Congenital Disability Effects on Parents' Labor Supply:

Evidence from the Zika Virus Outbreak

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UNAB

Introduction

- Birth of a child with severe disability is a large shock for the household
  - Unexpected strain on both time and money
- Families coping abilities have crucial implications for social security policies
  - Problem may be more severe in developing countries

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Introduction

- Challenge: chance of congenital disability affected by mother's health behaviors, environment
- Challenge: Low probability event

- We leverage the 2015 Zika virus outbreak in Brazil.
  - An exogenous shock to probability of disability
  - Fairly large event, affecting thousands of children

Introduction

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- We leverage the 2015 Zika virus outbreak in Brazil.
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This Paper

- **Question:** How does congenital disability affect parents' labor market outcomes?
- **Question:** How does congenital disability affect family composition?
- The Zika virus outbreak proves a compelling case study.
- **Results:** Mothers of children with microcephaly face a 66% higher child penalty (CI : 50%, 81%). No effects on fathers. Small effects on fertility and no effects of separation.
- **In progress**: The role of assistance programs

Literature

- **Child disability and parents' labor supply**: (Chen et al., 2023; Cheung et al., 2023; Gunnsteinsson & Steingrimsdottir, 2019; Martínez et al., 2023; Powers, 2001; Salkever, 1982; Wasi et al., 2012)
  - Contribution: Stronger identification argument

- **Parental response to children's health shocks** (Breivik & Costa-Ramón, 2022; Fadlon & Nielsen, 2020; Frijters et al., 2009)
  - Contribution: Identification that works for neonatal shocks

- **Motherhood penalty and gender inequality** (Berniell et al., 2021; Cortés & Pan, 2023; De Quinto et al., 2020; Kleven et al., 2019; Musick et al., 2020; Sieppi & Pehkonen, 2019)
  - Contribution: We study how the penalty is affected by higher child needs

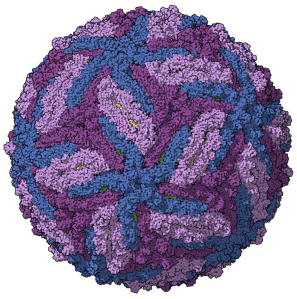
Background

Background

- Zika is a mosquito-borne virus, related to dengue
- Endemic to tropical Africa, Asia and Oceania, but never observed in the Americas (until 2015)
- The only vector is *Aedes aegypti*, endemic to most of Brazil

Background

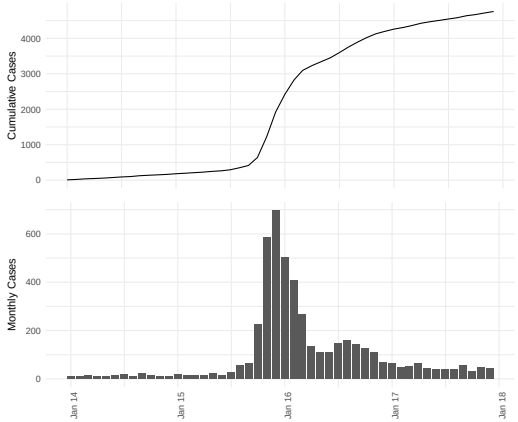
- Infection with the virus is often asymptomatic in adults
- Mild symptoms, similar to dengue
- Infection during pregnancy may cause microcephaly. **This link was previously unknown.**
- Therefore, epidemic went unnoticed until uptick in anomalous births



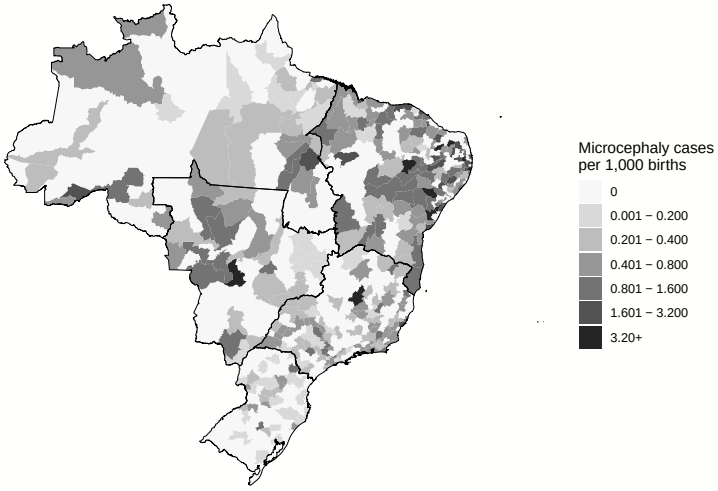
Background

- Microcephaly causes severe impairment of cognition, motor and speech development.
- Lifelong condition
- Requires therapy to deal with limitations
- Normally rare condition, associated with genetic syndromes or malnutrition

Background



- From mid-2015 to 2016, more than 4000 microcephaly cases
- Brazilian Health Authority declares emergency in late November 2015; WHO in February 2016.


Microcephaly cases
per 1,000 births
0
0.001 – 0.200
0.201 – 0.400
0.401 – 0.800
0.801 – 1.600
1.601 – 3.200
3.20+

Background

Several characteristics of the epidemic help with identification:

1. Role of preventive behaviors was minimal.
2. Little scope for selective abortion
3. Selective diagnosis is unlikely
4. No direct effects.

Background

Role of preventive behaviors was minimal.

- The link between Zika and microcephaly was not known. No scope for differential preventive behavior.
- Even after the public emergency was declared, there was little scope for preventive behavior to affect outcomes.
- Zika infection is most likely to lead to microcephaly in the first trimester (Johanson et al. 2016), so public awareness would only show up with a large delay.

Background

Little scope for selective abortion.

- Abortion is illegal in Brazil.
- Zika is asymptomatic in about 80% of cases (Haby et al., 2018), so a pregnant mother will not know they had Zika in most cases.
- Even when symptoms are present, they are very similar to dengue, and the mother may be unsure.
- Diagnosis of microcephaly in the uterus is (Chervenak et al., 1984; Leibovitz & Lerman-Sagie, 2018):
  a) Expensive: requiring detailed ultrasound imaging and/or genetic sequencing
  b) Inaccurate: traditional diagnostic protocols yield almost 50% overdiagnosis, while advanced methods can be about 80% accurate.

Selection by differential diagnosis unlikely

- Diagnosis is based on comparing head circumference to age- and sex-specific growth tabes (Ashwal et al., 2009).
- Minimal room for discretion or skill differences.
- Virtually every newborn in the country is measured and registered.

No direct effects

- Zika infection has no long-term effects, so any effect on mothers has to be mediated through microcephaly in the baby.
- One exception is a higher chance to develop Guillain-Barré Syndrome, a very serious, potentially lethal condition. However, the probability as so small as to be negligible for our purposes.

Data

Data

- Administrative health records from SISNASC/SUS
  - Births and microcephaly cases
  - Includes mothers' characteristics, but no individual ID
- Labor market data from RAIS
  - Track all formal employees over time
  - Includes individual IDs
- Single Registry
  - Recipients of any government program
  - Includes individual IDs
  - Use this data to link birth records to labor market data using mother and child's date of birth and municipality

Empirical Strategy

An informal model of infection

- Concentration of mosquito vectors in municipality m, at month t: c_{mt}.
- Share of vectors that carry the virus: λ_{mt}
- Individual's chance of infection depend on the concentration of infected vectors in their municipality: $c_{mt}\lambda_{mt}$
- Infection also depends on individual risk factors: X_i
- Threat to identification: c_{mt}, λ_{mt} or X_i are confounders.

Identification Strategy

- We have to control for **municipality** and **month of birth**, so $c_{mt}\lambda_{mt}$ is held constant.
- We also have to control for individual characteristics that affect infection conditional on municipality and month, X. Some candidates for X identified in the literature:
  a) Age (Siqueira-Junior et al. 2008)
  b) Education (ibid)
  c) Employment (Teurlai et al. 2015)
  d) Urbanization and population density (Wu at al. 2009)
  e) Socioeconomic Status? Evidence is mixed (Whiteman et al., 2020)
- Key assumption: Conditional Independence

Estimation

- We use exact matching based on:
  a) Municipality of residence
  b) Month of birth
  c) Maternal age, education, (formal work experience)
- Theoretical justification based on epidemiological characteristics
- Test assumptions by using LASSO to predict the incidence of microcephaly.
- Test for balance in other characteristics (race, income, labor market trajectory)

Empirical Strategy

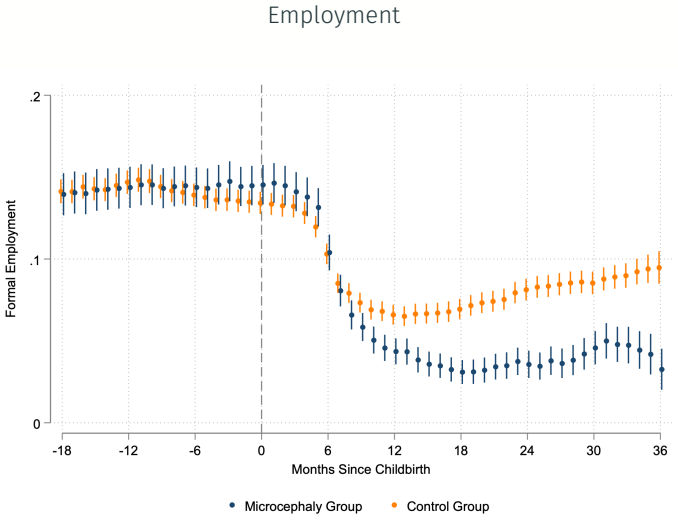
We estimate the treatment effect through the fully saturated model:

$$y_{ft} = \sum_{k \in (-18,\ldots,36)} \left[\beta_k^{Control} \cdot \mathbb{1}(t - \tau(f) = k) + \beta_k^{Treated} \cdot T_f \cdot \mathbb{1}(t - \tau(f) = k) \right] + \varepsilon_{ft}$$

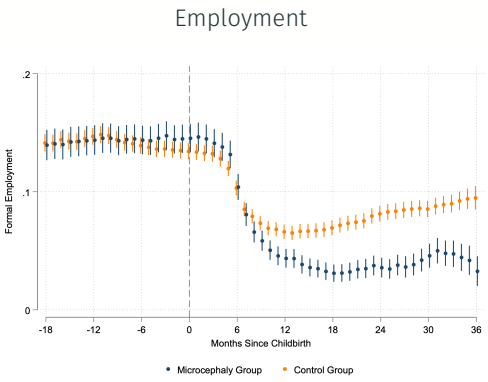
- y: outcome of interest for family f at year-month t.
- T_f is a dummy indicating families with a child with microcephaly.
- $\tau(f)$: date of birth of the child of family f, such that k is the time relative to birth.
- $\beta_k^{Treated}$: average of the outcome at period k for mothers of children with microcephaly
- $\beta_k^{Control}$: average of the outcome for control mothers.
- ε_{ft}: random error, clustered at the match-group level.
- Weights: Treated units receive a weight of 1 and all control units a weight of $\frac{n_t(g)}{n_c(g)}$

Results
Mothers' Labor Market Outcomes

Results

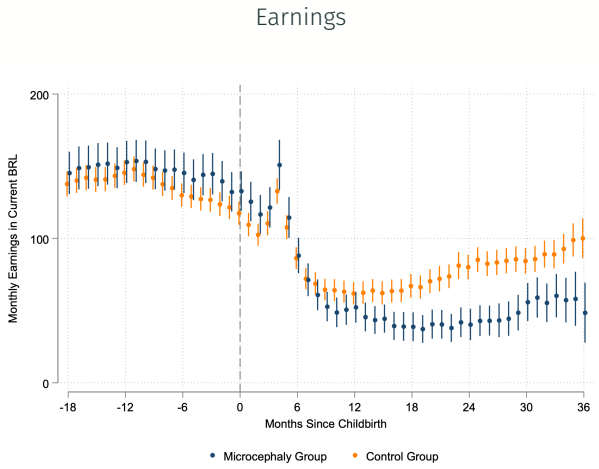

Employment
Formal Employment
.2
.1
0
-18
-12
-6
0
6
12
18
24
30
36
Months Since Childbirth
Microcephaly Group
Control Group

Results



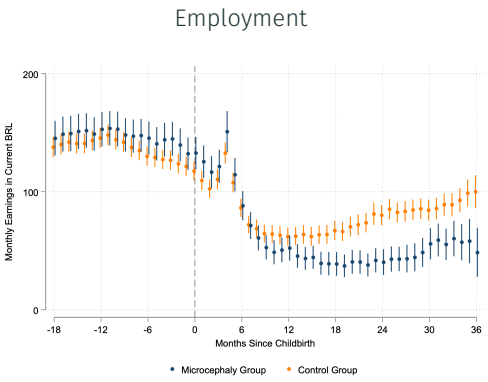
- Motherhood penalty for controls: 6 p.p (CI: 5.3;6.7) or 43% (CI: 40%;46%)
- Motherhood penalty for treated: 10.6 p.p (CI: 9.1;12.1) or 70.8% (CI: 65.7%;75.9%)
- Additional penalty for treated: 3.9 p.p (CI: 2.8;4.4) or 65.9% (CI: 50.3%;81.4%)

Results



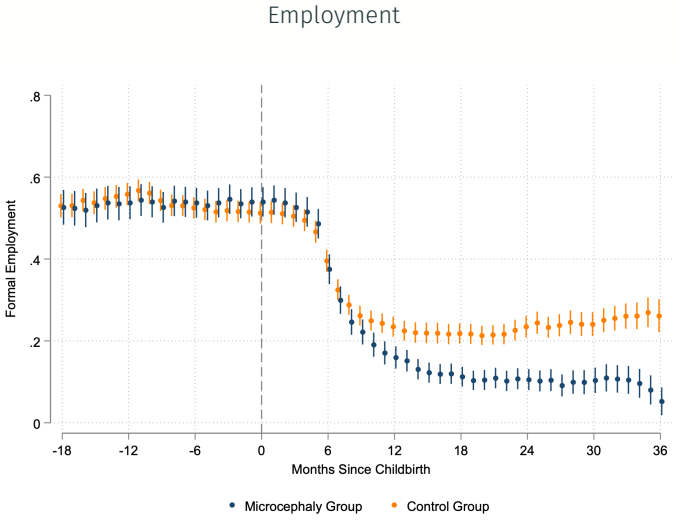
▸ Wage Distribution

Results



- Motherhood penalty for controls: 53.7 (CI: 49.2;61.3) or 41.1% (CI: 37.1%;45.2%)
- Additional penalty for treated: 31 (CI: 18.4;43.6) or 64.9% (CI: 56.0%;73.7%)

Results: Subsample with Previous Formal Employment



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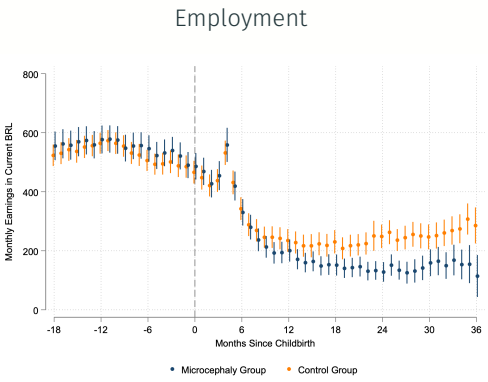
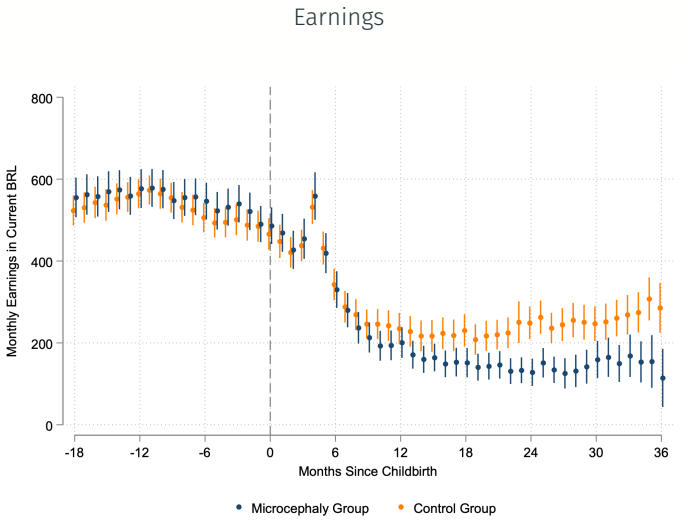
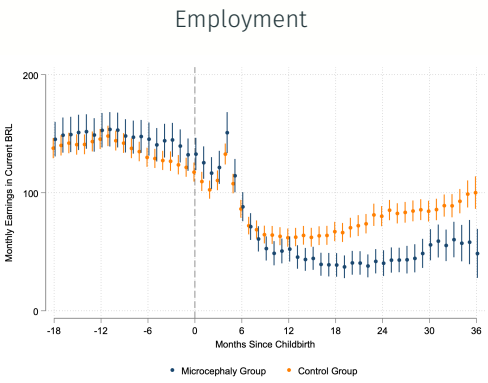


- Motherhood penalty for controls: 27.2 p.p. (CI: 24.8;29.7) or 51.9% (CI: 48.7.1%;55.0%)
- Additional penalty for treated: 12.8 p.p. (CI: 9.9;15.7) or 47.1% (CI: 35.1%;59.1%)

Results: Subsample with Previous Formal Employment



Results



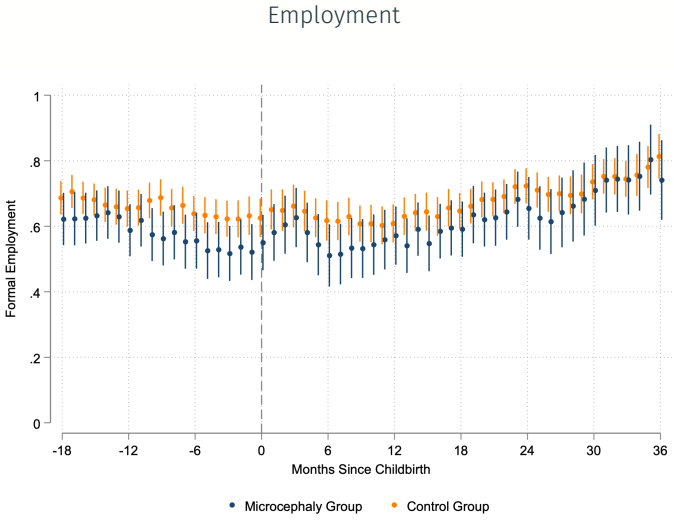
- Motherhood penalty for controls: 250 (CI: 220;278) or 49.1% (CI: 44.7%;53.5%)
- Additional penalty for treated: 107 (CI: 55;160) or 43.1% (CI: 20.7%;65.5%)

Full Sample				
	Works		Earnings	
	(1)	(2)	(3)	(4)
Treated	.0064	.0064	11	11
	(.0079)	(.0079)	(8.781)	(8.781)
Post	-.058***	-.056***	-50***	-47***
	(.0032)	(.0032)	(3.427)	(3.517)
Treated × Post	-.044***	-.044***	-40***	-40***
	(.0071)	(.0071)	(7.869)	(7.869)
Number of Obs	1,563,559	1,563,559	1,563,559	1,563,559
Number of Clusters	1,728	1,728	1,728	1,728
Match FE	No	Yes	No	Yes
Mean Dep. Var. Baseline	.1473	.1473	149.35	149.35

Work Experience Sample				
	Works		Earnings	
	(1)	(2)	(3)	(4)
Treated	-.00043	.011	-5.4	13
	(.0232)	(.0232)	(29.38)	(29.6)
Post	-.26***	-.26***	-237***	-230***
	(.0113)	(.0116)	(13.2)	(14.08)
Treated × Post	-.12***	-.12***	-97***	-98***
	(.0228)	(.0228)	(27.46)	(27.5)
Number of Obs	283,654	283,654	283,654	283,654
Number of Clusters	424	424	424	424
Match FE	No	Yes	No	Yes
Mean Dep. Var. Baseline	.5295	.5295	549.36	549.36

Results
Fathers' Labor Market Outcomes

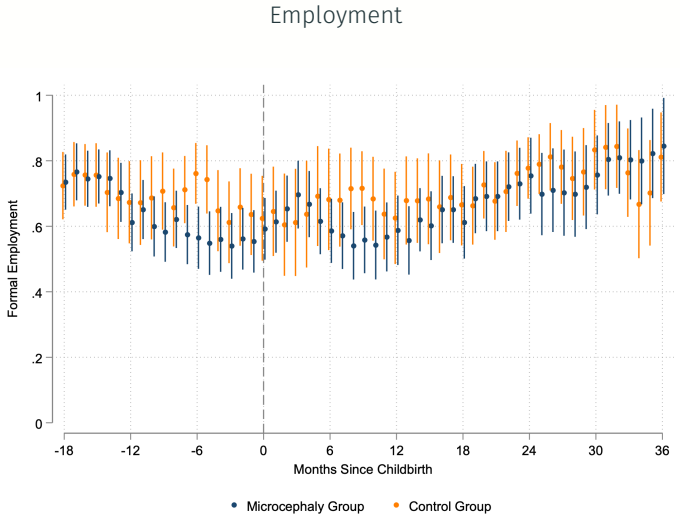
Results


Employment
Formal Employment
1
.8
.6
.4
.2
0
-18
-12
-6
0
6
12
18
24
30
36
Months Since Childbirth
Microcephaly Group
Control Group

Results


Earnings
Monthly Earnings in Current BRL
2000
1500
1000
500
0
-18
-12
-6
0
6
12
18
24
30
36
Months Since Childbirth
Microcephaly Group
Control Group

Results: Subsample with Previous Formal Employment



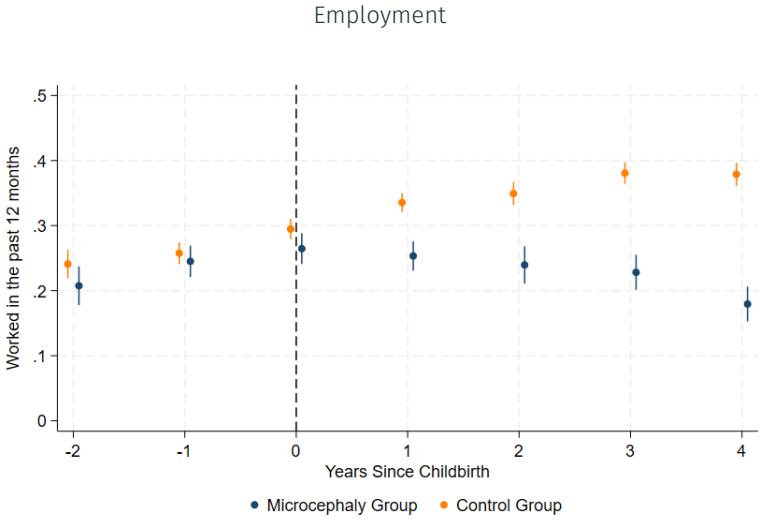
Results: Subsample with Previous Formal Employment

Results
Formal & Informal Work

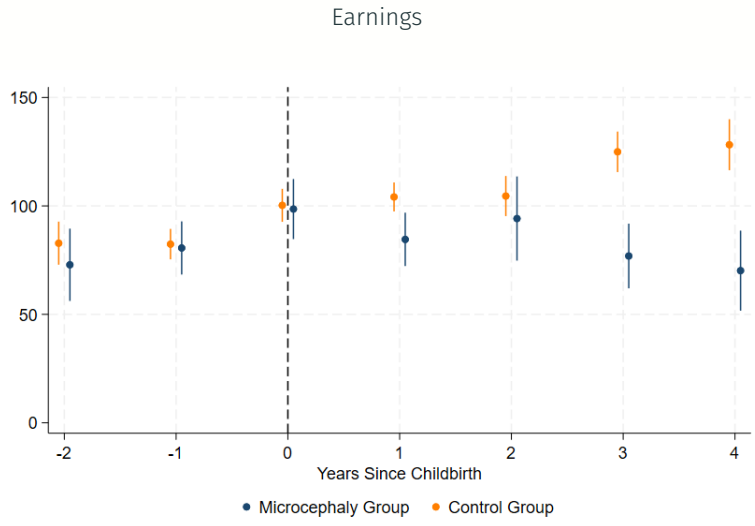
Formal and Informal Work

- We can look at the effect on total employment, including formal and informal, through self-reported employment
- Advantages: includes informal work
- Disadvantages: self-reported, incentive to underestimate, lower frequency

Results: Formal & Informal Work



Results: Formal & Informal Work



Results
Fertility

Subsequent Fertility

	Total Children After Treated/Control Child			
	(1)	(2)	(3)	(4)
Microcephaly	.000087	-.005	-.022*	.0076
	(.0081)	(.0087)	(.013)	(.014)
Constant	.13***	.13***	.15***	.13***
	(.003)	(.0044)	(.0069)	(.0065)
Number of Obs	36856	36457	17093	18970
Number of Clusters	1729	1717	1289	1457
Match FE	No	Yes	Yes	Yes
Sample	Full	Full	Firstborn	Not firstborn

Spillover Effects on Fertility

$$fertility_{mt} = \sum_{t \in 2010,..,2020, t \neq 2014} \gamma_t \cdot Incidence_m \cdot \mathbf{1}_{t \geq 2015} + \delta_m + \delta_t + \epsilon_{it}$$

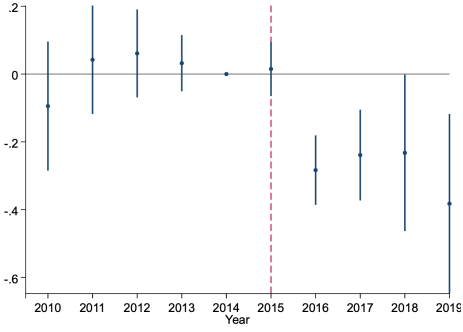
- $fertility_{mt}$: total number of babies in a municipality m at year t per 1,000 people
- $Incidence_m$: measure of the incidence of microcephaly cases during the Zika virus outbreak period in municipality m.
- $\mathbf{1}_{t \geq 2015}$: indicator function for years equal to or after 2015.
- δ_m: municipality fixed effects
- δ_t: year fixed effects .
- ϵ_{it}: random error, clustered at the municipality level

We use two different measures of incidence:

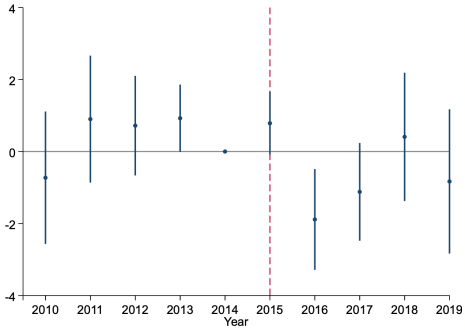
- (A) municipality is above the 75th percentile of the distribution of cases per capita
- (B) total number of cases per 1,000 inhabitants.

Spillover Effects on Fertility

A: High vs Low/No of Cases of Microcephaly



B: Share of Microcephaly on All Births



Results
Family Composition

Family Composition

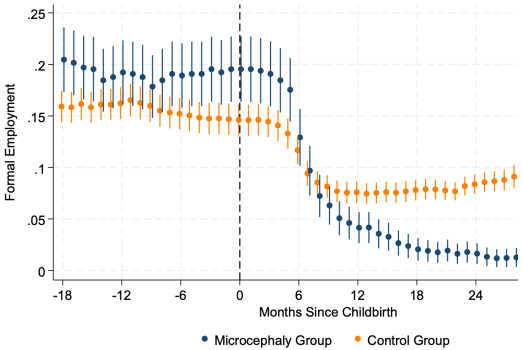
	Father Present in 2017	Father Present in 2019	
	(1)	(2)	(3)
Microcephaly	.013	.0085	-.0028
	(.0098)	(.0093)	(.0039)
Father present 2017			.86***
			(.0095)
Constant	.19***	.16***	.0023
	(.0049)	(.0046)	(.0033)
Number of Obs	37,089	37,089	37,089
Number of Clusters	1,728	1,728	1,728
Match FE	Yes	Yes	Yes

Government Transfers

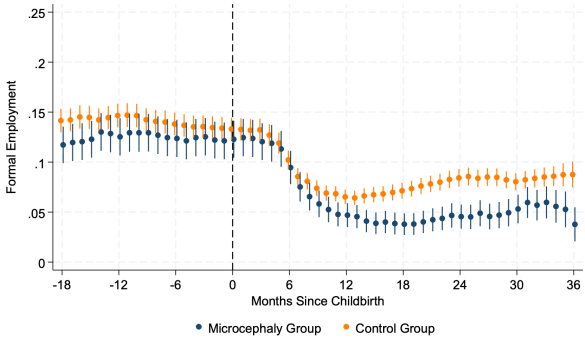
- Low income families with a person with a disability are entitled a transfer
  - Extended to all families impacted by Zika after 2019
- To what extent are the results driven by income effects from this transfer?
- We do not observe when each family starts receiving the benefit, but can identify which ones received it at last for some time.
- We split the sample on families that receive and do not receive this benefit
  $\rightarrow$ not causal, because we observe it *after* treatment assignment

Results

Received Transfers



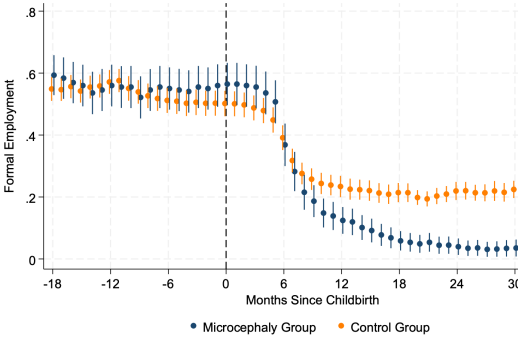
Did Not Receive Transfers



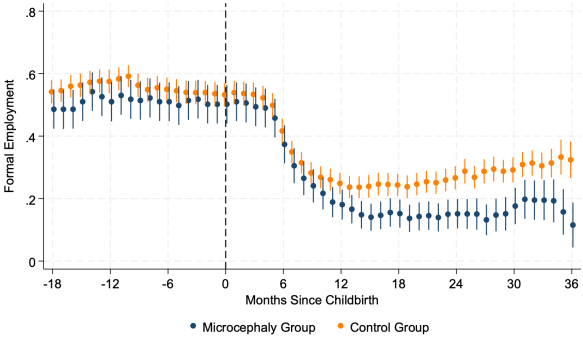
▸ Fathers

Results: Subsample with Previous Formal Employment

Received Transfer



Did Not Receive Transfer



▸ Fathers

Conclusion

- We study the effects of the Zika outbreak on parents' labor market outcomes, subsequent fertility, and family structure
- Unique features of the outbreak allow us minimize endogeneity concerns
- We find that motherhood penalty is increased by 66%
- Fathers' labor outcomes are not affected.
- Suggestive evidence that affected families have lower subsequent fertility and fathers are not less likely cohabitate.
- Our results help quantify the enormous human costs associated with disease and disability, and highlight the disproportionate effect on women.

Thank you!

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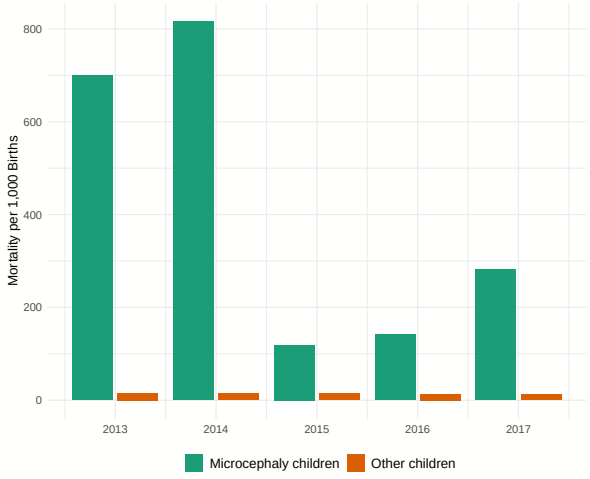
	Coefficient	p-value
Mother's Characteristics		
Race: "Black"	0.065	0.545
Age (years)	0.013	0.021
Type of job: Formal	-0.148	0.524
Type of job: No answer	0.168	0.049
Joint F-test		*0.0075*
Mother's Education		
Attending: Adult Education	0.538	0.193
Attending: Fifth grade	-0.575	0.002
Attending: Sixth grade	-0.182	0.239
Attending: Ninth grade	0.100	0.622
Did not finish highest grade attended	-0.226	0.001
Joint F-test		*0.0005*
Dwelling Characteristics		
Dwelling Type: "Informal"	-0.404	0.073
Number of Bedrooms: "Zero"	0.733	0.478
Type of Floor: "Wooden"	0.098	0.793
Type of Walls: "Thatch"	1.146	0.075
Trash Disposal: "Other"	0.132	0.410
Lighting: "Electric, community owned"	0.168	0.269
Street Paving: "Partial"	-0.032	0.818
Joint F-test		*0.2416*
Year-month Fixed Effects	Yes	0.0000

Back

Mortality



Back

Results: Down Syndrome

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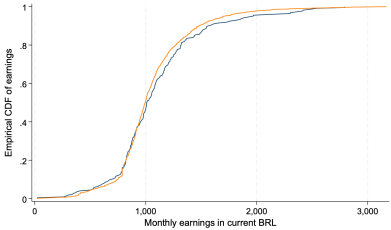
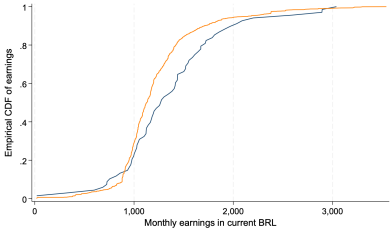
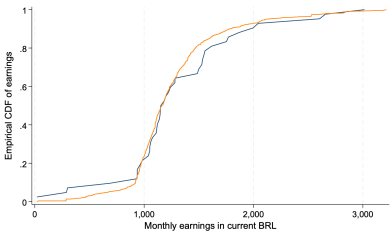
(a) Months since childbirth: 0



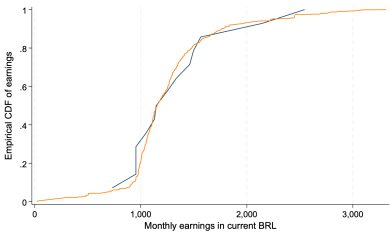
(b) Months since childbirth: 12



(c) Months since childbirth: 24

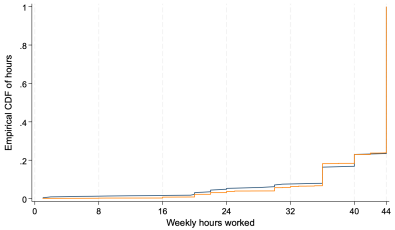


(d) Months since childbirth: 36

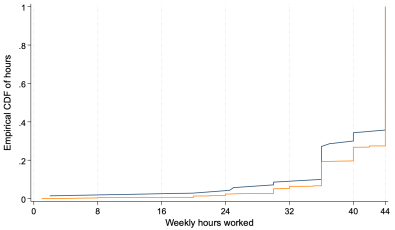


Back

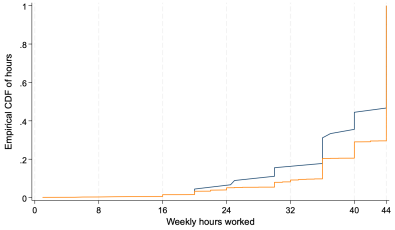
(a) Months since childbirth: 0



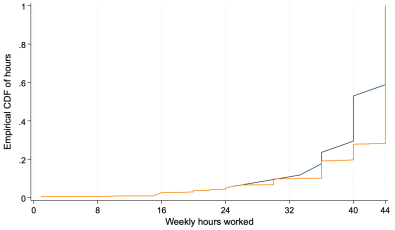
(b) Months since childbirth: 12



(c) Months since childbirth: 24

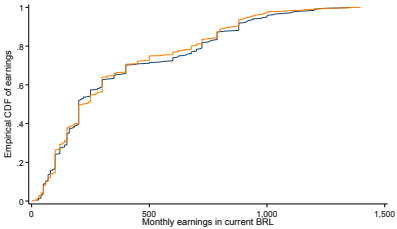


(d) Months since childbirth: 36

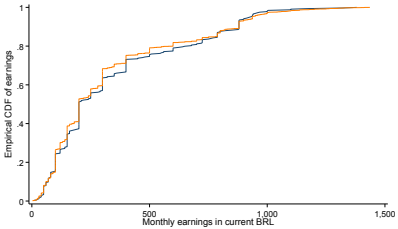


Back

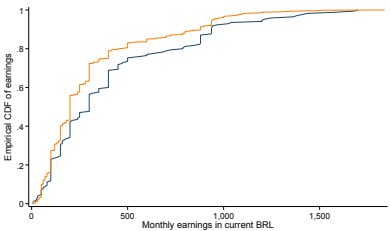
(a) Years since childbirth: 0



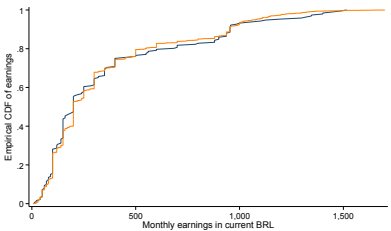
(b) Years since childbirth: 1



(c) Years since childbirth: 2



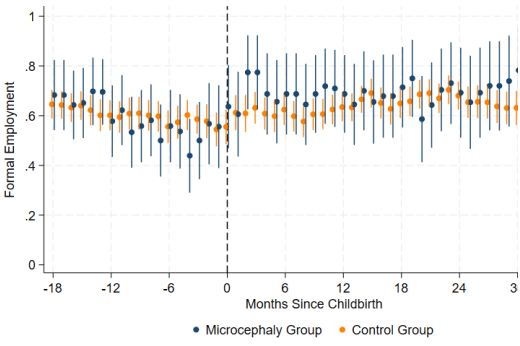
(d) Years since childbirth: 3



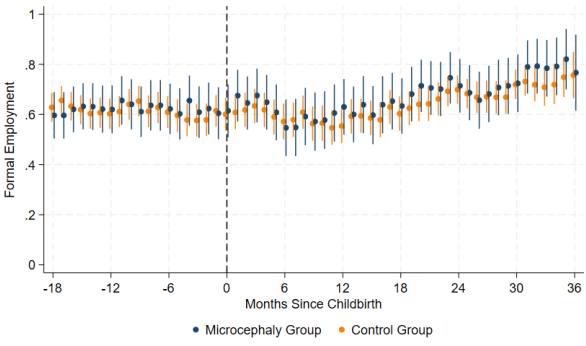
Back

Results (Father)

Received Transfers

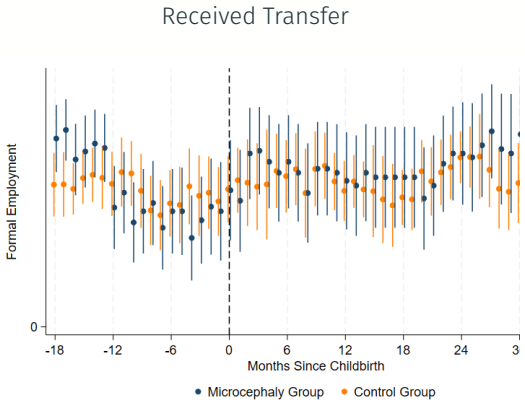


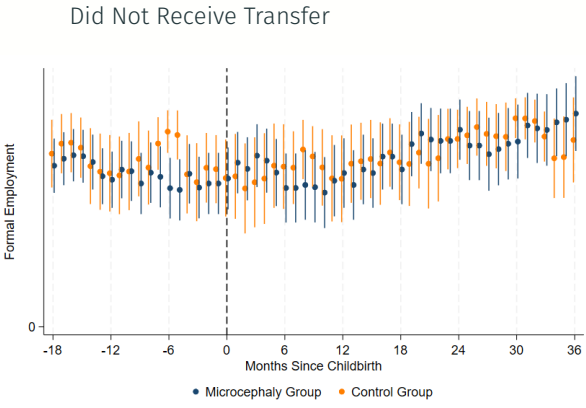
Did Not Receive Transfers



Back

Results: Subsample with Previous Formal Employment (Fathers)





Back