Female Labor Force Participation and Intergenerational Mobility *

Jørgen Modalsli
Oslo Business School and Statistics Norway

Claudia Olivetti
Dartmouth University and NBER

M. Daniele Paserman
Boston University and NBER

Laura Salisbury
York University and NBER

March 2024

*PRELIMINARY AND INCOMPLETE

Abstract

Women's labor force participation increased dramatically after WWII, especially among mothers of young children. Did this change impact the transmission of economic status across generations?

In this paper we develop a statistical framework that illustrates the link between mothers' labor force participation and estimates of intergenerational elasticity (IGE), assuming that a child's human capital is a function of parental income and time inputs. Mother's entry into the labor force can result in either a higher or lower father-child IGE estimate. The direction of the change depends on the degree of assortative matching, on wage and income elasticities of labor supply, and on the relative importance of time versus money inputs in the production of children's human capital.

Using Norwegian registry data we document a decline in father-son and father-daughter IGE for cohorts that experienced a large increase in mothers' labor force participation. We provide evidence that these patterns can be reconciled with the model if mother's money inputs are more important than mother's time inputs in the production of child human capital. We further leverage the data to explore the relationship between mothers' labor force participation and IGE at a finer level of disaggregation.

1 Introduction

Recent years have seen a resurgence of interest in intergenerational mobility (Mogstad and Torsvik, 2023). How are income and economic status transmitted across generations? What characterizes the degree of equality of opportunity in a society? Most of the existing literature on intergenerational income mobility has focused on the link between *fathers* and children's income (Solon, 1999; Black and Devereux, 2011). This choice, which is mainly dictated by data constraints, ignores the potentially important role of mothers in the transmission of economic status across generations. But the role of mothers in the family and in the labor market has changed dramatically over the post-WWII periods (Goldin, 2006; Olivetti and Petrongolo, 2016), with the bulk of the increase for mothers with preschool children occurring between the early-1970s and the early-1990s.

As illustrated in Figure 1, this very rapid increase in women's work is a common feature across developed economies. Approximately twenty percent of mothers of children in preschool age in Norway, US and Germany was in the labor force in 1970. By the early 1990s, their participation rate had more than tripled. It is natural to ask how this massive entry of mothers into the labor force may have affected the degree of intergenerational persistence.

Our premise is that children's human capital depends on both parental resources and on parental time inputs. Mothers' entry into the labor market represents a shift away from time inputs toward money inputs. This has potentially two contrasting effects on children: on one hand, the increase in family income raises the child's human capital and their potential earnings; on the other hand, the decrease in time input can have an opposite effect. The impact of these changes on intergenerational persistence depends not only on which of these two effects dominate, but also on *which* children benefit more or less from these changes. If the benefits are concentrated mostly on children of relatively affluent parents, there will be an increase in intergenerational persistence. If, on the other hand, the main beneficiaries are children further down the income distribution, intergenerational persistence can fall.

In this paper, we present a statistical model that illustrates theoretically the link between mothers' labor force participation and intergenerational persistence. We set up a standard intergenerational persistence equation, in which child's income is regressed on father's in-

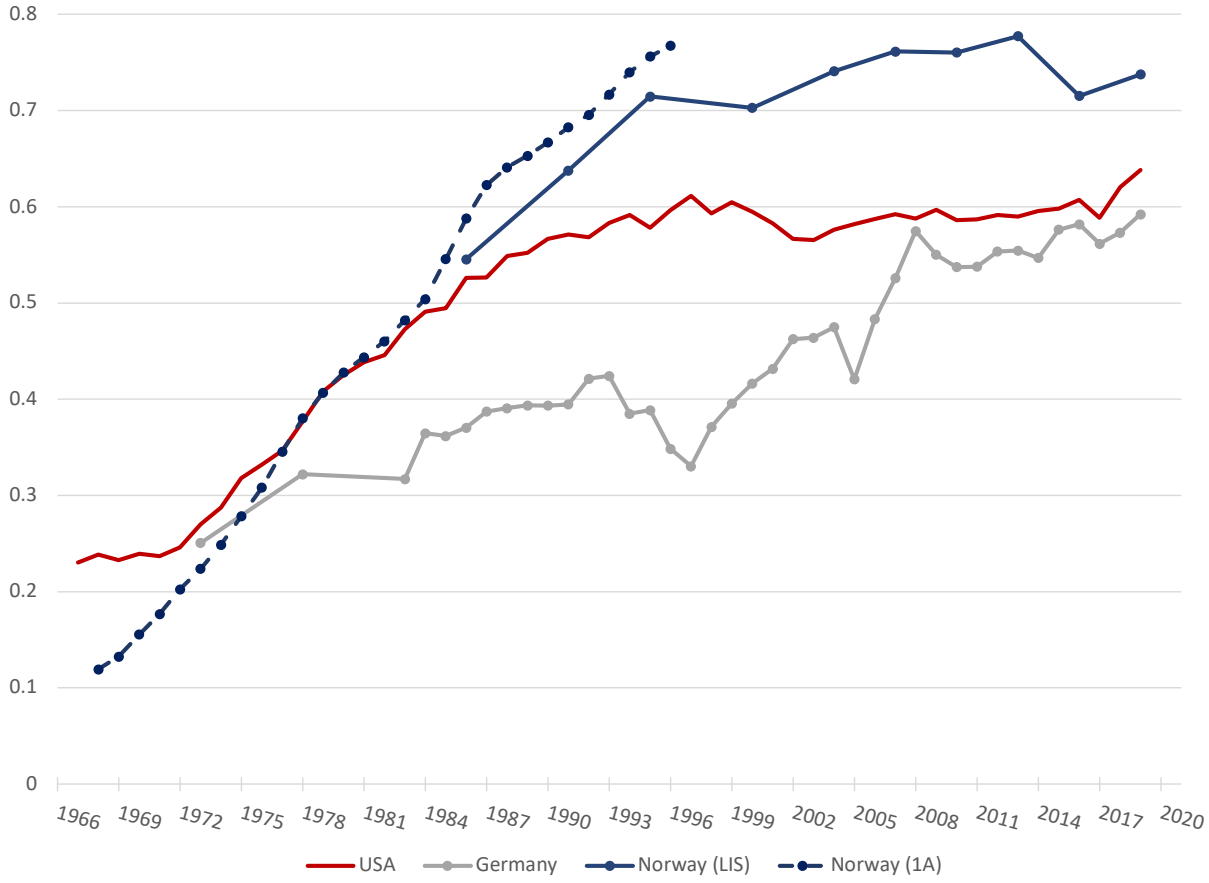

Figure 1: Trends in labor force participation of mothers of preschool children, select countries.

Notes: The solid lines for Germany, the US and Norway show the employment to population ratio for mothers aged 25-54 who have children in preschool age. Data source: Luxembourg Study of Income Dynamics. The series Norway (1A), the dashed line, is the share of working women among mothers of 5 year old children. Work is defined as having earnings higher than threshold $1A$. Data Source: Norway tax administrative records.

come.[1] Parental time inputs and mother's income are omitted variables in this regression. Therefore, the estimated degree of intergenerational persistence will depend on how these omitted variables co-vary with father's income.

To understand the role of mother's entry into the labor force, we consider two regimes: in the first regime, mothers do not supply any labor at all, and devote all their time to child-rearing; in the second, mother's labor supply depends on their own wage, on their productivity in child-rearing, and on husband's income. We then compare the estimated regression coefficients under these two regimes.

We find that the estimated degree of intergenerational persistence can either rise or fall as mothers enter the labor force. The sign of the effect depends on three factors: a) the degree of assortative mating in the economy, as well as its *nature* – namely, whether high income men sort with women with high productivity in the labor market or in child-rearing; b) the nature of the child human capital production function, and specifically the relative importance of time versus money inputs; and c) the selection of mothers into the labor force, which is a function of the wage and income elasticity of labor supply.

To give intuition on how these mechanisms operate, consider an economy in which men and women sort themselves in the marriage market based on their productivity in the labor market, and that money inputs matter more than time inputs in the production of child human capital. The effect of mothers' entry into the labor force on intergenerational persistence depends on whether working women are positively or negatively selected. Specifically, if the entry of mothers into the labor force is driven primarily by women drawn from the upper part of the skill distribution, the increase in resources will be concentrated among children of high income fathers, leading to an increase in intergenerational persistence; but if selection has the opposite sign, monetary resources will increase more for children in the bottom part of the distribution, making them more likely to catch up with their more affluent peers. The conclusion is opposite if time inputs matter more than money inputs: in the case of positive selection, mothers' entry into the labor force affects primarily the time

[1]The choice to use father's income (as opposed to family income) as the right hand side variable is motivated in part by analytical convenience, but also by the fact that many estimates in the literature, and especially those that involve comparisons across countries or over time, have father's income as the measure of parental socioeconomic status.

devoted to the children of affluent parents, leading to less persistence; negative selection, on the other hand, *favors* the relatively well-off, and raises persistence.

We apply this model to the analysis of intergenerational mobility and mothers' labor force participation in Norway, for cohorts born between the early 1960s and the late 1980s, who, at age 5, experienced an increase in mother's labor force participation from barely above 10% to more than 70%. The Norwegian registry data covers the entire population and allows one to link children and parents and calculate measures of intergenerational persistence and mothers' work behavior during childhood for a period of almost 30 years.

Using this data we document a U-shaped pattern of mothers' selection into the labor force. For children in the earlier cohorts, there was almost zero correlation (or at most a mildly positive one) between mothers' labor force participation and husband's income, by the cohorts born in the mid-1970s, the correlation had become clearly negative, with working mothers being married mostly to low income men. By the early 1980s the correlation had flipped sign (i.e. working mothers are mostly married to high income men) and has been on an upward trend ever since. At the same time, the father-son and father-daughter intergenerational elasticity (the coefficient in a regression of log child's income on log father's income) declined substantially from the 1960s to the 1980s cohorts.

Interpreting these trends in light of our model, we infer that money inputs are more important than time inputs in the production of child human capital – with negative selection of mothers into the labor force, a decrease in intergenerational persistence occurs because the increase in material resources available to children from lower income families outweighs the relative loss in maternal time inputs. A decomposition of the change in IGE from the early to the later cohorts in our sample, reveals that this *labor supply* effects is the main driver of the declining IGE across these cohorts. The selection effect reinforces the labor supply effect in the early period, but operates in the opposite direction in the latter period. Without the increased positive selection of working women in the late 1970s and 1980s, the IGE would have declined even more.

We then explore the relationship between female labor force participation and intergenerational elasticity at a more disaggregated level. We group 3-year birth cohorts at the county level, and calculate mothers' labor force participation rate and IGE estimates for

each county-cohort cell. We find a negative association between the father-son IGE and female labor force participation in this county-cohort panel, once we control for county and cohort fixed effects. We also document that, at the individual level, the relationship between son's income and father's income is weaker in families in which the mother worked when the son was a young child. We caution against attributing a causal interpretation to these associations, given the obvious concerns about omitted variable bias and endogenous female labor force participation. In ongoing work, we investigate more in depth the causal link from mothers' work to the IGE by exploiting plausibly exogenous shocks to women's labor force participation.

The rest of the paper is structured as follows. Section 2 reviews the existing literature. Section 3 presents our statistical model showing how the estimated intergenerational elasticity is affected by mothers' entry into the labor force. Section 4 presents our data. Section 5 describes the main trends in the selection of women into the labor force, and intergenerational elasticity. Section 6 interprets these trends in light of our statistical model. Section 7 proposes some possible avenues for establishing more convincingly a causal link between female labor force participation and interegenerational mobility. Section 8 concludes.

2 Literature

This paper is related to both the theoretical and empirical literature on intergenerational mobility (see Solon (1999), Black and Devereux (2011) and Mogstad and Torsvik (2023) for comprehensive reviews of the literature). On the theoretical side, a vast literature has characterized the transmission of economic status across generations as a process that depends on parents' investment in their children's human capital (Becker and Tomes, 1979, 1986). Extensions to this model have allowed for multiple skills (Cunha and Heckman, 2007) and multiple periods of child investment (Cunha and Heckman, 2007; Lee and Seshadri, 2019). However, all of these models adopt the unitary household assumption for the parents' generation. Our contribution is to model distinctly the role of mothers and fathers.

Within this literature, some papers have tried to estimate directly the production function of children's human capital. Cunha et al. (2010) estimate the technology of skill formation

in a life-cycle model with both cognitive and non-cognitive skill. They focus in particular on the dynamic complementarities between investment in one period and the stock of skills in that period, but do not distinguish between money and time investments.

Others have looked directly at the productivity of time investments. Del Boca et al. (2014) estimate a model in which both fathers and mothers provide both time and money inputs in the child quality production process. They find that parental time inputs are important, while money expenditures play a lesser role in producing child quality. On the other hand, Caucutt et al. (2020) estimate a dynamic demand system in which the skill production technology depends on several inputs (parental time, household investment, and market-based child care services), whose relative productivity depends on parental human capital. They find a moderately strong complementarity between home investments and child care inputs, but little evidence that parental education affects the productivity of investment inputs. Differences in observed investment by parental education derive from differences in resources and preferences, not productivity. Agostinelli and Sorrenti (2021) estimate the effect of EITC expansions on child development and find evidence of both an income effect (more resources improve child outcomes) and a substitution effect (less time spent by the mother in child care lowers child outcomes).[2]

Several studies have used changes in government policies to shed light on the role of maternal time and resources on child outcomes. An early review by Currie (2001) focused on early childhood education programs such as Head Start, and concluded that these programs can foster child development, especially among children who suffer from inadequate parental investments, in time or money, early in life. Many of these studies conclude that the quality of alternative child care arrangements is a key factor mediating the relationship between mother's work and child development, especially for low-SES women (Albanesi et al., 2023).

Some of these studies have focused specifically on the Norwegian context. Carneiro et al. (2015) investigate children's long-run outcomes following the introduction of 18 weeks'

[2]There is also a large literature aimed at studying directly the effect of maternal employment on child outcomes. Waldfogel (2002) andBrooks-Gunn et al. (2002) find that maternal employment in the first year of life is associated with lower cognitive development, while Waldfogel et al. (2002) also finds adverse effects of first-year employment, but some positive effects for second and third-year employment. Bernal (2008) estimates a structural model of employment and child care decisions and finds that maternal employment has a negative effect on children's cognitive outcomes.

paid maternity leave in Norway in 1977, and the extension of unpaid job-protected leave from 12 to 52 weeks. They find substantial gains in educational attainment and labor market outcomes among children affected by this policy. Importantly, these effects can be attributed exclusively to an increase in parental time, because paid maternity leave had a 100% replacement ratio, and therefore did not affect mothers' disposable income. Norway also expanded subsidized childcare in 1975. Havnes and Mogstad (2011) find that this reform had strong positive effects on children's educational attainment and labor force participation, with those with low-educated mothers benefiting the most. Havnes and Mogstad (2015) look at the effect of this reform on adult earnings using quantile regressions, and find that the effects were large and positive in the lower and middle parts of the earnings distribution, but turned negative in the upper part. They conclude that the expansion of universal child care substantially increased intergenerational income mobility.

By highlighting the role of the marriage market in the transmission of economic status, the paper is also related to the literature on assortative mating and inequality (Mare, 1991; Fernández and Rogerson, 2001; Greenwood et al., 2014; Eika et al., 2019).

Our paper is most closely related to recent work by Branden et al. (2023), who compare trends in intergenerational persistence (measured as rank-rank associations) between Sweden and the United States. They document different patterns in father-child and mother-child associations, and, similar to our work, also highlight the role of the association between fathers' and mothers' income in shaping intergenerational transmissions.

3 Model

We present here a simple statistical model that shows how the estimated intergenerational elasticity changes as women enter the labor force. The model highlights the role of assortative mating and selection of women into the labor force in shaping the intergenerational elasticity.

3.1 Underlying equations

We assume that men and women are endowed with a unit of time. We consider two states of the world: one in which mothers cannot work, and one in which they can. In *regime* 0,

women spend all their time in childrearing; in regime 1, women can split their time they split their time between childrearing (h) and working ($1-h$). Labor earnings per unit of time are denoted w, and the productivity of women's time in childrearing is denoted q. Men supply 1 unit of labor inelastically, so their earnings are $y_m = w$. Women's earnings are $y_f = (1-h)w$. Productivity in work and childrearing in the child generation (w', q', respectively) are a function of father's income, mother's income, and mother's time inputs in childrearing (qh). The allocation of women's time in the child generation is a function of her labor productivity, her productivity in childrearing, and her husband's income (y'_m).

In regime 0, in which mothers cannot work, the following equations determine w', q', and $1-h'$. All coefficients are positive in theory.

$$w' = \eta_0 + \eta_y y_m + \eta_q q + e \tag{1}$$

$$q' = \beta_0 + \beta_y y_m + \beta_q q + v \tag{2}$$

$$1 - h' = \alpha_0 + \alpha_w w' - \alpha_q q' - \alpha_y y'_m + u \tag{3}$$

The coefficients in the first two equations are all positive, reflecting the fact that productivity in the children's generation depends positively on parental inputs. The coefficients in the third equation are also assumed to be weakly positive – in other words, we assume that the labor supply function in the children's generation is not backward-bending.

In the world in which mothers can work, the following equations determine w', q', and $1-h'$. Again, all coefficients are positive.

$$w' = \eta_0 + \eta_y y_m + \eta_w w(1-h) + \eta_q qh + e \tag{4}$$

$$q' = \beta_0 + \beta_y y_m + \beta_w w(1-h) + \beta_q qh + v \tag{5}$$

$$1 - h' = \alpha_0 + \alpha_w w' - \alpha_q q' - \alpha_y y'_m + u \tag{6}$$

This assumes that labor productivity is transmitted by the same process for sons and daughters. We can capture the gender wage gap by allowing the intercept to differ for sons and daughters, which will not change anything that follows.

3.2 Intergenerational Elasticities

The father-son intergenerational elasticity (IGE) is the coefficient from a regression of y'_m on y_m:

$$IGE^S = \frac{Cov(y_m, y'_m)}{V(y_m)}$$

Similarly, the father-daughter IGE is the coefficient from a regression of y'_f on y_m:

$$IGE^D = \frac{Cov(y_m, y'_f)}{V(y_m)}$$

We derive these coefficients using the Bohrnstedt and Goldberger (1969) approximation for covariances of products of random variables. We assume that errors are uncorrelated with y_m and q.

3.2.1 Father-son IGE

When mothers fully specialize in childrearing, the father-son IGE simplifies to:

$$IGE_0^S = \eta_y + \eta_q \frac{Cov(y_m, q)}{V(y_m)} \tag{7}$$

The first term (η_y) represents the direct effect of fathers on their sons' earnings. The second term ($\eta_q \frac{Cov(y_m,q)}{V(y_m)}$) is a product of assortative mating. This will be positive if high-income fathers tend to marry women who are more productive in childrearing. This provides a relative advantage to the sons of high-income fathers, which tends to raise the IGE.

When mothers are able to work for pay, the father-son IGE becomes:

$$IGE_1^S = IGE_0^S + E[1-h] \underbrace{\left(\eta_w \frac{Cov(y_m, w)}{V(y_m)} - \eta_q \frac{Cov(y_m, q)}{V(y_m)} \right)}_{\text{A}} + \underbrace{\frac{Cov(y_m, 1-h)}{V(y_m)} \Big(\eta_w E[w] - \eta_q E[q] \Big)}_{\text{B}} \tag{8}$$

The change in the father-son IGE when mothers are able to work consists of two terms. The first term ("A") depends on the relative assortativeness between father's income and mother's labor productivity versus father's income and mother's childrearing productivity. Positive assortative mating tends to augment the father-son IGE. If there is a stronger

correlation between father's and mother's labor productivity than there is between father's labor productivity and mother's childrearing productivity, then this "assortative mating" effect will be augmented by the entry of mothers into the labor market. Otherwise, this shift will tend to lower the father-son IGE.

The second term ("B") is an interaction between the selection of mothers into the labor force and the relative importance of mother's money and time inputs for their children's human capital. To understand the intuition, consider the following example. Suppose $Cov(y_m, 1-h) < 0$, or women married to high-income men tend to supply less labor to the market. In other words, there is negative selection of mothers into labor force participation. The entire term B will be positive if the return to mothers' time investments (η_q) is sufficiently large compared to the return to mother's money investments. The intuition is straightforward. If time investments do more to increase children's human capital, this gives a relative advantage to the children of mothers who spend more time at home. Negative selection into labor force participation means that the children of high-income fathers are disproportionately getting this advantage. Anything that boosts the earnings of sons of high-income fathers tends to raise the IGE.

3.2.2 Father-daughter IGE

We assume that we only observe daughters in the regime in which women can work. Unlike sons, daughter's income depends on both labor productivity and labor supply. We can write the father-daughter IGE in the following way:

$$IGE^D = \frac{Cov(w'(1-h'), y_m)}{V(y_m)} = E[1-h'] \underbrace{\frac{Cov(w', y_m)}{V(y_m)}}_{\text{father-son IGE}} + E[w'] \underbrace{\frac{Cov(1-h', y_m)}{V(y_m)}}_{C^{1-h}} \quad (9)$$

In other words, the father-daughter IGE depends on the elasticity of daughters' *potential* earnings with respect to father's income (which is the exactly the same as the father-son IGE) and the elasticity of daughter's labor supply with respect to father's earnings. We are using C^{1-h} to denote the coefficient from a regression of daughter's labor supply on father's income.

When mothers cannot work, we can write C^{1-h} in the following way, using the equations that determine $1-h'$, w' and q'.

$$C_0^{1-h} = \underbrace{\alpha_w \eta_y - \alpha_q \beta_y}_{\text{A}} + \underbrace{(\alpha_w \eta_q - \alpha_q \beta_q) \frac{Cov(q, y_m)}{V(y_m}}_{\text{B}} + \underbrace{(-\alpha_y) \frac{Cov(y'_m, y_m)}{V(y_m)}}_{\text{C}} \tag{10}$$

Term A captures the direct effect of fathers on daughters' labor supply. Note that the sign is ambiguous. Fathers raise their daughters' labor productivity, which tends to increase labor supply. However, they also raise their daughters' childrearing productivity, which tends to reduce labor supply.

Term B captures the effect of sorting in the parent generation. High-income men tend to be married to women who are more productive in childrearing. If having a productive mother has a net positive effect on daughter's labor supply, this entire term will be positive, implying that daughters of high-income men supply more labor.

Term C captures sorting in the child generation. This term is negative so long as daughters of high-income fathers tend to have high-income husbands, and there is a negative family income effect on women's labor supply.

When mothers can work, C^{1-h} changes in a way that depends on three factors: (i) the nature of sorting in the marriage market; (ii) whether or not mother's childrearing time confers a comparative advantage in working or mothering to their daughters; (iii) selection of mothers into the labor market.

We can write C_1^{1-h} as the sum of C_0^{1-h} and two additional terms. The first term is:

$$E[1-h]\left((\alpha_w \eta_w - \alpha_q \beta_w) \frac{Cov(y_m, w)}{V(y_m)} - (\alpha_w \eta_q - \alpha_q \beta_q) \frac{Cov(y_m, q)}{V(y_m)} \right) \tag{11}$$

Suppose there is more sorting on labor productivity than childrearing productivity. Then, the "sorting effect" on C^{1-h} is augmented by the shift toward women's labor supply. Whether or not sorting in the parent generation tends to raise or lower C^{1-h} depends on the net effect of maternal inputs on daughter's labor supply.

The second term is:

$$\Big((\alpha_w\eta_w - \alpha_q\beta_w)E[w] - (\alpha_w\eta_q - \alpha_q\beta_q)E[q]\Big)\frac{Cov(y_m,(1-h))}{V(y_m)} \tag{12}$$

Note that $\alpha_w\eta_w - \alpha_q\beta_w$ is the net effect of mother's income on daughter's labor supply, and $\alpha_w\eta_q - \alpha_q\beta_q$ is the net effect of mother's childrearing time on daughter's labor supply. The following example will clarify what this term means.

Suppose there is negative selection into mother's labor supply so $\frac{Cov(y_m,1-h)}{V(y_m)} < 0$. And, suppose mother's income has a larger positive (or smaller negative) effect on daughter's labor supply than mother's time spent in childrearing (so $\alpha_w\eta_2 - \alpha_q\beta_w > \alpha_w\eta_q - \alpha_q\beta_q$). Then, this whole term will be negative. Daughters whose mothers work will be more likely to work themselves. Because of negative selection into mother's labor force participation, these daughters tend to have lower-income fathers. This tends to lower C^{1-h}.

4 Data

We use full-count Norwegian administrative data that covers the entire resident population, obtained from Statistics Norway. The data set for the baseline analysis is based on two main data sources. First, the population registry gives demographic characteristics (age, sex, parent-child relationships, residence status, municipality of residence and whether an individual has an immigrant background) for all years from 1964 to 2022. The population registry is a "snapshot" of the population database at the beginning or end of each calendar year. We count an individual as resident in a given year if she is resident both at the beginning and end of the year. We restrict the sample to non-immigrants: only individuals born in Norway with both parents also born in Norway are included.

Second, income is obtained from annual tax records. These are linked to the population registries at the individual level using personal identifiers. The variable that we use is *pensjonsgivende inntekt*, pension-granting income, which includes labor income, income from self-employment and taxable benefits, but not capital income. Income is counted for a full calendar year, and is available annually from 1967 to 2021. We adjust incomes by the

consumer price index. We follow the convention often used in Norwegian administrative data (see e.g. Havnes and Mogstad, 2011) and count an individual as working (in the labor force) if income in a given year is higher than G, the fundamental unit of the Norwegian social insurance system.[3]

We supplement our baseline data set with information from the 1970 and 1980 censuses, from the education registry and from a data set on childcare coverage, all from Statistics Norway. These will be further described when introduced to the analysis.

The fundamental unit of analysis is a father-mother-child triple, with observations at two separate time intervals: one where the child is young and the parents at working age, and one when the child is at working age. There are a number of trade-offs with respect to the number of years over which individuals are measured, at which age, and the length of time for which we can get comparable estimates. We average incomes over three years to smooth out some short-term variation in incomes and get closer to a permanent income concept. We observe parents' incomes as the average income for each of the years when the child is four, five and six years old, and children's incomes as an average for the years in which they are 29, 30 and 31 years old. In this way, the first observation is for the 1963 cohort (whose parents' incomes are observed 1967-1969 when they are 4-6 years old) and the last observation is for the 1990 cohort (whose own incomes are observed in 2019-2021 when they are 29-31 years old).

Intergenerational persistence is estimated using the equation

$$y_i = \alpha + \beta x_i + Z_i\gamma + \epsilon_i \tag{13}$$

where β is the parameter of interest. y_i is a function of the child's income when adult and x_i is a function of parent's income when the child is young. In the traditional intergenerational elasticity framework, the function is typically log, $y_i = \log(\text{child's income})$, but we will use different functional forms depending on context, as detailed below. Z_i is a vector of dummy variables for child's birth year when more than one cohort is included in the estimation.

[3]The amount is adjusted annually, and equal to NOK 5,400 in 1967 and NOK 104,716 in 2021.

5 Trends

5.1 Female labor force participation

The series Norway (1G) in Figure **??** shows the development of female labor force participation in Norway among mothers of 5-year-olds between 1968 and 1996. We see a substantial increase in participation in the labor market over the time period, measured as having income above our threshold. In 1968, only 12 per cent of mothers had substantial labor market income, compared to 43 per cent in 1980, 67 per cent in 1990 and 77 per cent in 1996. There is also a general increase in labor force participation among all women in Norway over the same period, but as participation was much higher among non-mothers than mothers in 1970, the changes amounts to a convergence where mothers and non-mothers become more similar in their labor market behaviour.

Figure 2 shows how mothers' labor force participation co-varies with the income of the father of their child, as measured by a regression of mother's labor market outcome (income above threshold) on father's income level. The association is around zero in the early period, decreasing until the late 1970s where higher father's income is associated with lower mothers' labor force participation. Around 1980, the trend starts to go in the other direction, and by the 1990s there is a positive association.

If we instead examine the association between mothers' and fathers' log income levels, we see a similar picture, with a positive or near-zero association around 1970, followed by a negative association in the late 1970s and a positive association in the 1990s.[Figure to be added]

5.2 Intergenerational elasticities

We now move to the trends in intergenerational elasticities, as calculated by the regression equation (13). There is a substantial decrease in the intergenerational elasticity between the cohorts born in the early 1960s and the cohorts born in the early 1980s, corresponding to an increase in intergenerational mobility. Figure 3 shows the development over time for the father-son elasticities. We pool three cohorts when running the regressions, controlling

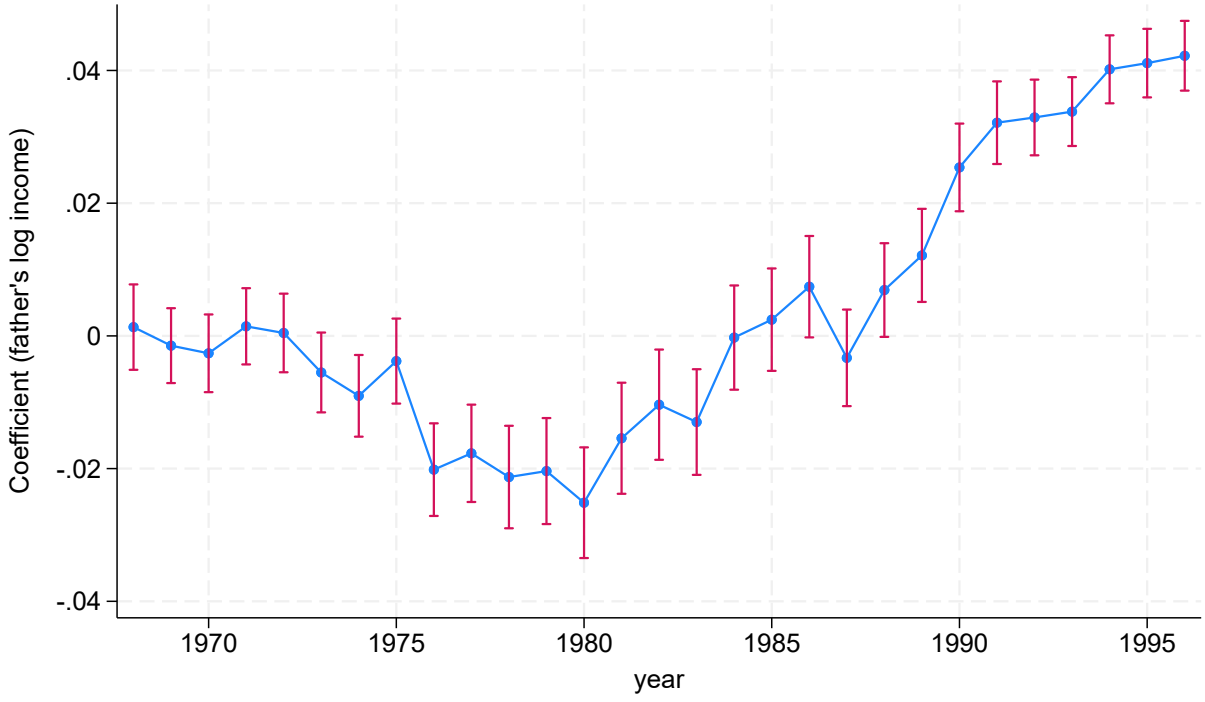

Figure 2: Association between father's income and mother's LFP. Note: Figure shows coefficient from regression with mother's LFP as outcome variable and log father's income as independent variable

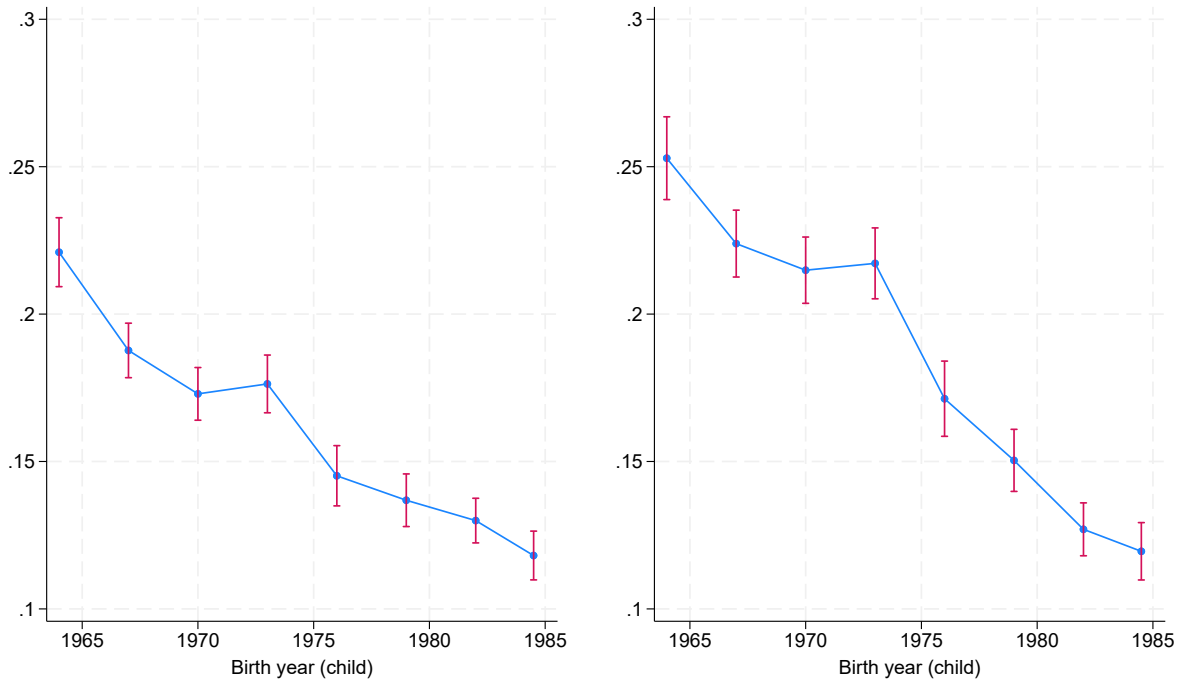

Figure 3: IGE, father-son. Note: Both panels have father's income (dependent variable) as log(3-year average income). The left panel has child's income as log(3-year average income). The right panel has child's income as log(3-year average income + one per cent of that year's mean of 3-year average income).

for birth year. The conventional estimation, using log income for parents and children, are shown in the left panel. In the right panel, in order to include the entire population in the childrens' generation, we adjust income up by 1 per cent of the population mean, giving a low value to those with zero incomes, before running the regression. [4]

Figure 4 shows the father-daughter intergenerational elasticity over the same period. Again, there is a substantial decrease in elasticity, that is, increased intergenerational mobility. We see from the right panel that accounting for the extensive margin by including daughters with zero income does not change the downward-sloping trend in persistence, but increases the levels during the early period.

We see from these trends (as well as various robustness checks, to be added in an appendix) that the massive increase in female LFP has co-incided with an increase in inter-

[4]We experimented with a range of different specifications to include the extensive margin of children's income. Regardless of the treatment of zeros, the pattern of a strong downward trend in the IGE is very robust.

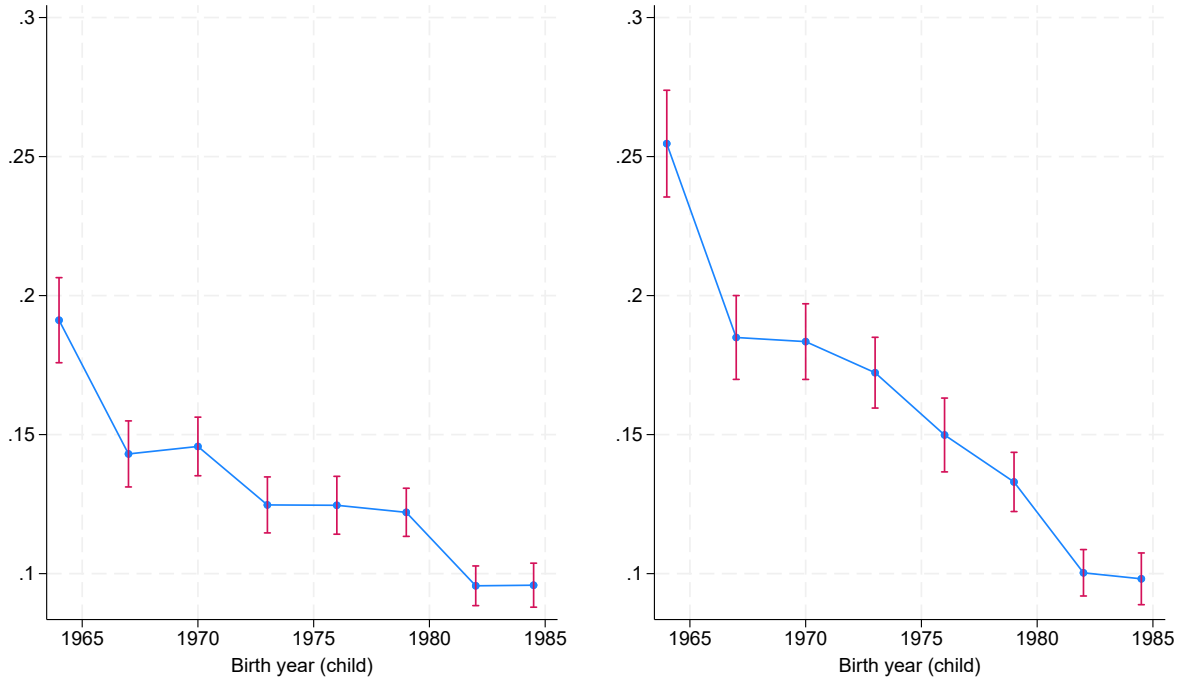

Figure 4: IGE, father-daughter. Note: Both panels have father's income (dependent variable) as log(3-year average income). The left panel has child's income as log(3-year average income). The right panel has child's income as log(3-year average income + one per cent of that year's mean of 3-year average income).

generational mobility. The association between fathers' and mothers' income, however, have exhibited an U-shape over the same period. In the next section we will interpret these changes through the lens of the model presented in Section 3.

6 Interpreting the trends

6.1 Father-Son IGE

We now aim to interpret the trends in the IGE in terms of the model described in Section 3. To simplify things, we make the relatively innocuous assumption that labour market productivity and childrearing productivity have the same mean, so $E[w] = E[q]$. We also normalize this mean to be equal to 1. Finally, we adopt the notation $\phi_x = \frac{Cov(y_m,x)}{V(y_m)}$, for $x = w, q$. Then, we can re-write equation (8) in the following way:

$$\begin{aligned}
\Delta IGE^S &= E[1-h]\left(\eta_w\phi_w - \eta_q\phi_q \pm \eta_q\phi_w\right) + \frac{Cov(y_m, 1-h)}{V(y_m)}(\eta_w - \eta_q)E[w] \\
&= E[1-h]\eta_q\left(\phi_w - \phi_q\right) + \\
&\quad + (\eta_w - \eta_q)\left(E[1-h]\phi_w + E[w]\frac{Cov(y_m, 1-h)}{V(y_m)}\right) \\
&= E[1-h]\eta_q\left(\phi_w - \phi_q\right) + (\eta_w - \eta_q)\frac{Cov(y_m, w(1-h))}{V(y_m)}
\end{aligned}$$

The expression above describes the change in the IGE between any period and the "regime 0" period, in which women do not work. But we can use the above to easily derive an expression for the difference in the IGE between any two periods:

$$\Delta IGE^S = \Delta E[1-h]\eta_q\left(\phi_w - \phi_q\right) + (\eta_w - \eta_q)\Delta\frac{Cov(y_m, w(1-h))}{V(y_m)}$$

In other words, we can decompose the change in the IGE into the sum of two terms: the first term depends on the change in female labor supply ($\Delta E(1-h)$) and on the difference between assortativeness on the labor market and childrearing dimensions, scaled by η_q,

$(\eta_q(\phi_w - \phi_q))$; the second term depends on the change in the covariance between husbands' income and wives' income ($\Delta Cov(y_m, w(1-h))$) and on the relative productivity of money and time inputs in the production of child human capital $(\eta_w - \eta_q)$.

We label the first term a *labor supply effect*: an increase in female labor participation is associated with an increase in the IGE if marriage assortativeness is primarily based on women's labor market productivity, as high income men are more likely to be married to high-wage women, thus exacerbating the difference in resources available to the next generation; but it is associated with a decrease in the IGE if assortativeness is primarily based on childrearing productivity – the decline in time inputs of wives married to high income men narrows the gap for the next generation.

The second term is instead a *selection* effect. If working women become more positively selected ($\Delta Cov(y_m, w(1-h)) > 0$), then the IGE increases if money inputs matter more than time inputs ($\eta_w > \eta_q$), and decreases if time inputs matter more. The effect of the relative importance of time and money inputs is instead reversed in periods in which women become more negatively selected.

We can operationalize this expression by splitting the sample into two periods. The first period, encompassing cohorts born between 1963 and 1975, is characterized by a sharp fall in the IGE, a steady increase in female labor supply, and a decrease in the covariance between wives' and husbands' income (i.e., increased negative selection of working mothers). The second period (cohorts born from 1975 onwards) features the same steady increase in labor supply, a somewhat more moderate decline in the IGE, and a change in the pattern of selectivity of working mothers (see Table 1, Panels A and B).

We can then write the following system of equations, in matrix form:

$$\begin{bmatrix} \Delta IGE_{1975-1963} \\ \Delta IGE_{1990-1975} \end{bmatrix} = \begin{bmatrix} \Delta LFP_{1975-1963} & \Delta SEL_{1975-1963} \\ \Delta LFP_{1990-1975} & \Delta SEL_{1990-1975} \end{bmatrix} \begin{bmatrix} (\phi_w - \phi_q) \\ (\eta_3 - \eta_2) \end{bmatrix}$$

It is then straightforward to solve this system for the unknown parameters, $(\phi_w - \phi_q)$ and $(\eta_w - \eta_q)$. The resulting estimates are presented in panel C of Table 1.

The results indicate that assortativeness is primarily based on childrearing productivity, consistent with the literature on specialization in the household (Becker, 1993). In addition,

Panel A

	IGE	LFP	SEL
1963	0.236	0.119	-0.049
1975	0.146	0.428	-0.142
1990	0.084	0.756	0.203

Panel B

	ΔIGE	ΔLFP	ΔSEL
1963-1975	-0.090	0.308	-0.093
1975-1990	-0.062	0.329	0.345

Panel C

$\phi_w - \phi_q$	-0.270
	(0.040)
$\eta_2 - \eta_3$	0.076
	(0.063)

Panel D

	Share of ΔIGE accounted by:	
	Labor supply effect	Selection effect
1963-1975	-0.083	-0.007
1975-1990	-0.089	0.026

Table 1: IGE, LFP, selection and implied model parameters

money inputs appear to be more important than time inputs in the production of human capital. Moreover most of the decline in the IGE is explained by the labor supply effect. The selection effect reinforces the labor supply effect in the early period, but operates in the opposite direction in the latter period. Without the increased positive selection of working women in the late 1970s and 1980s, the IGE would have declined even more.

7 Micro-level Evidence

In this section we explore ways to empirically assess the relationship between mothers' labor force participation and intergenerational mobility. This is work in progress and the results presented here should be regarded as provisional.

We begin by calculating intergenerational elasticities at a regional level, to exploit cross-county variation in the rate of mothers' LFP. We use the pre-1972 definition of the Norwegian counties, with 20 counties of varying population size. We run panel regressions of IGE in county c at time t on the rate of mothers' LFP. The results are shown in Table 2.

	(1) IGE 1967-69 cohort	(2) IGE 1975-77 cohort	(3) IGE 1982-84 cohort	(4) IGE All cohorts	(5) IGE All cohorts	(6) IGE All cohorts
FLFP	0.173	0.199	-0.0722	-0.0939***	0.0878**	-0.196**
	(0.275)	(0.150)	(0.116)	(0.0196)	(0.0397)	(0.0962)
Cohort dummies	No	No	No	No	Yes	Yes
County dummies	No	No	No	No	No	Yes
N	20	20	20	320	320	320

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Regressions of intergenerational elasticity on female LFP, across sub-national regions

Column (6) of the table shows the estimation from a model accounting for both county and cohort fixed effects. We see that higher female labor force participation is associated with lower intergenerational elasticities; that is: areas with higher female labor force participation have higher intergenerational mobility.

We continue by considering individual-level income regressions, where we control for mothers' labor force participation, and/or ways of exploiting differences in child-care coverage

or industrial composition across regions. This is work in progress and will be elaborated on in later revisions of this text.

8 Conclusion

[To be completed]

References

Agostinelli, Francesco and Sorrenti, Giuseppe (2021). "Money vs. time: family income, maternal labor supply, and child development,"Technical Report 273.

Albanesi, Stefania, Olivetti, Claudia, and Petrongolo, Barbara (2023). "Families, Labor Markets, and Policy," in Lundberg, Shelly and Voena, Alessandra eds. *Handbook of the Economics of the Family*, 1, 255–326: Elsevier.

Becker, Gary S (1993). *A treatise on the family: Enlarged edition*: Harvard university press.

Becker, Gary S. and Tomes, Nigel (1979). "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility," *Journal of Political Economy*, 87 (6), 1153–1189.

——— (1986). "Human Capital and the Rise and Fall of Families," *Journal of Labor Economics*, 4 (3), S1–S39.

Bernal, Raquel (2008). "The effect of maternal employment and child care on children's cognitive development," *International Economic Review*, 49 (4), 1173–1209.

Black, Sandra E. and Devereux, Paul J. (2011). "Recent Developments in Intergenerational Mobility," in Card, David and Ashenfelter, Orley eds. *Handbook of Labor Economics*, 4, 1487–1541: Elsevier, https://doi.org/10.1016/S0169-7218(11)02414-2.

Bohrnstedt, George W and Goldberger, Arthur S (1969). "On the exact covariance of products of random variables," *Journal of the American Statistical Association*, 64 (328), 1439–1442.

Branden, Gunnar, Nybom, Martin, and Vosters, Kelly (2023). "Like Mother, Like Child? The Rise of Women's Intergenerational Income Persistence in Sweden and the United States," *Working paper*.

Brooks-Gunn, Jeanne, Han, Wen-Jui, and Waldfogel, Jane (2002). "Maternal employment and child cognitive outcomes in the first three years of life: The NICHD study of early child care," *Child development*, 73 (4), 1052–1072.

Carneiro, Pedro, Løken, Katrine V, and Salvanes, Kjell G (2015). "A flying start? Maternity leave benefits and long-run outcomes of children," *Journal of Political Economy*, 123 (2), 365–412.

Caucutt, Elizabeth M, Lochner, Lance, Mullins, Joseph, and Park, Youngmin (2020). "Child skill production: Accounting for parental and market-based time and goods investments,"Technical report, National Bureau of Economic Research.

Cunha, Flavio and Heckman, James J. (2007). "The Technology of Skill Formation," *The American Economic Review*, 97 (2), 31–47.

Cunha, Flavio, Heckman, James J., and Schunnach, Lais (2010). "Estimating the Technology of Cognitive and Noncognitive Skill Formation," *Econometrica*, 78 (3), 883–931.

Currie, Janet (2001). "Early childhood education programs," *Journal of Economic perspectives*, 15 (2), 213–238.

Del Boca, Daniela, Flinn, Christopher, and Wiswall, Matthew (2014). "Household choices and child development," *Review of Economic Studies*, 81 (1), 137–185.

Eika, Lasse, Mogstad, Magne, and Zafar, Basit (2019). "Educational assortative mating and household income inequality," *Journal of Political Economy*, 127 (6), 2795–2835.

Fernández, Raquel and Rogerson, Richard (2001). "Sorting and long-run inequality," *The Quarterly Journal of Economics*, 116 (4), 1305–1341.

Goldin, Claudia (2006). "The quiet revolution that transformed women's employment, education, and family," *American Economic Review*, 96 (2), 1–21.

Greenwood, Jeremy, Guner, Nezih, Kocharkov, Georgi, and Santos, Cezar (2014). "Marry your like: Assortative mating and income inequality," *American Economic Review*, 104 (5), 348–353.

Havnes, Tarjei and Mogstad, Magne (2011). "No Child Left Behind: Subsidized Child Care and Children's Long-Run Outcomes," *American Economic Journal: Economic Policy*, 3 (2), 97–129.

——— (2015). "Is Universal Child Care Leveling the Playing Field?" *Journal of Public Economics*, 127, 100–114.

Lee, Sang Yoon and Seshadri, Ananth (2019). "On the intergenerational transmission of economic status," *Journal of Political Economy*, 127 (2), 855–921.

Mare, Robert D (1991). "Five decades of educational assortative mating," *American sociological review*, 15–32.

Mogstad, Magne and Torsvik, Gaute (2023). "Family background, neighborhoods, and intergenerational mobility," in Lundberg, Shelly and Voena, Alessandra eds. *Handbook of the Economics of the Family*, 1, 327–387: Elsevier.

Olivetti, Claudia and Petrongolo, Barbara (2016). "The evolution of gender gaps in industrialized countries," *Annual Review of Economics*, 8, 405–434.

Solon, Gary (1999). "Intergenerational Income Mobility," in Ashenfelter, Orley and Card, David eds. *Handbook of Labor Economics*, 3A, 1761–1800: North-Holland.

Waldfogel, Jane (2002). "Child care, women's employment, and child outcomes," *Journal of Population Economics*, 15, 527–548.

Waldfogel, Jane, Han, Wen-Jui, and Brooks-Gunn, Jeanne (2002). "The effects of early maternal employment on child cognitive development," *Demography*, 39 (2), 369–392.