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# In-utero exposure to conflict-related stress and later-life economic outcomes:

Evidence from second-generation migrants in the US

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# Motivation

- ▶ In US we observe intergenerational correlations of socio-economic status (Corak 2004; Solon 1999);
- ▶ A well-established literature demonstrate that in utero and early-life exposure to shocks affects birth outcomes as well as later in life socio-economic status (Almond & Currie 2011);
- ▶ Robust evidence in favour of a negative effect of in utero exposure to stress on later life outcomes is limited to few Scandinavian countries.

## Aim of this study

- ▶ Isolate the long-term effects of exposure to stress during gestation;
  - ▶ Difficulties in isolating stress from other environmental factors.
- ▶ Establish external validity by employing a “cross-cultural” dataset (US data);

### Relevance

- ▶ The results of this study speak directly to several SDGs (3: ensure healthy lives, 5: promote gender equality, 10: fight inequality);
- ▶ This study is relevant for the Global Compact for Migration in its commitment to migrant integration and addressing the needs of both migrants and the receiving communities (UN General Assembly 2016).

## Identification Strategy

- ▶ Difference in Difference Approach;
- ▶ Treatment and Control groups: US-born offspring from mothers born abroad and in US;
- ▶ Stress: exposure to conflict in home country while pregnant and being in the US;
- ▶ Stress caused by families members being in danger because of war;
- ▶ Conflict intensity: in utero exposure to conflict in the country of origin for mothers born outside US that gave birth in US.

## Possible mechanisms

Biological response to stress:

- ▶ Stress stimulates the production of a placental corticotrophin hormone (associated with lower gestational age and birth weight) (Hobel & Culhane 2003);
- ▶ Stress inhibits immune system and associates with high blood pressure;

Behavioral response to stress (not in this presentation):

- ▶ Smoking cigarettes and drinking alcohol;
- ▶ Unhealthy diet during pregnancy/lactation;
- ▶ Lower use of prenatal care;
- ▶ Negative parenting;
- ▶ Aggression in child interaction.

# Review of the literature I

A limited number of studies focus on the effects of stress during pregnancy on offspring's outcome:

Author(s)	Stress proxy	Method	Results	Context	Rob. to Endogen.
Glynn et al. 2001	earthquake timing.	OLS, Cross-Sec.	Negative	40 obs. US	
Torche 2011	earthquake exposure.	DinD	Negative	Chile, Birth Cert.	++
Simeoneva 2011	extreme weather	OLS, Cross-Sec.	Negative	US, Vital Stat.	+
Currie & Rossin-Slater	extreme weather	Panel	Negative	US birth cert.	++
Mansour and Rees 2012	conflict	OLS Mother FE	Negative	Palestine, DHS	+
Berkowitz et al. 2003	9/11	OLS B/A	Mixed	Manhattan data	
Eccleston 2011	9/11	OLS + area controls	Negative	New York, Vital Stat.	+
Lederman 2004	9/11	OLS	Negative	Manhattan data	
Camacho 2008	landmine explosions	OLS + municipal FE	Negative	Colombia, Vital Stat.	+

## Review of the literature II

- ▶ Aizer et al. 2016 (JHR) estimate the effect of maternal stress on child outcomes in both the short- and long-term (Data on 12 US cities, mother f.e.);
  - ▶ Stress negatively affect cognitive skills.
- ▶ Black et al. 2016 (AEJ) study the short- and long-term effects of stress during pregnancy on offspring health and economic outcomes (Norwegian birth and death records 1961-2010);
  - ▶ Stress affects birth weight but no long-term effect is found.
- ▶ Persson and Rossin-Slater 2018 (AER) find short- and long-term negative effects of in utero exposure to stress (Norwegian birth and death records).

# Data I

- ▶ American Community Survey 2005-2016:
  - ▶ Original sample size 100 million obs.
  - ▶ Here I use a random sub-sample of 100 million obs.
  - ▶ After further sub-setting the sample according to the group of reference it counts 144,080 obs.;
  - ▶ Only adults born in US aged more than 15 at time of interview and in utero after 1989 (16-28);
  - ▶ The final analysis will count approximately 14 million obs.
- ▶ Uppsala Conflict Data Program Geo-referenced database:
  - ▶ 142,902 events in total (2,022,229 recorded fatalities in 118 countries);
  - ▶ I use 134,301 events with start and end date precision of 7days or lower (1,305,884 fatalities).



# Data II

- ▶ The ACS provides:
  - ▶ Ancestry for each observation and their mothers/fathers (200 different ancestries);
  - ▶ Country of birth for each observation and their mothers/fathers (72 countries, and 52 US States & territories);
  - ▶ Birth date precise at the quarter of birth (random assignment within quarter);
  - ▶ Economic, Health and Educational outcomes.

# Data III

- ▶ Outcomes:
  - ▶ Unemployment status (dummy variable): the relative models exclude observations out of labor force;
  - ▶ Yearly individual total income: includes net rental income, interests and dividends, wages and public assistant income (very imprecise at the moment).

# Methods I

- ▶ Control and Treatment:
  - ▶ (i) US-born obs. by US-born mothers (control group);
  - ▶ (ii) US-born obs. by non-US-born mothers (treatment group: second-gen migrants);
- ▶ Excluded observations;
  - ▶ (iii) non-US born obs. by US-born mothers (US citizens born abroad);
  - ▶ (iv) non-US born obs. by non-US-born mothers (first-gen immigrants).
- ▶ I exclude US citizen born abroad (iii) and first gen-migrants (iv) because they may be exposed to conflict directly;
- ▶ Results are robust to the inclusion of these categories, in fact, downward bias because both would end up in the control group.

## Methods II

- ▶ Conflict intensity at mother's home country while in utero.
  - ▶ Number of per-capita (1 million inh.) fatalities during in utero period: (quasi) continuous variable (Poisson in nature);
  - ▶ Because I do not look at a single country of origin (i.e., the mothers of the treated group individuals come from different countries) I need to randomly assign a "pseudo" ancestry to obs. in the control group;
  - ▶ Alternatively, DiD using 2nd and higher orderer generation migrants from the same country and PSM exploiting parental characteristics.

## Methods III

$$Y_i = \alpha + \beta_1 T_i + \beta_2 F_i + \beta_3 T_i * F_i + \beta_4 IC_i + \gamma AncMother_i + \delta County_i + \zeta BirthYear_i + \epsilon_i$$

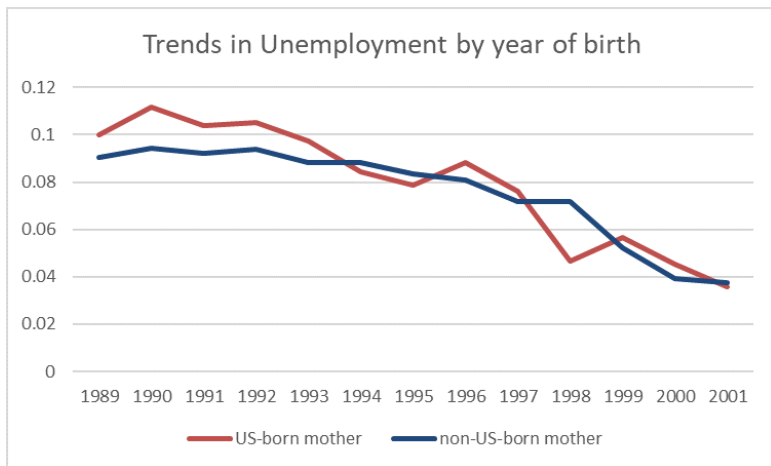
where:

- ▶ Y is the outcome variable (alternatively unemployment or income);
- ▶ T and F are the treatment and (continuous) conflict intensity variables, respectively;
- ▶ IC is a vector of individual controls (age, sex, and a categorical variable controlling for ability to speak English);
- ▶ Models estimated using individual sampling weights and standard errors clustered at the mother's ancestry level.

## Methods IV

- ▶ My identification strategy relies on the assumption that the outcome variables' trends for non-exposed US-born by US-born and by non-US-born mothers are parallel;
- ▶ Using data of individuals born after 1990 does not pose concerns about stress induced by the cold-war (propaganda could bias the results);
- ▶ Results are robust when individuals born by mothers from the former USSR countries are excluded.

## Methods V: Parallel trends



Trends in unemployment by year of birth for observations not exposed to any level of conflict during gestation.

## Methods VI: Threats to causality

- ▶ Declared mother ancestry does not correspond with actual one:
  - ▶ Observations are miss-assigned to control group which would results in a downward bias;
- ▶ Endogeneity of time of pregnancies: very unlikely because the conflict is long-distance;
  - ▶ If non-US born mothers avoid pregnancies in periods of conflict at the home country the estimates would be understated.
- ▶ Role of remittances (bias due to possible different channel than stress);



# Characteristics of the sample

Table: Characteristics of the sample (only US-born obs.)

Variable (1)	Mean (2)	Standard Deviation (3)
Mother US-born (dummy)	0.884	0.319
In utero fatalities	1.619	0.0276
Unemployed (dummy)*	0.092	0.289
Income (USD/year)	9,055	15,981
Age	19.982	3.141
Sex (male)	0.511	0.499
Birth year	1993	3.150
Number of Counties	128	
Number of ancestries	200	
Observations	144,080	

Notes: Descriptive statistics computed using individual sampling survey weights. \* The sample used for this estimate excludes those out of labor force.

**Table:** Effect of in utero exposure to long-distance conflict on unemployment probability (LPM)

	<i>Dependent variable:</i>			
	<i>Unemployed</i>			
	(1)	(2)	(3)	(4)
US-born-non-US-mother	0.035*** (0.000)	0.025*** (0.008)	0.018** (0.008)	-0.009 (0.007)
Fatalities pregnancy	0.002*** (0.000)	0.0009*** (0.000)	0.000 (0.002)	0.0001 (0.0003)
US-born-non-US-mother*Fatalities pregnancy	0.092** (0.037)	0.109*** (0.033)	0.108*** 0.033	0.149*** (0.020)
Year of birth FE	No	Yes	Yes	Yes
Individual Controls	No	Yes	Yes	Yes
County FE	No	No	Yes	Yes
Mother Ancestry FE	No	No	No	Yes
Observations	78,137	78,137	78,137	78,137
R <sup>2</sup>	0.0008	0.040	0.046	0.063
Adjusted R <sup>2</sup>	0.0008	0.040	0.044	0.059
Residual Std. Error	3.937	3.858	3.849	3.820
F Statistic	***	***	***	***

Notes: All models are computed using survey sampling weights. The sample excludes individual declaring to be out of labor force.

Standard errors clustered at the mother country of birth in parenthesis.

**Table:** Effect of in utero exposure to long-distance conflict on income (OLS)

	<i>Dependent variable:</i>			
	<i>Income</i>			
	(1)	(2)	(3)	(4)
US-born-non-US-mother	-363.767*** (148.916)	-150.801 *** (20.027)	-154.477 *** (27.535)	-4.195 (19.486)
Fatalities pregnancy	81.082*** (0.000)	58.668*** (0.458)	56.131*** (0.606)	53.769*** (0.525 )
US-born-non-US-mother*Fatalities pregnancy	-232.124** (115.671)	-355.136*** (108.869)	-356.322*** (117.933)	-306.413*** (93.645)
Year of birth FE	No	Yes	Yes	Yes
Individual Controls	No	Yes	Yes	Yes
County FE	No	No	Yes	Yes
Mother Ancestry FE	No	No	No	Yes
Observations	144,080	144,080	144,080	144,080
R <sup>2</sup>	0.005	0.273	0.279	0.285
Adjusted R <sup>2</sup>	0.005	0.273	0.278	0.284
Residual Std. Error	166,200	142,000	141,600	141,000
F Statistic	***	***	***	***

Notes: All models are computed using survey sampling weights. Standard errors clustered at the mother country of birth in parenthesis.

# Placebos

- ▶ To assess the robustness of my analysis I construct a set of placebos where I interact the treatment dummy variable with fatalities measured in the mother's country of birth in a random period of 9 months 360 days before the actual (assumed) conception date.
  - ▶ Recall that conceive and birth date are approximated at the quarter of birth (random error of  $\pm 1.5$  months);
  - ▶ Randomly choosing the placebo in utero exposure (within a 360day window before conception) allows to avoid picking up conflict seasonality (likely in protracted conflict settings).

**Table:** Placebo for in utero exposure to long-distance conflict on unemployment probability (LPM)

	<i>Dependent variable:</i>			
	<i>Unemployed</i>			
	(1)	(2)	(3)	(4)
US-born-non-US-mother	0.035*** (0.008)	0.033*** (0.008)	0.031*** (0.008)	-0.017** (0.008)
Fatalities pregnancy	-0.001*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)
US-born-non-US-mother*Fatalities pregnancy	0.004 (0.032)	0.003 (0.032)	0.001 (0.031)	0.096 (0.073)
Year of birth FE	No	Yes	Yes	Yes
Individual Controls	No	Yes	Yes	Yes
County FE	No	No	Yes	Yes
Mother Ancestry FE	No	No	No	Yes
Observations	78,133	78,133	78,133	78,133
R <sup>2</sup>	0.0008	0.002	0.007	0.031
Adjusted R <sup>2</sup>	0.0007	0.002	0.006	0.027
Residual Std. Error	3.937	3.935	3.927	3.884
F Statistic	***	***	***	***

Notes: All models are computed using survey sampling weights. The sample excludes individual declaring to be out of labor force.

Standard errors clustered at the mother country of birth in parenthesis.

**Table:** Placebo for in utero exposure to long-distance conflict on income (OLS)

	<i>Dependent variable:</i>			
	<i>Income</i>			
	(1)	(2)	(3)	(4)
US-born-non-US-mother	-359.868*** (13.502)	-272.577*** ( 13.165)	-300.150*** (13.566)	50.077** (19.677)
Fatalities pregnancy	14.225*** (8.737)	22.590*** (8.498)	23.562*** (8.466)	19.866*** (0.463)
US-born-non-US-mother*Fatalities pregnancy	-113.202 (73.033)	-82.495 (71.021)	-81.895 (70.753)	-147.614 (98.672)
Year of birth FE	No	Yes	Yes	Yes
Individual Controls	No	Yes	Yes	Yes
County FE	No	No	Yes	Yes
Mother Ancestry FE	No	No	No	Yes
Observations	144,080	144,080	144,080	144,080
R <sup>2</sup>	0.005	0.060	0.070	0.120
Adjusted R <sup>2</sup>	0.005	0.060	0.070	0.118
Residual Std. Error	166,200	161,600	160,800	156,400
F Statistic	***	***	***	***

Notes: All models are computed using survey sampling weights. Standard errors clustered at the mother country of birth in parenthesis.

# Conclusions

- ▶ This study finds important long-term effects of in utero exposure to stressful events on economic outcomes later in life;
- ▶ The empirical setting proposed allows estimating the effect of stress on SES net of any direct effect caused by the shock itself;
- ▶ This setting has also the potential to disentangle the parental programming channel from the behavioural one by accounting for stress experienced by fathers (something that studies using biomarkers cannot achieve).
- ▶ Finally, this study supports the hypothesis of a detrimental effect of long-distance conflict on psychological vulnerability to stress for those migrant population which experience conflict in the country of origin.