ECON 340: Economics of the Family
TA Session 5

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Today

- Can Women Have Children and a Career? (AER 2017)
- IV Interlude

Motivation

- The child penalty: A key component of gender inequality
- In almost all labor markets, women with children work and earn less than women without children
- Estimating the causal impact of children is hard. Why?

Motivation

- The child penalty: A key component of gender inequality
- In almost all labor markets, women with children work and earn less than women without children
- Estimating the causal impact of children is hard. Why?
  - Fertility choices are endogenous
- Causation: having children has adverse labor market consequences for women
- Adverse selection: women with children work and earn less, regardless of having children

Motivation

- Identifying the labor market effects of having children (the extensive fertility margin), as opposed to the labor market effects of having additional children among women who already have children (the intensive fertility margin), is very difficult
- Why does this matter? Most family policies (e.g., parental leave, childcare subsidies) are intended to support women with children
- But the effect of these policies may be different if the selection is adverse

Today's Paper

Lundborg, Plug & Rasmussen (2017). *Can Women Have Children and a Career? IV Evidence from IVF Treatments. American Economic Review*, 107(6):1611–37.

- **Question:** What is the *causal* effect of having (a first) child on women's earnings and careers?
- **Approach:** Use **IVF treatment success at first treatment** as an instrument for fertility among *childless* women in Denmark.
- **Why new?** Identifies effects at the **extensive margin** (becoming a mother) rather than adding an extra child.

Literature Before This

- Twins at first birth (Rosenzweig and Wolpin 1980; Jacobsen, Pearce, and Rosenbloom 1999; and Vere 2011)
  - Mothers with twins work less than mothers with singletons, but eventually catch up
- Sex composition of first two children with preferences for mixed gender composition (Angrist and Evans 1998; Iacovou 2001; Cruces and Galiani 2007)
  - Mothers with two kids of the same sex work less, because they are likely to have a third child
- Useful experiments but only identify the intensive margin (additional child)
- But theoretically, the extensive margin is more important

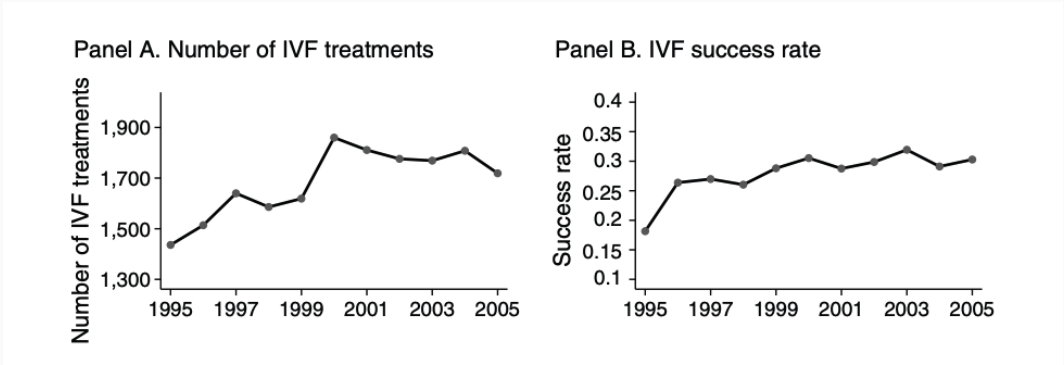
Setting & Data

- **Denmark:** Generous paid leave, subsidized childcare, job protections
- Parental leave compensation 70 - 90% of previous earnings for up to 32 weeks
- **IVF register:** Information on all IVF treatments taking place in public and private fertility clinics in Denmark.
- Mandatory reporting since 1994 up to 2005
- Highly detailed information about the causes of infertility, number of eggs collected, and treatment outcomes (pregnancy and live birth)
- Linked to labor market registers, **31,666** women and **96,807** IVF treatments (1991–2009)

IVF Treatment

- IVF is a medical procedure to help infertile couples conceive: last resort typically
- Danish National Health Care System entitles women with a referral to have three IVF treatments at no cost
- IVF treatment can fail at any stage of its 4-step process

IVF Treatment



- IVF usage increased until the year 2000, after which usage more or less stabilized.
- The IVF success rate per treatment increased substantially

Constructing the Instrument

- The Goal: exogenous shock in IVF-driven fertility
- Women can undergo multiple treatments - endogenous
  - Restrict to first IVF treatment
- Extensive margin decision
  - Focus on childless women
- Want the women to be as similar as possible
  - Focus on women who have successfully reached the fourth stage and had embryos implanted

Descriptive Stats

TABLE 1—DESCRIPTIVE STATISTICS OF SELECTED VARIABLES

	IVF failure (1)	IVF success (2)	Representative sample (3)	(2)–(1)	(2)–(3)
Pretreatment outcomes					
Age at first treatment	32.490	31.415	28.274	−1.075	3.141
	(4.445)	(3.886)	(4.297)	(0.069)	(0.060)
Year at first treatment	2,000.149	2,000.295	2,001.446	0.146	−1.151
	(3.121)	(3.069)	(4.069)	(0.050)	(0.056)
Annual earnings (1,000s DKK)	245.360	243.912	201.717	−1.448	42.195
	(143.366)	(131.741)	(136.384)	(2.268)	(1.906)
Schooling	12.820	12.843	12.548	0.023	0.295
	(2.359)	(2.294)	(2.325)	(0.038)	(0.033)
Partner earnings (1,000s DKK)	327.006	322.318	287.883	−4.688	34.436
	(209.665)	(191.939)	(185.995)	(3.464)	(2.722)
Partner schooling	12.678	12.673	12.547	−0.005	0.125
	(2.389)	(2.323)	(2.316)	(0.040)	(0.034)
Sickness benefits	0.170	0.169	0.143	−0.001	0.026
	(0.376)	(0.375)	(0.350)	(0.006)	(0.005)
Married	0.521	0.523	0.306	0.002	0.217
	(0.500)	(0.500)	(0.461)	(0.008)	(0.006)
Positive earnings	0.910	0.922	0.900	0.013	0.022
	(0.288)	(0.268)	(0.300)	(0.005)	(0.004)
Full-time employment[a]	0.934	0.934	0.780	0.000	0.154
	(0.248)	(0.249)	(0.414)	(0.004)	(0.006)

Descriptive Stats

Posttreatment outcomes					
Annual earnings (1,000s DKK)	241.815	211.525	178.907	−30.290	32.618
	(144.983)	(128.649)	(127.712)	(2.274)	(1.788)
Positive earnings	0.888	0.864	0.852	−0.024	0.011
	(0.267)	(0.282)	(0.349)	(0.004)	(0.005)
Log (hourly wages (DKK))[a]	5.314	5.294	5.255	−0.020	0.038
	(0.317)	(0.316)	(0.323)	(0.006)	(0.005)
Hours worked[a]	30.034	27.216	25.390	−2.818	1.826
	(26.823)	(21.634)	(7.655)	(0.483)	(0.151)
Observations	13,168	5,370	103,826		

Today

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IV Methodology

- What is an instrument?
  - Something that shifts our endogenous variable but does not directly affect our outcome variable
- Two key requirements:
  - Relevance: instrument must be correlated with the endogenous regressor
  - Exogeneity: instrument must not be correlated with the error term in the outcome equation
- In this setting, something that affects fertility but does not directly affect earnings or careers of women

- Structural equation:

$$Y_{it} = \gamma_t X_i + \delta_t F_{it} + \nu_{it}$$

- First-stage equation:

$$F_{it} = \alpha_t X_i + \beta_t Z_i + u_{it}$$

- Reduced-form equation:

$$Y_{it} = \sigma_t X_i + \pi_t Z_{it} + \nu_{it}$$

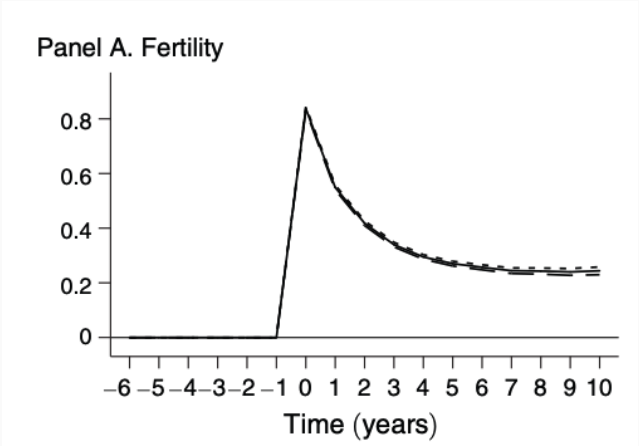
- Wald estimator: $\delta_t = \frac{\pi_t}{\beta_t}$

IVF as IV

δ_t is identified if:

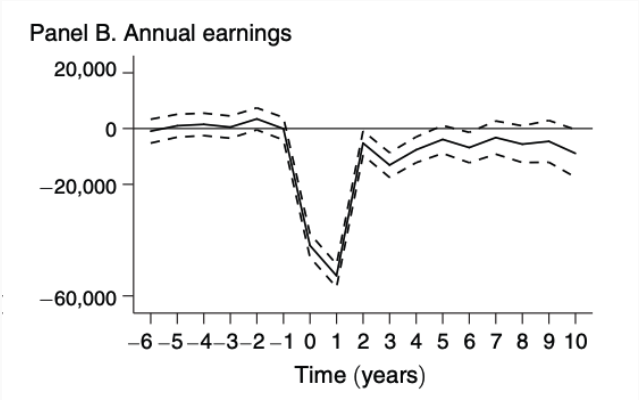
- Relevance: treatment success is correlated with fertility
- Exclusion: treatment success exclusively affects labor earnings through its first-stage impact on fertility

IVF as IV: First-Stage



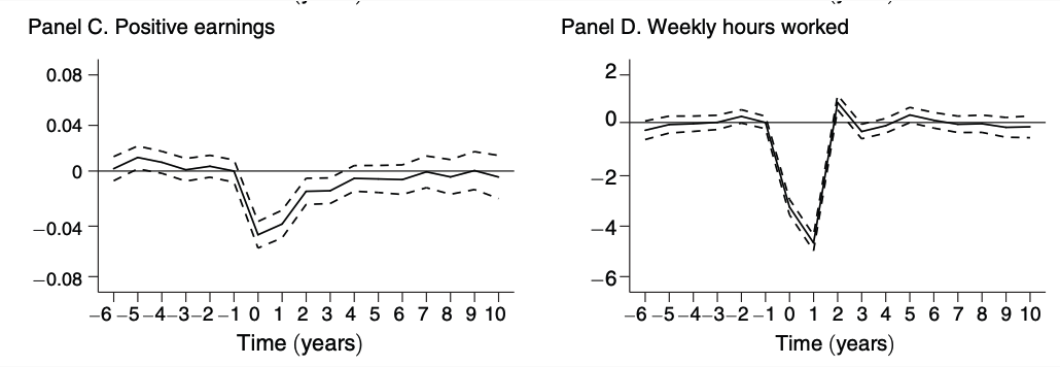
IVF success is strongly correlated with fertility

IVF as IV: Reduced Form



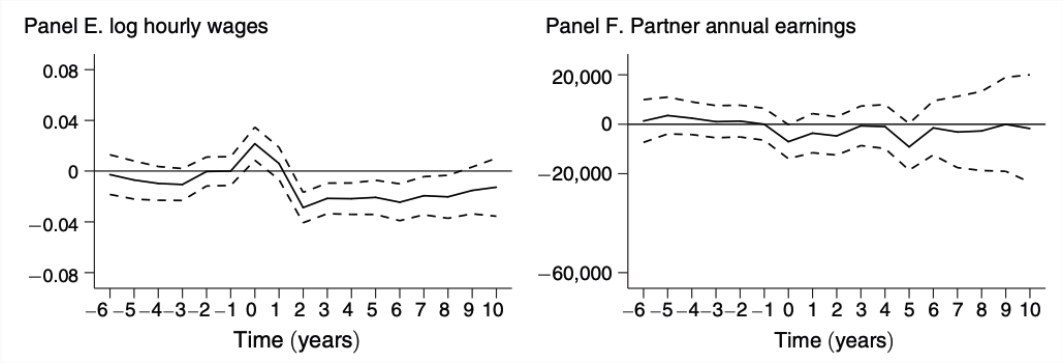
Women earn persistently less because of childbearing

IVF as IV: Hours Worked



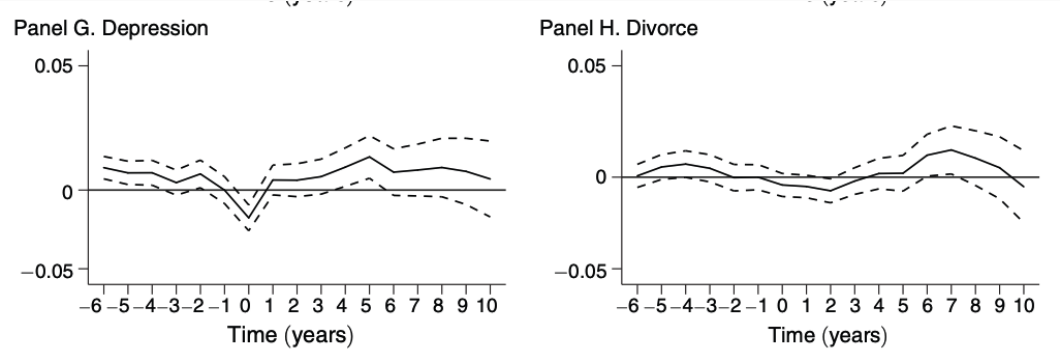
Women work less immediately after but eventually return

IVF as IV: Hourly Wages



No effect in first two years but persistent wage penalty thereafter; no effects on partner's earnings

IVF as IV: Ruling Out Other Channels



Little evidence of either divorce or depression effects

IV Estimation

TABLE 3—FERTILITY EFFECTS ON FEMALE LABOR MARKET OUTCOMES: RESULTS FROM INSTRUMENTAL VARIABLE REGRESSIONS

	Earnings (1)	Positive earnings (2)	Weekly hours (3)	Wages (4)
Panel A. Years 0–1				
Fertility	−70,088	−0.072	−5.911	4.244
	(2,054)	(0.006)	(0.190)	(3.235)
Percent impact	−31	−8	−21	2
Observations	18,538	18,538	14,022	14,022
Panel B. Years 2–5				
Fertility	−29,378	−0.041	1.473	−26.851
	(5,285)	(0.012)	(0.355)	(4.453)
Percent impact	−12	−5	5	−13
Observations	18,435	18,435	12,332	12,332
Panel C. Years 6–10				
Fertility	−30,675	−0.015	0.487	−25.301
	(10,546)	(0.022)	(0.634)	(8.801)
Percent impact	−11	−2	2	−12
Observations	13,779	13,779	9,627	9,627
Baseline mean	223,038	0.90	28.63	183.01
Pretreatment effect	874	0.010	0.519	−0.061
	(1,811)	(0.004)	(0.375)	(1.162)

Having children reduces earnings by DKK 70,000 in the short run, DKK 30,000 in the medium run, and DKK 30,000 in the long run

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Women work less because of children, but only when children are young

Significant, negative, and large effects in the medium and long run

Why do women earn less?

Why do women earn less?

TABLE 4—FERTILITY EFFECTS ON JOB CHANGES AND JOB CHARACTERISTICS: RESULTS FROM INSTRUMENTAL VARIABLE REGRESSIONS

	Occ. change (1)	Firm change (2)	Occ. earnings (3)	Occ. (log) wages (4)	Occ. hours (5)	Firm earnings (6)	Firm (log) wages (7)	Firm hours (8)	Firm gender ratio (9)	Public sector (10)	Distance (in km) (11)
Panel A. Years 0–1											
Fertility	0.017	0.040	−3,687	0.001	−0.346	−1,197	−0.002	−0.050	−0.008	−0.005	1.379
	(0.010)	(0.010)	(1,090)	(0.002)	(0.080)	(1,003)	(0.003)	(0.061)	(0.003)	(0.005)	(0.568)
Observations	17,941	18,194	18,019	18,019	18,019	18,264	18,195	18,194	18,280	17,914	14,440
Panel B. Years 2–5											
Fertility	0.046	0.038	−4,881	−0.005	−0.262	−5,761	−0.017	0.213	−0.004	0.010	−3.667
	(0.028)	(0.025)	(2,679)	(0.006)	(0.179)	(2,528)	(0.008)	(0.034)	(0.008)	(0.013)	(1.083)
Observations	14,166	18,058	17,934	17,934	17,934	18,169	18,072	18,084	18,188	17,824	10,618
Panel C. Years 6–10											
Fertility	0.010	−0.013	−5,030	−0.005	−0.383	−7,063	−0.022	−0.301	0.001	0.023	−5.530
	(0.044)	(0.043)	(4,962)	(0.011)	(0.315)	(4,839)	(0.014)	(0.366)	(0.016)	(0.026)	(2.145)
Observations	11,680	11,782	13,470	13,470	13,470	13,595	13,522	10,974	13,616	13,337	5,173
Baseline mean	0.54	0.57	221,346	5.24	22.33	244,288	5.20	25.58	0.63	0.55	12.58
Pretreatment effect	−0.005	−0.007	−270	−0.001	0.125	955	−0.004	0.022	−0.002	−0.009	0.639
	(0.008)	(0.008)	(990)	(0.002)	(0.070)	(993)	(0.003)	(0.064)	(0.003)	(0.008)	(0.360)

Job Moves & Commuting Distance

- Mothers more likely to **change occupation/firm** in 0–5 years.
- By 6–10 years, women with children work **closer to home**: long-run commute distance 5.5 km lower
- Suggestive of job re-sorting toward proximity/flexibility; small declines in average occupation and firm earnings premia.

Heterogeneity

TABLE 5—FERTILITY EFFECTS ON FEMALE LABOR EARNINGS: HETEROGENEITY ANALYSES

Indicator I	Earnings Qrt. 4 (1)	Schooling $\geq$ 15 yrs (2)	Age $\geq$ 32 yrs (3)	Partner earnings Qrt. 4 (4)	Sector public (5)	Time $\geq$ 2002 (6)
Panel A. Fertility effects in reference group sample $(I = 0)$ *(years)*						
0–1	−64,033	−68,039	−63,904	−64,411	−76,627	−66,553
	(2,215)	(2,300)	(3,019)	(2,343)	(3,353)	(2,542)
2–5	−20,418	−26,245	−16,392	−15,600	−36,637	−30,600
	(5,383)	(5,479)	(8,890)	(5,896)	(8,726)	(6,483)
6–10	−19,238	−28,538	−16,313	−13,963	−35,523	−31,324
	(10,520)	(10,233)	(19,598)	(11,719)	(16,940)	(11,647)
Percent impact						
0–1	−35	−35	−33	−31	−33	−30
2–5	−10	−12	−8	−7	−15	−13
6–10	−8	−12	−6	−5	−13	−12
Panel B. Fertility effects in indicator group sample $(I = 1)$ *(years)*						
0–1	−86,284	−74,280	−74,282	−89,586	−67,281	−75,023
	(4,707)	(4,294)	(2,772)	(4,804)	(2,638)	(3,410)
2–5	−48,647	−36,130	−36,733	−79,865	−24,212	−28,442
	(13,956)	(13,274)	(6,513)	(14,666)	(6,817)	(8,909)

Extensive vs. Intensive Margin

- Compare childless women to women who already have children at the start of IVF treatment
- Also exploit the larger prevalence of twins among IVF births

Extensive vs. Intensive Margin

TABLE 6—FERTILITY EFFECTS ON FEMALE LABOR EARNINGS: INTENSIVE MARGINS

	Extensive margin	Intensive margin		
Instrument:	IVF success	IVF success	Twins	Twins
Sample:	IVF sample	IVF sample	IVF sample	Repr. sample
	(1)	(2)	(3)	(4)
Panel A. Years 0–1				
Fertility	−70,088	−52,686	−14,507	−13,052
	(2,054)	(3,198)	(2,930)	(2,197)
Percent impact	−31	−24	−7	−8
Observations	18,538	4,598	4,557	103,826
Panel B. Years 2–5				
Fertility	−29,378	−9,477	−6,049	−3,824
	(5,285)	(5,151)	(5,661)	(4,574)
Percent impact	−12	−4	−3	−2
Observations	18,435	4,581	4,540	103,178
Panel C. Years 6–10				
Fertility	−30,675	4,518	−13,154	−2,648
	(10,546)	(7,434)	(9,935)	(9,938)
Percent impact	−11	2	−5	−1
Observations	13,779	3,290	3,543	72,987
Baseline mean	223,038	210,064	221,786	174,156
Pretreatment effect	874	6,794	−4,616	12,073
	(1,811)	(3,816)	(3,592)	(2,767)

Measured at the intensive margin, effects are relatively small and mostly short lived

Conclusion

- Short run: **leave/participation/hours** drive initial loss.
- Medium/long run: **wage penalties** persist via job re-sorting (closer to home; slightly lower-paying occupation/firm averages).
- Consistent with career track interruptions, reduced accumulation of specific human capital, and job mobility toward family-friendly matches.
- Are these results generalizable? In settings with less generous benefits and support?

See you next time!