Short-term Challenges of Long-Term Growth: Gendered Consequences of Infrastructure Projects in Brazil

Débora Machado Nunes[1]* and Vinicius Curti Cicero[2]

[1] Assistant Professor at Monmouth University, New Jersey
dmachado@monmouth.edu

[2] Assistant Professor at Denison University, Ohio
cicerov@denison.edu

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Structure

- Motivation and Research Question
- Background
- Our case study
- Qualitative data
- Quantitative Data and Next Steps
- Policy implications

Motivation and Research Question

Motivation and Research Question

- Infrastructure building is a vital component of economic growth and development
  - Physical infrastructure: electricity and energy access, water and sanitation, transportation, information and communication technology (ICT)
  - Social infrastructure: education, healthcare, social care services
- Unique impacts for women and girls
  - Large effect on economic empowerment and time-use
- What about the impacts of actually building infrastructure?
  - Significant influx of construction workers (middle-age men)

Motivation and Research Question

- Research Question: How does the temporary influx of construction workers during infrastructure projects affect the safety, education, and health outcomes of women and girls?
  - Short-term consequences with possible long-term effects
- Case study: the duplication of the Ferro Carajás Railroad in Northern Brazil, which started in 2010
- Hypotheses
  - Higher vulnerability of rural, impoverished communities
  - Unequal gendered distribution of jobs among local labor force
  - Perception of poverty trap escape through migration

Background

Background

- Gendered impacts of social infrastructure
  - Education: likely the most well-documented cases. Impacts of more access to women, children, and men. Large impacts on fertility, age of first marriage, domestic violence, intra-household bargain, LFPR, employment, gender pay gap...
  - Healthcare: evidence of reproductive, non-reproductive, and mental health care having significant impacts for women's well-being. Large impact on paid work opportunities.
  - Social care: childcare, elderly care, care for disabled people. Robust body of evidence shows impacts on time use, gender pay gap, LFPR…

Background

- Gendered impacts of physical infrastructure
  - Electricity and energy: significant decrease on time spent on unpaid domestic work. Concave relationship with life expectancy, school enrollment, literacy, LFPR, employment.
  - Water and sanitation: improvements in health outcomes for women (particularly pregnant women) and all family members. Decrease on time spend on unpaid domestic work (water transportation).
  - ICT: sense of independence, freedom, self-esteem, and access to resources.
  - Transportation: safety considerations dictate the gendered impacts of transportation infrastructure building. Ability to access social infrastructure is vital, and large traveling times for women impact time-use.

Background

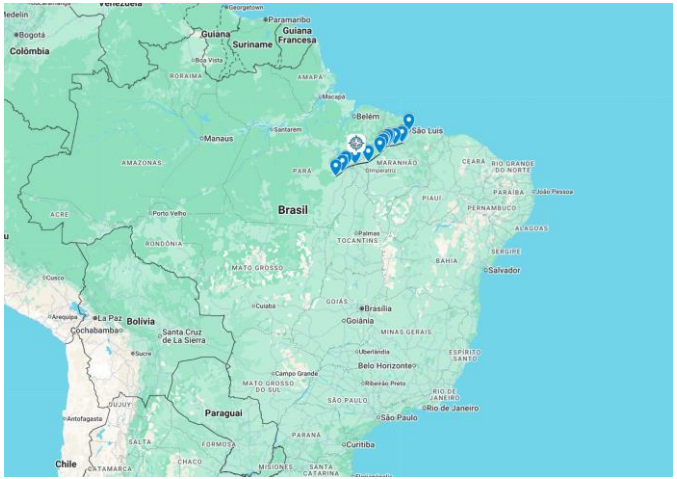
- Type of infrastructure matters
  - Gender inclusiveness
- Women's time use has significant impacts on growth and development
- Models frequently explore the following mechanism:
  - Public infrastructure → women's time use → Productivity effect; Effects on home production; Effects on human capital

Background

- Immediate impacts on health and violence less explored
  - Contemporaneous to infrastructure building
- World Bank's assessments criteria of gender inclusion and gendered impacts of infrastructure:
  1. Consultation (public meetings with local women);
  2. Presence of gender analysis in social and environmental assessments;
  3. Listing gender equality goals as project development objectives;
  4. Gender-responsive design (gender quotas, etc);
  5. Targeting gender activities and designs in the budget;
  6. Monitoring gender responsive indicators as the project progresses.

Our case study

Our case study



- Duplication of the *Ferro Carajás* Railroad (EF-315)
  - Nickname: Ponta da Madeira-Carajás
  - Extension: 996 km (891.7 km before the expansion)
  - Operated by: Vale S.A.
  - Use: passenger trains and freight trains
    - Transportation of copper, pig iron, iron ore, and manganese ore
    - On average, 1,300 passengers use Vale's transportation service per day (92% occupancy rate) and 350,000 throughout the year (2008-2019)
    - 96.6% of total revenue from own products transportation
    - Connects the Carajás Mine (the world's largest open-pit iron ore mine, located in Pará) to the Madeira Point Maritime Terminal (also property of Vale S.A.)
    - The need to duplicate the tracks of the EFC is intimately connected with Vale's S11D project (4.24 billion tons or iron ore mining potential; largest project in Vale's history).
    - Duplication increased transportation capacity by 53%.

Our case study

- Qualitative data from Tufilândia (MA)
  - Approximately 5,000 inhabitants
  - 280km from São Luis
  - 20km from Santa Inês (85,000 inhabitants)
  - More than 1,000 families rely on *Bolsa Família*
  - Poverty rate: 52%

- In 2014: sudden influx of over 300 (male) workers employed in road-building project
  - Three-year project
  - Projection of at least 200 direct jobs and 100 indirect jobs

Qualitative data

Qualitative Data

- Collected by journalist Auri Rebello
  - Immersive participation in community life during one week in 2015
  - Informal interviews with reduced positionality bias
  - *As Novinhas e os Visitadores*
- Employment and training
  - Lack of direct jobs, almost all for men
  - Direct bargain with worksite managers, usually involves exchange of favors
    - Briery, child prostitution, sexual favors…
  - Indirect employment too competitive, temporary, also frequently involves exchange of favors
    - Restaurants, bars, *marmitas* (to-go food)
  - Official numbers (provided by Vale S.A.):
    - 50 people accessed free training programs (carpenter, steel fixer, mason, track maintenance officer, dump truck operator, and welder)
    - 177 employees contracted by Vale (not simultaneously)

Qualitative Data

- Employment and training
  - *“Não tem vez para este pessoal mal qualificado e sem experiência. Os trabalhadores do local acabam sempre pegando mesmo as vagas que sobraram, que não deu para preencher com o povo de fora”*

19/08/2015 11h04 - Atualizado em 20/08/2015 07h34

Moradores incendeiam automóveis e trecho da EFC em Tufilândia (MA)

Operações estão interrompidas; moradores da cidade reivindicam empregos.
Empregados e terceirizados da Vale foram vítimas de apedrejamento.

Do G1 MA

Qualitative Data

- Conversations among constructor workers and girls (*novinhas)*
  - *Whatsapp* conversations among older man (late 20, early 40s) and your girls (16 y. o. maximum)
  - Dates at *Praia do Jacaré*
    - High alcohol consumption (sponsored by construction site workers)
    - Party environment
    - Frequent sexual encounters
  - Gifts and exclusivity
    - *“Quando a gente come uma aqui que gosta mais, nóis diz pra ela que tá namorando para ela parar de dar para os outros e só você comer. Aí dá um presente, uma sandália, um celular, traz um negócio diferente para comer, um chocolate, trata bem e tal”*
  - Lack of older women available for relationships
    - *“Tem de 15, 16, 17, 14… Aqui, em Tufilândia, não tem esse negócio de menor de idade, não. Mesmo porque com 18, 20, as meninas já tão tudo é acabada, barriguda, com filho… Então, tem que aproveitar enquanto elas é novinha mesmo. Não tem problema, sempre foi assim aqui e ninguém acha ruim, não. As novinha aqui tudo começa cedo, engravida cedo e envelhece cedo. Fica tudo gorda e acabada antes dos 25. A hora delas aproveitar e nóis aproveitar elas é agora.”*

Qualitative Data

- Grooming of minors
  - *Durante a semana que passei em Tufilândia sem me identificar como jornalista, fui apresentado — por aliciadores de ocasião da cidade, operários de fora e em abordagens diretas nos bares e quiosques — para 11 adolescentes. A mais velha tinha 17, e a mais nova, 13 anos de idade. Algumas estavam dispostas a contato sexual em troca de dinheiro; outras, em troca de presentes; várias, sem cobrar nada — simplesmente em busca de uma noitada de "ostentação" regada a bebida alcoólica, passeio de carro, acesso a drogas ou qualquer outro divertimento que pudesse ser proposto.*
  - *Várias das meninas são atraídas para os relacionamentos com os operários, eventualmente de apenas uma noite, em troca de nada. Apenas pela oportunidade de ficar com alguém bem apessoado vindo de fora, mesmo que muito mais velho, que paga a conta do bar, por exemplo, pela esperança de um romance mais duradouro que possa tirar elas dali, pela promessa de serem levadas embora para uma cidade com horizontes mais amplos para a vida delas, ou só pela aventura mesmo. Outras, cobram dinheiro explicitamente pelo uso de seus corpos, mas nunca mais do que R$ 30 ou R$ 50. Algumas, são pressionadas a fazer isso por conhecidos e familiares. Outras, pedem e ganham presentes como celulares, bijuterias, roupas, sandálias e tênis.*
  - *"Pega uma mesa ali fora no canto, desce uma cervejinha, vocês se conhecem, conversam… aí é só arrastar ali pra praia e descer a rola. Se me der uns R$ 20, eu deixo usar minha cama na cabana ali atrás. É de solteiro, mas é melhor que a areia, né?"*
  - *Pela ajuda com as apresentações, contatos e telefonemas, ele não cobra um valor definido. "Depois nóis se ajeita aí", e diz que qualquer nota de R$ 20 resolve o problema.*

Qualitative Data

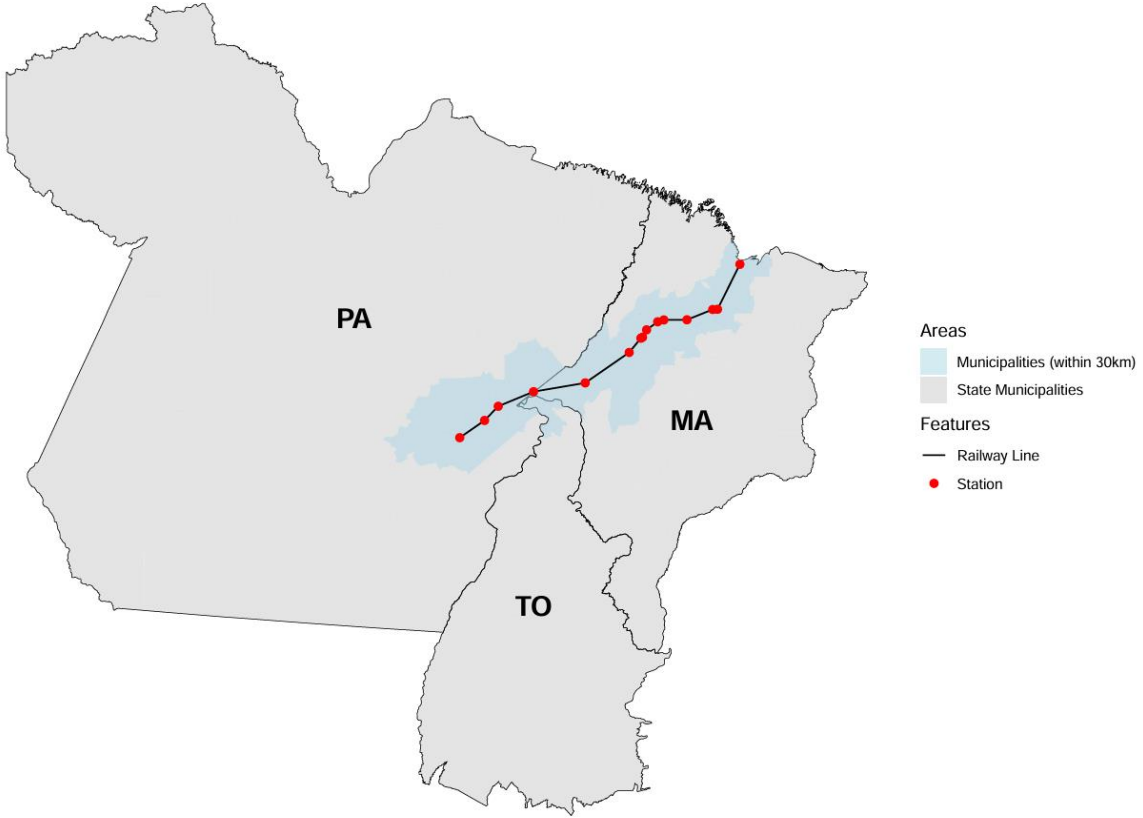
- Conversations among girls
  - Hopes of marriage, family, leaving Tufilândia
    - *“Ele disse que não pode, que já tem filho… mas não gosta da mulher, gosta é de mim.”*
  - Rumors of STIs
    - *“Se eu fosse você, tomava cuidado com essas daí. Essas não precisa nem dar oi, elas já saem abrindo as pernas. Com esse monte de homem que andou por aqui, a Aids tá solta por essas bandas, meu filho”*
  - Lack of “quality local men”
- Drug use
  - *“Sabe do que gosta essa daí? Dê pó. Ela gosta. Se botar um pó, o cara come até o cu.”*

Qualitative Data

- Lack of public services
  - Absent mayor (lives in São Luiz do Maranhão and responds for several crimes)
  - Abandoned police station. Closest one in Pindaré-Mirim (100km away)
    - *“Lá atrás, no começo da obra, a empreiteira que tocava a obra era a Camargo Corrêa. Chegaram algumas denúncias, cerca de uma dezena, sobre isso. Funcionários das obras ali na frente estavam oferecendo dinheiro e outras vantagens para as meninas da vila em troca de favores sexuais. Chegamos a abrir investigação, mas, quando fomos lá, a empresa já tinha abandonado a obra e os suspeitos ido embora. A polícia não encontrou nenhuma vítima ou testemunha dos casos de abuso e exploração para prosseguir com o inquérito. Ficou por isso mesmo. Agora, também já está acabando lá, né?”*
  - Conselho Tutelar (guardanship council) haven’t had elections since 2003. Pindaré-Mirim social workers cannot absorve the demand.
    - *“A maioria dos administradores da região, quando vê uma obra dessa chegar, vê como uma oportunidade de arrumar empregos para a população, e é nesse sentido que eles vão negociar. Ninguém pensa nos outros impactos que isso vai ter. Do meu ponto de vista, se a Vale ou qualquer outra das empresas desenvolve um trabalho social, é algo incipiente. Se fosse algo relevante, nós teríamos ouvido falar. Acho que fica mesmo essa questão da corrida pelo ouro, do lucro pelo lucro, é só com isso que se importam mesmo. No futuro, o que fica aqui é um rastro muito negativo. Se for pegar, pesar, medir e conferir, acho que o impacto negativo que essas obras deixam pelo caminho é muito maior do que o impacto positivo. Depois que elas vão embora, vai surgir uma demanda muito forte para as políticas públicas atenderem, porque deixa um rastro: gravidez precoce, doenças sexualmente transmissíveis, famílias desfeitas, e por aí vai.”*

Quantitative data

Identification Strategy



Summary Statistics

Variable	Treated x Full Sample				Treated x Selected States (Control)			
	Treated (N=69)	Full Sample (N=5488)	Difference	p-value	Treated (N=69)	Control (N=430)	Difference	p-value
Population and Income								
Population (thousands)	50.871	34.329	16.542	0.287	50.871	27.680	23.191	0.141
GDP per capita (thousands of reais)	7.337	12.608	-5.271	0.003	7.337	6.793	0.543	0.752
Agriculture and primary sector value added (% of GDP)	20.612	21.185	-0.573	0.700	20.612	25.931	-5.319	0.001
Manufacturing sector value added (% of GDP)	11.625	14.699	-3.073	0.122	11.625	9.470	2.156	0.292
Service (minus public) sector value added (% of GDP)	26.243	30.305	-4.062	0.011	26.243	23.217	3.026	0.066
Public sector value added (% of GDP)	41.520	33.811	7.709	0.000	41.520	41.383	0.137	0.944
Social Transfers								
Bolsa Familia beneficiaries (per 100,000 inhabitants)	13769.342	9322.075	4447.267	0.000	13769.342	12849.138	920.204	0.013
BPC disability beneficiaries (per 100,000 inhabitants)	898.556	912.967	-14.411	0.814	898.556	853.070	45.486	0.522
BPC elderly beneficiaries (per 100,000 inhabitants)	917.673	615.338	302.335	0.001	917.673	669.572	248.101	0.011
Poverty Measures								
Poverty rate (%)	44.458	22.946	21.511	0.000	44.458	42.617	1.841	0.309
Extreme poverty rate (%)	24.986	11.170	13.817	0.000	24.986	24.252	0.735	0.631
Human Development and Transit Accidents								
HDI	0.595	0.660	-0.065	0.000	0.595	0.596	-0.001	0.936
Inadequate sanitation rate (%)	33.007	8.906	24.101	0.000	33.007	26.035	6.972	0.000
Transit accidents mortality rate (per 100,000 inhabitants)	22.271	26.551	-4.280	0.009	22.271	25.457	-3.186	0.109

Notes: The table reports municipality-level averages for selected socioeconomic characteristics in 2010. The treated group includes municipalities intersected by the EFC railway corridor. The "Full Sample" comparison includes all Brazilian municipalities, while the "Selected States" control group includes only municipalities in Maranhão, Pará, and Tocantins not treated by the railway. Differences report treated minus control means. p-values correspond to two-sided t-tests for equality of means.

Modeling Strategy

- Standard two-way fixed effects Difference-in-Differences (DiD) model

$$Y_{it} = \alpha_i + \gamma_t + \beta(Treated_i \times Post_t) + \varepsilon_{it}$$

  - Y_{it}: outcome of interest (e.g., homicide rate, adolescent birth share, AIDS diagnosis rate) for municipality i in year t;
  - α_i: municipality fixed effects capturing time-invariant local characteristics;
  - γ_t : year fixed effects capturing common shocks;
  - $Treated_i$: =1 for municipalities affected by the infrastructure project, =0 otherwise;
  - $Post_t$: =1 for years t ≥ 2010, =0 otherwise.

- Regressions are weighted by municipal population and clustered at the microregion level.

Preliminary Results

	Homicide rate	Female homicide rate	Deaths of despair (broad)	Deaths of despair (narrow)	Transit accident rate
	(1)	(2)	(3)	(4)	(5)
Treated × Post	-5.509	-0.4833*	-2.014***	-2.124***	-2.926
	(5.462)	(0.2758)	(0.4995)	(0.5123)	(2.047)
Observations	5,988	5,988	5,988	5,988	5,988
R^2	0.74521	0.26784	0.41123	0.40946	0.56114
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

	Birth rate (per 1,000)	Share of adolescent births	Share of prime-age births	Share of advanced-age births	Mean maternal age
	(1)	(2)	(3)	(4)	(5)
Treated × Post	-0.1575	-0.0046	-0.0040	0.0087	0.3088**
	(0.5791)	(0.0033)	(0.0053)	(0.0058)	(0.1217)
Observations	5,988	5,988	5,988	5,988	5,988
R^2	0.79379	0.86154	0.70808	0.80210	0.92049
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓

Notes: Standard errors (in parentheses) are clustered for microregions. Unit of analysis is a municipality. All specification have weighted observations and inclusion of municipality fixed effect and year fixed effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Preliminary Results

	AIDS rate (young females) (1)	AIDS rate (females) (2)	AIDS rate (total) (3)
Treated × Post	-0.1016	-0.6390	0.2663
	(0.0861)	(0.4208)	(1.806)
Observations	5,988	5,988	5,988
R^2	0.13640	0.56541	0.78900
Municipality fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓

Notes: Standard errors (in parentheses) are clustered for microregions. Unit of analysis is a municipality. All specification have weighted observations and inclusion of municipality fixed effect and year fixed effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Event Studies: Modeling Strategy

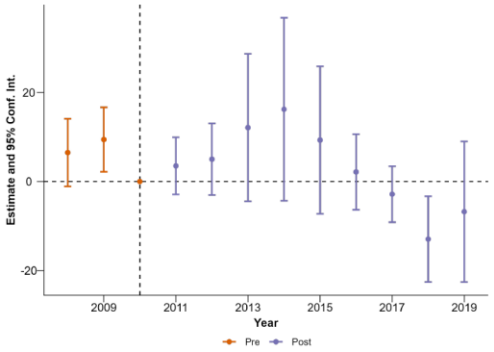
- Event study version of the baseline DiD model:

$$Y_{it} = \alpha_i + \gamma_t + \sum_{k \neq k_0} \beta_k \left(Treated_i \times I\{t = k\}\right) + \varepsilon_{it}$$

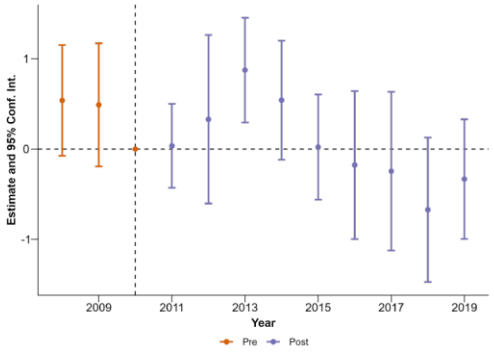
  - β_k measures the differential outcome in treated municipalities relative to the control group in year k, with $k_o = 2010$ as the omitted (reference) year

- Coefficients for years prior to 2010 trace pre-treatment trends, while those for later years capture the dynamic effects of exposure to the infrastructure project.

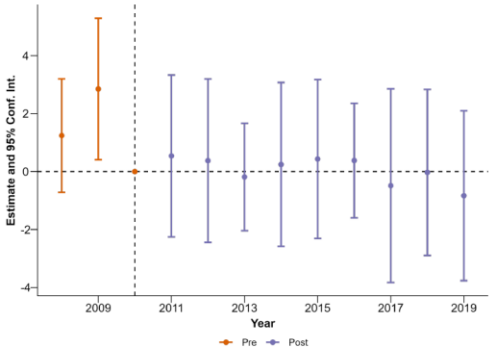
Preliminary Results: Mortality Outcomes



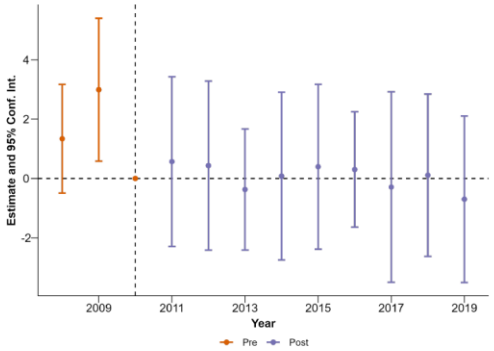
(a) Homicide rate



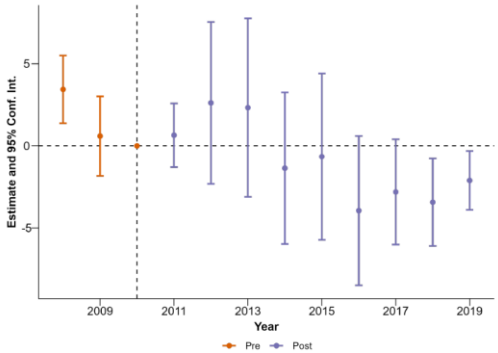
(b) Female homicide rate



(c) Deaths of despair (broad)

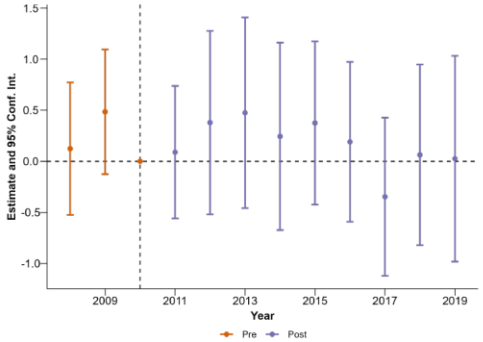


(d) Deaths of despair (narrow)

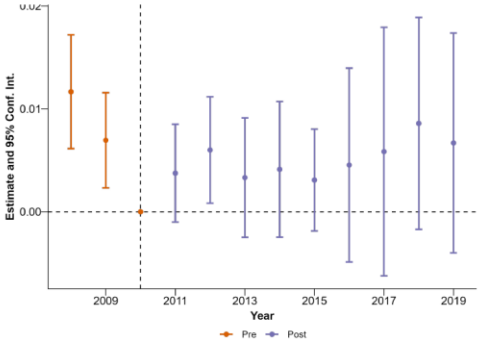


(e) Transit accident rate

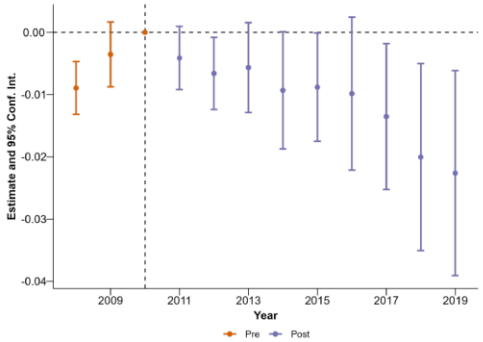
Preliminary Results: Fertility Outcomes



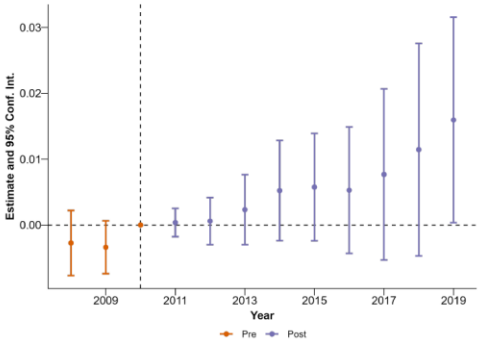
(a) Birth rate



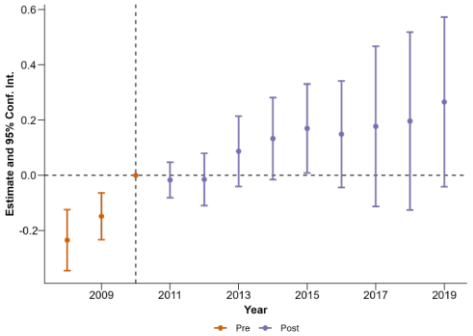
(b) Adolescent birth share



(c) Prime-age birth share

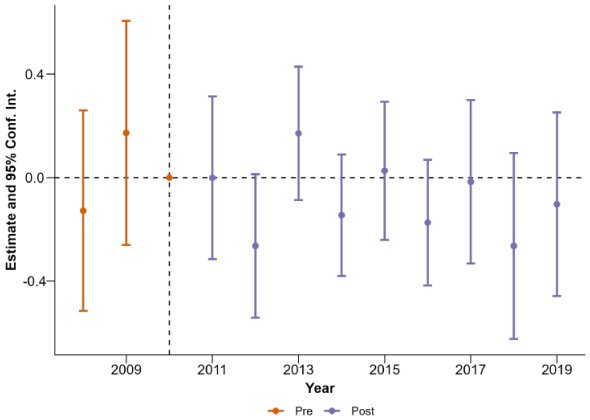


(d) Advanced-age birth share

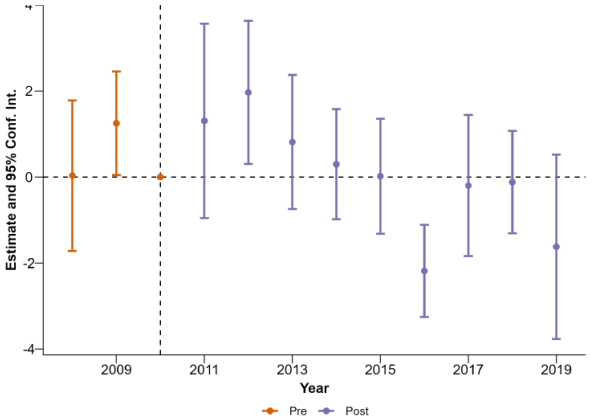


(e) Mean maternal age

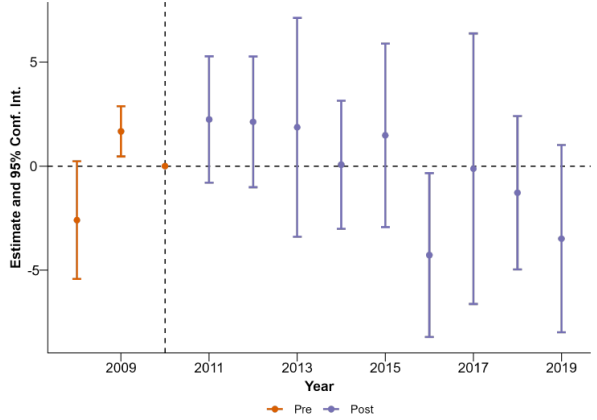
Preliminary Results: AIDS diagnosis



(a) Young female rate



(b) Female rate



(c) Total rate

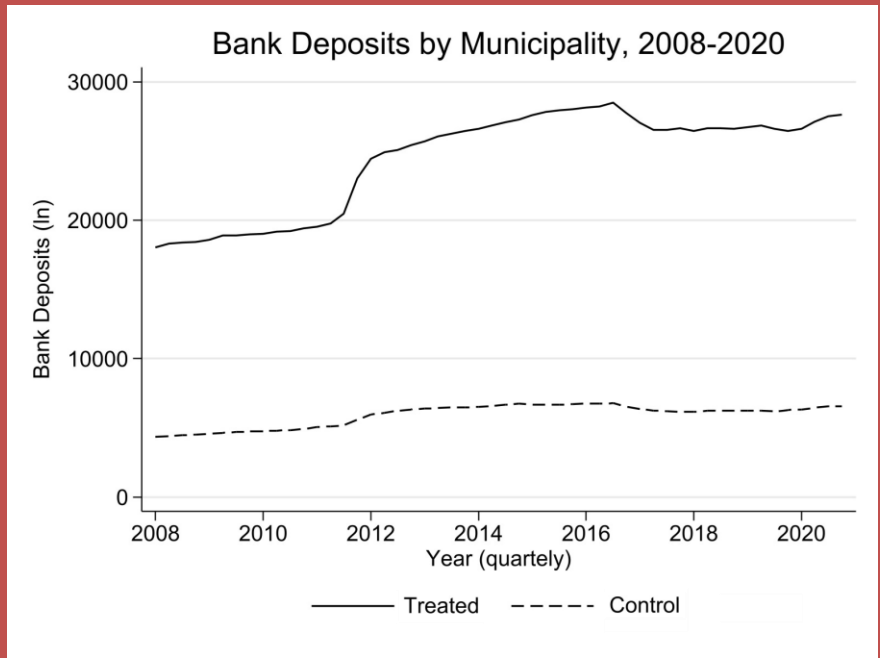
Next Steps

- Precise timeline (shock identification by municipality)
  - Electricity consumption data
  - ESTBAN (BACEN)
- Local Projections Difference-in-Difference
- Heterogeneous treatment effects (Sun and Abraham, 2021)
- Continuous DiD
  - Smaller versus larger shocks
  - Varies according to type of constructions (worksite, railroad duplication, etc)
  - Varies according to %△ in population

Next Steps

Precise timeline (shock identification by municipality/microregion)

- Electricity consumption data
- ESTBAN (BACEN)



Policy implications

Policy implications

- Prevention of policy blind-spots
- Potential impact on infrasctructure development projects design
  - Mostly focused on adults, employment related and time-use outcomes
- Long-term consequences for growth and development
  - Further complexities when health impacts and outmigration of girls is considered

Thank you!

(and sorry!)

dmachado@monmouth.edu