Milne (1991)	Canada 1948 to 1986 Aggregate data	The dependent variable was the log value of the TFR. The study analysed the impacts of maternity benefits (over the 1971 to 1979 period), female income and a combination of ongoing family payments and male income.	The study found weak positive effects.

Table E.3 continued

Authors	*Methods*	*Variables included*	*Findings*
Ermisch (1988)	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. The coefficients from the logit regression were then used to simulate the explanatory variables impacts on steady state changes in family size.	The study found a positive and significant effect of child benefits on fertility. It was estimated that doubling child benefits would increase the TFR by 0.17 birth per women. Other findings were: • higher relative female to male wages decrease CFR • higher male wages increase CFR • higher house prices decrease CFR • women from larger generations tend to have lower completed fertility and to have their children later in life. The findings suggested that increases in women's pay relative to men's, increases in real house prices and changes in relative generation size were the factors primarily responsible for falls in fertility rates between 1971 and 1985.

Table E.4 **Child-care and family friendly policy studies**

Authors	*Methods*	*Variables included*	*Findings*
Lalive and Zweimuller (2005)	Austria The study examined the effect of the extensions of maternity leave from one year to two years in June 1990. Women giving birth to an additional child whilst on leave qualify for additional maternity leave — that is they avoid the requirements of having had worked 20 weeks prior to birth. Previously, few people had subsequent children within a year and so the follow-on option was rarely available. It was hypothesised that extending the maximum duration of maternity leave would provide an incentive to have children more rapidly and potentially to have more children. The study used data from the Austrian Social Security Database (ASSD), which covers all Austrian employees.	The dependent variable was whether a woman had given birth or not. The effect of policy was captured by a dummy variable indicating whether a mother gave birth before or after the introduction date. The regression controlled for age, employment prior to birth, unemployment prior to birth, occupation type (white or blue collar), region, industry and wage in previous work.	During the first 3 years the group giving birth after the reform had 15 per cent more births than the group giving birth before the reform. After 10 years the difference was around 12 per cent.
Del Boca (2002)	Italy The study used a fixed effect logit model on individual level panel data. The panel data were drawn from the Bank of Italy's Survey of Households Income and Wealth. There were three years of data collected over the 1991 to 1995 period.	The dependent variable was whether or not women gave birth in the last 2 years. Explanatory variables were: the proportion of children aged 1 to 3 years in childcare for each of the Italian regions; the proportion of women in part-time work for each of the Italian regions; the mother's age at first birth; household income; family transfers (from relatives); schooling; and whether grandparents were still alive.	The fixed effects model found that increasing the availability of childcare by 1 per cent increased the relative odds of having a child by 0.198 per cent (Del Boca 2002, p. 567). Having a greater proportion of part-time workers in a region was found to have a statistically significant impact in the pooled cross-sectional model, which had a larger sample size (but that did not remove Italy-wide fixed effects). This model also found mothers' age to have a negative effect, and additional family transfers to have a positive effect.

Table E.4 continued

Authors	*Methods*	*Variables included*	*Findings*
Hank and Kreyenfeld (2001)	West Germany Logit model 1984 to 1995.	The dependent variable was the probability of having a first child. The explanatory variables included the availability of public childcare and the availability of childcare through social networks.	The study found the availability of childcare had no effect on the decision to have a first child.
Kravdal (1996)	Norway Logistic regression. The study obtained information from Family and Occupation Surveys conducted in 1988. These were linked with migration information and with regional social science time series data. The study was also based on histories collected for 4019 women born between 1945 and 1968 and for 1543 men born in 1945 and 1960.	The dependent variable was whether or not the respondent had given birth, by parity of the child. The policy variable was the childcare supply, which was defined as the number of children aged 1 to 3 years in public or private childcare centres.	The study found a weak positive association between childcare supply and fertility. Using the most optimistic assumptions, a 20 percentage point increase in childcare coverage generated a 6 percentage point increase in the probability of progressing from parity two to parity three.