

Congenital Disability Effects on Parents' Labor Supply: Evidence from the Zika Virus Outbreak

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USACH

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

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

This Paper

- **Questions:** How does congenital disability affect parents' labor market outcomes? How does it 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

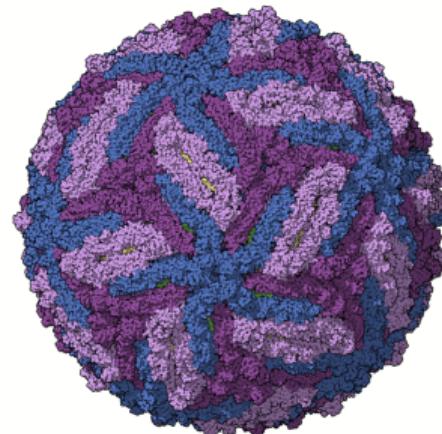
Background

- 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 mild, often asymptomatic
- Infection during pregnancy may cause microcephaly. **This link was previously unknown.**
- Therefore, epidemic went unnoticed until uptick in anomalous births

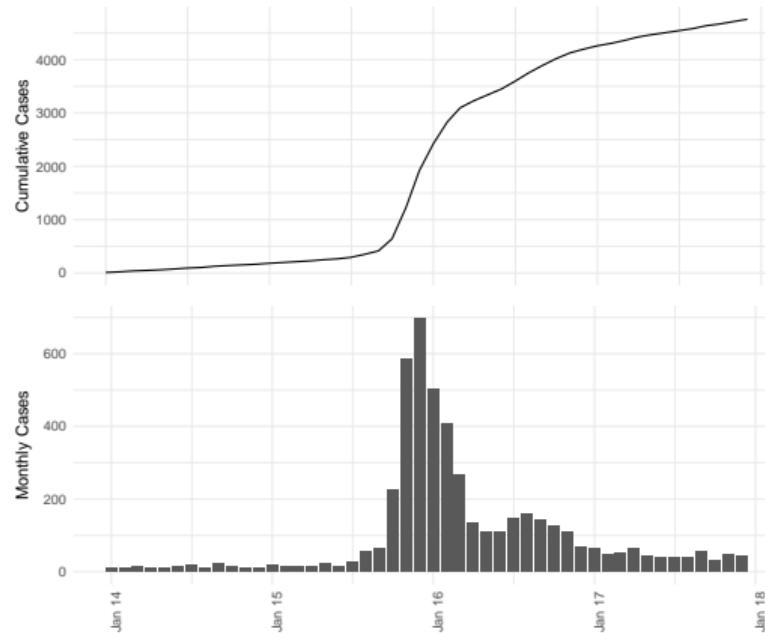


Background

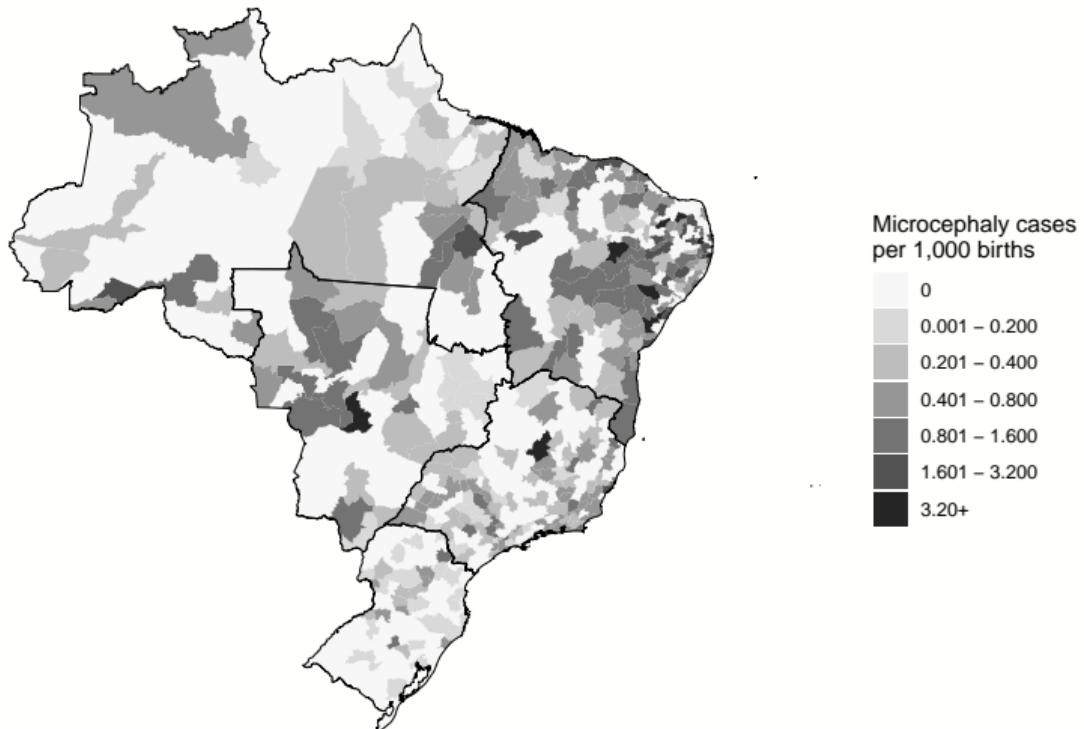
- Microcephaly causes severe impairment of cognition, motor and speech development.
- Requires therapy to deal with limitations
- Normally rare condition, associated with genetic syndromes or malnutrition



Background



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



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

Identification

Roadmap

- 1 Why the Zika epidemic is an interesting case study. Role selection on unobservables.
- 2 An informal model to fix ideas
- 3 The identification strategy.
- 4 Estimation.

Zika characteristics

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.

Zika characteristics

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 (Johansson et al. 2016) – public awareness would help with a large delay.

Zika characteristics

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 (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.

Zika characteristics

Selection by differential diagnosis unlikely

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

Zika characteristics

No direct effects

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

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 depends 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:

- Time and place of birth, so $c_{mt}\lambda_{mt}$ is held constant.
- Individual characteristics that affect infection X. Candidates 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 et 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,
 - d) Education (completed high school)
 - e) **Some specs:** 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)

Estimation

We estimate the treatment effect through the fully saturated model:

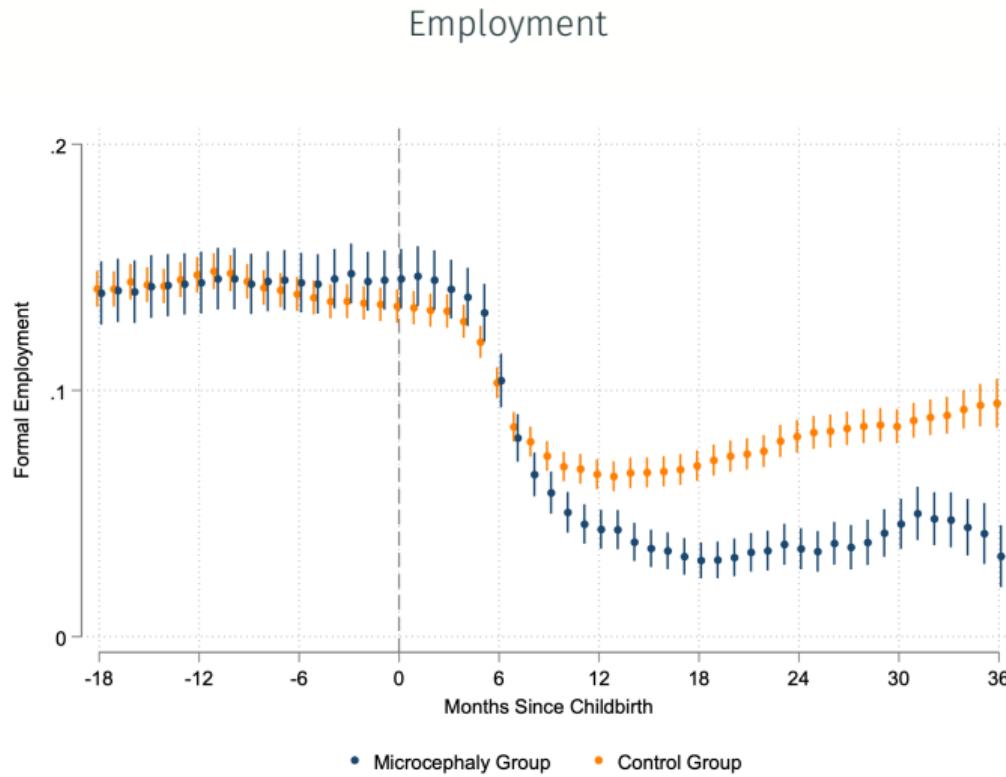
$$y_{it} = \sum_{k \in (-18, \dots, 36)} \left[\beta_k^{\text{Control}} + \beta_k^{\text{Microceph}} \cdot \text{Microceph}_i \right] \text{Time}_k + \varepsilon_{it}$$

- y : outcome of interest for family i at year-month t .
- Microceph_i is a dummy indicating families with a child with microcephaly.
- $\beta_k^{\text{Microceph}}$: average of the outcome at period k for mothers of children with microcephaly
- β_k^{Control} : average of the outcome for control mothers.
- Weights: Treated units receive a weight of 1 and all control units a weight of $\frac{n_t(s)}{n_c(s)}$

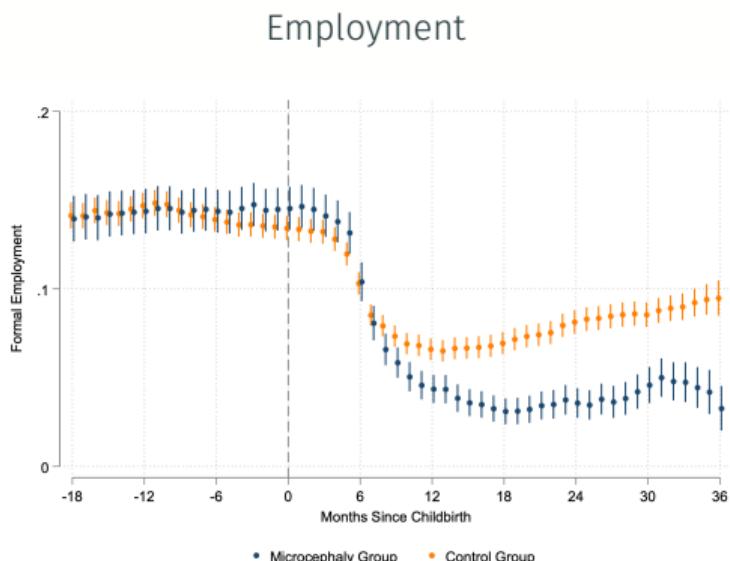
Results

Mothers' Labor Market Outcomes

Results



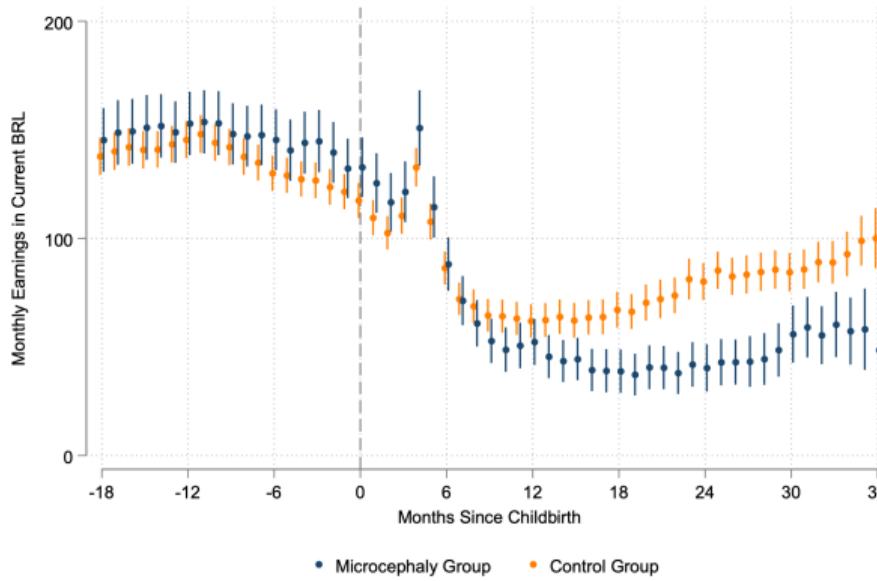
Results



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

Results

Earnings

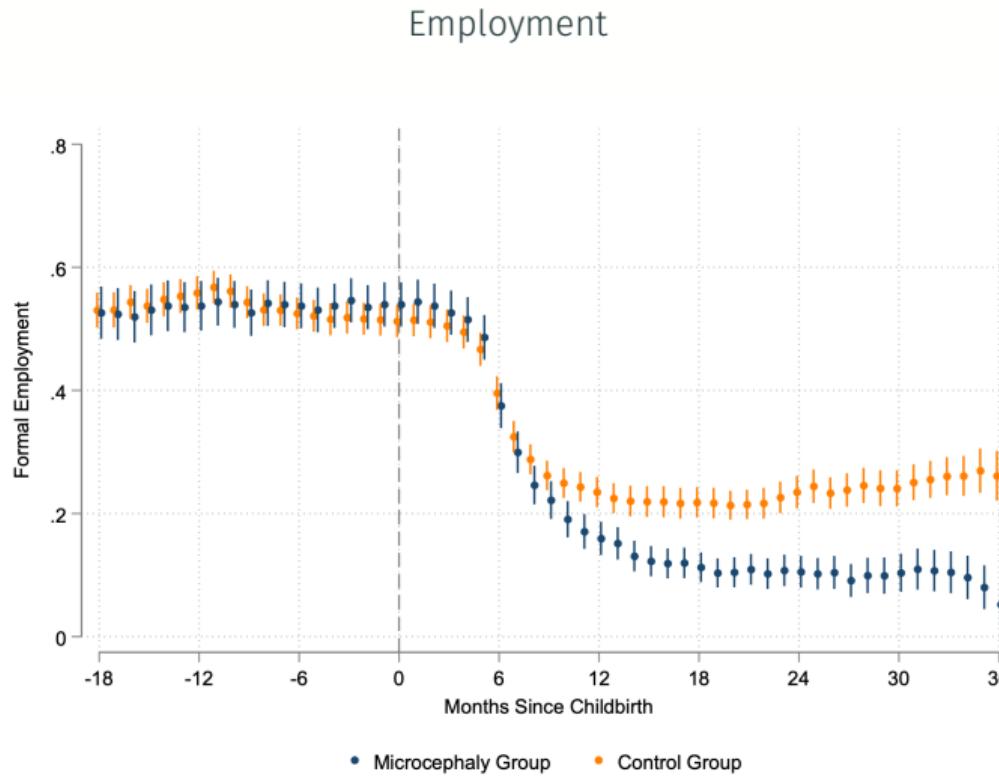


Results

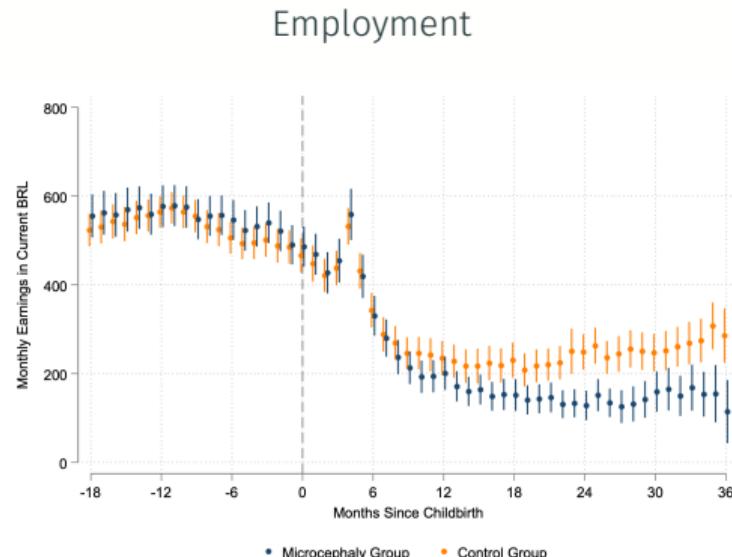


- Motherhood penalty for controls:
 - 53.7 BRL (CI: 49.2 – 61.3)
 - 41.1% (CI: 37.1% – 45.2%)
- Additional penalty for treated:
 - 31.0% (CI: 18.4 – 43.6)
 - 64.9% (CI: 56.0% – 73.7%)

Results: Subsample with Previous Formal Employment

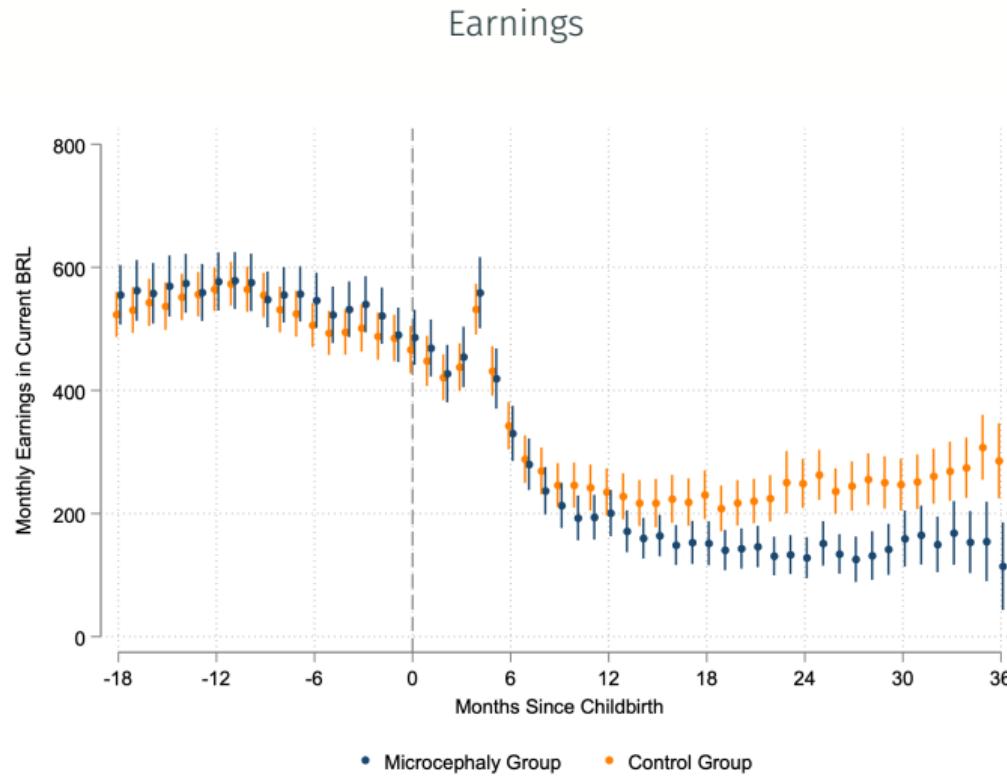


Results: Subsample with Previous Formal Employment

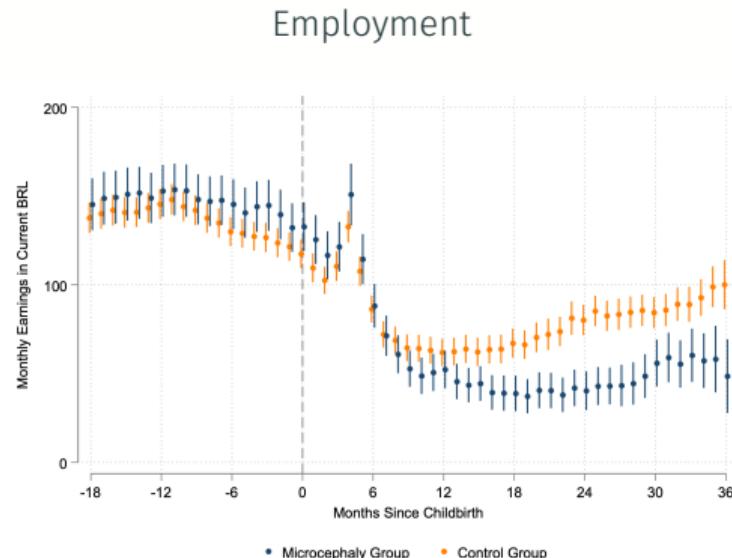


- Motherhood penalty for controls:
 - 27.2 p.p. (CI: 24.8 – 29.7)
 - 51.9% (CI: 48.71% – 55.0%)
- Additional penalty for treated:
 - 12.8 p.p. (CI: 9.9 – 15.7)
 - 47.1% (CI: 35.1% – 59.1%)

Results: Subsample with Previous Formal Employment



Results

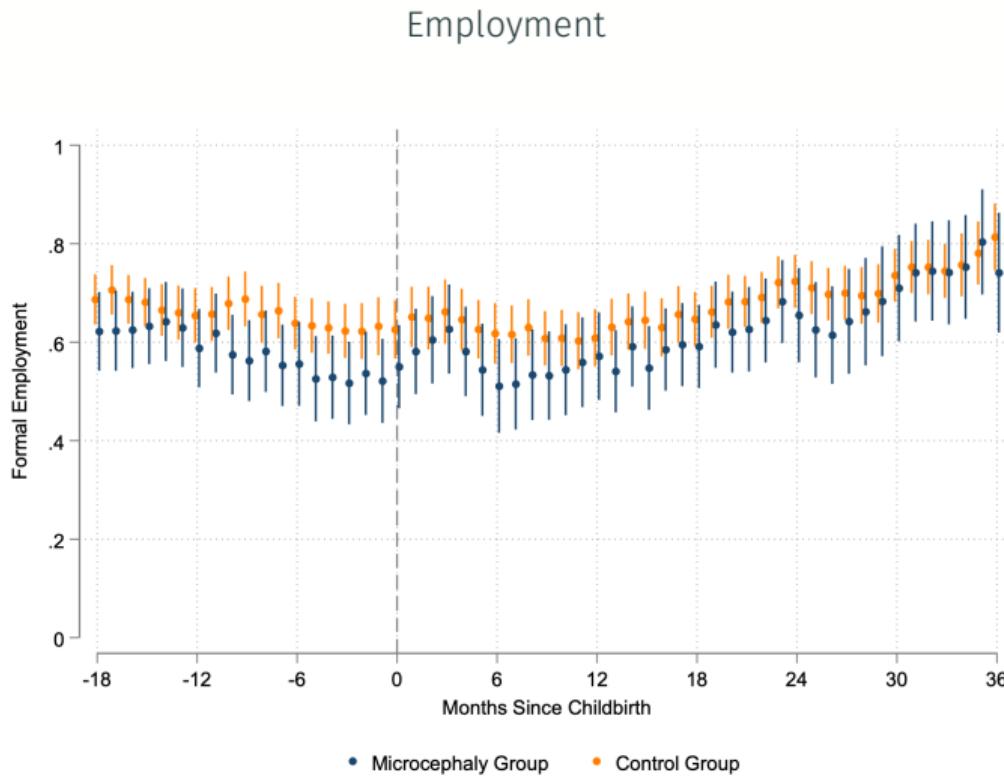


- Motherhood penalty for controls:
 - 250 BRL (CI: 220;278)
 - 49.1% (CI: 44.7%;53.5%)
- Additional penalty for treated:
 - 107 (CI: 55;160)
 - 43.1% (CI: 20.7%;65.5%)

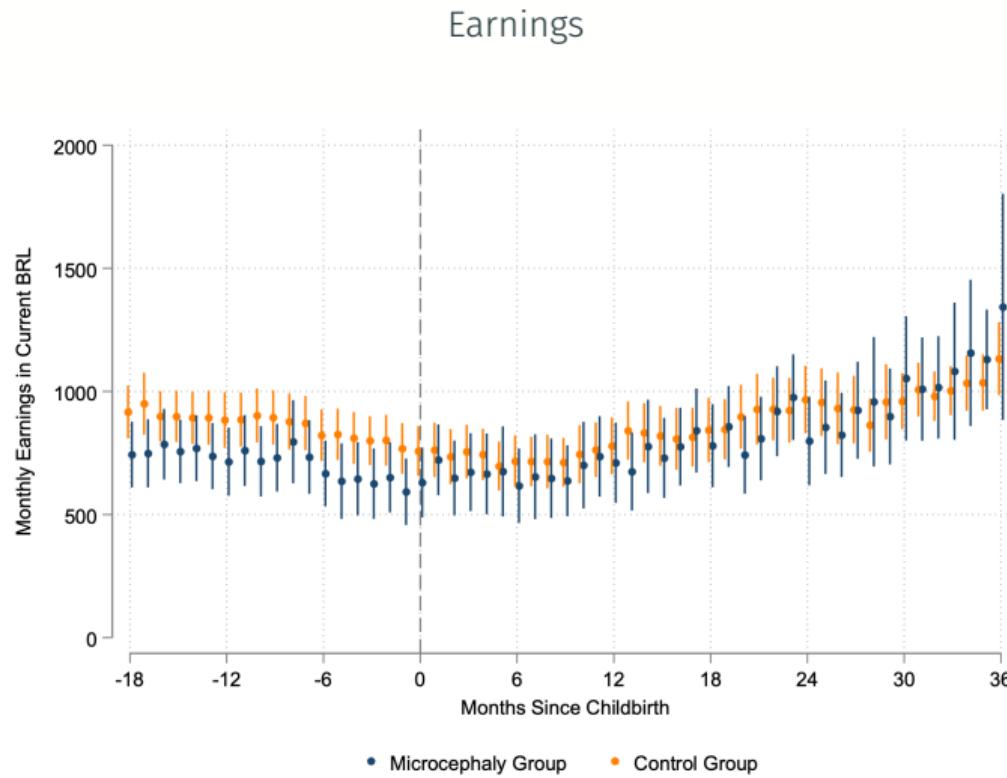
Results

Fathers' Labor Market Outcomes

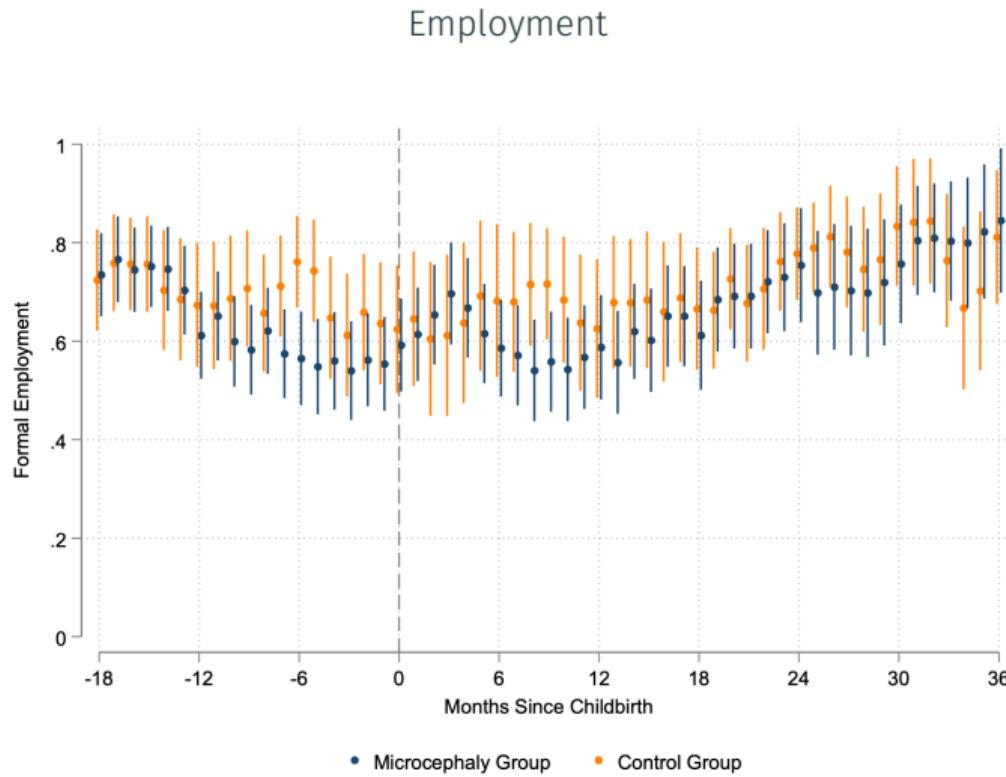
Results



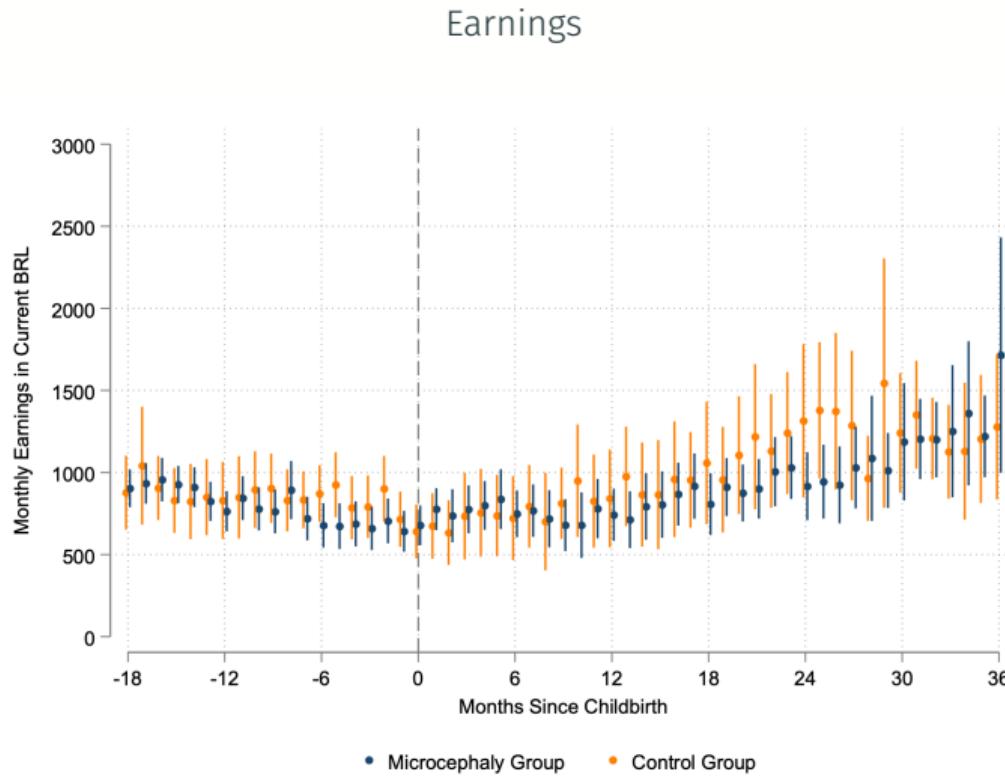
Results



Results: Subsample with Previous Formal Employment



Results: Subsample with Previous Formal Employment



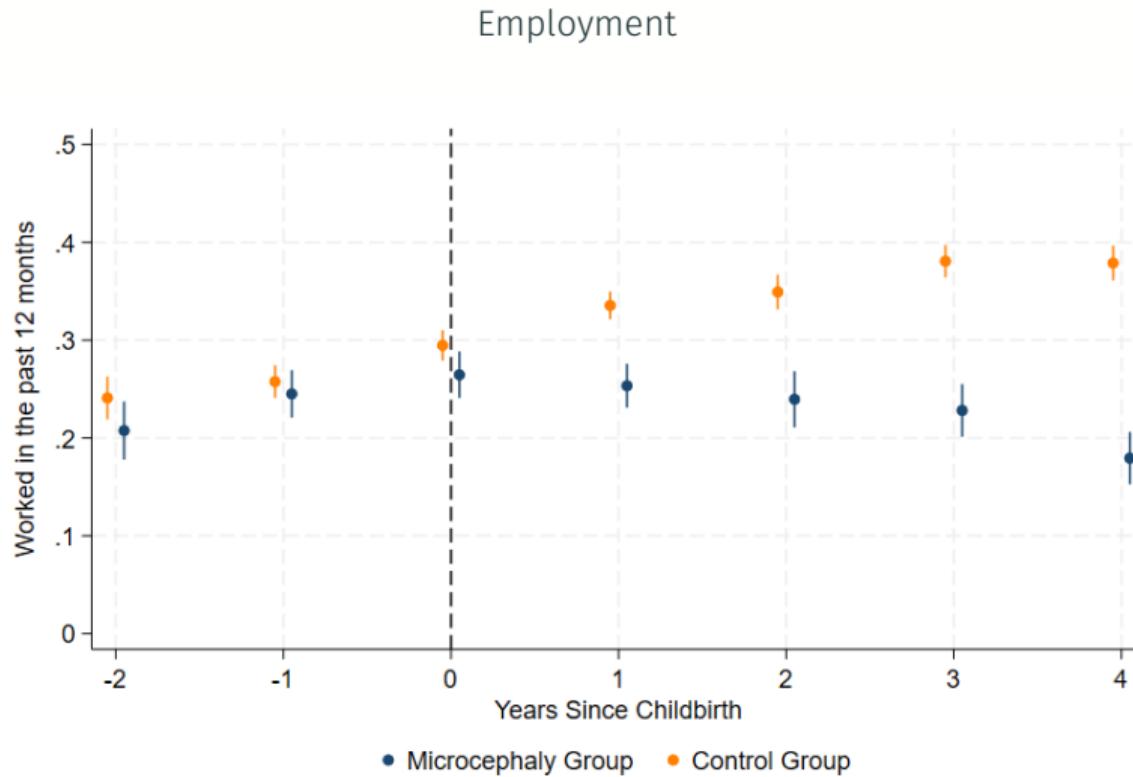
Results

Formal & Informal Work

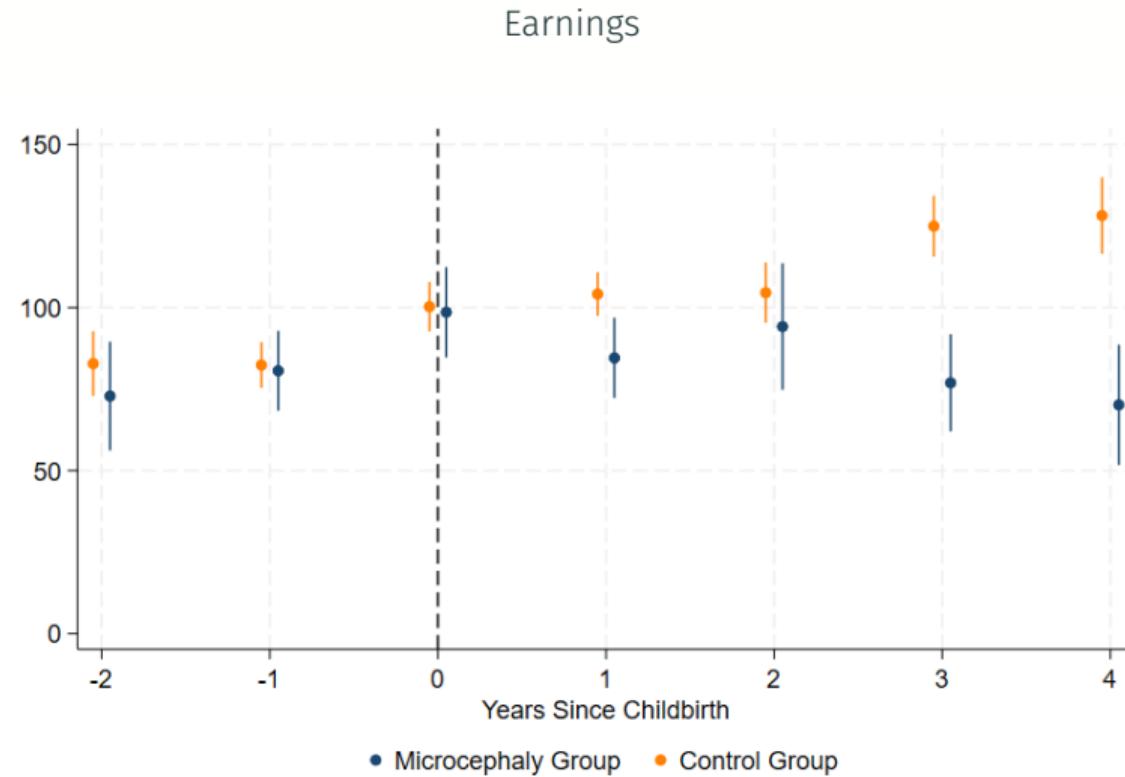
Formal and Informal Work

- 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 (.0081)	-.005 (.0087)	-.022* (.013)	.0076 (.014)
Constant	.13*** (.003)	.13*** (.0044)	.15*** (.0069)	.13*** (.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

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

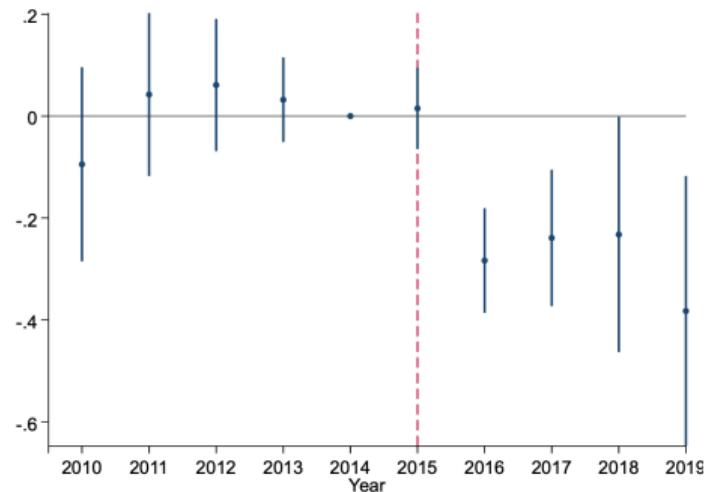
- $fertility_{mt}$: births in a municipality m at year t per 1,000 people
- $Incidence_m$: incidence of microcephaly during the Zika outbreak in m .
- $\mathbf{1}_{t \geq 2015}$: indicator function for years equal to or after 2015.
- δ_m : municipality fixed effects
- δ_t : year fixed effects .

We use two different measures of incidence:

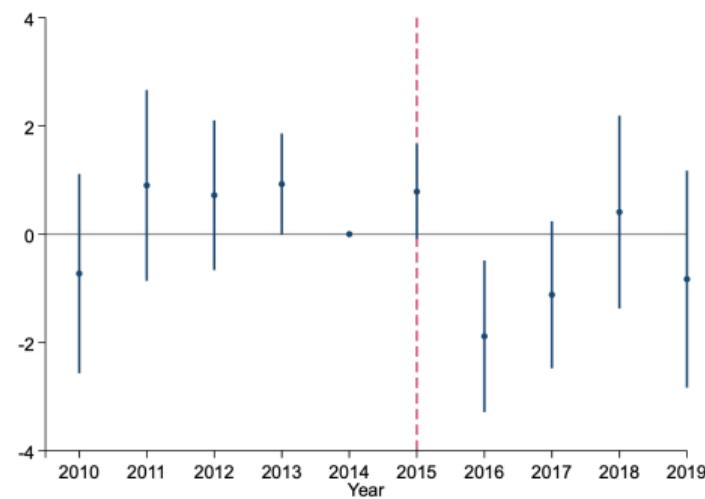
- (A) m is above the 75th percentile of cases per capita
- (B) cases per 1,000 inhabitants.

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

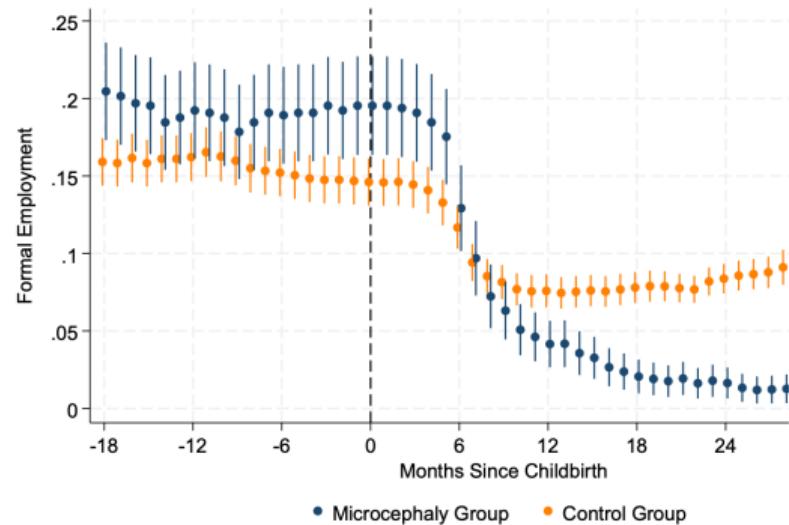
	Father Present in 2017	Father Present in 2019	
	(1)	(2)	(3)
Microcephaly	.013 (.0098)	.0085 (.0093)	-.0028 (.0039)
Father present 2017			.86*** (.0095)
Constant	.19*** (.0049)	.16*** (.0046)	.0023 (.0033)
Number of Obs	37,089	37,089	37,089
Number of Clusters	1,728	1,728	1,728
Match FE	Yes	Yes	Yes

Government Transfers

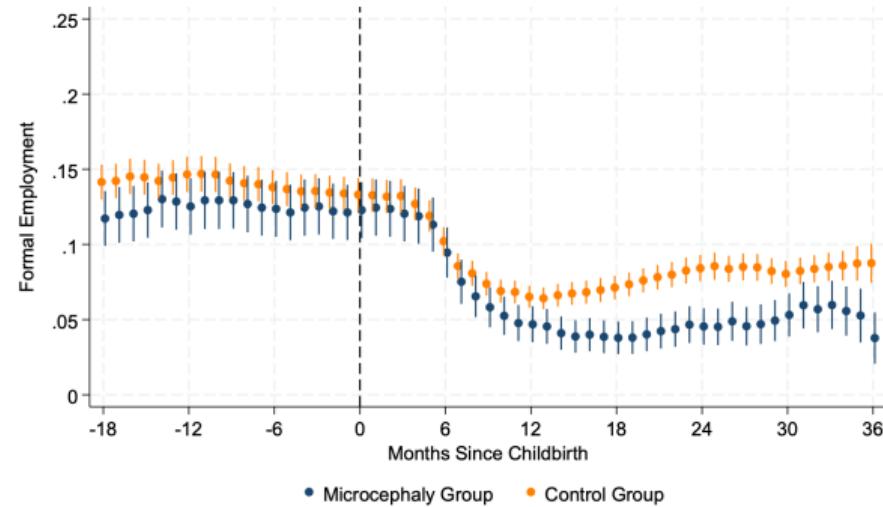
- Low income families with a person with a disability are entitled a transfer
 - Extended to all families impacted by Zika after 2019
- To what extent are the results driven by income effects from this transfer?
- We do not observe when each family starts receiving the benefit, but can identify which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

Results

Received Transfers

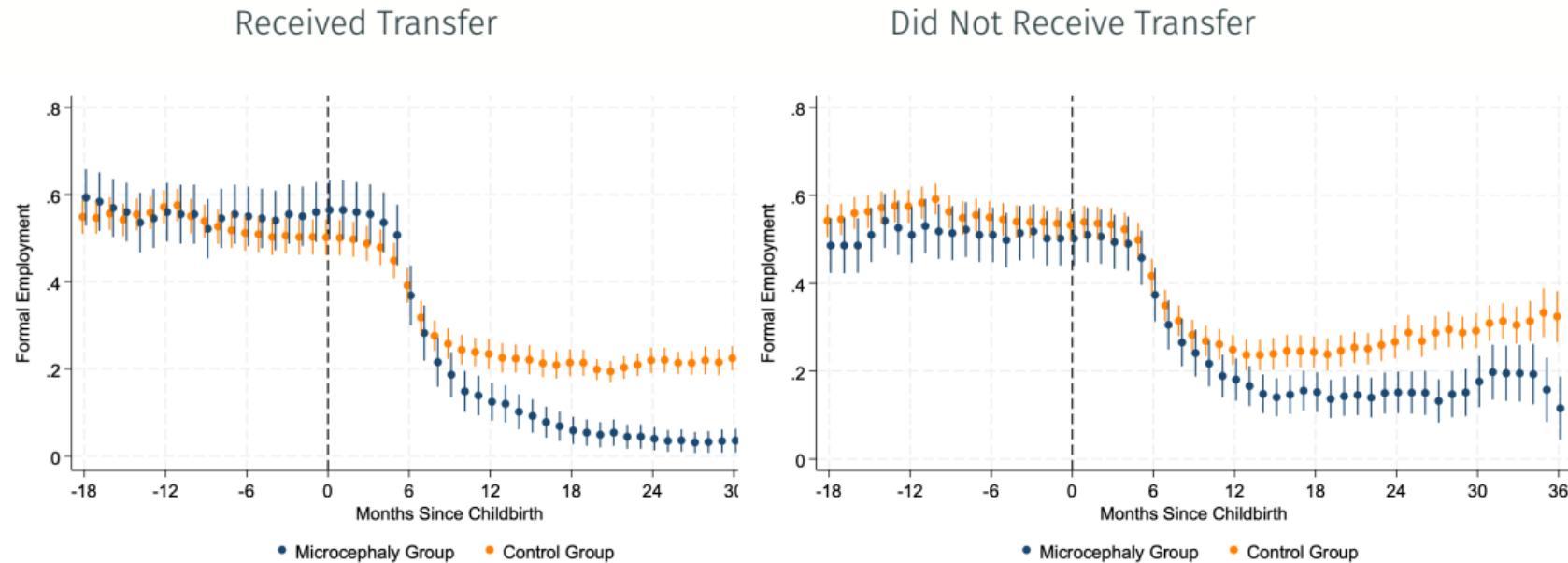


Did Not Receive Transfers



Fathers

Results: Subsample with Previous Formal Employment



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 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 cohabit.
- Our results help quantify the enormous human costs associated with disease and disability, and highlight the disproportionate effect on women.

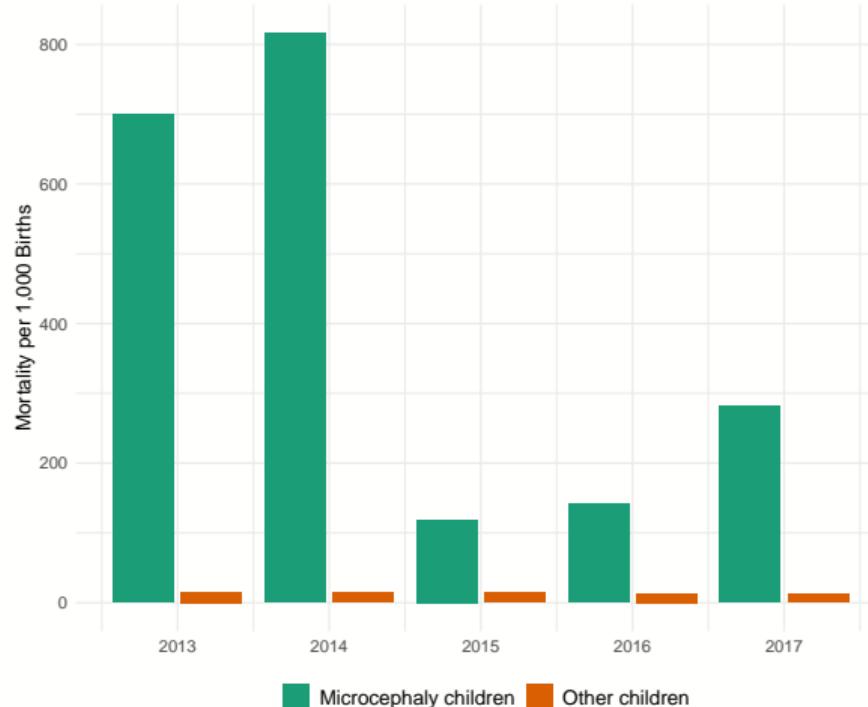
Thank you!

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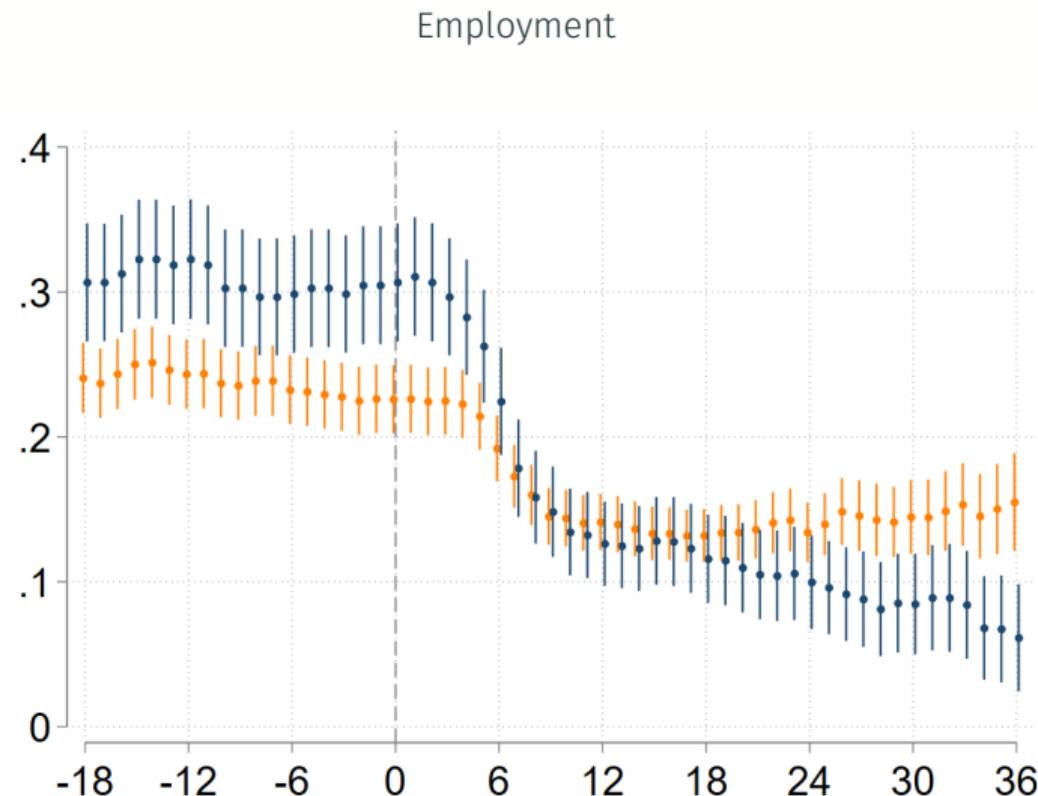
	Coefficient	p-value
Mother's Characteristics		
Race: "Black"	0.065	0.545
Age (years)	0.013	0.021
Type of job: Formal	-0.148	0.524
Type of job: No answer	0.168	0.049
<i>Joint F-test</i>		<i>0.0075</i>
 Mother's Education		
Attending: Adult Education	0.538	0.193
Attending: Fifth grade	-0.575	0.002
Attending: Sixth grade	-0.182	0.239
Attending: Ninth grade	0.100	0.622
Did not finish highest grade attended	-0.226	0.001
<i>Joint F-test</i>		<i>0.0005</i>
 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
<i>Joint F-test</i>		<i>0.2416</i>
 Year-month Fixed Effects		
	Yes	0.0000

◀ Back

Mortality

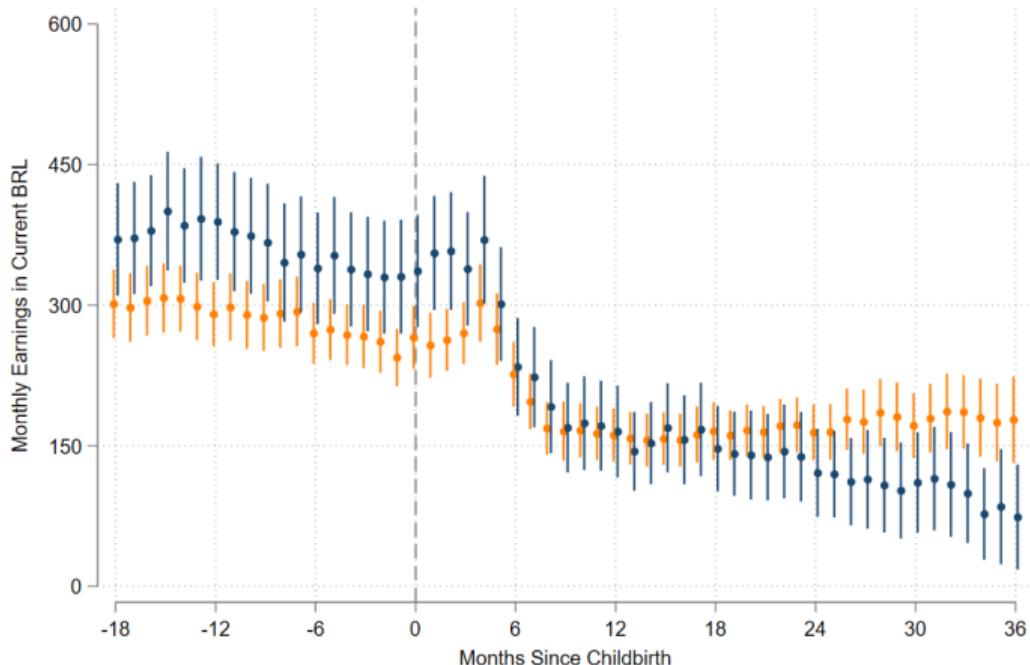


Results: Down Syndrome

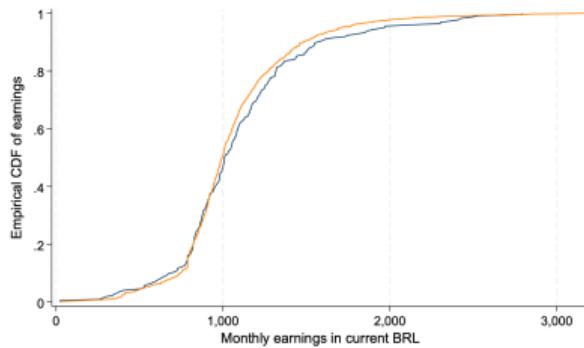


Results: Down Syndrome

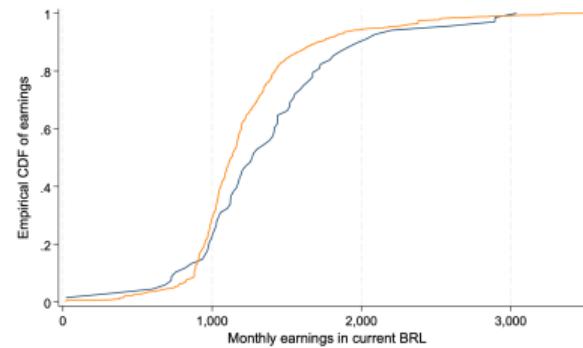
Earnings



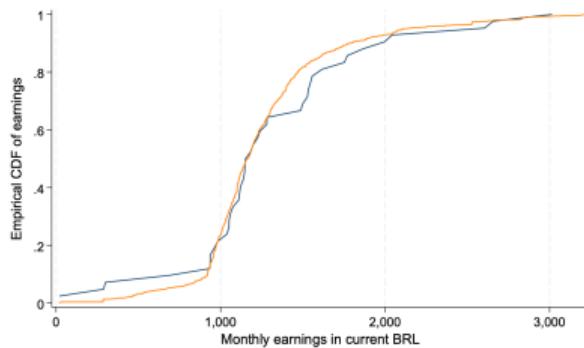
(a) Months since childbirth: 0



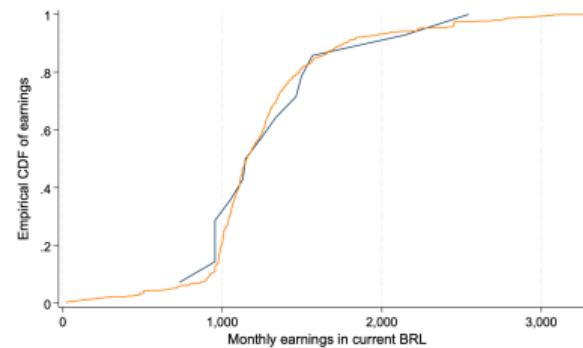
(b) Months since childbirth: 12



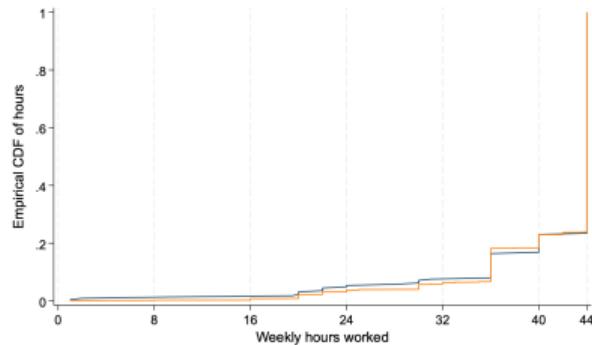
(c) Months since childbirth: 24



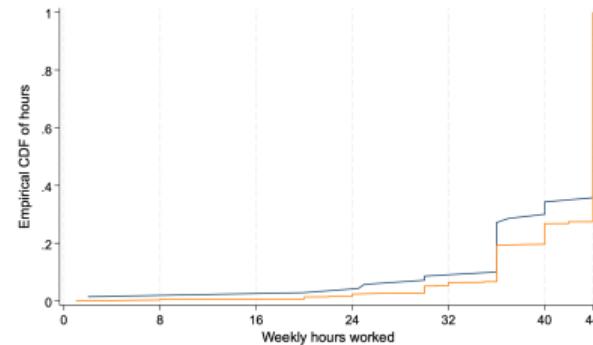
(d) Months since childbirth: 36



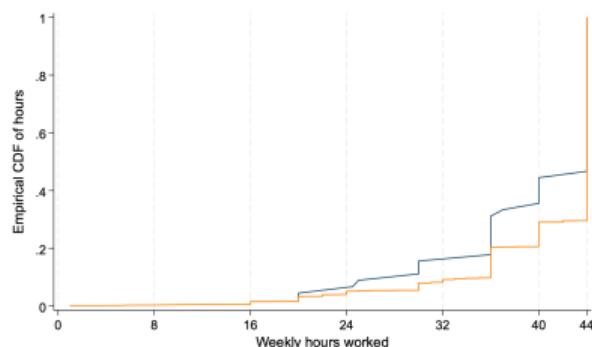
(a) Months since childbirth: 0



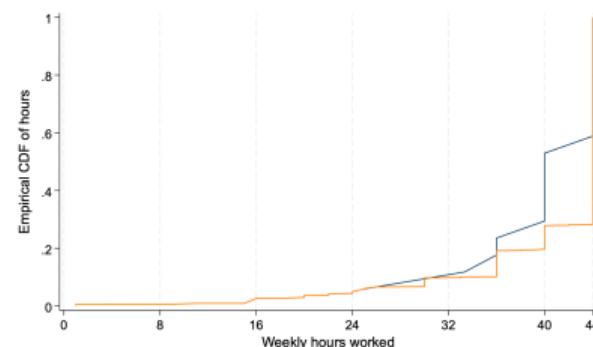
(b) Months since childbirth: 12



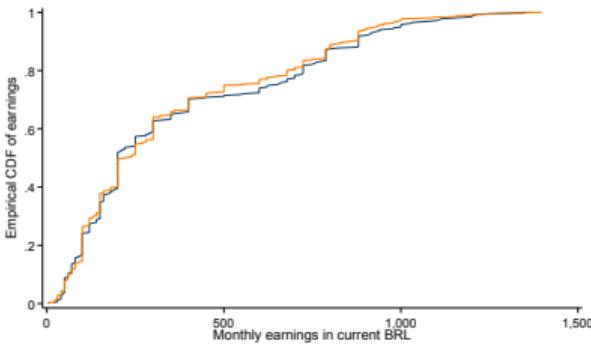
(c) Months since childbirth: 24



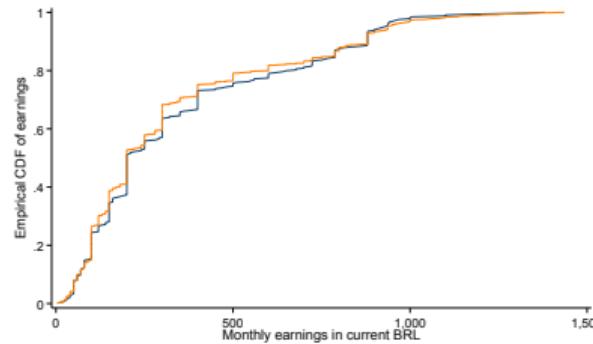
(d) Months since childbirth: 36



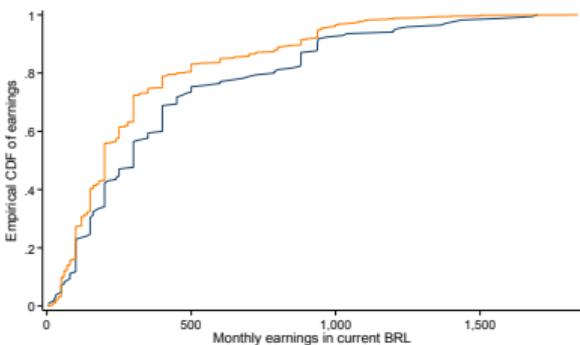
(a) Years since childbirth: 0



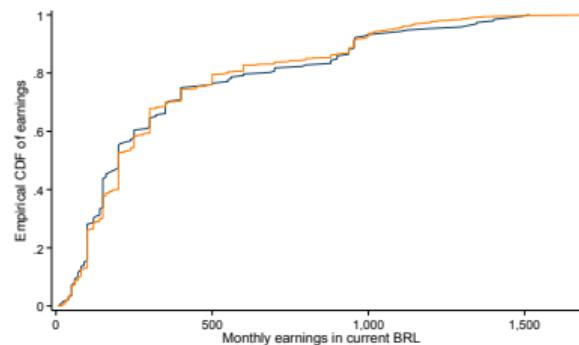
(b) Years since childbirth: 1



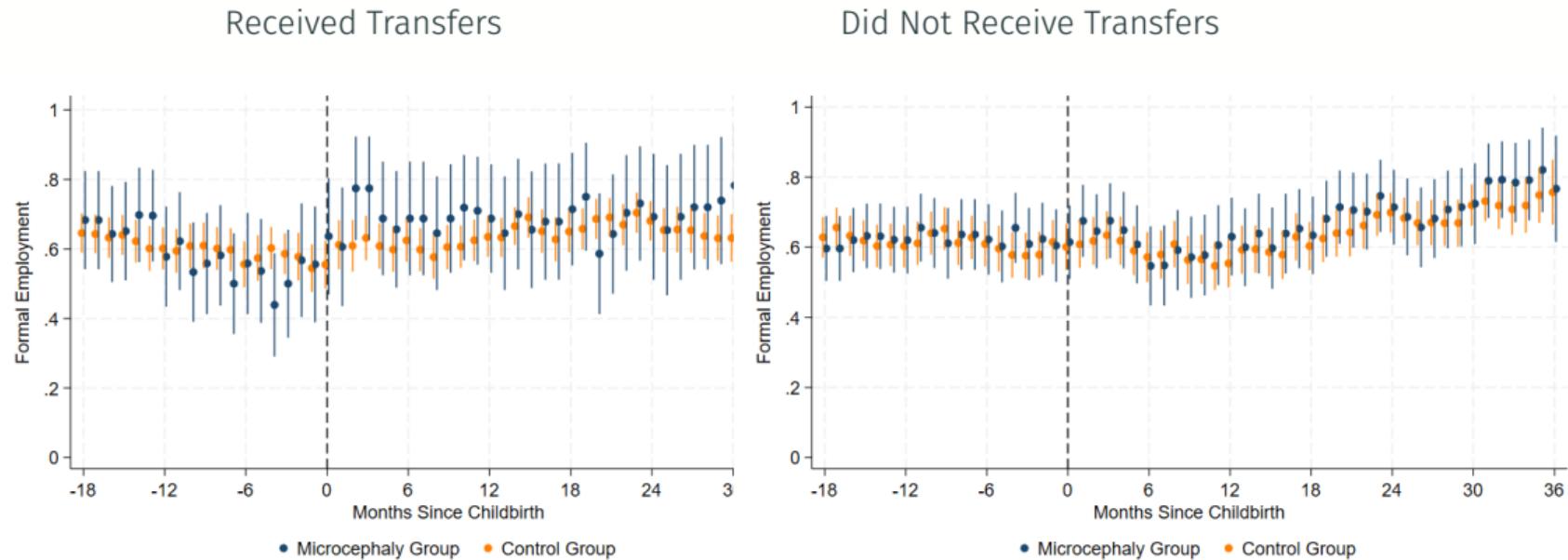
(c) Years since childbirth: 2



(d) Years since childbirth: 3

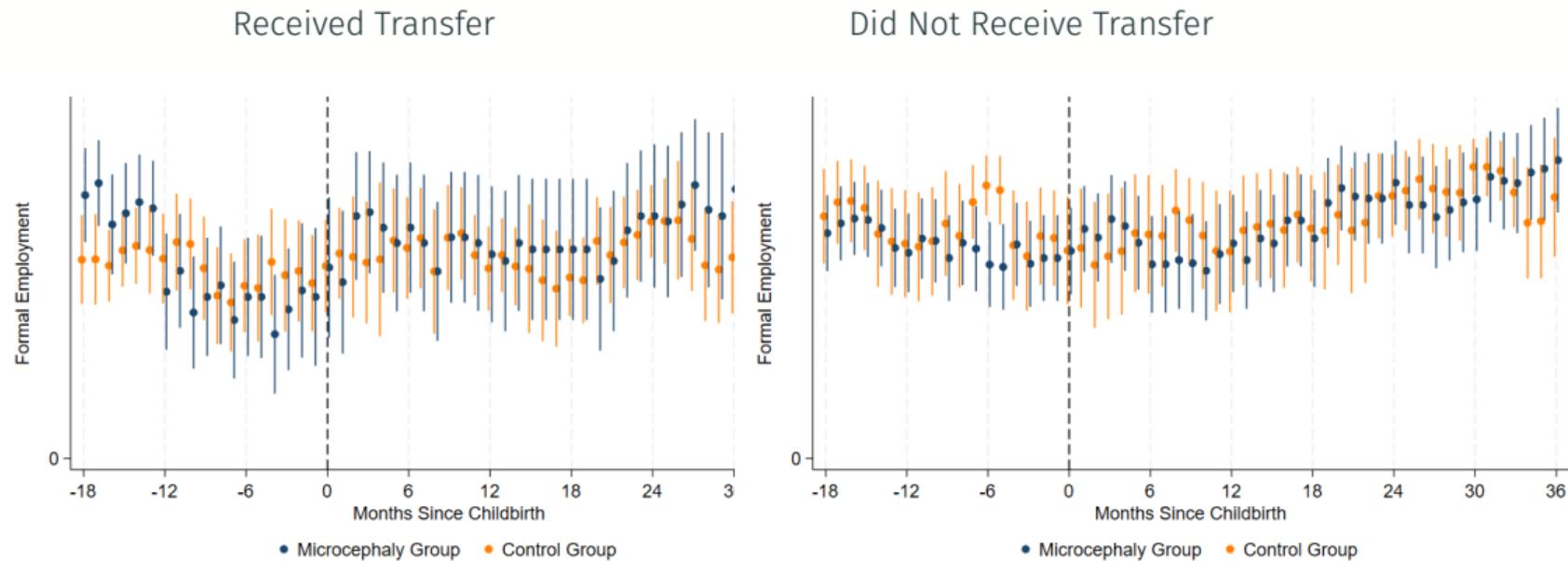


Results (Father)



◀ Back

Results: Subsample with Previous Formal Employment (Fathers)



◀ Back

Full Sample				
	Works	Earnings		
	(1)	(2)	(3)	(4)
Treated	.0064 (.0079)	.0064 (.0079)	11 (8.781)	11 (8.781)
Post	-.058*** (.0032)	-.056*** (.0032)	-50*** (3.427)	-47*** (3.517)
Treated × Post	-.044*** (.0071)	-.044*** (.0071)	-40*** (7.869)	-40*** (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 (.0232)	.011 (.0232)	-5.4 (29.38)	13 (29.6)
Post	-.26*** (.0113)	-.26*** (.0116)	-237*** (13.2)	-230*** (14.08)
Treated × Post	-.12*** (.0228)	-.12*** (.0228)	-97*** (27.46)	-98*** (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