

REVEALED COMPARATIVE DISADVANTAGE OF INFANTS: EXPOSURE TO NAFTA AND BIRTH OUTCOMES

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OUTLINE

- Background on NAFTA
- Literature Review
- Contribution and Policy Implication
- Empirical Strategy
- Results
 - Selective Fertility
 - Event Study
 - Main Results
 - Mechanisms
- Discussion on Magnitude of the Results
- Conclusion

BACKGROUND: NAFTA

- Reagan's administration initiated bilateral trade agreements with Canada:
 - Trade and Tariff Act (TTA) of 1984
 - Free Trade Agreement (FTA) of 1989
- George H. W. Bush entered negotiations for expansions of these agreements to include Mexico
- The trilateral agreement proposal, later known as the North American Free Trade Agreement (NAFTA), was passionately debated in the media, specifically around the presidential campaign of 1992
- Bill Clinton signed NAFTA into law in December 1993
- NAFTA became effective in January 1994

BACKGROUND: NAFTA AND LABOR MARKETS

- Within the United States, studies on aggregate welfare effects suggest very small rises in net benefits (Caliendo & Parro, 2015; Romalis, 2007).
- Hakobyan & McLaren (2016) search for local labor market effects of NAFTA. They find that blue-collar workers residing in trade-exposed vulnerable localities experience sharp reductions in wage growth post-NAFTA.
- Hakobyan & McLaren (2017) show that NAFTA affected the wage growth of married blue-collar women much more than other demographic groups.
- Choi et al. (2021) document reductions in employment in local areas with higher exposure to import competition following NAFTA.

BACKGROUND: ECONOMIC CONDITIONS AND INFANTS' HEALTH

- Income shocks influences birth outcomes through several channels:
 - Consumption of materials that directly impact health, e.g., nutrition (Haeck & Lefebvre (2016); Almond & Mazumder (2011))
 - Consumption of materials that indirectly affect health, for instance:
 - health insurance (Corman et al., 2019; Goodman-Bacon, 2018)
 - Residential location with better/worse amenities, crime rates, pollution (Currie et al., 2009; Currie & Walker, 2011; Mark & Torrats-Espinosa, 2022)
 - Stress and maternal mental health (Carlson, 2015; Carney, 2021)
- Offsetting role of social programs (Amarante et al., 2016; Hoynes et al., 2015).
- Healthy recessions: drop in work-related stress and pollution (Chay & Greenstone, 2003; Rossin, 2011)

BACKGROUND: ECONOMIC CONDITIONS AND INFANTS' HEALTH

- Mocan et al. (2015) use Natality birth records (1989-2004) to investigate the effects of mothers' earnings on birth outcomes. Their findings suggest that doubling mothers' income is associated with an increase in birth weight of about 100 grams and an increase in gestational age of 0.7 weeks.
- Lindo (2011) employs PSID (1967-1997) data and explores the effects of parents' job loss on birth outcomes. He finds that husbands' job loss reduces birth weight by about 5 percent.
- De Cao et al. (2022) use data from England and employ mother fixed-effects to explore the effects of local labor market shocks on infants' health. They find that a one-percentage-points increase in the local area unemployment rate is associated with roughly 5.3 grams lower birth weight.

CONTRIBUTIONS

- This is the first study to explore the local effects of NAFTA on infants' health outcomes.
 - It relates to life-cycle effects of health at birth (Behrman & Rosenzweig, 2004; Black et al., 2007; Kleven et al., 2022; Royer, 2009).
- This paper adds to the literature on the costs and benefits of trade liberalization
 - The overlooked negative externalities for infants
- This paper contributes to the ongoing literature on the Fetal Origin Hypothesis
 - The influence of economic conditions during pregnancy on birth outcomes

POLICY IMPLICATIONS

- NAFTA has been one of the long-lasting, highly controversial, and intensely debated policies in the US international trade agreements
 - It received criticism from 2016 U.S. presidential candidates (replaced by USMCA in 2020)
- An optimal tariff schedule depends on the net benefits extracted from welfare analyses
 - Sub-optimal levels in the absence of full costs
- The procyclical infant's health calls for policies that enhance social insurance spending
 - During periods of unemployment and job loss
 - Following trade policy change
 - Targeting pregnant women

ECONOMETRIC METHOD: VULNERABILITY INDEX

- The comparative advantage of an industry: its efficiency in producing a particular volume of products versus other trading partners
- *Revealed Comparative Advantage* (RCA): what the market informs outsiders about the industry-specific efficiency of a country

$$RCA_i = \frac{\left(\frac{X_i^{mexico}}{X_i^{row}}\right)}{(\sum_i X_i^{mexico}) / (\sum_i X_i^{row})}$$

- i : industry; X : Export; row : rest of world

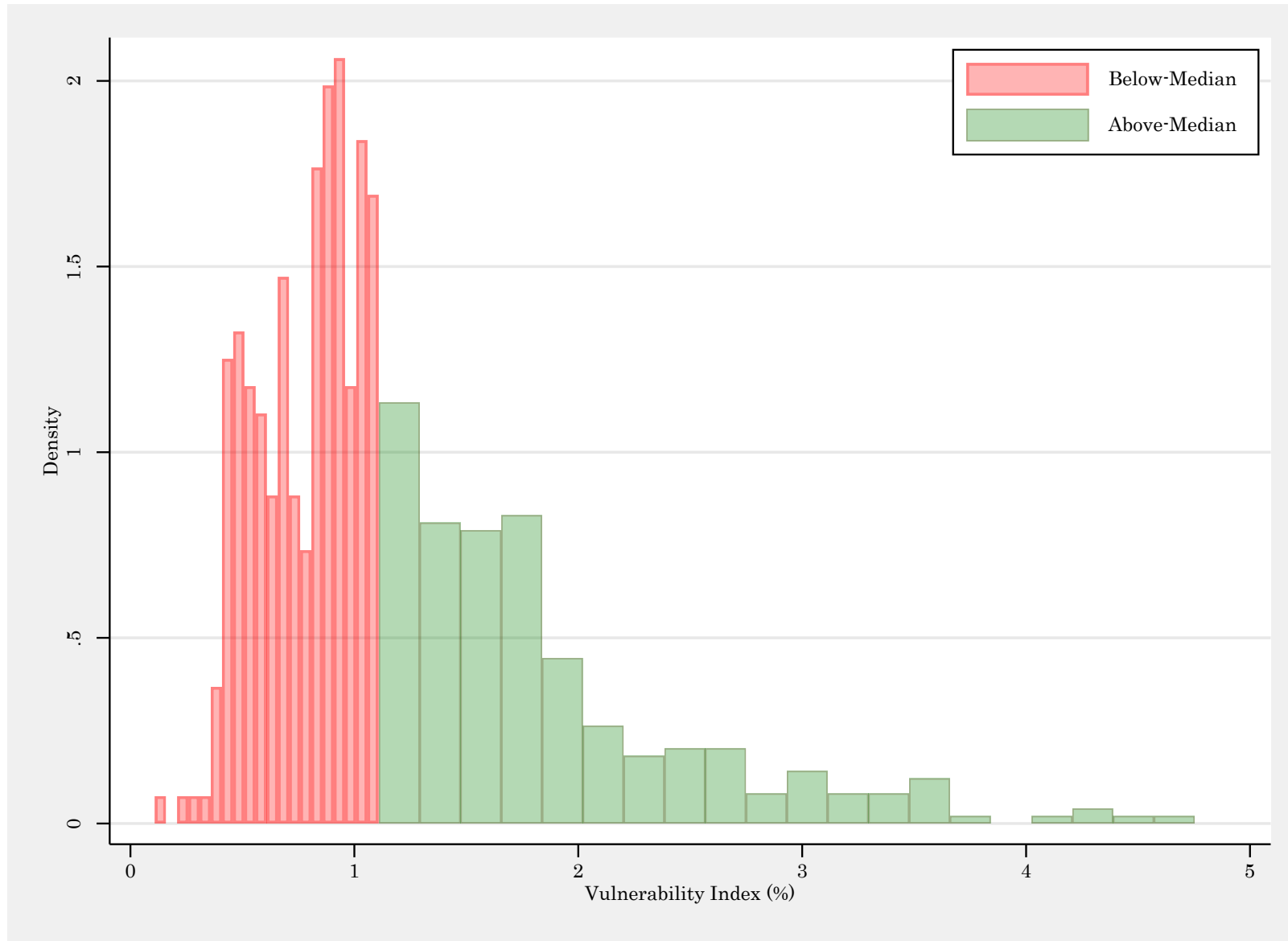
ECONOMETRIC METHOD: VULNERABILITY INDEX

- US counties with a higher pre-NAFTA reliance on industries for which Mexico's RCA is higher are more exposed to import competition and vice versa.

$$Vulnerability_{c1990} = \frac{\sum_i EMP_{ic} \tau_i RCA_i}{\sum_i EMP_{ic} RCA_i}$$

- EMP: Employment in industry i and county c in 1990
- τ represents ad-valorem equivalent tariff rates

DENSITY OF VULNERABILITY INDEX



→ boxplot

→ map

ECONOMETRIC METHOD: EVENT-STUDY

- The event-study examines changes in outcomes of infants born in different years relative to NAFTA in counties with different vulnerability:

$$y_{icst} = \alpha + Vul_{cs}^{1990} \times \left\{ \sum_{k=\underline{T}}^{1993} \xi_t I(k = t) + \sum_{k=1995}^{\bar{T}} \zeta_t I(k = t) \right\} + \beta X_{icst} + \delta Z_{cst} + \lambda_c + \gamma_{st} + \varepsilon_{icst}$$

- i : infant; c : county; s : state; t : year
- ξ and ζ : pre-trend and post-trend coefficients
- X : infant's gender, infant's birth order, maternal race, maternal ethnicity, maternal education, maternal age, maternal marital status, paternal age, paternal race, and paternal ethnicity
- Z : China trade exposure interacted with year FE
- λ : county FE; γ : state-year FE
- Standard errors are clustered at the county level

ECONOMETRIC METHOD: DIFF-IN-DIFF

- The DD method compares birth outcomes of infants born post-versus-pre-NAFTA and localities with differential exposure to import competition:

$$y_{icst} = \alpha + \varphi Vul_{cs}^{1990} \times Post_t + \beta X_{icst} + \delta Z_{cst} + \lambda_c + \gamma_{st} + \varepsilon_{icst}$$

- $Post$ is a dummy that equals one for post-1994 years and zero otherwise
- φ is the parameter of interest that shows the changes in birth outcomes following NAFTA for a one-unit difference in vulnerability index

DATA SOURCES

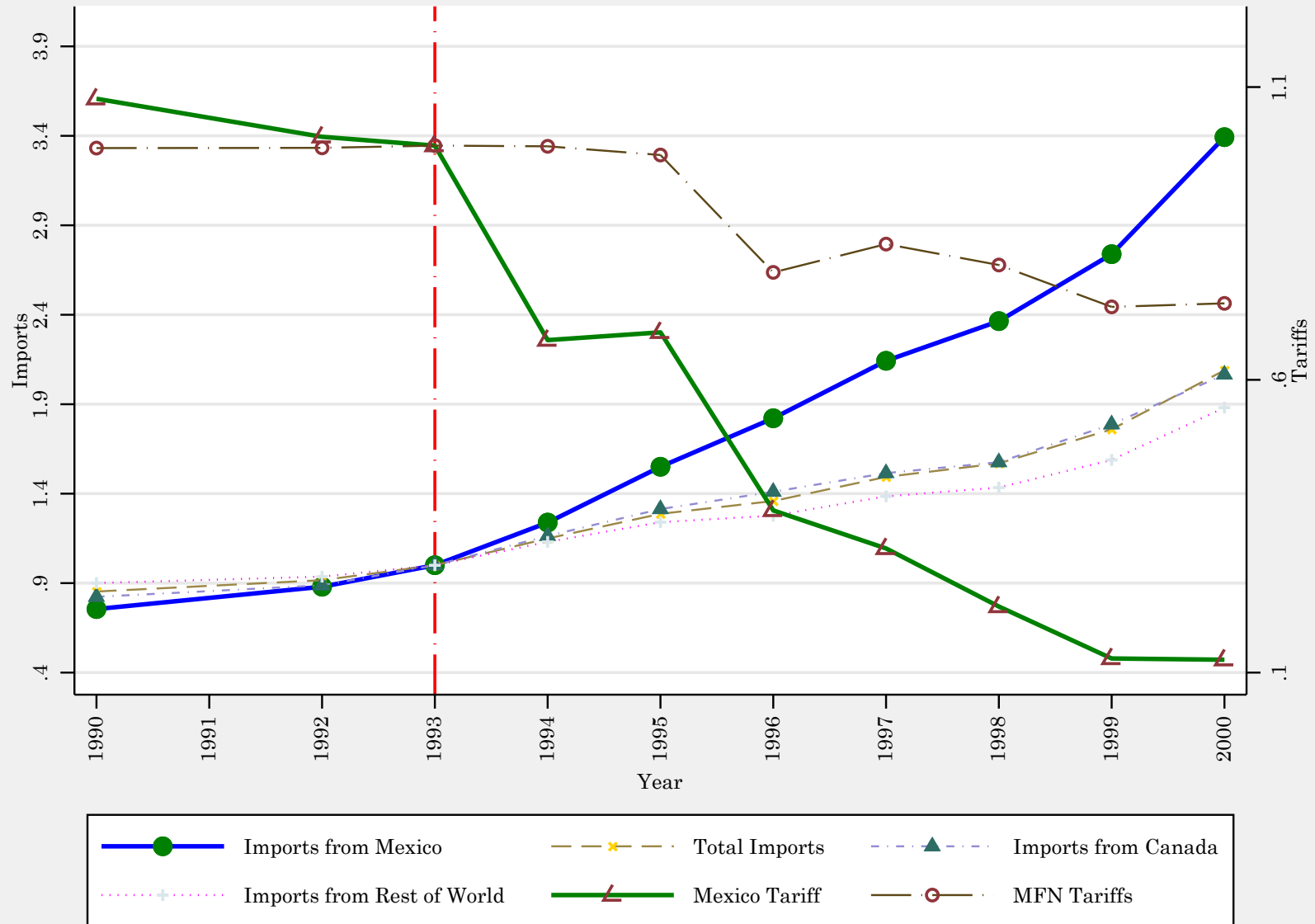
- Birth data: Natality Vital Statistics of National Center for Health Statistics
 - Dropping multiple births
 - Dropping missing values in primary outcomes
 - Limiting to birth years 1986-2008 (and 1980-2015)
- Trade data: (Feenstra et al., 2002; Pierce & Schott, 2009, 2020)
- Industry employment data: County Business Pattern
- Other data sources: Quarterly Census of Employment and Wages, Bureau of Economic Analysis, Bureau of Labor Statistics, Census/CPS (IPUMS), Environmental Protection Agency, Uniform Crime Reporting, Federal Housing Finance Agency

SHORT SUMMARY STAT

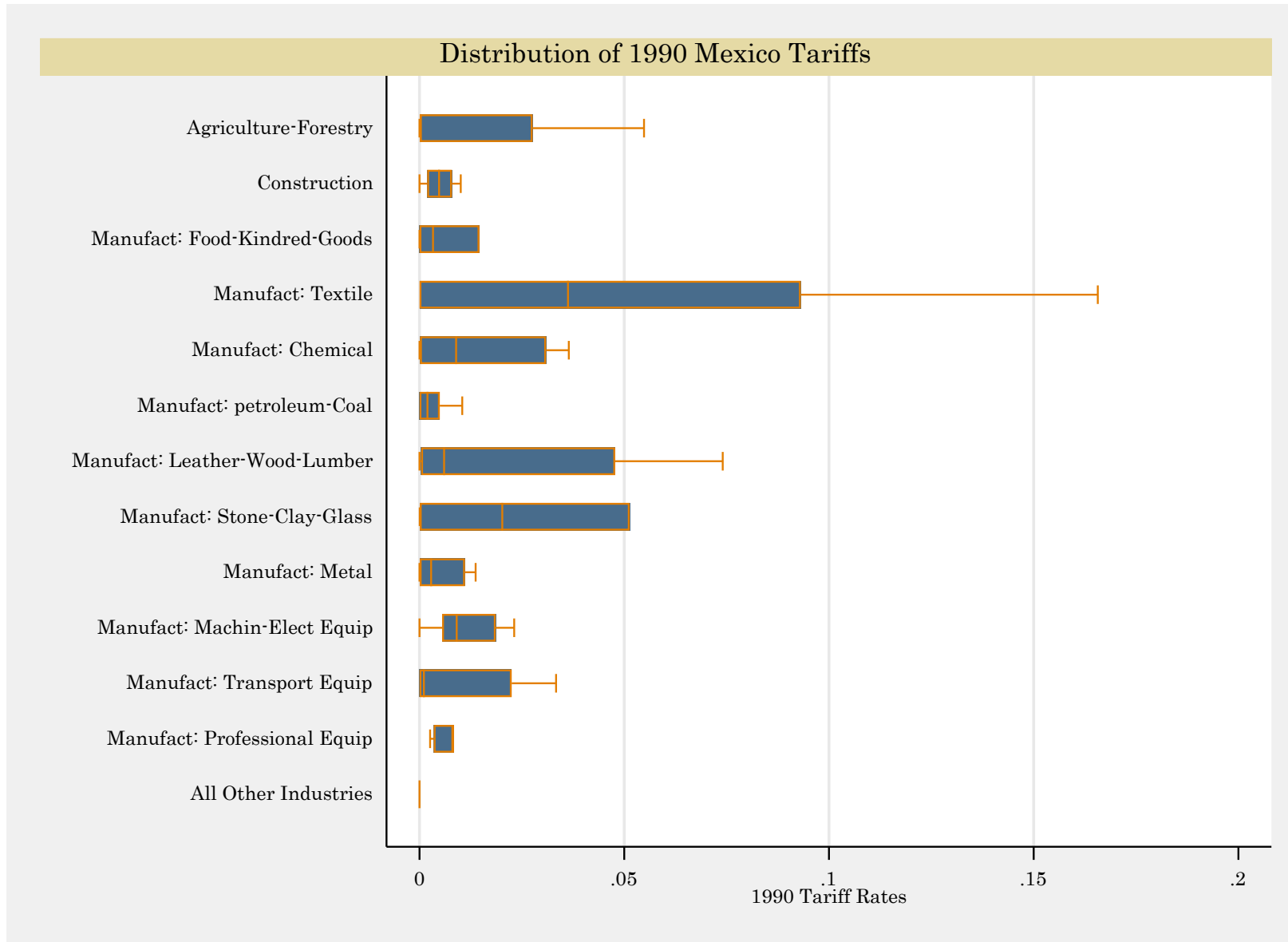
Variable	Mean	Std. Dev.	Min	Max
Birth Weight (grams)	3339.6	574.1	227	8165
Gestational Age (Weeks)	38.9	2.5	17	52
Fetal Growth (grams/week)	85.5	13.6	5	361.8
Low Birth Weight	0.061	0.239	0	1
Preterm	0.102	0.302	0	1
Low Apgar Score	0.029	0.168	0	1
Mother White	0.791	0.406	0	1
Mother Black	0.152	0.359	0	1
I(Year>1994)	0.636	0.481	0	1
Vulnerability Index	1.216	0.667	0.109	4.753
Observation	88,881,197			

→ detailed summary

EVOLUTION OF IMPORTS AND TARIFFS



MEXICO TARIFFS BY INDUSTRY



BALANCING TESTS

	<i>Outcomes:</i>					
	Birth Counts	Log Birth Counts	Child Female	Mother White	Mother Black	Mother's Age <20
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	31.89586 (55.82162)	0.00213 (0.00754)	0.00031 (0.00021)	0.01147*** (0.00355)	-0.00127 (0.00317)	0.00007 (0.00082)
Observations	76,721	76,721	76,721	76,721	76,721	76,721
R-squared	0.96906	0.98624	0.06081	0.9762	0.98605	0.9311
Mean DV	1242.075	5.838	0.488	0.793	0.150	0.117
%Change	2.568	0.036	0.064	1.446	-0.850	0.057

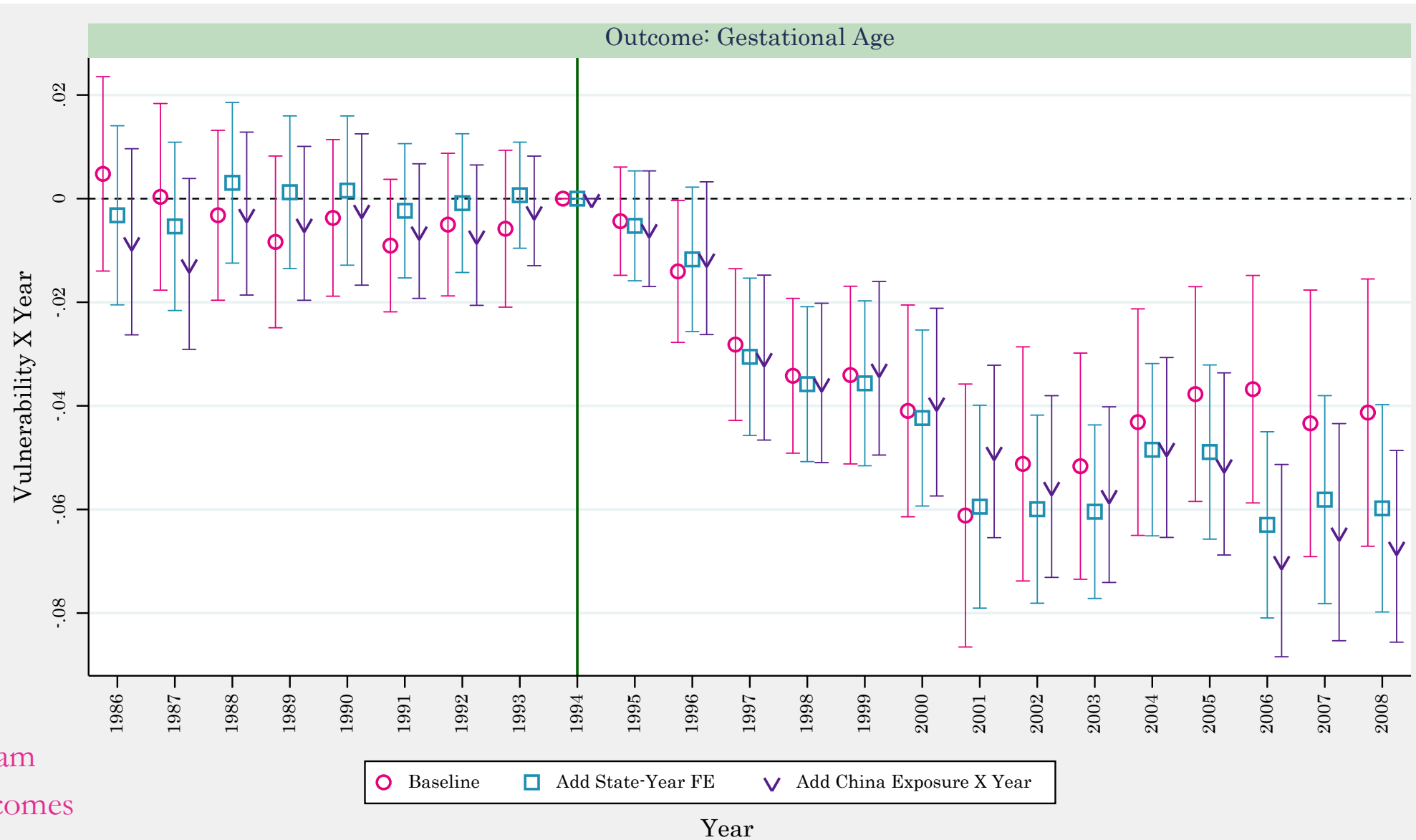
BALANCING TESTS

	<i>Outcomes:</i>					
	Mother's Schooling <12	Mother's Education Missing	Father White	Father Black	Father's Age <25	Father's Age Missing
	(7)	(8)	(9)	(10)	(11)	(12)
I(year>1994) × Vulnerability Index	-0.00059 (0.00332)	-0.00225** (0.00115)	0.00219 (0.00426)	-0.00039 (0.00302)	-0.00006 (0.00171)	0.00468* (0.00276)
Observations	76,721	76,721	76,721	76,721	76,721	76,721
R-squared	0.93375	0.99271	0.95695	0.95702	0.92727	0.93327
Mean DV	0.203	0.068	0.696	0.103	0.184	0.143
%Change	-0.293	-3.316	0.315	-0.381	-0.035	3.275

EVENT-STUDY RESULTS



EVENT-STUDY RESULTS



→ sun-abraham
→ other outcomes

MAIN RESULTS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.4149*** (1.2837)	-0.0352*** (0.0075)	-0.0695*** (0.0242)	0.0013*** (0.0002)	0.0024*** (0.0005)	0.0018*** (0.0006)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.0630	0.025	0.0605	0.016	0.0153	0.0086
Mean DV	3339.60	38.93	85.59	0.06	0.10	0.02
%Change	-0.16	-0.09	-0.08	2.14	2.39	6.28

→ subsamples

→ county controls

→ alternative exposure: imports

→ Alt Clusters

→ other outcomes

→ MFA

→ birth window

→ PUMA-level

→ Adao et al. SE

→ lbw thresholds

MECHANISMS

ASEC of Current Population Survey Data 1985-2010

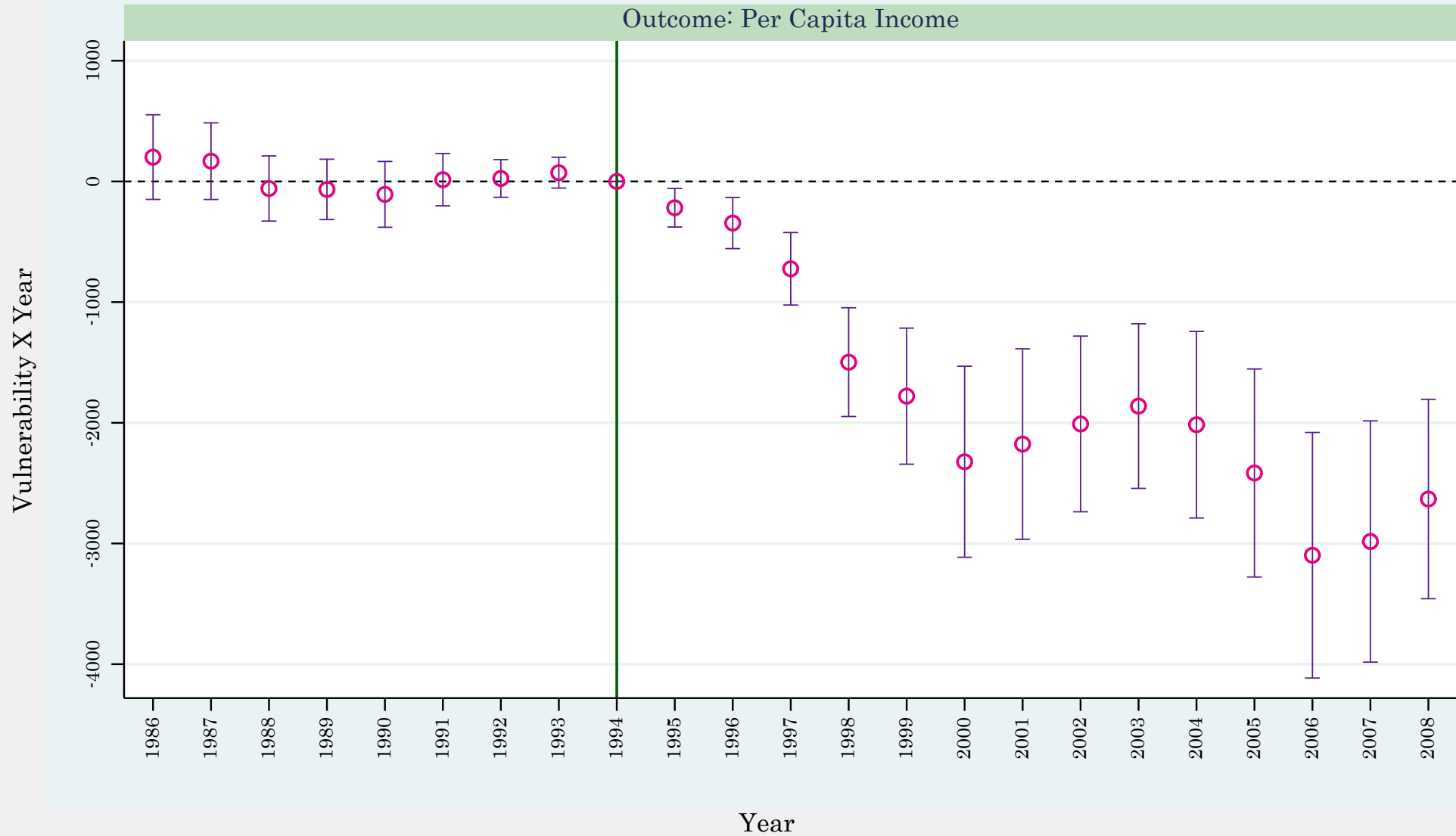
	Any Insurance	Any Private Insurance	Any Public Insurance	Any Insurance on Medicaid-SCHIP	Wage Income of Householder	Welfare Income of Householder	House Owner
	(1)	(2)	(3)	(4)	(5)	(6)	(9)
I(year>1994) × Vulnerability Index	-0.0089*** (0.0030)	-0.0118*** (0.0040)	0.0030*** (0.0010)	0.0034*** (0.0011)	-319.49*** (106.48)	1.0458** (0.4864)	-0.0028 (0.0018)
Observations	156,804	156,804	156,804	156,804	182,945	182,945	5,030,386
R-squared	0.0404	0.0502	0.0235	0.0259	.042	0.0147	0.0705
Mean DV	0.86	0.80	0.07	0.06	22,003.56	25.32	0.64
%Change	-1.04	-1.46	3.97	5.60	-1.45	4.12	-0.45

MECHANISMS

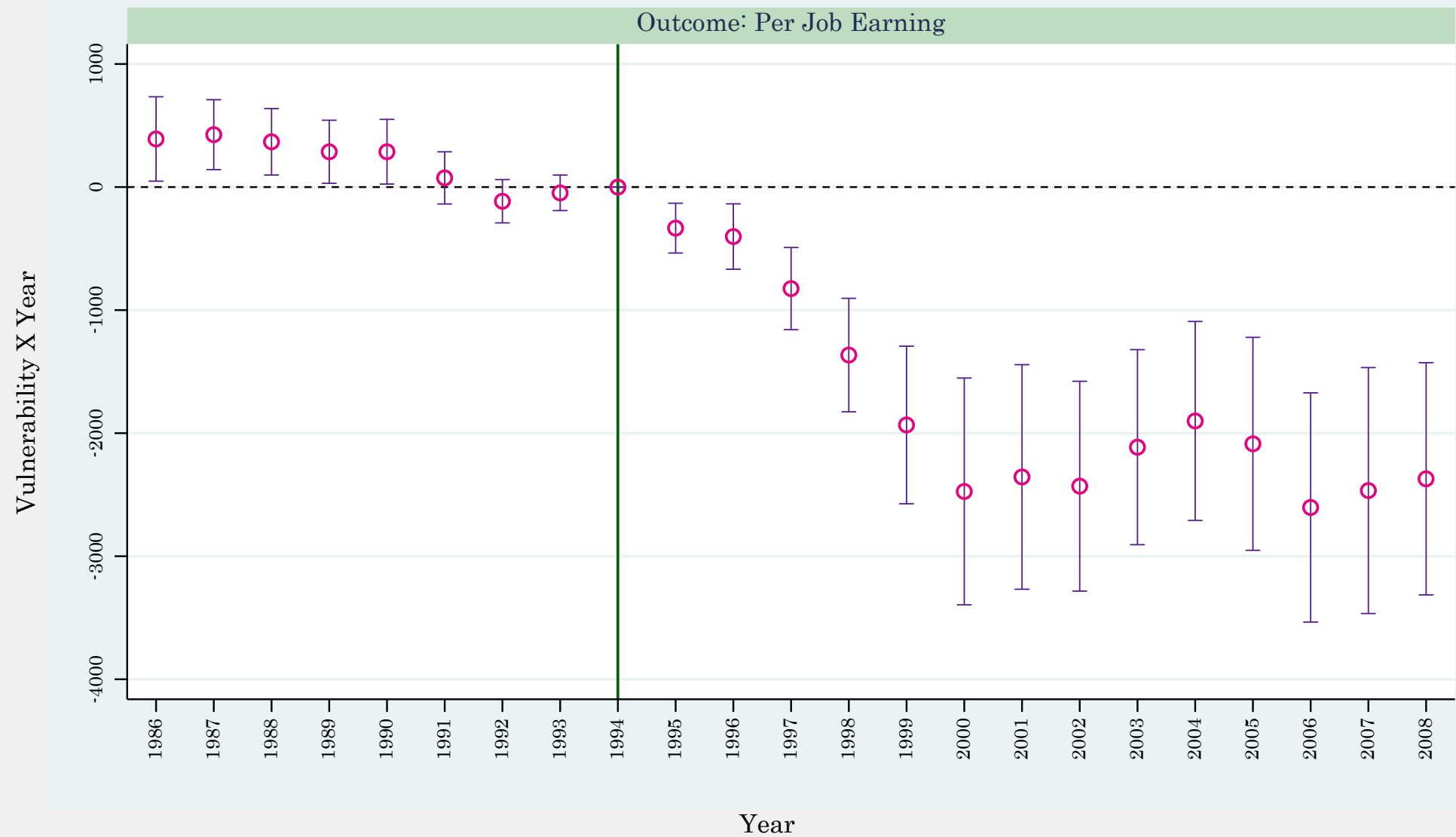
	Census 1990-2000 (5%)		
	Occupational Income Score of Householder	House Value	House Owner
	(7)	(8)	(9)
I(year>1994) × Vulnerability Index	-0.1629*** (0.0314)	-7.1724*** (1.9354)	-0.0028 (0.0018)
Observations	4,504,041	3,322,369	5,030,386
R-squared	0.0357	0.3484	0.0705
Mean DV	25.09	127.91	0.64
%Change	-0.65	-5.60	-0.45

→ health care

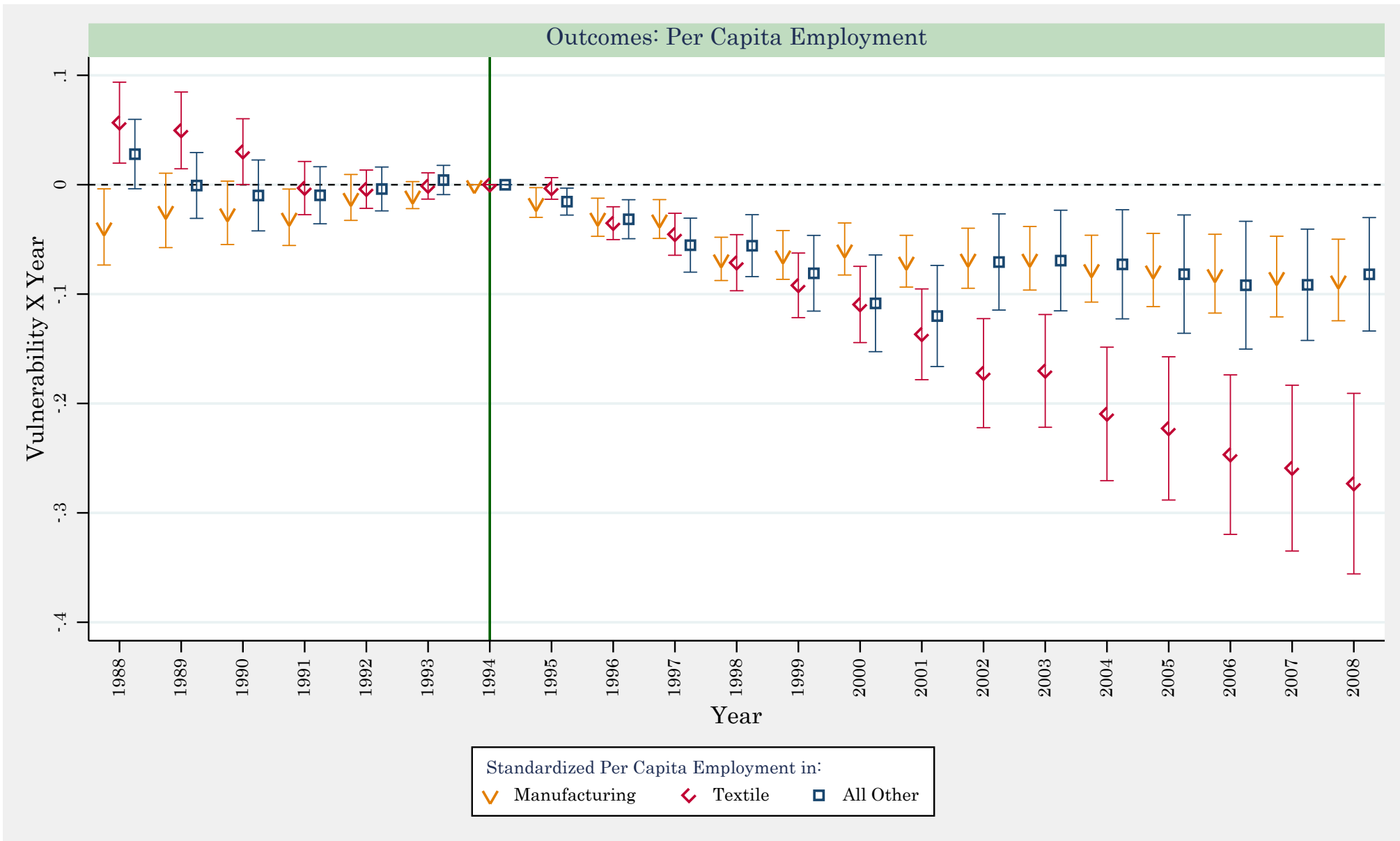
MECHANISMS



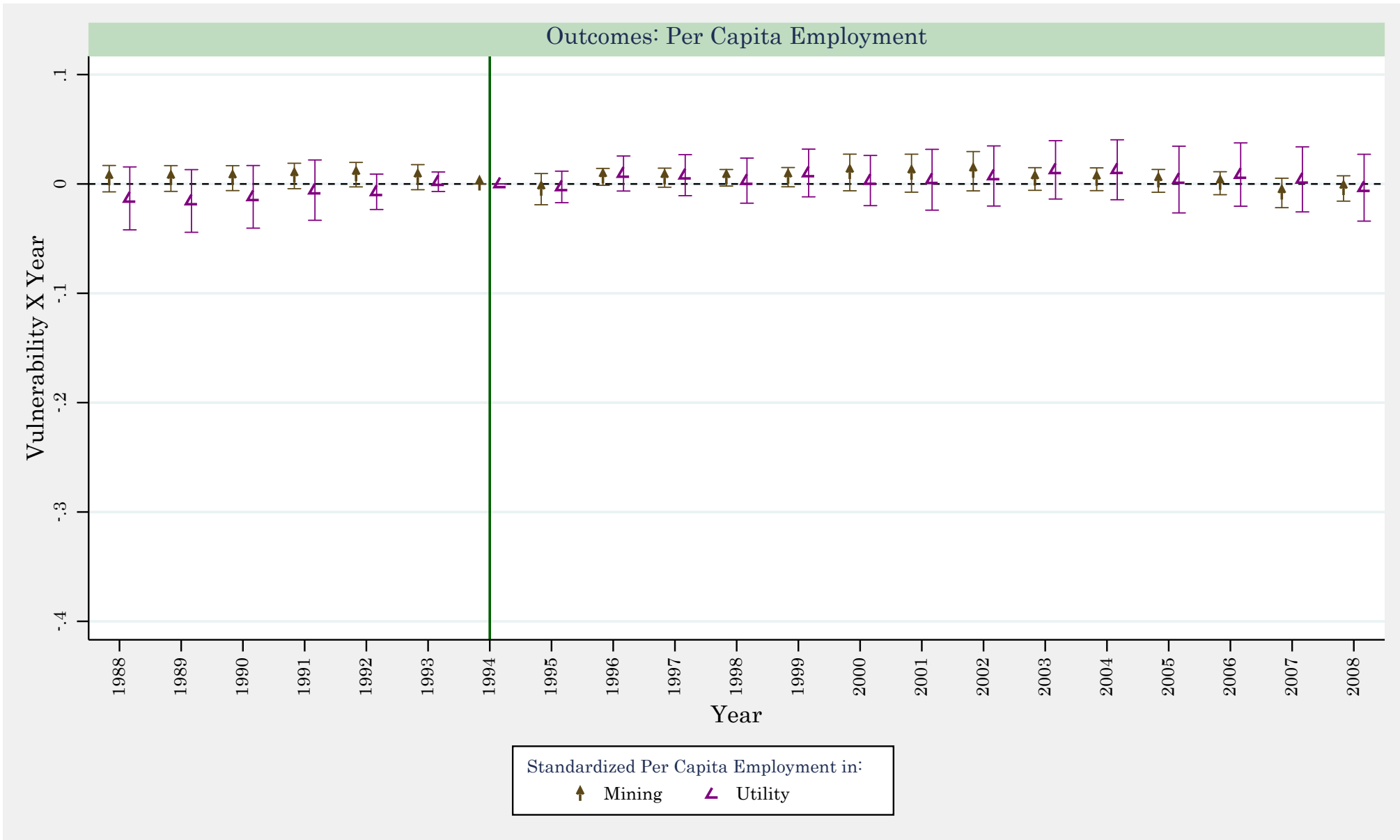
MECHANISMS



MECHANISMS



MECHANISMS



MECHANISMS



MAGNITUDE: LITERATURE COMPARISON

- Comparison of top-versus-bottom deciles of vulnerability index (a difference of 2-units):
 - A reduction in birth weight of 11 grams
 - A reductions in per-capita earnings of about \$2,500
- Chung et al. (2016) explore the birth outcome effects of Alaska Permanent Fund payments:
 - An increase of \$2,700 is associated with 18 grams of additional birth weight
- Hoynes et al. (2015) explore the infants' health effects of Earned Income Tax Credit (EITC):
 - An increase in income by about \$2,500 is associated with about 13 grams of additional birth weight

MAGNITUDE: LITERATURE COMPARISON

- Hoynes et al. (2011) investigate the effects of the Supplemental Program for Women Infants and Children (WIC) on birth outcomes. They calculate treatment-on-treated effects of about 18-29 grams.
 - ITT of NAFTA is about 40-60 percent of TOT of WIC
- Almond et al. (2011) examine the impacts of the introduction of the Food Stamp Program on birth outcomes. Their treatment-on-treated calculations suggest increase in birth weight of 15-20 grams among whites and 13-42 grams among blacks.
 - ITT of NAFTA is about 35-90 percent of TOT of FSP

MAGNITUDE: ITT TO TOT

- Among the top-quartile of trade exposure counties:
 - 5 percentage-points reductions in employment per capita
 - Labor force participation rate of 60 percent
- The treatment-on-treated effect of parental job loss due to NAFTA implies 133 grams lower birth weight.
- Lindo (2011) explores the effect of parental job loss on birth outcomes. He finds an effect size equivalent to a reduction of 150 grams.

MAGNITUDE: IMPLICATIONS

- Almond et al. (2005) use the twin strategy to calculate the hospital costs of being born with below-normal birth weight in excess of the costs for normal birth weight.
 - An average cost of about \$13K
- In the year 2000, low birth weight infants counted to 307,000
- Comparison of above-versus-below-median of vulnerability index (a difference of 1-unit):
 - An increase in the probability of low birth weight by about 2.1%
 - An increase of about 6.6K incidences of low birth weight in 2000
 - An annual extra hospital cost of about \$86M related to low birth weight

CONCLUSION

- The transition from protection to liberalization could be beneficial for some groups and harmful for others
- This paper revealed one aspect of trade liberalization: the impact of NAFTA on infants' health outcomes
- Policy relevance:
 - birth outcomes are linked to life-cycle and intergenerational outcomes
 - The results help to implement a more optimal cost-benefit welfare analysis of trade liberalization

CONCLUSION

- The DD estimates comparing mothers at the top-versus-bottom deciles of vulnerability:
 - low birth weight, preterm birth, and low Apgar score increase by 4.2, 4.8, and 12.6 percent from the mean of their respective outcome
- several potential pathways:
 - reductions in income-employment
 - decreases in housing wealth
 - lower health care utilization
 - lower health insurance use and lower-quality health insurance

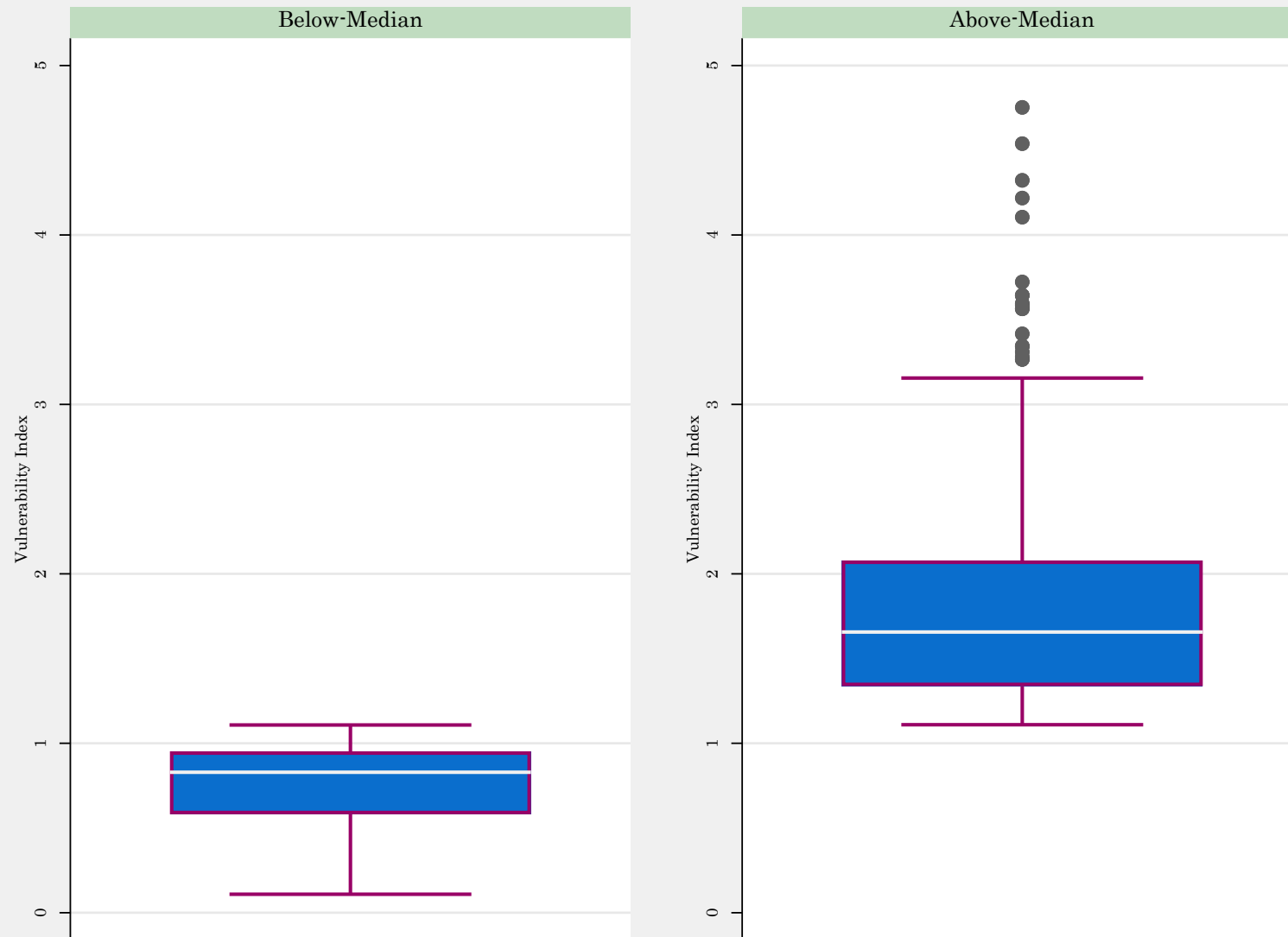
QUESTIONS



APPENDICES

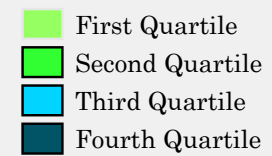
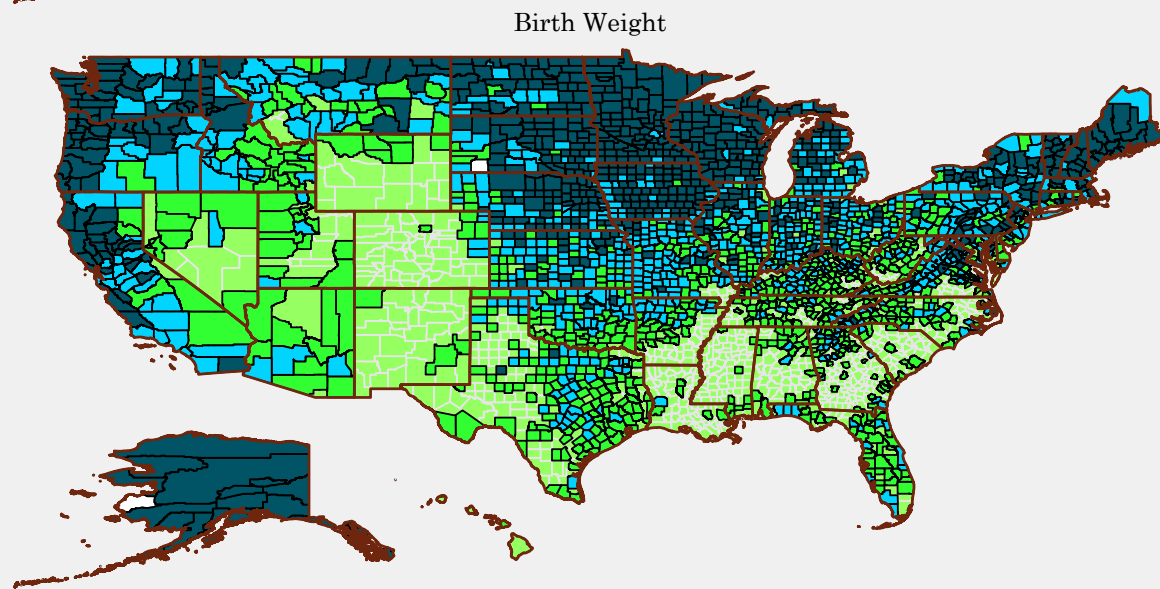
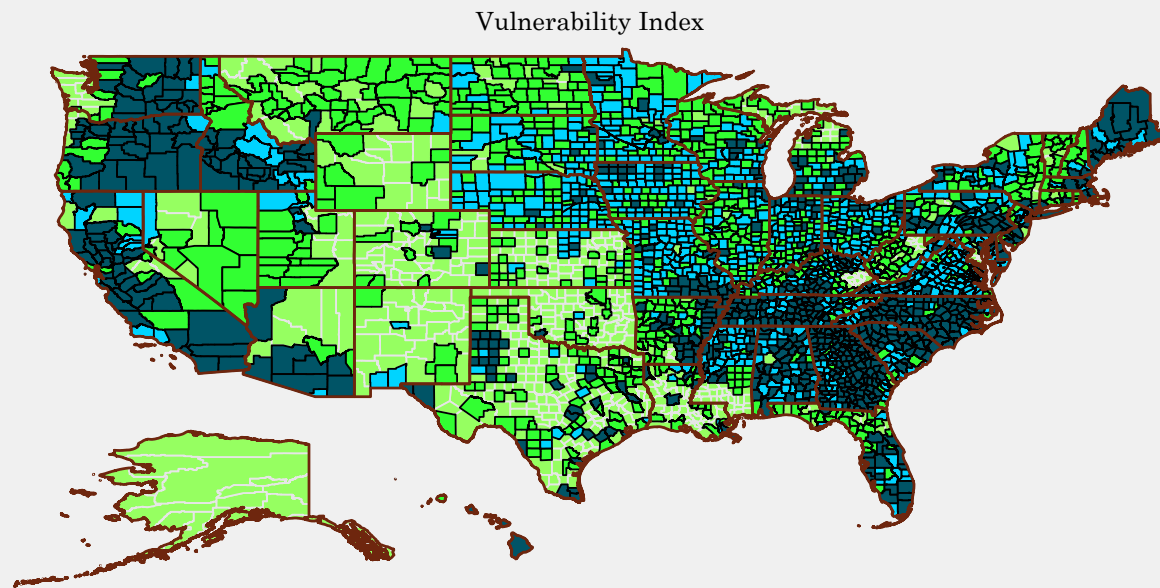


BOX PLOTS OF VULNERABILITY INDEX



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MAPS



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TRADE FIGURES

- Mexico:
 - Imports in 1990: 30.2 billion
 - Imports in 2000: 336 billion
 - Average tariff in 1990: 3.74%
 - Average tariff in 2000: 0.42%
- Most Favored Nation (MFN) Tariff:
 - Average tariff in 1990: 5.98%
 - Average tariff in 2000: 4.38%

TRADE FIGURES

- All Countries:
 - Imports in 1990: 497 billion
 - Imports in 2000: 1.22 trillion
- Canada:
 - Imports in 1990: 91.4 billion
 - Imports in 2000: 229 billion

SUMMARY STAT

	Below Median Vulnerability		
	Observations	Mean	SD
Birth Weight	44,507,425	3332.585	573.296
Gestational Age	44,507,425	38.917	2.514
Fetal Growth	44,507,425	85.457	13.612
Term Birth Weight	39,940,089	3412.02	479.11
Low Birth Weight	44,507,425	0.061	0.24
Preterm Birth	44,507,425	0.103	0.303
Apgar Score	34,399,283	8.9	0.749
Low Apgar Score	34,399,283	0.029	0.168
Female	44,507,425	0.488	0.5

SUMMARY STAT

	Above Median Vulnerability		
	Observations	Mean	SD
Birth Weight	44,373,772	3346.642	574.741
Gestational Age	44,373,772	38.957	2.512
Fetal Growth	44,373,772	85.737	13.653
Low Birth Weight	44,373,772	0.06	0.237
Very Low Birth Weight	44,373,772	0.011	0.102
Preterm Birth	44,373,772	0.1	0.301
Apgar Score	37,860,857	8.926	0.768
Low Apgar Score	37,860,857	0.029	0.168
Female	44,373,772	0.488	0.5

SUMMARY STAT

	Below Median Vulnerability	
	Mean	SD
Mother White	0.77	0.421
Mother Black	0.164	0.371
Mother Other Races	0.064	0.245
Mother's Age<20	0.117	0.321
Mother's Age 20-24	0.25	0.433
Mother's Age 25-29	0.279	0.449
Mother's Age 30-34	0.229	0.42
Mother's Age 35-39	0.104	0.305
Mother's Age 40-45	0.021	0.144
Mother's Education less than HS	0.053	0.225
Mother's Education HS	0.149	0.356
Mother's Education HS Graduate	0.294	0.456
Mother's Education Some College	0.206	0.405
Mother's Education $\geq$ Bachelor	0.225	0.418
Mother's Education Missing	0.072	0.259
First-Time Mother	0.337	0.473
Mother is Married	0.669	0.471
Mother's Marital Status Missing	0.001	0.003
Father's Age < 25	0.18	0.384
Father's Age 25-34	0.461	0.498
Father's Age 35-44	0.191	0.393
Father's Age > 45	0.022	0.148
Father's Age Missing	0.146	0.353
Any Prenatal Visits	0.985	0.123
Any Prenatal Care	0.986	0.117
I(Year>1994)	0.637	0.481
Vulnerability Index	0.741	0.21
Exposure to China Imports Index	0.887	0.406
Observations	44,507,425	

return ↺

SUMMARY STAT

	Above Median Vulnerability	
	Mean	SD
Mother White	0.813	0.39
Mother Black	0.139	0.346
Mother Other Races	0.047	0.212
Mother's Age<20	0.121	0.326
Mother's Age 20-24	0.264	0.441
Mother's Age 25-29	0.286	0.452
Mother's Age 30-34	0.217	0.412
Mother's Age 35-39	0.093	0.29
Mother's Age 40-45	0.018	0.135
Mother's Education less than HS	0.056	0.231
Mother's Education HS	0.156	0.363
Mother's Education HS Graduate	0.319	0.466
Mother's Education Some College	0.215	0.411
Mother's Education $\geq$ Bachelor	0.202	0.402
Mother's Education Missing	0.052	0.222
First-Time Mother	0.336	0.472
Mother is Married	0.666	0.472
Mother's Marital Status Missing	0.001	0.004
Father's Age < 25	0.191	0.393
Father's Age 25-34	0.47	0.499
Father's Age 35-44	0.176	0.38
Father's Age > 45	0.02	0.14
Father's Age Missing	0.143	0.35
Any Prenatal Visits	0.989	0.103
Any Prenatal Care	0.99	0.098
I(Year>1994)	0.635	0.481
Vulnerability Index	1.693	0.627
Exposure to China Imports Index	1.276	0.566
Observations	44,373,772	

return ↶

SUMMARY STAT

Variable	N	Mean	SD
<i>Trade Exposure Measures:</i>			
I(Year>1994)	82777	0.6784	0.4671
Vulnerability Index	82777	1.3107	0.8227
Exposure to China Index	78361	1.127	0.5941
Multifiber Arrangement (MFA) Exposure Index	78425	0.5814	2.655
<i>Economic Indicators:</i>			
Real Personal Per Capita Income	79042	34602.268	9153.5981
Real Average Weekly Wage	79269	279.1959	68.2887
Real Per Capita Current Transfer Receipt	79042	6280.3755	1958.3053
Real Per Capita Income Maintenance Benefit	79042	609.7524	343.2249
Real Per Capita Employer Contribution to Social Insurance	79042	1113.6262	762.5287
Per Capita Employment in Agriculture	78119	0.0017	0.0042
Per Capita Employment in Mining	78119	0.0042	0.0246
Per Capita Employment in Utility	78119	0.003	0.0068
Per Capita Employment in Construction	78119	0.0154	0.0129
Per Capita Employment in Manufacturing	78119	0.0551	0.0526
Per Capita Employment in Textile Manufacturing	78119	0.0032	0.0117
Per Capita Employment in Apparel Manufacturing	78119	0.0031	0.0104
Per Capita Employment in Machinery Manufacturing	78119	0.0046	0.0109
Per Capita Employment in Other Manufacturing	78119	0.0018	0.0046
Per Capita Employment in Other Industries	78119	0.1317	0.0909

return ↺

SUMMARY STAT

Variable	N	Mean	SD
<i>Crime Rates:</i>			
Total Male Arrest Rate per 100,000	77982	5991.9441	5179.6019
Total Female Arrest Rate per 100,000	77982	1515.6564	1414.9775
Total Arrest Rate per 100,000	77982	3717.7485	3186.5458
<i>Housing Price Measure:</i>			
Housing Price Index	54985	211.4617	130.182
<i>Natural Resource measures:</i>			
Total Gas Production (thousand cubic feet)	78192	6.0837	58.3024
Total Oil Production (thousand barrels)	78192	0.5755	9.5438
<i>Alternative Economic Indicators:</i>			
Real Per Capita Net Earnings	79042	21579.415	7202.1195
Real Per Capita Retirement Income	79042	5501.7645	1722.6128
Real Per Capita Dividend-Rent-Interest	79042	6742.4763	3288.3823
Real Per Job Earning	79042	41940.5	10803.021
Real Per Capita non-Farm Income	79042	27055.027	14437.197
Real Per Capita Proprietary Income	79042	3563.2235	3058.9425
<i>State/County Earning and Expenditure:</i>			
Real Per Capita Total Tax	51487	0.4819	1.14
Real Per Capita Alcohol Tax	51487	0.0008	0.0034
Real Per Capita Educational Expenditure	51487	0.2198	0.6317
Real Per Capita Health Expenditure	51487	0.0742	0.1186
Real Per Capita Police Expenditure	51487	0.0751	0.0948
Real Per Capita Correctional Institution Expenditure	51487	0.0488	0.0998

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SUBSAMPLE: LOW-EDUCATED MOTHERS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-8.2056*** (2.3962)	-0.0300*** (0.0097)	-0.1536*** (0.0504)	0.0021*** (0.0005)	0.0032*** (0.0010)	0.0013* (0.0007)
Observations	18,432,603	18,432,603	18,432,603	18,432,603	18,432,603	13,645,818
R-squared	0.0509	0.0215	0.0474	0.0148	0.0139	0.009
Mean DV	3249.71	38.83	83.52	0.07	0.12	0.03
%Change	-0.25	-0.07	-0.18	2.76	2.52	3.97

[return ↶](#)

SUBSAMPLE: FEMALES

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.21497*** (1.27464)	-0.03475*** (0.00785)	-0.06698*** (0.02458)	0.00139*** (0.00032)	0.00233*** (0.00059)	0.00189*** (0.00062)
Observations	43,368,970	43,368,970	43,368,970	43,368,970	43,368,970	35,250,013
R-squared	0.05292	0.02714	0.04583	0.01771	0.01634	0.00839
Mean DV	3280.752	39.000	83.965	0.065	0.096	0.027
%Change	-0.159	-0.089	-0.080	2.134	2.426	7.003

[return ↵](#)

SUBSAMPLE: MALES

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.60381*** (1.35962)	-0.03564*** (0.00751)	-0.0719*** (0.02598)	0.00124*** (0.00027)	0.00256*** (0.00063)	0.00176*** (0.00065)
Observations	45,512,227	45,512,227	45,512,227	45,512,227	45,512,227	37,010,127
R-squared	0.05461	0.02382	0.0494	0.01403	0.01407	0.00876
Mean DV	3395.682	38.877	87.151	0.056	0.107	0.031
%Change	-0.165	-0.092	-0.083	2.205	2.392	5.665

[return ↶](#)

SUBSAMPLE: MOTHERS' AGE<25

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.7169*** (1.28329)	-0.02716*** (0.00809)	-0.06702*** (0.0257)	0.00134*** (0.00033)	0.0025*** (0.00066)	0.00184*** (0.00067)
Observations	33,413,069	33,413,069	33,413,069	33,413,069	33,413,069	26,983,965
R-squared	0.05314	0.02423	0.0449	0.01242	0.01362	0.00815
Mean DV	3266.531	38.956	83.689	0.071	0.115	0.033
%Change	-0.144	-0.070	-0.080	1.883	2.174	5.568

SUBSAMPLE: WHITES

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.92669*** (1.25912)	-0.02748*** (0.00654)	-0.07427*** (0.02492)	0.00119*** (0.00025)	0.00183*** (0.00042)	0.00196*** (0.00068)
Observations	70,348,633	70,348,633	70,348,633	70,348,633	70,348,633	56,656,281
R-squared	0.04274	0.02043	0.04637	0.00726	0.00752	0.00803
Mean DV	3385.995	39.052	86.579	0.050	0.089	0.026
%Change	-0.146	-0.070	-0.086	2.385	2.051	7.528

[return ↶](#)

SUBSAMPLE: BLACKS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.77147*** (1.77206)	-0.02325** (0.00977)	-0.08971** (0.03549)	0.0013* (0.0007)	0.00127 (0.00113)	0.001 (0.00084)
Observations	13,496,017	13,496,017	13,496,017	13,496,017	13,496,017	11,973,462
R-squared	0.02645	0.0104	0.0263	0.00892	0.01026	0.00642
Mean DV	3125.537	38.372	81.101	0.115	0.165	0.043
%Change	-0.153	-0.061	-0.111	1.130	0.771	2.328

SUBSAMPLE: TOP-QUARTILE OF VULNERABILITY

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.42263*** (1.78398)	-0.01464 (0.01006)	-0.11988*** (0.03461)	0.00094** (0.00038)	0.00089 (0.00087)	0.00307** (0.00126)
Observations	21,798,076	21,798,076	21,798,076	21,798,076	21,798,076	19,737,158
R-squared	0.06483	0.02831	0.06134	0.01629	0.01569	0.00871
Mean DV	3329.355	38.906	85.396	0.064	0.106	0.030
%Change	-0.163	-0.038	-0.140	1.474	0.840	10.243

MECHANISMS

	Any Prenatal Visits	Any Prenatal Care
	(1)	(2)
I(year>1994) × Vulnerability Index	-0.00121* (0.0007)	-0.00116* (0.00062)
Observations	88,881,197	88,881,197
R-squared	0.02516	0.02537
Mean DV	0.987	0.988
%Change	-0.122	-0.117

ROBUSTNESS: ADDING MFA MEASURE BY YEAR FE

	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.30613*** (1.31865)	-0.03154*** (0.00778)	-0.0748*** (0.02394)	0.00123*** (0.00029)	0.00227*** (0.00059)	0.00182*** (0.00062)
Observations	88,881,027	88,881,027	88,881,027	88,881,027	88,881,027	72,259,975
R-squared	0.06309	0.02592	0.06052	0.0161	0.01535	0.00866
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.159	-0.081	-0.087	2.012	2.222	6.290

return ↵

ROBUSTNESS: ADDING INCOME CONTROLS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-3.99264*** (1.20721)	-0.02564*** (0.00685)	-0.05144** (0.02309)	0.00095*** (0.00025)	0.00198*** (0.00057)	0.00156** (0.00063)
Observations	88,881,027	88,881,027	88,881,027	88,881,027	88,881,027	72,259,975
R-squared	0.06311	0.02594	0.06053	0.01611	0.01535	0.00866
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.120	-0.066	-0.060	1.549	1.937	5.367

ROBUSTNESS: ADDING SOCIAL SPENDING CONTROLS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.05666*** (1.23496)	-0.0299*** (0.00724)	-0.04422* (0.02325)	0.00096*** (0.00025)	0.00211*** (0.00058)	0.00166*** (0.00063)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.06311	0.02592	0.06053	0.01611	0.01535	0.00866
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.121	-0.077	-0.052	1.573	2.069	5.713

ROBUSTNESS: ADDING EMPLOYMENT CONTROLS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.70442*** (1.26563)	-0.03057*** (0.00683)	-0.06036** (0.02447)	0.00111*** (0.00026)	0.00224*** (0.00057)	0.00163** (0.00063)
Observations	88,728,226	88,728,226	88,728,226	88,728,226	88,728,226	72,108,275
R-squared	0.06296	0.02588	0.06043	0.01596	0.01523	0.00865
Mean DV	3339.920	38.938	85.603	0.061	0.101	0.029
%Change	-0.141	-0.079	-0.071	1.818	2.222	5.619

ROBUSTNESS: ADDING POPULATION CONTROLS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.76338*** (1.25504)	-0.02826*** (0.00718)	-0.0691*** (0.02422)	0.00115*** (0.00027)	0.00202*** (0.00058)	0.00168*** (0.00063)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.0631	0.02592	0.06052	0.0161	0.01535	0.00865
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.143	-0.073	-0.081	1.882	1.977	5.777

return ↵

ALTERNATIVE MEASURE OF TRADE EXPOSURE: ACTUAL IMPORTS

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.84384*** (1.82567)	-0.02451** (0.01116)	-0.10695*** (0.03359)	0.00143*** (0.00038)	0.00219*** (0.00083)	0.00161** (0.00073)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.06309	0.0259	0.06052	0.0161	0.01534	0.00865
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.175	-0.063	-0.125	2.340	2.149	5.553

ROBUSTNESS: BIRTH YEARS 1989-2004

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.0284*** (1.14371)	-0.02489*** (0.00765)	-0.05585*** (0.02075)	0.0012*** (0.00027)	0.00197*** (0.00063)	0.00095*** (0.00037)
Observations	58,434,475	58,434,475	58,434,475	58,434,475	58,434,475	44,651,582
R-squared	0.06348	0.02226	0.06229	0.01688	0.01597	0.0061
Mean DV	3351.815	38.991	85.784	0.060	0.100	0.028
%Change	-0.120	-0.064	-0.065	2.004	1.965	3.409

ROBUSTNESS: BIRTH YEARS 1980-2015

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-4.95277*** (1.32186)	-0.03478*** (0.00751)	-0.05843** (0.02642)	0.00093*** (0.0003)	0.00207*** (0.0006)	0.0019*** (0.00064)
Observations	117,465,581	117,465,581	117,465,581	117,465,581	117,465,581	98,670,781
R-squared	0.0541	0.02743	0.05168	0.01349	0.01377	0.0095
Mean DV	3306.462	38.830	84.908	0.076	0.114	0.033
%Change	-0.150	-0.090	-0.069	1.227	1.817	5.766

ROBUSTNESS: EXPOSURE AT CONS-PUMA LEVEL

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.76089*** (1.58161)	-0.04241*** (0.00817)	-0.06331** (0.03168)	0.00158*** (0.00032)	0.00322*** (0.00062)	0.00205*** (0.0007)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.06232	0.02531	0.05991	0.01594	0.0151	0.00796
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.173	-0.109	-0.074	2.588	3.154	7.055

ROBUSTNESS: CLUSTERING SE AT COUNTY-YEAR

	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.41496*** (1.50406)	-0.03521*** (0.00904)	-0.06952** (0.02614)	0.00131*** (0.00033)	0.00245*** (0.00064)	0.00182** (0.00074)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.06309	0.0259	0.06052	0.0161	0.01534	0.00865
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.162	-0.090	-0.081	2.147	2.399	6.281

[return ↵](#)

ROBUSTNESS: TWO-WAY CLUSTERING SE AT COUNTY AND STATE-YEAR

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.41496*** (1.37238)	-0.03521*** (0.00801)	-0.06952*** (0.02566)	0.00131*** (0.0003)	0.00245*** (0.00061)	0.00182*** (0.00066)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.06309	0.0259	0.06052	0.0161	0.01534	0.00865
Mean DV	3339.603	38.937	85.597	0.061	0.102	0.029
%Change	-0.162	-0.090	-0.081	2.147	2.399	6.281

FIRST-DIFFERENCE WITH STATE FE, CLUSTER SE AT STATE LEVEL

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.57343*** (1.22616)	-0.03924*** (0.00608)	-0.06698** (0.02689)	0.00246*** (0.00045)	0.00377*** (0.00064)	0.01007*** (0.00191)
Observations	3,131	3,131	3,131	3,131	3,131	2,965
R-squared	0.24214	0.228	0.20921	0.1462	0.18423	0.06765

FIRST-DIFFERENCE WITH STATE FE, CORRECTING SE USING ADÃO ET AL. (2019)

	<i>Outcomes:</i>					
	Birth Weight	Gestational Age	Fetal Growth	Low Birth Weight	Preterm Birth	Low Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-5.57343** (2.32569)	-0.03924** (0.01567)	-0.06698 (0.04288)	0.00246*** (0.00086)	0.00377** (0.00148)	0.01007 (0.00873)
Observations	3,131	3,131	3,131	3,131	3,131	2,965
R-squared	0.24214	0.228	0.20921	0.1462	0.18423	0.06765

ALTERNATIVE BIRTH OUTCOMES

	<i>Outcomes:</i>					
	Gestational Age- Adjusted Birth Weight	Full-Term Birth Weight	Very Low Birth Weight	Extremely Low Birth Weight	Very Preterm Birth	Apgar Score
	(1)	(2)	(3)	(4)	(5)	(6)
I(year>1994) × Vulnerability Index	-3.94414*** (0.8286)	-3.60594*** (1.17918)	0.00027*** (0.00007)	0.00017*** (0.00005)	0.00012* (0.00007)	-0.01967*** (0.00662)
Observations	88,881,197	88,881,197	88,881,197	88,881,197	88,881,197	72,260,140
R-squared	0.02376	0.06975	0.00493	0.00329	0.00404	0.03764
Mean DV	3315.940	3418.557	0.011	0.005	0.006	8.913
%Change	-0.119	-0.105	2.443	3.451	2.037	-0.221

return ↩



COUNTY-LEVEL ANALYSES: INCOME

	Personal Per Capita Income	Average Weekly Wage	Per Capita Current Transfer Receipt	Per Capita Income Maintenance Benefit	Per Capita Employer Contribution to Social Insurance
	(1)	(2)	(3)	(4)	(5)
I(year>1994) × Vulnerability Index	-1790.11*** (344.47)	-13.99*** (2.45)	125.75*** (35.18)	2.54 (9.80)	-89.72*** (16.62)
Observations	76,721	78,112	76,721	76,721	76,721
R-squared	0.95	0.94	0.97	0.97	0.97
Mean DV	42633.7	358.48	5870.02	646.47	1730.62
%Change	-4.16	-3.90	2.14	0.39	-5.18



COUNTY-LEVEL ANALYSES: EARNINGS

	Per Capita Net Earnings	Per Capita Retirement Income	Per Capita Dividend-Rent- Interest	Per Capita Job Earnings	Per Capita Non-Farm Income	Per Capita Proprietary Income	Per Capita Total Tax
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I(year>1994) × Vulnerability Index	-1249.22*** (274.38)	138.88*** (30.78)	-666.65*** (108.47)	-2015.20*** (369.11)	-3210.59*** (818.93)	-628.15*** (118.03)	0.00103 (0.00759)
Observations	76,721	76,721	76,721	76,721	76,721	76,721	51,378
R-squared	0.95	0.96	0.92	0.94	0.73	0.77	0.93894
Mean DV	29,051.62	5030.93	8176.67	55,001.19	36,010.32	3545.41	0.481
%Change	-4.30	2.76	-8.15	-3.66	-8.91	-17.71	0.215



COUNTY-LEVEL ANALYSES: EMPLOYMENT

	Per Capita Employment in Mining	Per Capita Employment in Utility	Per Capita Employment in Manufacturing	Per Capita Employment in Textile	Per Capita Employment in Apparel	Per Capita Employment in All Industries
	(7)	(8)	(9)	(10)	(11)	(12)
I(year>1994) × Vulnerability Index	-0.00008 (0.00007)	0.00009 (0.00009)	-0.00174* (0.00104)	-0.00218*** (0.00035)	-0.00242*** (0.00028)	-0.00675*** (0.00255)
Observations	77,832	77,832	77,832	77,832	77,832	77,832
R-squared	0.83085	0.83994	0.92942	0.88401	0.72033	0.97434
Mean DV	0.002	0.002	0.057	0.002	0.002	0.378
%Change	-3.876	4.533	-3.046	-108.847	-121.071	-1.786

COUNTY-LEVEL ANALYSES: EXPENDITURES

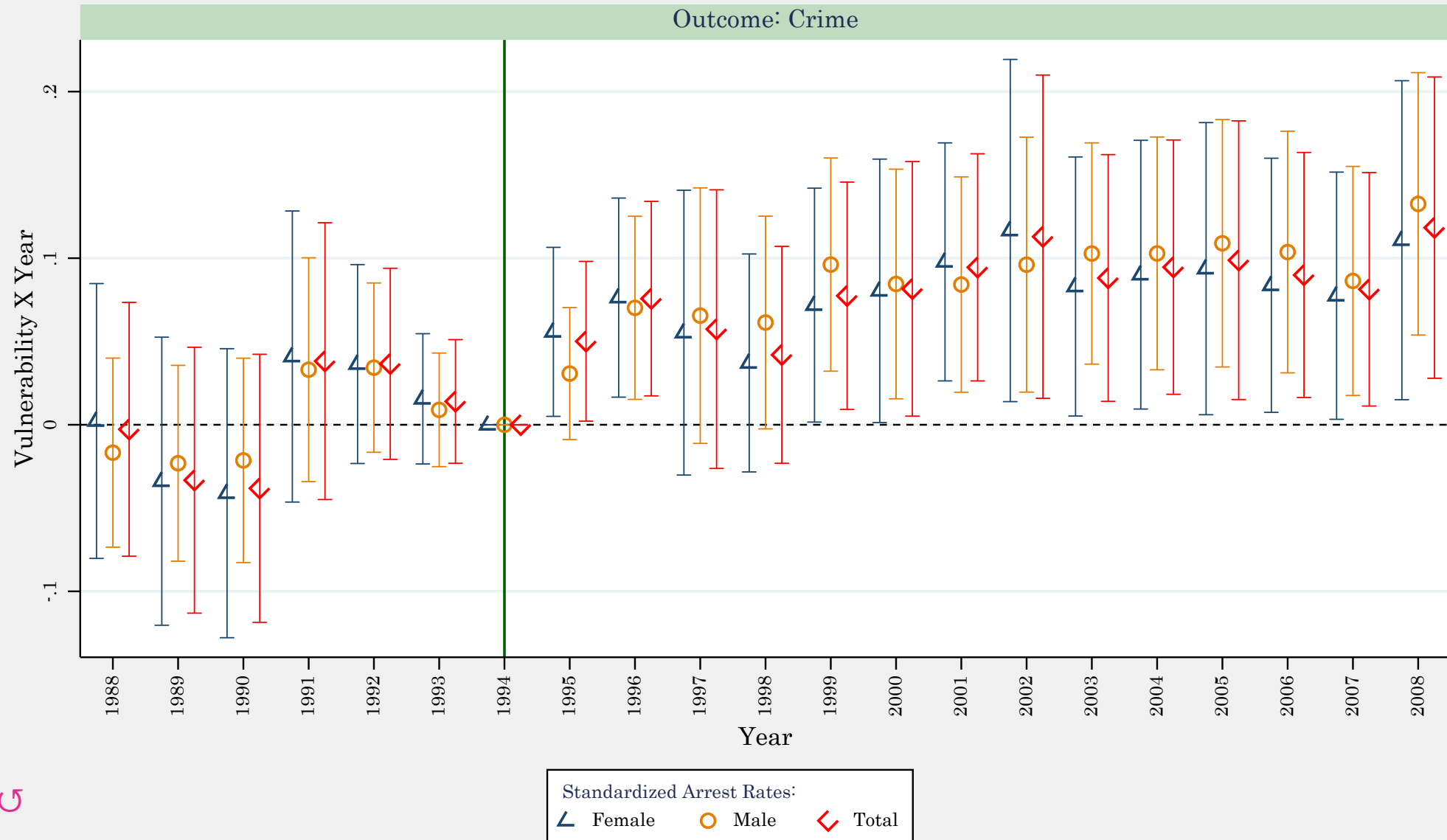
	Per Capita Education Expenditure	Per Capita Health Expenditure	Per Capita Police Expenditure	Per Capita Correctional Institutions Expenditure	Total Arrest Rates per 100,000	Housing Price Index	Total Oil- Equivalent Production
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
I(year>1994) × Vulnerability Index	0.00362 (0.00512)	0.00123 (0.00365)	-0.00286* (0.0015)	0.00401** (0.00171)	236.74* (125.29)	-32.30*** (6.14)	0.21517 (1.48116)
Observations	51,378	51,378	51,378	51,378	77,728	54,794	77,672
R-squared	0.98999	0.83196	0.92041	0.72797	0.80	0.96	0.85624
Mean DV	0.189	0.102	0.077	0.077	4765.85	359.30	12.812
%Change	1.917	1.210	-3.720	5.202	4.96	-8.99	1.679



COUNTY-LEVEL ANALYSES: POLLUTION

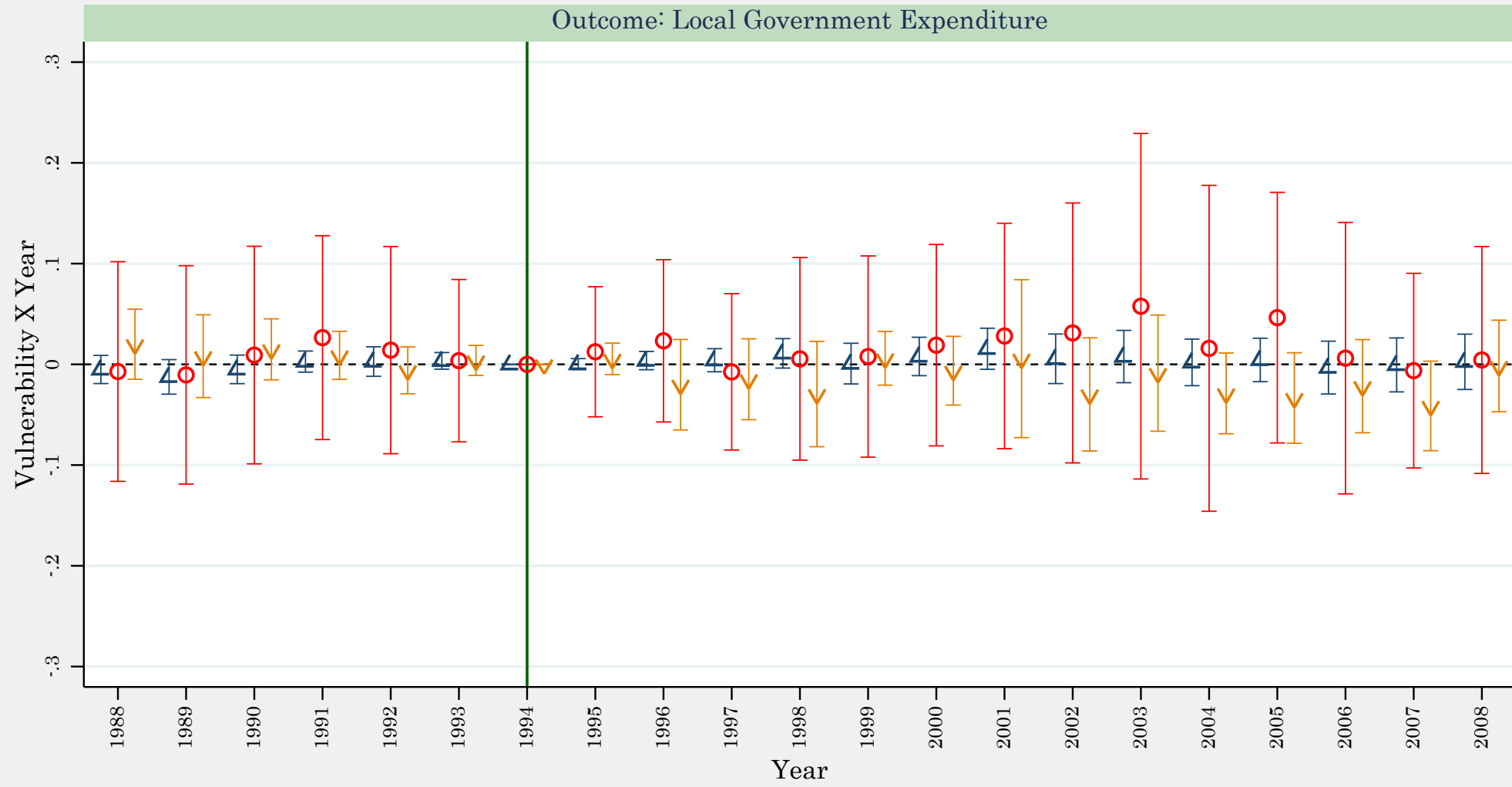
	<i>Outcomes: Standardized Pollution Per Area</i>								
	Carbon Monoxide	Sulfur Dioxide	Nitrogen Dioxide	Ozone	PM10	HAPS	Lead	Nonoxynol- 9	Pm10 Speciation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I(year>1994) × Vulnerability Index	0.00567 (0.02549)	0.01087 (0.02556)	0.01277 (0.00947)	-0.00109 (0.00542)	-0.00259 (0.0045)	0.02688 (0.04596)	0.05021* (0.02978)	0.0074 (0.02586)	0.03873 (0.0327)
Observations	5,724	8,620	5,404	15,810	12,482	3,731	3,315	4,418	4,480
R-squared	0.90718	0.93637	0.98334	0.98539	0.94177	0.94134	0.76343	0.90086	0.9584

COUNTY-LEVEL ANALYSES: CRIME



return ↻

COUNTY-LEVEL ANALYSES: GOV EXPENDITURE



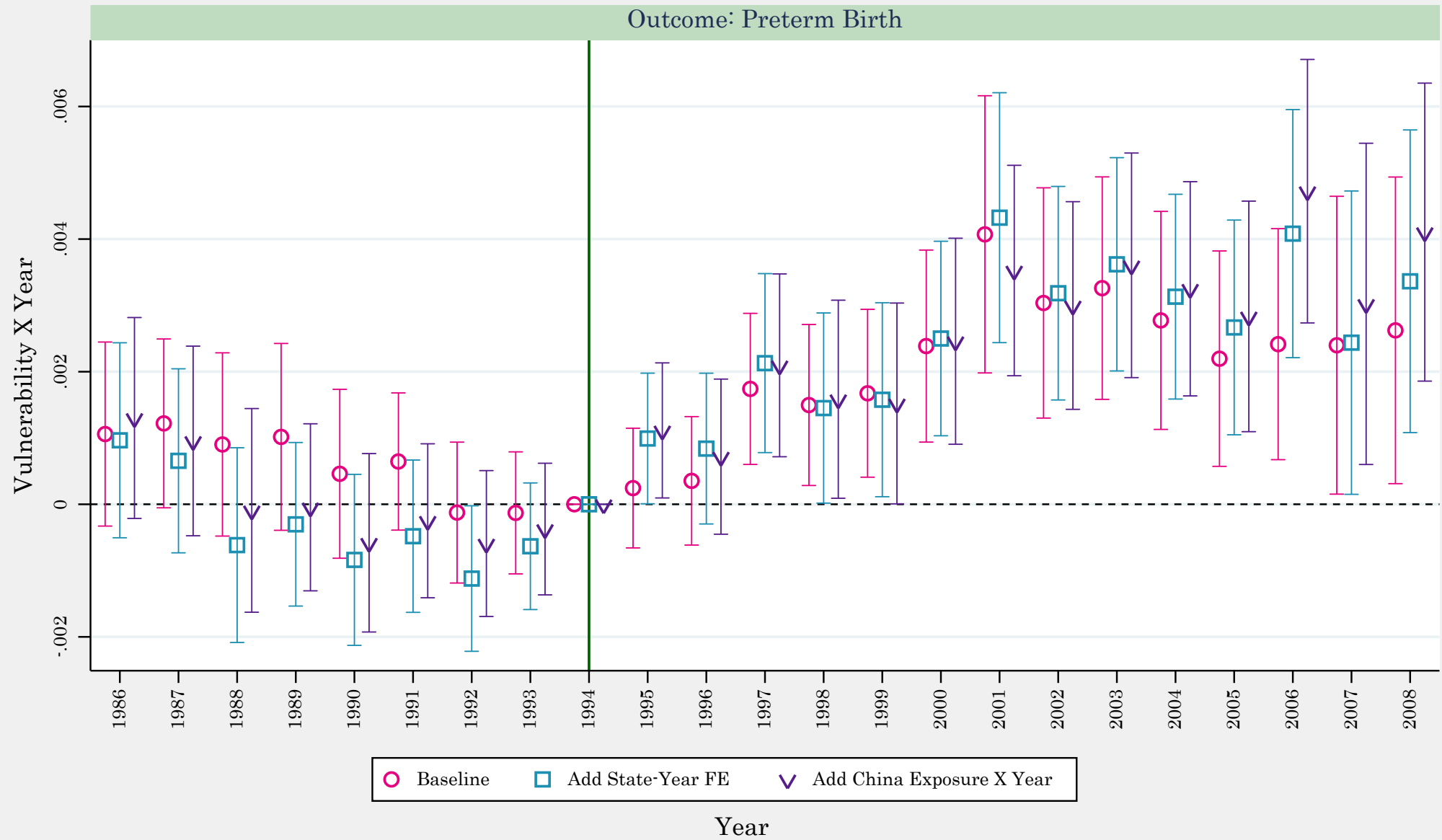
return ↻

EVENT-STUDY



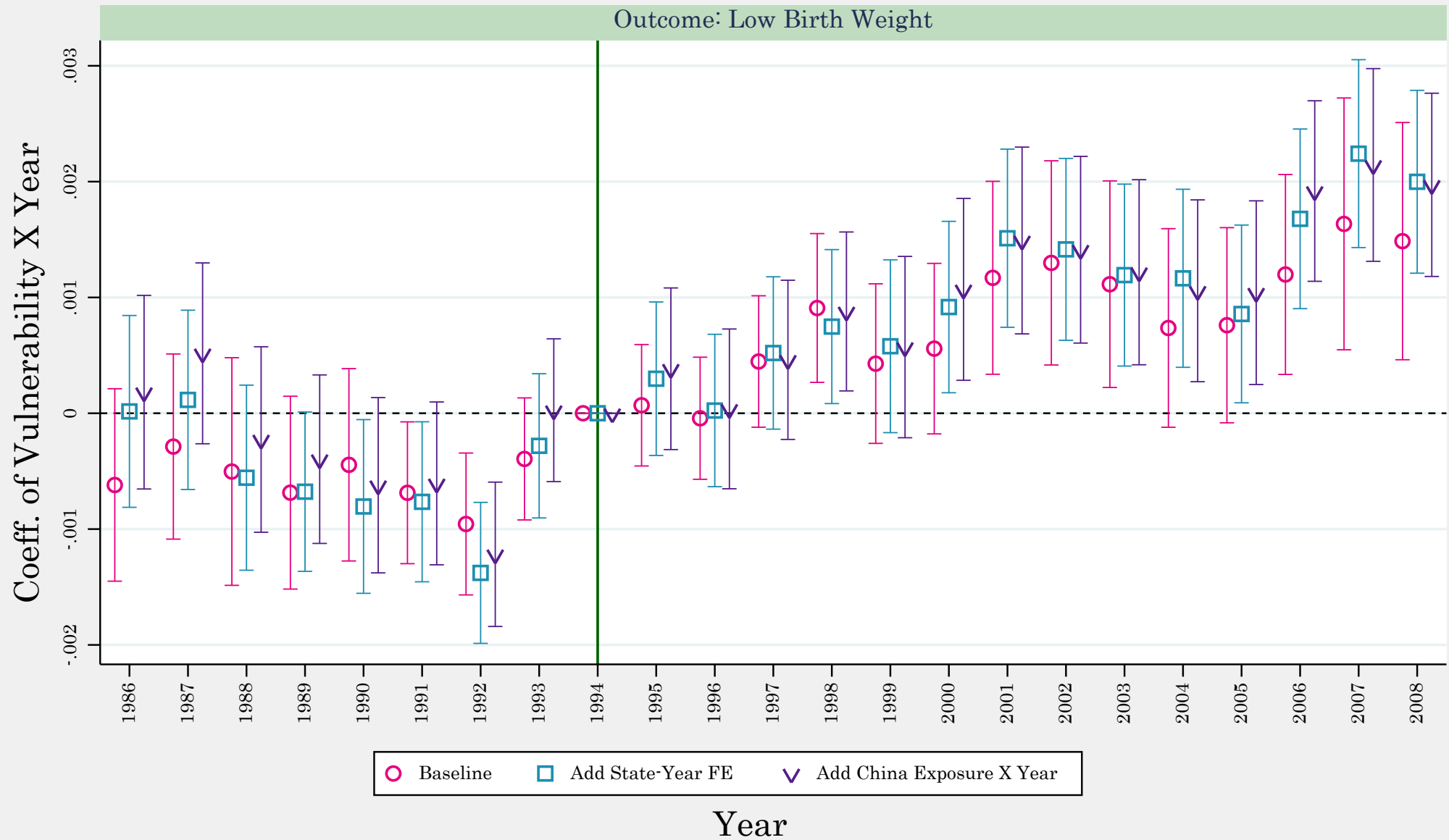
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EVENT-STUDY



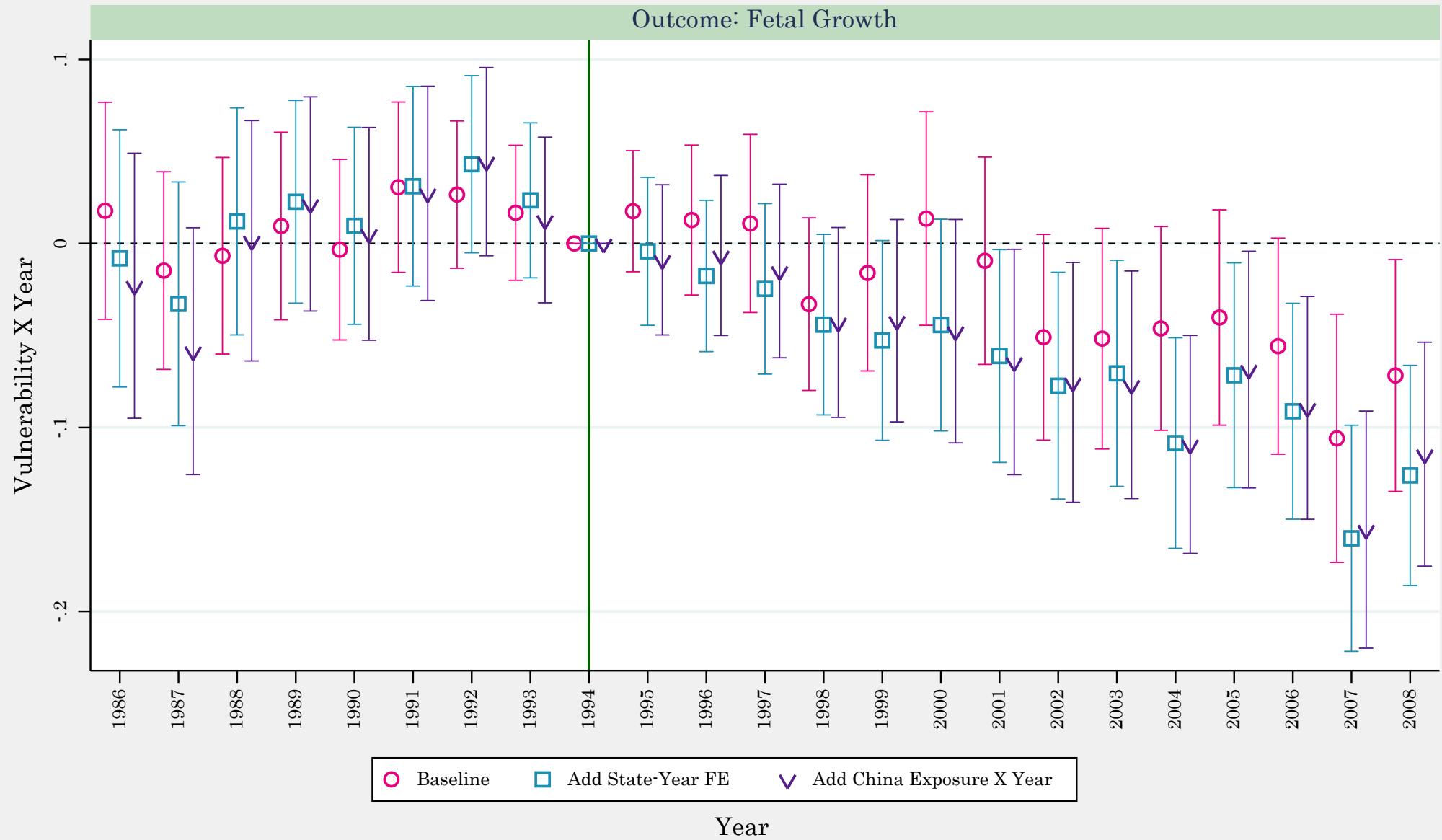
return ↺

EVENT-STUDY



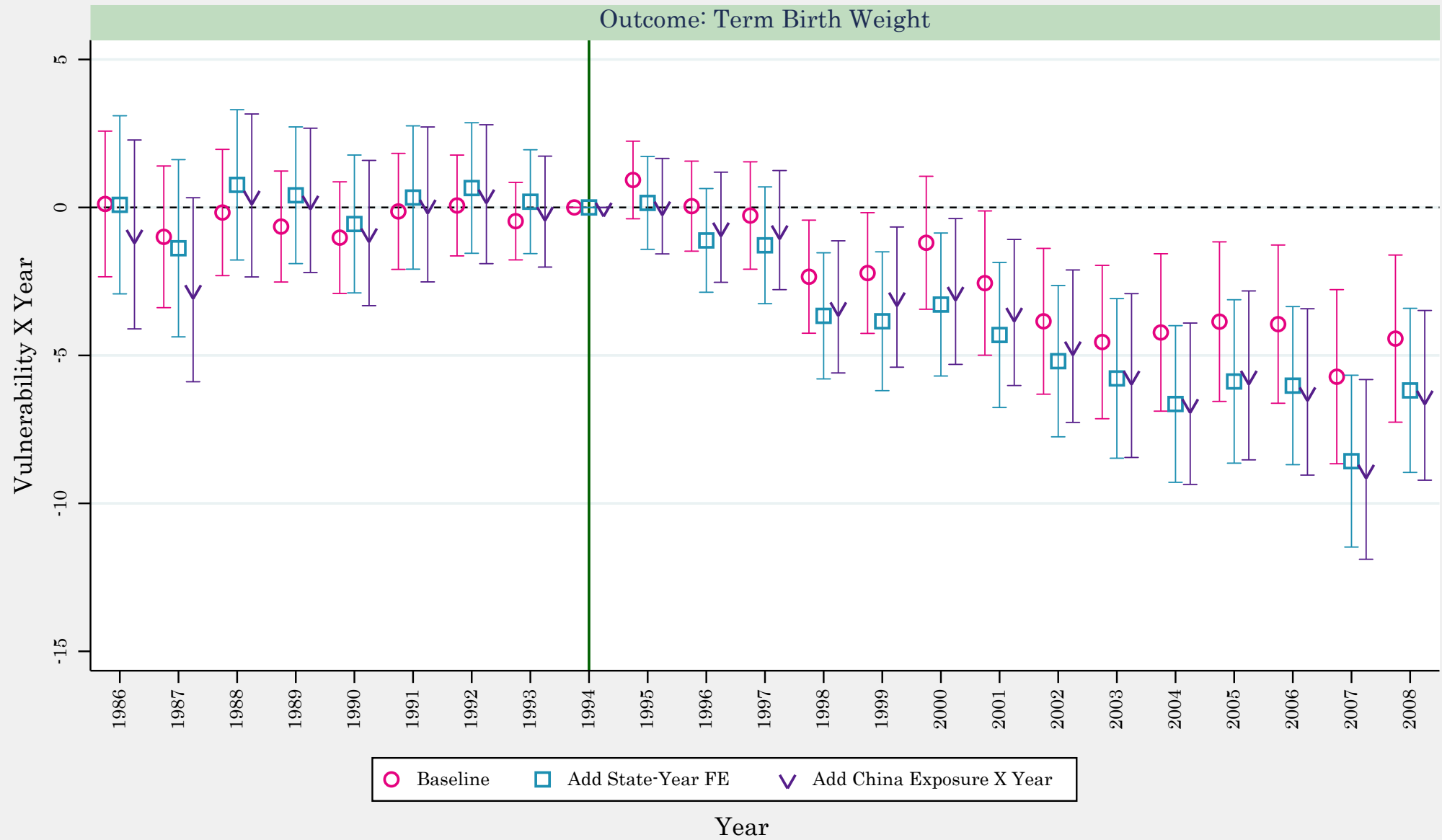
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EVENT-STUDY



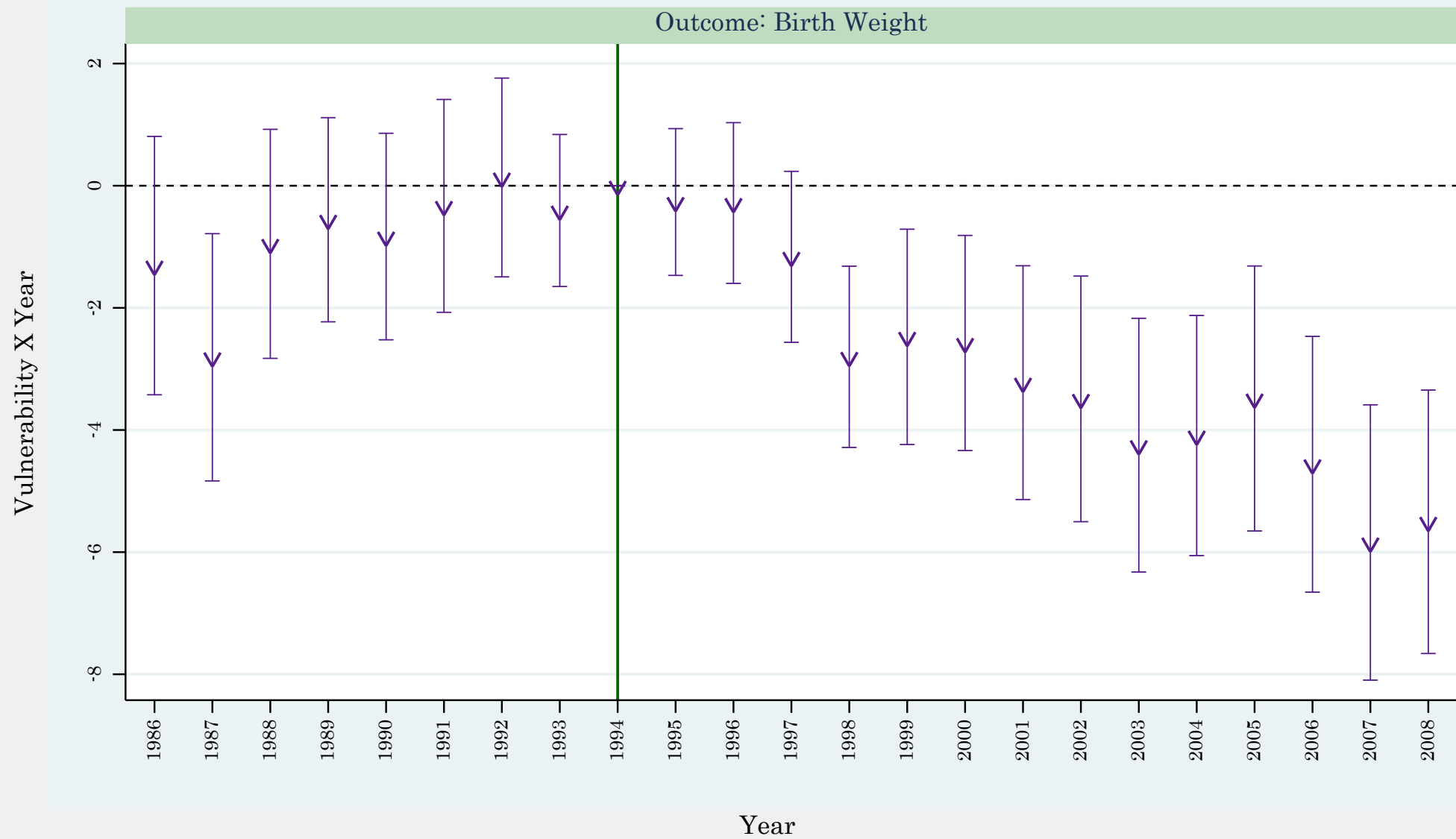
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EVENT-STUDY



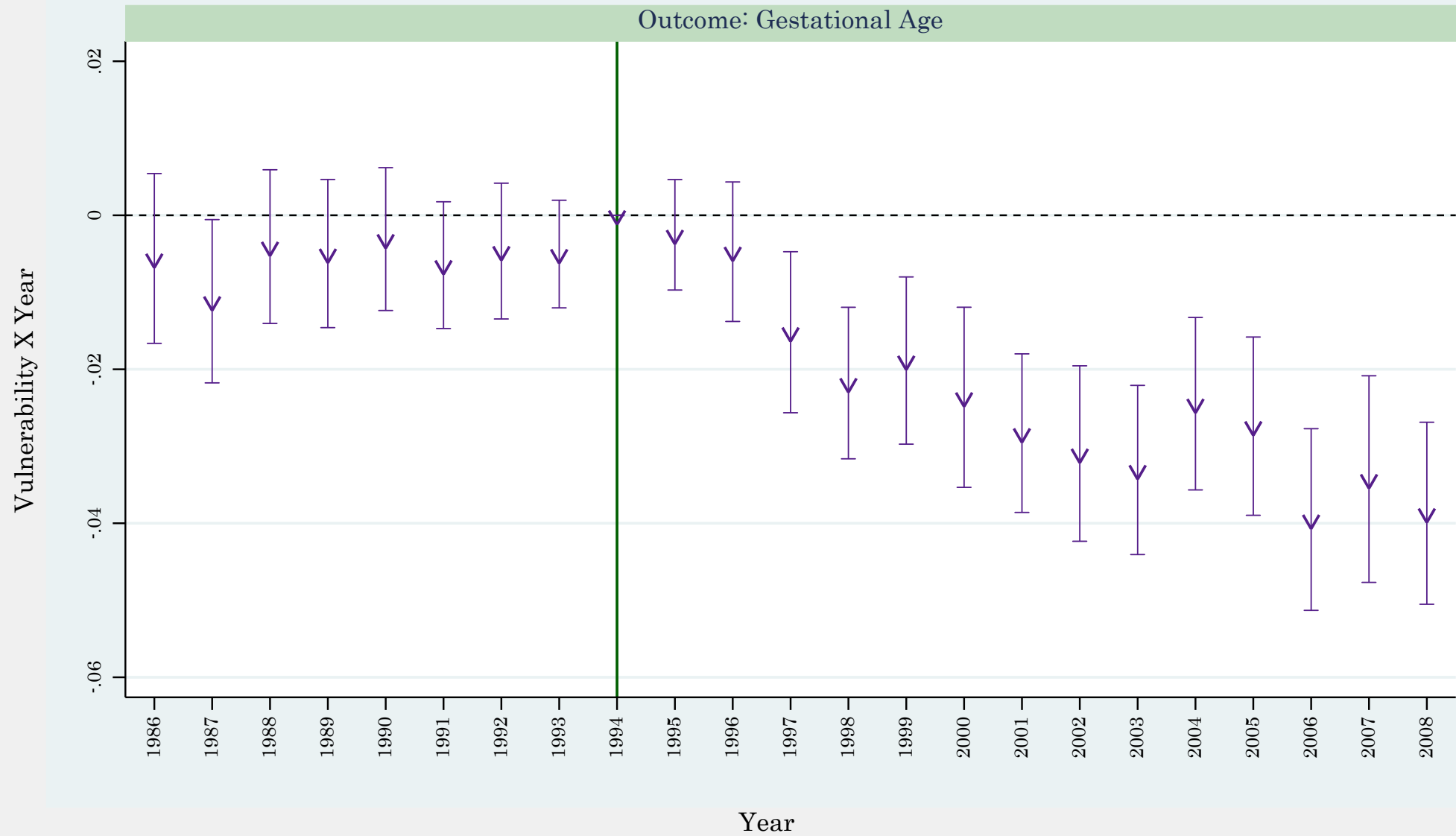
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SUN-ABRAHAM EVENT-STUDY



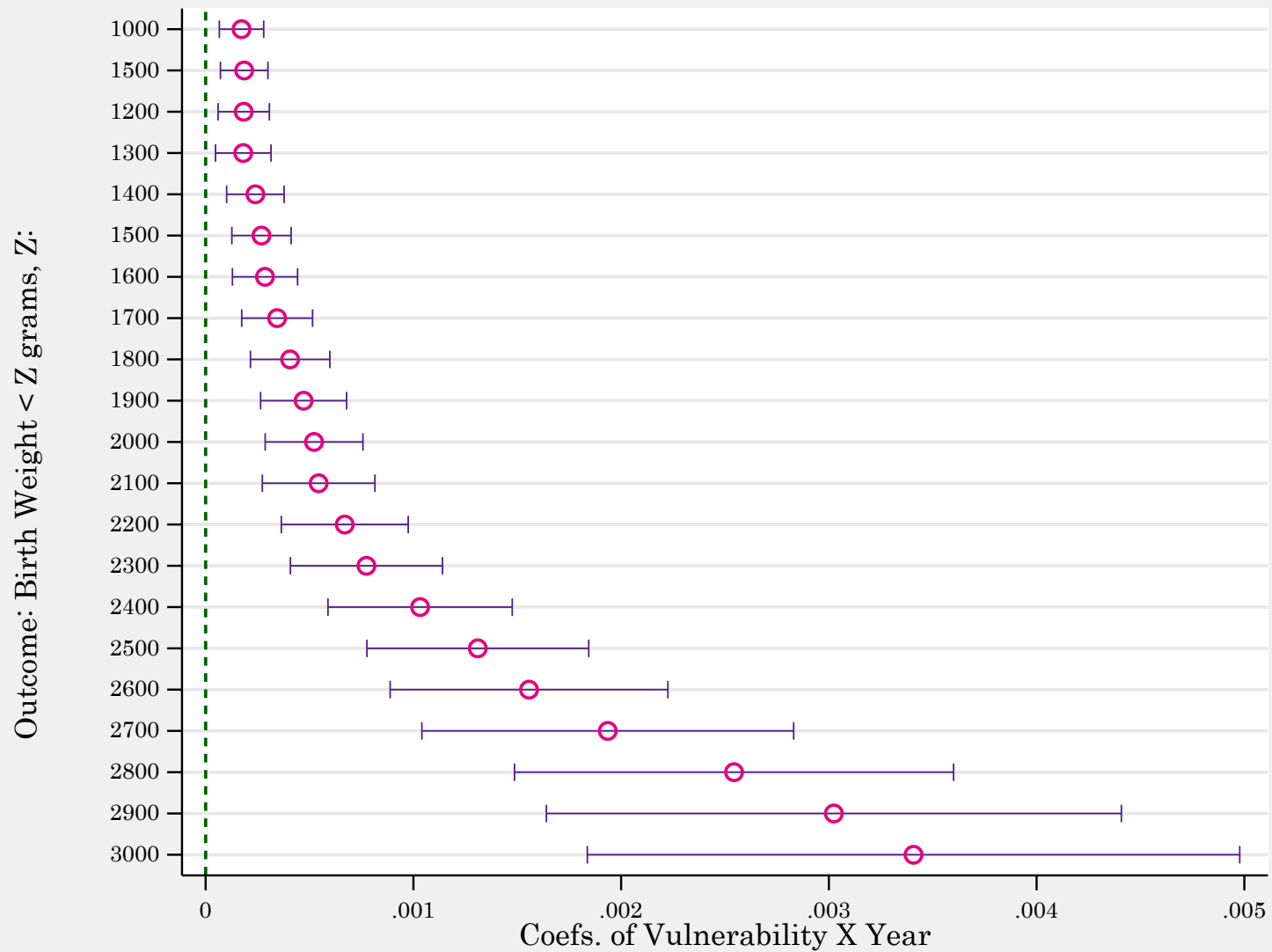
return ↺

SUN-ABRAHAM EVENT-STUDY



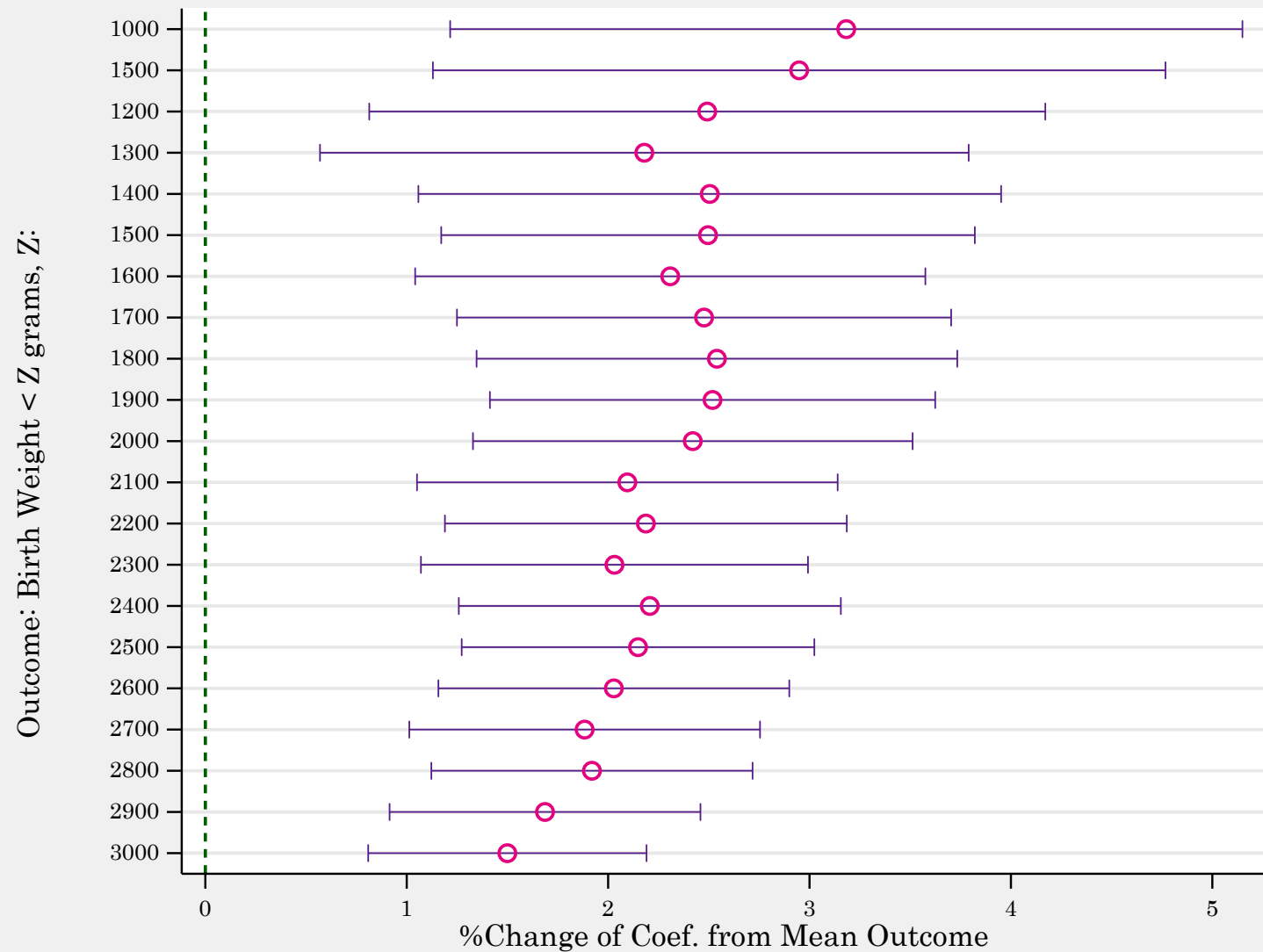
return ↺

LOW BIRTH WEIGHT THRESHOLD ANALYSIS



return ↺

LOW BIRTH WEIGHT THRESHOLD ANALYSIS



return ↻