בית ספר טיומקין לכלכלה

הבינתחומי הרצליה

The Interdisciplinary Center Herzliya

School of Economics

Economic Policy Paper

Is There a Positive Link Between Maternity Leave and Children's Cognitive Development?

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09/07/2017

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Policy Question and Research Objective

This paper attempts to answer the following question: Is there a positive link between maternity leave and children's cognitive development?

A large body of academic research exists on the topic of maternity leave (and in recent years, paternity leave, as well), but this research is mainly focused on the effects of such policy on the women giving birth – health benefits from allowing the body to recover and heal after going through labor, as well as improvements to working women's career prospects due to laws mandating that their job position be held during the period of leave, which in turn also partially assists in narrowing the wage gap between men and women.

In breaking with the existing literature and research objectives, this paper looks at the importance of maternity leave solely through the lens of the newly born children, and the springboard provided to them by a nurturing and embracing entrance to the world. Specifically, this research attempts to ascertain whether a positive link exists between maternity leave and children's cognitive development, as well as whether this effect is stronger on children born into households of low socio-demographic status. Children don't get to choose which households they're born into, and there's much to be said about giving children born into sub-optimal conditions as many tools as possible to fulfill their potential.

Summary and Recommendations

Summary

The Federal Maternity Leave Act, enacted in 1993, had a pronounced and statistically significant effect on children's cognitive abilities, as measured by mathematics test scores. Specifically, an additional 3.41 points (on a scale of 1-100) can be attributed to the FMLA. Additionally, this effect is stronger and more significant for households of lower socio-economic standing. Similar effects are found for two out of the three states which legislated similar maternity leave acts during the late 1980s, prior to the FMLA.

Recommendations

- Loosen the eligibility criteria for unpaid leave. Women of lower socio-economic status are less likely to be eligible under current conditions, while the positive impact of maternity leave is greatest for those cohorts.
- Consider enacting broader *paid* leave laws. While the immediate economic costs are significant, the long-term benefits can be substantial. The positive cognitive effects may be even greater than those obtained under unpaid leave, as this should reduce the number of women who are eligible for maternity leave, but don't currently utilize such benefits because of insufficient economic means.

Background

Maternity leave is a relatively new phenomenon, which has gained relevance and traction in tandem with the changing composition of the typical western household. As shown by Becker, the growing proportion of women joining the workforce during the middle part of the 20th century has compelled employers, society and lawmakers to evolve their views regarding the benefits and rights entitled to working women prior to and after giving birth (Becker, G.(1993). *A Treatise on the Family*. Cambridge, Massachusetts: Harvard University Press).

While maternity leave rights and benefits in Europe are relatively broad and encompassing (especially in the Scandinavian countries), the situation is starkly different in the United States (OECD, Key characteristics of parental leave systems). The first state to put into place laws requiring employers to grant mothers unpaid maternity leave was Minnesota, in 1987, which was followed by Wisconsin (1988) and Washington (1989). Subsequently, the Federal Maternity Leave Act was enacted in 1993, granting women up to 12 weeks of unpaid maternity leave, on condition of meeting the following criteria (United States Department of Labor, Family and Medical Leave Act):

- Having been at the business at least 12 months
- Having worked at least 1,250 hours over the past 12 months
- Employed at a location where the company employs 50 or more employees within 75 miles

For women of lower socio-economic, the condition of having worked at the same business for at least 12 months is likely to represent a barrier to eligibility, as these women are more likely to have been unemployed during some period within the preceding year, or to have changed jobs during this time frame.

Economic Analysis

To measure the effect of maternity leave on children's cognitive abilities, I analyze the changes in children's math and reading comprehension scores, focusing on time periods before and after maternity leave laws went into effect, at a state and federal level. The datasets used are the NLSY (https://www.nlsinfo.org/content/cohorts/NLSY79) and CNLSY (https://www.nlsinfo.org/content/cohorts/NLSY79-Children). The Maternity Leave Acts, which are exogenous to a woman's decision regarding pregnancy, can be viewed as a "treatment" effect impervious to any selection bias - at a state level, it's highly unlikely that mothers chose their place of residence based on a specific state's maternity leave laws. At the nation-wide level, it's safe to assume that child bearing decisions were made independently of impending legislature.

Model analysing the nation-wide effect of the FMLA

The following linear regression is applied:

$$mathp = B_0 + B_1 federaltreatment + B_2 afqt79 + B_3 cyrb + B_4 black + B_5 Hispanic + B_6 magebir + B_7 magebir2 + B_8 cfemale + B_9 year \text{ if } mathp > 0$$

where

mathp = child's math score
federaltreatment = dummy variable that receives 1 if the child was born after 1993, 0 otherwise
afqt79 = mother's Armed Forces Qualification Test score (percentile)
cyrb = child's year of birth
black = dummy variable that receives 1 if the child is black, 0 otherwise
hispanic = dummy variable that receives 1 if the child is Hispanic, 0 otherwise
magebir = mother's age at child's birth
magebir2 = square of mother's age at child's birth
cfemale = dummy variable that receives 1 if the child is female, 0 otherwise
year = survey year
** the regression is restricted to observations where the observed math score is greater than 0 due to NLSY coding conventions that assign negative values when the test results are unknown or missing.*

```
. xi: reg mathp federaltreatment afqt79 cyrb black hispanic magebir magebir2 cfemale year if mathp > 0

      Source |       SS       df       MS              Number of obs =   20806
-------------+------------------------------           F(  9, 20796) =  666.10
       Model |  3722663.45     9  413629.273           Prob > F      =  0.0000
    Residual |  12913733.8 20796  620.972003           R-squared     =  0.2238
-------------+------------------------------           Adj R-squared =  0.2234
       Total |  16636397.2 20805   799.63457           Root MSE      =  24.919

------------------------------------------------------------------------------
       mathp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
federaltreatment |   3.41304   .7041901     4.85   0.000     2.032772    4.793307
      afqt79 |    .378046   .0076742    49.26   0.000     .3630039     .393088
        cyrb |   .2624718   .1170021     2.24   0.025     .0331386     .491805
       black |  -6.679853   .4820421   -13.86   0.000    -7.624693   -5.735013
    hispanic |   -3.79866   .5035684    -7.54   0.000    -4.785693   -2.811627
     magebir |   .3913157   .4146982     0.94   0.345    -.4215252    1.204157
    magebir2 |   -.012782   .0071967    -1.78   0.076     -.026888     .001324
     cfemale |  -.8793257   .3456865    -2.54   0.011    -1.556898   -.2017532
        year |   .5228209   .0627733     8.33   0.000     .3997803    .6458616
       _cons |  -1525.869    199.591    -7.64   0.000    -1917.083   -1134.655
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```

The "treatment", or the FMLA enacted in 1993, is statistically significant and is responsible for a marginal increase of 3.41 points in mathematics scores. Similar results are obtained for reading comprehension scores.

Additionally, the differential effect of the FMLA on different socio-economic cohorts can be captured by running multiple regressions, whereby the afqt79 scores are limited to a different bucket every time. For example, running an identical regression to the one above, but also limiting afqt79 scores to the range of 0-10, brings out the treatment effect for children likely to have been born into less advantaged surroundings.

Afqt79 range	**Coeff**	**P > |t|**
0-10	4.55	0.016
10-20	1.07	0.588
20-30	7.79	0.001
30-40	4.05	0.097
40-50	5.94	0.011
50-60	-1.33	0.612
60-70	2.27	0.345
70-80	0.91	0.703
80-90	1.99	0.481
90-100	2.71	0.195

The treatment effect is most pronounced, as well as statistically significant, for mothers with below median afqt79 scores. Moreover, it's plausible that these figures are downward biased due to the lower likelihood of less affluent mothers being able to afford taking unpaid leave.

Models analysing the effects of state specific legislature, prior to the FMLA

For each of the three states that legislated maternity leave acts prior to the FMLA, a linear regression model using a difference-in-differences technique is applied:

$$mathp = B_0 + B_1 DMinnesota + B_2 Dafter1987 + B_3 DMinnesotaXDafter1987 + B_4 afqt79 + B_5 cyrb + B_6 black + B_7 Hispanic + B_8 magebir + B_9 magebir2 + B_{10} cfemale + B_{11} year \text{ if } DWisconsin = 0 \ \& \ DWashington = 0 \ \& \ cyrb < 1993 \ \& \ mathp > 0$$

where

mathp = child's math score
B_0 = constant
DMinnesota = dummy variable that receives 1 for the state of Minnesota, 0 otherwise
Dafter1987 = dummy variable that receives 1 if the child was born during or after 1987, 0 otherwise
DMinnesotaXDafter1987 = interaction variable between DMinnesota and Dafter1987
afqt79 = mother's Armed Forces Qualification Test score (percentile)
cyrb = child's year of birth
black = dummy variable that receives 1 if the child is black, 0 otherwise
hispanic = dummy variable that receives 1 if the child is Hispanic, 0 otherwise
magebir = mother's age at child's birth
magebir2 = square of mother's age at child's birth
cfemale = dummy variable that receives 1 if the child is female, 0 otherwise
year = survey year
** The 2 additional states that enacted maternity leave legislature during this period are excluded from the regression in order to correctly account for the nation-wide trend. The child's year of birth is restricted to births before the FMLA went into place, and math scores are restricted to non-negative values because of missing or unknown data.*

```
. xi: reg mathp  i.DMinnesota*i.Dafter1987 afqt79 cyrb black hispanic magebir magebir2 cfemale year if  DWisconsin==0 &
>  DWashington==0 & cyrb<1993 & mathp > 0
i.DMinnesota      _IDMinnesot_0-1     (naturally coded; _IDMinnesot_0 omitted)
i.Dafter1987      _IDafter198_0-1     (naturally coded; _IDafter198_0 omitted)
i.DMi~a*i.Daf~7   _IDMiXDaf_#_#       (coded as above)

      Source |       SS       df       MS              Number of obs =   14356
-------------+------------------------------           F( 11, 14344) =  362.98
       Model |  2406534.93    11  218775.902           Prob > F      =  0.0000
    Residual |  8645516.35 14344  602.727018           R-squared     =  0.2177
-------------+------------------------------           Adj R-squared =  0.2171
       Total |  11052051.3 14355  769.909528           Root MSE      =   24.55

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       mathp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_IDMinnesot_1 |  -3.935441   2.241241    -1.76   0.079    -8.328564    .4576825
_IDafter198_1 |   .9749048   .7891326     1.24   0.217    -.5718972    2.521707
_IDMiXDaf_1_1 |    4.67729   2.876498     1.63   0.104    -.9610172     10.3156
      afqt79 |   .4026162   .0092045    43.74   0.000     .3845742    .4206582
        cyrb |   .1527809   .1902668     0.80   0.422    -.2201666    .5257284
       black |  -5.819512   .5642062   -10.31   0.000    -6.925429   -4.713595
    hispanic |  -3.487271   .5911608    -5.90   0.000    -4.646023   -2.328519
     magebir |   -.435106   .8750942    -0.50   0.619    -2.150404    1.280192
    magebir2 |   .0028665   .0164172     0.17   0.861    -.0293133    .0350463
     cfemale |  -.0580404   .4104632    -0.14   0.888    -.8626013    .7465206
        year |   .3838465   .0732993     5.24   0.000     .2401703    .5275227
       _cons |  -1021.569   343.9534    -2.97   0.003    -1695.762    -347.376
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- *The effect is substantial and close to significant at the 10% level. Similar results are obtained for reading comprehension scores*

Washington

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. xi: reg mathp  i.DWashington*i.Dafter1989 afqt79 cyrb black hispanic magebir magebir2 cfemale  year if
> DWisconsin==0 & DMinnesota==0 & cyrb<1993 & mathp > 0
i.DWashington     _IDWashingt_0-1     (naturally coded; _IDWashingt_0 omitted)
i.Dafter1989      _IDafter198_0-1     (naturally coded; _IDafter198_0 omitted)
i.DWa~n*i.Daf~9   _IDWaXDaf_#_#       (coded as above)
```

Source	SS	df	MS		
Model	2448381.59	11	222580.144	Number of obs	= 14326
Residual	8638210.39	14314	603.479837	F(11, 14314)	= 368.83
				Prob > F	= 0.0000
Total	11086592	14325	773.933123	R-squared	= 0.2208
				Adj R-squared	= 0.2202
				Root MSE	= 24.566

mathp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_IDWashingt_1	-14.22857	1.892454	-7.52	0.000	-17.93802	-10.51911
_IDafter198_1	1.273321	.8326129	1.53	0.126	-.3587084	2.90535
_IDWaXDaf_1_1	6.820535	3.043202	2.24	0.025	.8554649	12.78561
afqt79	.4087781	.0092643	44.12	0.000	.3906189	.4269374
cyrb	.0961063	.1960922	0.49	0.624	-.2882598	.4804724
black	-5.536446	.5631615	-9.83	0.000	-6.640315	-4.432576
hispanic	-3.218928	.587864	-5.48	0.000	-4.371218	-2.066638
magebir	.1012399	.8573748	0.12	0.906	-1.579326	1.781806
magebir2	-.0076752	.0160816	-0.48	0.633	-.0391973	.0238469
cfemale	-.224062	.4109176	-0.55	0.586	-1.029514	.5813897
year	.373548	.0733399	5.09	0.000	.2297922	.5173037
_cons	-895.2538	356.9587	-2.51	0.012	-1594.939	-195.5685

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- *The effect is substantial and statistically significant, and a similar effect is obtained for reading comprehension.*

Wisconsin

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. xi: reg mathp  i.DWisconsin*i.Dafter1988 afqt79 cyrb black hispanic magebir magebir2 cfemale year if  DM
> innesota==0 & DWashington==0 & cyrb<1993  & mathp > 0
i.DWisconsin      _IDWisconsi_0-1     (naturally coded; _IDWisconsi_0 omitted)
i.Dafter1988      _IDafter198_0-1     (naturally coded; _IDafter198_0 omitted)
i.DWi~n*i.Daf~8   _IDWiXDaf_#_#       (coded as above)

      Source |       SS       df       MS              Number of obs =   14597
-------------+------------------------------           F( 11, 14585) =  359.96
       Model |  2401006.55    11  218273.323           Prob > F      =  0.0000
    Residual |  8844021.82 14585   606.37791           R-squared     =  0.2135
-------------+------------------------------           Adj R-squared =  0.2129
       Total |  11245028.4 14596  770.418497           Root MSE      =  24.625

------------------------------------------------------------------------------
       mathp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_IDWisconsi_1 |   .6953956    1.61074     0.43   0.666    -2.461858    3.852649
_IDafter198_1 |   .3912162   .8307294     0.47   0.638    -1.237119    2.019551
_IDWiXDaf_1_1 |  -.8192454   2.151693    -0.38   0.703    -5.036835    3.398345
      afqt79 |   .3946658   .0091486    43.14   0.000     .3767333    .4125983
        cyrb |    .299878   .1971408     1.52   0.128    -.0865429    .6862989
       black |  -6.129101   .5621817   -10.90   0.000    -7.231048   -5.027154
    hispanic |   -3.70155   .5922542    -6.25   0.000    -4.862444   -2.540657
     magebir |   .4002536   .8515929     0.47   0.638    -1.268976    2.069484
    magebir2 |  -.0137648   .0159719    -0.86   0.389    -.0450716    .0175421
     cfemale |   -.304916    .408056    -0.75   0.455    -1.104757    .4949254
        year |   .3515758   .0728769     4.82   0.000     .2087279    .4944237
       _cons |  -1258.825   365.6429    -3.44   0.001    -1975.531   -542.1189
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- *For Wisconsin, the results are slightly negative but not statistically significant. While there is no obvious explanation for the, the relatively small sample size (83 births) may be partially at fault.*

Additional model for analyzing the impact of the FMLA

In order to measure the change in math scores before and after the FMLA, for children born to the same mother, the following linear regression model is applied:

xi: areg mathp federaltreatment i.bthordr if mathp>0 & cyrb >= 1990 & cyrb <= 1997, absorb(mpubid)

where

mathp = child's math score
federaltreatment = dummy variable receiving a value of 1 if the FMLA is already in effect, 0 otherwise
bthordr = sequence of child born into the family. 1 signifies the eldest child
mpubid = mother's unique ID in the NLSY dataset
cyrb = child's year of birth
** math scores are restricted to non-negative values because of missing or unknown data. Years of birth are restricted to 1990-1997 to isolate the years immediately before and after the FMLA*

```
. xi: areg mathp federaltreatment i.bthordr if mathp>0 & cyrb >= 1990 & cyrb <= 1997, absorb(mpubid)
i.bthordr         _Ibthordr_1-11      (naturally coded; _Ibthordr_1 omitted)
note: _Ibthordr_11 omitted because of collinearity

Linear regression, absorbing indicators           Number of obs   =       8743
                                                  F(  10,   7160) =       5.24
                                                  Prob > F        =     0.0000
                                                  R-squared       =     0.6070
                                                  Adj R-squared   =     0.5201
                                                  Root MSE        =    19.7960
```

mathp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
federaltreatment	2.133293	1.134082	1.88	0.060	-.0898437	4.356429
_Ibthordr_2	2.521333	.9733329	2.59	0.010	.6133133	4.429353
_Ibthordr_3	2.744163	1.58998	1.73	0.084	-.3726663	5.860993
_Ibthordr_4	2.171347	2.360812	0.92	0.358	-2.456541	6.799235
_Ibthordr_5	6.061517	3.224542	1.88	0.060	-.2595381	12.38257
_Ibthordr_6	3.173172	4.40735	0.72	0.472	-5.466536	11.81288
_Ibthordr_7	16.44107	5.934907	2.77	0.006	4.8069	28.07524
_Ibthordr_8	23.411	7.666374	3.05	0.002	8.382639	38.43935
_Ibthordr_9	14.14614	8.040366	1.76	0.079	-1.615354	29.90763
_Ibthordr_10	23.4455	9.663373	2.43	0.015	4.502432	42.38856
_Ibthordr_11	0	(omitted)				
_cons	55.63782	.7502548	74.16	0.000	54.1671	57.10854
mpubid	F(1572, 7160) =		6.204	0.000	(1573 categories)	

- *The treatment effect is substantial and statistically significant. Additionally, the birth order effect, which Heiland found to be negative, is reversed (Heiland, F., (2004), Does the Birth Order Affect the Cognitive Development of a Child? Retrieved from http://paa2005.princeton.edu/papers/51236).*

The likelihood of taking unpaid level, as well as the effects of paid leave

In addition to the analysis conducted on the effects of unpaid leave, attempts were made to calculate the probability of women of different cohorts utilizing their leave rights. Unfortunately, this effort was unsuccessful due to inconsistencies and errors in the data – the figures from which unpaid leave can be inferred were incorrectly reported or incorrectly recorded by the surveyors.

Similarly, research was conducted into the link between paid leave and children's cognitive development. In this case, methodological challenges are imposed by the endogenous relationship between a woman's decision or ability to take paid leave and her actually doing so - women eligible for paid leave are expected to be of a higher socio-economic status, as well as the possibility that women who prefer to spend more time at home with their newborns are more likely to utilize their paid leave rights than women which are less inclined to do so. Unfortunately, this effort was also unfruitful due to errors and inconsistencies in the data indicating maternity paid leave of absence.

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