Oil Discoveries and Gender Inequality

Anca M. Grecu[[1]](#footnote-1) and Edner Bataille[[2]](#footnote-2)

Appendix A – not for publication

Sample countries with no giant discoveries between 1935 and 1950: Afghanistan; Albania; Algeria; Angola; Argentina; Armenia; Australia; Bahrain; Bangladesh; Belarus; Belgium; Benin; Bhutan; Bolivia; Bosnia and Herzegovina; Botswana; Brazil; Bulgaria; Burkina Faso; Burundi; Cambodia; Cameroon; Central African Republic; Chad; Chile; China; Colombia; Comoros; Congo, Dem. Rep.; Congo, Republic of; Costa Rica; Cote d`Ivoire; Croatia; Cuba; Cyprus; Czech Republic; Denmark; Djibouti; Dominican Republic; Ecuador; Egypt; El Salvador; Equatorial Guinea; Estonia; Ethiopia; Fiji; Finland; France; Gabon; Gambia, The; Georgia; Germany; Ghana; Greece; Guatemala; Guinea; Guinea-Bissau; Haiti; Honduras; Hungary; India; Indonesia; Iran; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Kenya; Korea, Republic of; Korea D.P.R.O.; Kuwait; Kyrgyzstan; Laos; Latvia; Lebanon; Lesotho; Liberia; Lithuania; Libya; Macedonia; Madagascar; Malawi; Malaysia; Mali; Mauritania; Mauritius; Mexico; Moldova; Mongolia; Morocco; Mozambique; Myanmar; Namibia; Nepal; Netherlands; New Zealand; Nicaragua; Niger; Nigeria; Norway; Oman; Pakistan; Panama; Paraguay; Peru; Philippines; Poland; Portugal; Qatar; Romania; Rwanda; Senegal; Sierra Leone; Singapore; Slovak Republic; Slovenia; Somalia; South Africa; Spain; Sri Lanka; Sudan; Swaziland; Sweden; Switzerland; Syria; Tajikistan; Tanzania; Thailand; Togo; Trinidad & Tobago; Tunisia; Turkey; Turkmenistan; Uganda; Ukraine; United Kingdom; Uruguay; Uzbekistan; Vietnam; Yemen; Yugoslavia; Zambia; Zimbabwe.

Figure A1. Pre-Trends in Countries With and Without Giant Discoveries

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The figures use data for countries that did not find a giant oil field between 1935 and 1960. The data is split between countries that did not discover giant oil fields after 1950, the dashed fitted line, and those that did, the solid fitted line. The shaded areas identify the 95% confidence intervals.

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| Table A1. The Effect of Giant Oil Discoveries on Sex Ratio (Male/Female) by Age |  |  |  |  |  |
| Disc. at per. | Panel A: All Countries | Panel B: Exclude Africa |
| age<1 | age 1 |  age 2 |  age 3 | age 4 | age 5 | age 10 | age<1 | age 1 |  age 2 |  age 3 | age 4 | age 5 | age 10 |
| t  | 0.001 | 0.029 | 0.072 | 0.059 | 0.075 | 0.153 | 0.189 | 0.026 | 0.127\*\*\* | 0.227\*\*\* | 0.247\*\* | 0.285\*\* | 0.292\*\* | 0.055 |
|  | (0.048) | (0.075) | (0.122) | (0.155) | (0.171) | (0.110) | (0.121) | (0.054) | (0.047) | (0.082) | (0.101) | (0.116) | (0.115) | (0.134) |
| t-1  | 0.073\* | 0.064 | 0.070 | 0.101 | 0.104 | 0.158 | 0.275\*\* | 0.086 | 0.117\*\*\* | 0.171\*\*\* | 0.242\*\*\* | 0.273\*\*\* | 0.325\*\*\* | 0.242\* |
|  | (0.039) | (0.051) | (0.079) | (0.116) | (0.138) | (0.129) | (0.106) | (0.054) | (0.034) | (0.058) | (0.088) | (0.103) | (0.115) | (0.140) |
| t-2 | 0.055 | 0.058\* | 0.028 | 0.028 | 0.041 | 0.073 | 0.265\*\* | 0.066 | 0.097\*\* | 0.073 | 0.102\* | 0.139\* | 0.212\*\* | 0.343\*\* |
|  | (0.044) | (0.032) | (0.052) | (0.062) | (0.087) | (0.113) | (0.110) | (0.063) | (0.043) | (0.051) | (0.055) | (0.073) | (0.088) | (0.159) |
| t-3  | 0.038 | 0.009 | 0.063\* | -0.002 | -0.032 | -0.008 | 0.380 | 0.048 | 0.031 | 0.122\*\*\* | 0.043 | 0.025 | 0.105 | 0.558\* |
|  | (0.045) | (0.034) | (0.036) | (0.054) | (0.077) | (0.110) | (0.232) | (0.066) | (0.045) | (0.037) | (0.055) | (0.095) | (0.103) | (0.297) |
| t-4  | -0.001 | -0.032 | -0.017 | 0.070 | 0.043 | 0.038 | 0.195 | -0.013 | -0.041 | -0.017 | 0.111\*\* | 0.086\*\* | 0.137\*\* | 0.356\*\* |
|  | (0.036) | (0.045) | (0.059) | (0.043) | (0.052) | (0.092) | (0.137) | (0.056) | (0.065) | (0.078) | (0.045) | (0.043) | (0.061) | (0.154) |
| t-5 | 0.005 | 0.020 | -0.017 | 0.014 | 0.080\* | 0.086 | 0.245 | -0.000 | 0.006 | -0.037 | -0.001 | 0.097\* | 0.162\*\* | 0.469\*\* |
|  | (0.052) | (0.042) | (0.045) | (0.040) | (0.044) | (0.078) | (0.184) | (0.081) | (0.066) | (0.067) | (0.057) | (0.050) | (0.065) | (0.217) |
| t-6  | -0.019 | -0.026 | 0.014 | -0.020 | -0.005 | 0.042 | 0.229 | -0.038 | -0.057 | -0.017 | -0.061 | -0.046 | 0.064 | 0.462\* |
|  | (0.043) | (0.039) | (0.036) | (0.043) | (0.040) | (0.055) | (0.213) | (0.066) | (0.063) | (0.060) | (0.068) | (0.063) | (0.058) | (0.247) |
| t-7  | -0.029 | -0.031 | -0.029 | 0.010 | -0.005 | 0.042 | 0.178 | -0.043 | -0.068 | -0.068 | -0.025 | -0.048 | 0.036 | 0.356\* |
|  | (0.047) | (0.044) | (0.043) | (0.039) | (0.043) | (0.052) | (0.165) | (0.076) | (0.074) | (0.072) | (0.068) | (0.074) | (0.074) | (0.183) |
| t-8 | 0.006 | 0.014 | 0.014 | 0.026 | 0.058 | 0.100 | 0.184 | 0.012 | 0.019 | 0.015 | 0.044 | 0.090 | 0.155\*\* | 0.327\*\* |
|  | (0.046) | (0.052) | (0.048) | (0.042) | (0.049) | (0.068) | (0.142) | (0.066) | (0.079) | (0.076) | (0.067) | (0.072) | (0.078) | (0.129) |
| t-9 | 0.023 | 0.059 | 0.044 | 0.050 | 0.072 | 0.108 | 0.083 | 0.030 | 0.073 | 0.057 | 0.065 | 0.105 | 0.170 | 0.188 |
|  | (0.060) | (0.072) | (0.081) | (0.084) | (0.086) | (0.096) | (0.144) | (0.093) | (0.114) | (0.131) | (0.132) | (0.132) | (0.131) | (0.153) |
| t-10 | 0.004 | -0.040 | -0.016 | -0.038 | -0.045 | -0.008 | 0.008 | -0.007 | -0.069 | -0.036 | -0.058 | -0.065 | -0.008 | 0.042 |
|  | (0.081) | (0.100) | (0.107) | (0.112) | (0.111) | (0.112) | (0.134) | (0.121) | (0.156) | (0.169) | (0.179) | (0.178) | (0.170) | (0.150) |
| Obs. | 6,774 | 6,774 | 6,774 | 6,774 | 6,774 | 6,774 | 6,774 | 4,466 | 4,466 | 4,466 | 4,466 | 4,466 | 4,466 | 4,466 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables is the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A2. The Impact of oil discoveries: matched sample |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Primary School Enrollment | Female/Male Secondary School Enrollment | Female/Male Tertiary School Enrollment |
| Discovery, t  | 3.273\*\*\* | 0.191\*\*\* | 1.942\*\* | 0.222 | 0.411 | -2.142\*\*\* |
|  | (0.728) | (0.056) | (0.943) | (0.543) | (1.217) | (0.650) |
| Discovery, t-1  | 3.251\*\*\* | 0.123\*\*\* | 1.519\* | 1.288\*\*\* | 1.684\*\* | -0.899 |
|  | (0.924) | (0.034) | (0.822) | (0.434) | (0.832) | (0.732) |
| Discovery, t-2 | 2.365\*\*\* | 0.086\*\*\* | 0.914 | 0.715 | 1.014\* | -2.151\*\* |
|  | (0.709) | (0.024) | (0.571) | (0.550) | (0.520) | (1.026) |
| Discovery, t-3  | 2.512\*\* | 0.144\*\*\* | 1.238\* | 0.103 | 0.258 | 0.835 |
|  | (1.236) | (0.032) | (0.736) | (0.503) | (0.715) | (1.216) |
| Discovery, t-4  | 2.151\* | 0.081 | 1.150\* | -0.420 | 0.065 | -0.895 |
|  | (1.151) | (0.049) | (0.598) | (0.495) | (0.603) | (0.723) |
| Discovery, t-5 | 1.749\* | 0.052 | 0.632 | 0.213 | 1.156\*\*\* | -1.631\*\*\* |
|  | (0.958) | (0.033) | (0.509) | (0.563) | (0.393) | (0.528) |
| Discovery, t-6  | 1.476\*\* | 0.043 | 0.402 | -0.121 | 0.763\*\* | -1.683\*\*\* |
|  | (0.603) | (0.041) | (0.430) | (0.593) | (0.358) | (0.621) |
| Discovery, t-7  | 1.136\*\* | -0.018 | -0.058 | -0.583 | -0.164 | -0.602 |
|  | (0.512) | (0.057) | (0.531) | (0.609) | (0.614) | (0.470) |
| Discovery, t-8 | 1.755\* | 0.037 | -0.090 | -0.665 | 0.373 | -1.524\* |
|  | (0.990) | (0.037) | (0.483) | (0.612) | (0.544) | (0.820) |
| Discovery, t-9 | 2.326 | 0.085 | -0.662 | -0.773 | 0.935\* | 0.362 |
|  | (1.624) | (0.056) | (1.094) | (0.779) | (0.545) | (0.945) |
| Discovery, t-10 | 2.336 | 0.031 | -0.042 | -1.038 | -0.355 | -2.304 |
|  | (1.601) | (0.114) | (0.936) | (0.833) | (0.878) | (1.511) |
| No. countries | 86 | 50 | 50 | 93 | 92 | 93 |
| Obs. | 4,266 | 2,761 | 2,761 | 3,195 | 2,605 | 2,211 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950 matched using propensity score matching. The propensity score matching was obtained based on pre-period country characteristics (the initial period is different for different outcome variables according to data availability). These characteristics were identified by previous literature as possible correlates with oil exploration:

- Whether the country expropriated/nationalized oil. The literature suggests that productivity drops in the aftermath of nationalization (Yergin 1991, Melek 2016). The adoption of new technology may be slower in these countries. Nationalization could discourage FDI and since for most developing countries technological progress is a process of adaptation and adoption, new technologies may be slow to penetrate. For instance, innovation was discouraged in Latin America by barriers to FDI (Lederman and Maloney 2007)

- War status – a measure of stability; war can slow down exploration

- Democracy and Democracy squared as a proxy for stability. Weak democracies tend to be less stable than countries at both ends of the democracy spectrum, a disincentive for investors and prospectors. The pace of technological diffusion depends on institutions and governance structure (Parente and Prescott 1999; Howitt and Mayer-Foulkes 2005)

- GDP per capita. Diffusion of new technologies tends to be slower in developing versus developed countries (Global Economic Prospects 2008).

- Economic Growth

- Area

- Proportion of area that is mountainous (geography may affect the cost of exploration)

The independent variables are the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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Melek, Nida Cakir (2016) Productivity, Nationalization, and the Role of “News”: Lessons from the 1970’s. The Federal Reserve Bank of Kansas City, RWP 10-06.

Parente, Stephen L., and Edward C. Prescott (1999) Monopoly Rights: A Barrier to Riches. *American Economic Review* 89: pp 1216-33.

Yergin, Daniel (1991) The Prize: The Epic Quest for Oil, Money, and Power, New York, NY; Simon and Schuster.

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| Table A3. The Impact of Giant Oil Discoveries, Countries with Polity Score≥-5 |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.449 | 0.074\* | 0.078 | -0.018 | -2.114\* |
|  | (1.172) | (0.038) | (0.049) | (0.556) | (1.153) |
| Discovery, t-1  | 1.152 | 0.061\*\* | 0.070\*\* | -0.298 | -1.860\*\*\* |
|  | (1.030) | (0.024) | (0.032) | (0.394) | (0.593) |
| Discovery, t-2 | 1.735 | 0.021 | 0.031 | -0.499 | -2.374\* |
|  | (1.292) | (0.030) | (0.037) | (0.488) | (1.207) |
| Discovery, t-3  | 0.581 | 0.098\*\* | 0.159\*\*\* | -0.487 | -0.599 |
|  | (1.115) | (0.042) | (0.058) | (0.528) | (1.447) |
| Discovery, t-4  | 1.006 | 0.068 | 0.081 | -0.757 | -1.012 |
|  | (1.442) | (0.042) | (0.052) | (0.598) | (0.889) |
| Discovery, t-5 | -0.122 | -0.006 | -0.038 | -0.604 | -2.110\*\*\* |
|  | (0.860) | (0.053) | (0.068) | (0.595) | (0.619) |
| Discovery, t-6  | 0.233 | 0.006 | -0.044 | -0.847 | -1.949\*\*\* |
|  | (0.712) | (0.052) | (0.075) | (0.642) | (0.445) |
| Discovery, t-7  | -0.480 | -0.006 | -0.057 | -0.802 | -1.693\*\*\* |
|  | (0.692) | (0.056) | (0.078) | (0.636) | (0.458) |
| Discovery, t-8 | -0.235 | 0.081 | 0.072 | -0.808 | -0.831 |
|  | (0.838) | (0.055) | (0.077) | (0.613) | (1.017) |
| Discovery, t-9 | 0.322 | 0.121\* | 0.132 | -1.381 | -0.711 |
|  | (1.118) | (0.064) | (0.098) | (0.883) | (0.980) |
| Discovery, t-10 | -0.184 | -0.002 | -0.022 | -0.718 | -0.840 |
|  | (0.947) | (0.117) | (0.166) | (1.048) | (1.398) |
| Obs. | 3,894 | 4,129 | 3,059 | 4,129 | 2,050 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables measure the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A4. The Impact of Giant Oil Discoveries, Countries with less than 10% Muslim Population |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 2.181\*\*\* | 0.154 | 0.186 | 0.131 | -1.447 |
|  | (0.780) | (0.121) | (0.143) | (0.852) | (1.005) |
| Discovery, t-1  | 1.857\*\* | 0.124\* | 0.137 | 0.041 | 0.395 |
|  | (0.802) | (0.065) | (0.083) | (0.689) | (0.977) |
| Discovery, t-2 | 1.206 | 0.072\*\*\* | 0.071\*\* | -0.282 | -1.247 |
|  | (0.779) | (0.024) | (0.029) | (0.471) | (1.240) |
| Discovery, t-3  | 1.386 | 0.069\*\* | 0.081\*\* | -0.133 | -0.617 |
|  | (1.071) | (0.031) | (0.033) | (0.520) | (1.126) |
| Discovery, t-4  | 1.063 | 0.061\* | 0.051 | -0.595 | -1.656\*\* |
|  | (1.003) | (0.032) | (0.039) | (0.599) | (0.832) |
| Discovery, t-5 | 0.695 | 0.007 | -0.009 | -0.540 | -1.760\*\* |
|  | (0.894) | (0.051) | (0.059) | (0.530) | (0.726) |
| Discovery, t-6  | 0.053 | -0.036 | -0.051 | -0.935 | -1.839\*\*\* |
|  | (0.706) | (0.069) | (0.078) | (0.601) | (0.526) |
| Discovery, t-7  | -0.379 | -0.070 | -0.109 | -1.339\* | -1.492\*\*\* |
|  | (0.519) | (0.086) | (0.097) | (0.676) | (0.405) |
| Discovery, t-8 | -0.031 | -0.083 | -0.113 | -0.952 | -1.026 |
|  | (0.617) | (0.090) | (0.107) | (0.696) | (1.118) |
| Discovery, t-9 | -0.095 | -0.071 | -0.096 | -1.476 | 0.551 |
|  | (0.843) | (0.131) | (0.165) | (1.149) | (1.192) |
| Discovery, t-10 | -0.905 | -0.089 | -0.123 | -1.924 | -0.796 |
|  | (0.795) | (0.161) | (0.198) | (1.185) | (1.246) |
| Obs. | 3,654 | 3,906 | 3,200 | 3,906 | 1,808 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables measure the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A5. The Impact of Giant Discoveries on Women Labor Participation Rate (% of female population ages 15+) |
|   | Oil Discoveries | Oil Discoveries/Area | Amount Oil Discovered/Area | Oil and Gas Discoveries |
| Discovery, t  | 0.319 | 1.338 | 0.213 | 0.072 |
|  | (0.521) | (5.284) | (0.277) | (0.350) |
| Discovery, t-1  | 0.029 | -0.777 | -0.070 | -0.171 |
|  | (0.298) | (3.400) | (0.124) | (0.237) |
| Discovery, t-2 | 0.048 | -0.635 | -0.041 | -0.131 |
|  | (0.311) | (3.140) | (0.120) | (0.185) |
| Discovery, t-3  | -0.070 | -4.191 | -0.096\*\* | -0.113 |
|  | (0.278) | (3.394) | (0.039) | (0.185) |
| Discovery, t-4  | -0.093 | -4.614 | -0.107\*\*\* | -0.109 |
|  | (0.300) | (3.009) | (0.036) | (0.203) |
| Discovery, t-5 | -0.209 | -5.716\*\* | -0.113\*\* | -0.184 |
|  | (0.313) | (2.719) | (0.054) | (0.231) |
| Discovery, t-6  | -0.204 | -4.295 | -0.105\*\*\* | -0.161 |
|  | (0.277) | (2.813) | (0.031) | (0.179) |
| Discovery, t-7  | -0.189 | -4.592\* | -0.071\*\*\* | -0.044 |
|  | (0.257) | (2.514) | (0.021) | (0.174) |
| Discovery, t-8 | -0.162 | -4.273 | -0.059\*\* | -0.173 |
|  | (0.246) | (2.717) | (0.025) | (0.129) |
| Discovery, t-9 | -0.244 | -4.053 | -0.089\*\* | -0.357\*\* |
|  | (0.273) | (3.651) | (0.035) | (0.163) |
| Discovery, t-10 | -0.382 | -5.122 | -0.086\*\* | -0.486\*\* |
|  | (0.393) | (4.615) | (0.035) | (0.223) |
| Obs. | 3,934 | 3,770 | 3,770 | 3,934 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables measure the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A6. The Impact of oil and gas discoveries |  |  |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.419\* | 0.101 | 0.196\*\*\* | 1.848 | -1.484 |
|  | (0.726) | (0.077) | (0.060) | (1.270) | (0.970) |
| Discovery, t-1  | 1.679\*\* | 0.091 | 0.157\*\*\* | 1.320 | -0.700 |
|  | (0.797) | (0.057) | (0.056) | (0.906) | (0.744) |
| Discovery, t-2 | 1.359\* | 0.073 | 0.125\*\* | 1.169\* | -1.658 |
|  | (0.692) | (0.048) | (0.050) | (0.673) | (1.136) |
| Discovery, t-3  | 1.575\* | 0.093\*\* | 0.142\*\*\* | 1.058\*\* | -0.833 |
|  | (0.904) | (0.038) | (0.044) | (0.514) | (1.657) |
| Discovery, t-4  | 1.344\* | 0.029 | 0.043 | 0.761\* | -1.366 |
|  | (0.792) | (0.049) | (0.060) | (0.442) | (1.372) |
| Discovery, t-5 | 1.200 | 0.015 | 0.016 | 0.202 | -1.887\*\* |
|  | (0.742) | (0.037) | (0.050) | (0.361) | (0.835) |
| Discovery, t-6  | 1.344\* | 0.018 | 0.010 | -0.164 | -2.146\* |
|  | (0.743) | (0.020) | (0.031) | (0.405) | (1.090) |
| Discovery, t-7  | 1.413\* | -0.011 | -0.022 | -0.173 | -1.532\* |
|  | (0.770) | (0.024) | (0.033) | (0.392) | (0.873) |
| Discovery, t-8 | 1.125 | 0.008 | 0.004 | -0.529 | -1.509 |
|  | (0.874) | (0.026) | (0.032) | (0.445) | (1.142) |
| Discovery, t-9 | 1.280 | 0.056 | 0.073 | -1.035\* | -2.469 |
|  | (0.927) | (0.042) | (0.056) | (0.607) | (1.921) |
| Discovery, t-10 | 1.490 | 0.027 | 0.034 | -1.128 | -1.319 |
|  | (1.098) | (0.051) | (0.068) | (0.692) | (0.840) |
| Obs. | 6,386 | 6,774 | 4,466 | 6,774 | 3,099 |

The sample includes only countries that did not make any giant oil and/or gas discoveries between 1935 and 1950. The independent variables measure the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A7. The impact of oil discoveries - robustness to sample. Data for all countries. |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 2.297\*\*\* | 0.038 | 0.114\* | 2.847\* | -3.105\*\* |
|  | (0.880) | (0.080) | (0.064) | (1.525) | (1.325) |
| Discovery, t-1  | 2.431\*\*\* | 0.044 | 0.091\*\* | 2.164\* | -0.177 |
|  | (0.790) | (0.051) | (0.039) | (1.110) | (1.026) |
| Discovery, t-2 | 2.134\*\*\* | -0.013 | 0.005 | 1.444\*\* | -0.915 |
|  | (0.779) | (0.048) | (0.052) | (0.710) | (1.169) |
| Discovery, t-3  | 2.198\*\* | 0.042 | 0.067\*\* | 1.086 | -0.480 |
|  | (0.958) | (0.026) | (0.032) | (0.659) | (1.179) |
| Discovery, t-4  | 2.128\*\* | 0.001 | 0.003 | 0.936 | -1.877\* |
|  | (0.831) | (0.041) | (0.048) | (0.644) | (1.089) |
| Discovery, t-5 | 2.089\*\* | -0.019 | -0.023 | -0.042 | -1.899\*\*\* |
|  | (0.924) | (0.033) | (0.042) | (0.582) | (0.618) |
| Discovery, t-6  | 1.746\*\* | -0.001 | -0.014 | -0.514 | -2.136\*\*\* |
|  | (0.817) | (0.028) | (0.038) | (0.592) | (0.536) |
| Discovery, t-7  | 1.735\*\* | 0.017 | 0.019 | -0.860 | -2.170\*\*\* |
|  | (0.863) | (0.046) | (0.062) | (0.536) | (0.796) |
| Discovery, t-8 | 1.610\* | 0.018 | 0.018 | -1.564\*\* | -2.302 |
|  | (0.918) | (0.035) | (0.046) | (0.668) | (1.512) |
| Discovery, t-9 | 1.595 | 0.018 | 0.021 | -2.213\*\*\* | -2.651 |
|  | (0.975) | (0.055) | (0.071) | (0.633) | (2.474) |
| Discovery, t-10 | 1.767 | 0.025 | 0.034 | -2.542\*\*\* | -2.832\*\* |
|  | (1.186) | (0.073) | (0.096) | (0.810) | (1.422) |
| Obs. | 6,716 | 7,162 | 4,854 | 7,162 | 3,283 |

The sample includes all data available, including countries that made giant discoveries between 1935-1950. The independent variables measure the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A8. What can predict a giant oil discovery? |
| Male/Female age 0 | -0.004 |
|  | (0.009) |
| Male/Female age 1 | 0.014 |
|  | (0.012) |
| Male/Female age 2 | -0.007 |
|  | (0.009) |
| Male/Female age 3 | -0.018 |
|  | (0.012) |
| Male/Female age 4 | 0.023 |
|  | (0.017) |
| Male/Female age 5 | -0.005 |
|  | (0.006) |
| Male/Female age 10 | -0.002 |
|  | (0.002) |
| Male/Female age 15 | 0.000 |
|  | (0.001) |
| Teen births | -0.000 |
|  | (0.000) |
| Crude birth rate | 0.001 |
|  | (0.002) |
| Fertility rate | -0.009 |
|  | (0.011) |
| Male life expectancy | -0.002 |
|  | (0.004) |
| Female life expectancy | 0.000 |
|  | (0.003) |
| Female/Male primary school enrollment | 0.000 |
|  | (0.000) |
| Female/Male secondary school enrollment | 0.000 |
|  | (0.000) |
| Female/Male tertiary school enrollment | -0.000 |
|  | (0.000) |
| Labor participation rate | -0.000 |
|  | (0.000) |
| Population | 0.001 |
|  | (0.001) |
| GDP per capita | 0.000\* |
|  | (0.000) |
| Economic Growth | 0.002\*\* |
|  | (0.001) |
| Democracy | -0.031 |
|  | (0.021) |
| War | 0.016 |
|  | (0.018) |
| Observations | 1,844 |
| R-squared | 0.046 |

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| Table A9. The Impact of oil discoveries; population and GDP variables detrended |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.742\* | 0.072 | 0.227\*\*\* | 3.796\* | -2.540 |
|  | (1.026) | (0.122) | (0.082) | (2.194) | (1.566) |
| Discovery, t-1  | 2.534\*\* | 0.070 | 0.171\*\*\* | 2.881\* | -0.136 |
|  | (1.053) | (0.079) | (0.058) | (1.502) | (1.269) |
| Discovery, t-2 | 2.250\*\* | 0.028 | 0.073 | 1.956\*\* | -1.770 |
|  | (1.042) | (0.052) | (0.051) | (0.852) | (1.905) |
| Discovery, t-3  | 2.430\* | 0.063\* | 0.122\*\*\* | 2.112\*\*\* | -0.703 |
|  | (1.291) | (0.036) | (0.037) | (0.670) | (2.004) |
| Discovery, t-4  | 2.168\* | -0.017 | -0.017 | 1.811\*\*\* | -1.133 |
|  | (1.201) | (0.059) | (0.078) | (0.624) | (1.717) |
| Discovery, t-5 | 2.115\* | -0.017 | -0.037 | 0.772 | -2.130\*\* |
|  | (1.236) | (0.045) | (0.067) | (0.539) | (1.061) |
| Discovery, t-6  | 1.875\* | 0.014 | -0.017 | -0.002 | -3.006\* |
|  | (1.098) | (0.036) | (0.060) | (0.676) | (1.591) |
| Discovery, t-7  | 1.895 | -0.029 | -0.068 | -0.224 | -3.122\* |
|  | (1.159) | (0.043) | (0.072) | (0.680) | (1.768) |
| Discovery, t-8 | 1.845 | 0.014 | 0.015 | -0.574 | -4.178 |
|  | (1.301) | (0.048) | (0.076) | (0.650) | (2.913) |
| Discovery, t-9 | 2.133 | 0.044 | 0.057 | -1.445\* | -5.297 |
|  | (1.525) | (0.081) | (0.131) | (0.852) | (3.886) |
| Discovery, t-10 | 2.311 | -0.016 | -0.036 | -1.445 | -4.459\*\* |
|  | (1.674) | (0.107) | (0.169) | (0.974) | (2.114) |
| Obs. | 6,386 | 6,774 | 4,466 | 6,774 | 3,099 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables are the number of discoveries in a country-year. All regressions control for detrended population, detrended GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects. Robust standard errors clustered at country level are reported in parentheses.

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| Table A10. The Impact of oil discoveries; Newey-West standard errors |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.742\*\* | 0.072 | 0.227\*\*\* | 3.796\*\* | -2.540\* |
|  | (0.873) | (0.091) | (0.071) | (1.692) | (1.459) |
| Discovery, t-1  | 2.534\*\*\* | 0.070 | 0.171\*\*\* | 2.881\*\* | -0.136 |
|  | (0.911) | (0.067) | (0.066) | (1.212) | (1.349) |
| Discovery, t-2 | 2.250\*\* | 0.028 | 0.073 | 1.956\*\* | -1.770 |
|  | (0.908) | (0.054) | (0.067) | (0.886) | (1.795) |
| Discovery, t-3  | 2.430\*\* | 0.063 | 0.122\*\* | 2.112\*\*\* | -0.703 |
|  | (1.087) | (0.044) | (0.058) | (0.808) | (1.886) |
| Discovery, t-4  | 2.168\*\* | -0.017 | -0.017 | 1.811\*\* | -1.133 |
|  | (1.043) | (0.068) | (0.094) | (0.777) | (1.562) |
| Discovery, t-5 | 2.115\*\* | -0.017 | -0.037 | 0.772 | -2.130\* |
|  | (1.063) | (0.054) | (0.078) | (0.801) | (1.143) |
| Discovery, t-6  | 1.875\* | 0.014 | -0.017 | -0.002 | -3.006\* |
|  | (0.988) | (0.055) | (0.080) | (0.845) | (1.578) |
| Discovery, t-7  | 1.895\* | -0.029 | -0.068 | -0.224 | -3.122\* |
|  | (1.058) | (0.054) | (0.080) | (0.842) | (1.720) |
| Discovery, t-8 | 1.845\* | 0.014 | 0.015 | -0.574 | -4.178\* |
|  | (1.071) | (0.049) | (0.073) | (0.787) | (2.269) |
| Discovery, t-9 | 2.133\* | 0.044 | 0.057 | -1.445 | -5.297\* |
|  | (1.233) | (0.073) | (0.112) | (1.009) | (3.050) |
| Discovery, t-10 | 2.311\* | -0.016 | -0.036 | -1.445 | -4.459\*\* |
|  | (1.321) | (0.090) | (0.137) | (1.129) | (1.951) |
| Obs. | 6,386 | 6,774 | 4,466 | 6,774 | 3,099 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables are the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects.

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| Table A11. The Impact of oil discoveries; panel corrected standard error accounting for cross-sectional dependence standard errors (Driscoll and Kraay 1998) |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.742\*\* | 0.072 | 0.227\*\*\* | 3.796\* | -2.540\*\* |
|  | (0.727) | (0.054) | (0.064) | (2.060) | (0.998) |
| Discovery, t-1  | 2.534\*\*\* | 0.070 | 0.171\*\*\* | 2.881\* | -0.136 |
|  | (0.861) | (0.056) | (0.050) | (1.580) | (1.596) |
| Discovery, t-2 | 2.250\*\* | 0.028 | 0.073 | 1.956 | -1.770 |
|  | (0.870) | (0.048) | (0.055) | (1.339) | (1.536) |
| Discovery, t-3  | 2.430\*\* | 0.063\*\* | 0.122\*\* | 2.112\* | -0.703 |
|  | (0.990) | (0.031) | (0.057) | (1.146) | (2.319) |
| Discovery, t-4  | 2.168\*\* | -0.017 | -0.017 | 1.811\* | -1.133 |
|  | (0.976) | (0.058) | (0.084) | (1.013) | (1.893) |
| Discovery, t-5 | 2.115\*\* | -0.017 | -0.037 | 0.772 | -2.130 |
|  | (0.841) | (0.051) | (0.084) | (1.040) | (1.429) |
| Discovery, t-6  | 1.875\*\* | 0.014 | -0.017 | -0.002 | -3.006\*\* |
|  | (0.935) | (0.064) | (0.101) | (1.076) | (1.501) |
| Discovery, t-7  | 1.895\* | -0.029 | -0.068 | -0.224 | -3.122\* |
|  | (1.062) | (0.063) | (0.100) | (1.103) | (1.765) |
| Discovery, t-8 | 1.845\* | 0.014 | 0.015 | -0.574 | -4.178\* |
|  | (1.052) | (0.060) | (0.084) | (0.917) | (2.217) |
| Discovery, t-9 | 2.133\* | 0.044 | 0.057 | -1.445 | -5.297\* |
|  | (1.204) | (0.069) | (0.102) | (1.080) | (3.145) |
| Discovery, t-10 | 2.311\*\* | -0.016 | -0.036 | -1.445 | -4.459\* |
|  | (1.155) | (0.079) | (0.119) | (1.151) | (2.356) |
| Obs. | 6,386 | 6,774 | 4,466 | 6,774 | 3,099 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables are the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects.

Reference

Driscoll, John C., and Aart C. Kraay (1998) Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *Review of Economics and Statistics* 80: 549–560.

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| Table A12. The Impact of oil discoveries; no controls |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.625 | 0.055 | 0.198\*\*\* | 3.669 | -2.526 |
|  | (1.087) | (0.110) | (0.048) | (2.284) | (1.620) |
| Discovery, t-1  | 2.494\*\* | 0.054 | 0.157\*\*\* | 2.794\* | -0.355 |
|  | (1.086) | (0.075) | (0.048) | (1.591) | (1.366) |
| Discovery, t-2 | 2.267\*\* | 0.023 | 0.064 | 1.713\* | -1.923 |
|  | (1.004) | (0.049) | (0.048) | (0.912) | (2.068) |
| Discovery, t-3  | 2.601\*\* | 0.049 | 0.098\*\* | 2.016\*\*\* | -0.951 |
|  | (1.304) | (0.038) | (0.048) | (0.643) | (2.065) |
| Discovery, t-4  | 2.125\* | -0.039 | -0.054 | 1.708\*\*\* | -1.332 |
|  | (1.178) | (0.066) | (0.091) | (0.597) | (1.908) |
| Discovery, t-5 | 2.224\* | -0.034 | -0.061 | 0.943\* | -2.281\* |
|  | (1.231) | (0.049) | (0.073) | (0.506) | (1.198) |
| Discovery, t-6  | 2.122\* | -0.010 | -0.045 | 0.282 | -3.105\* |
|  | (1.148) | (0.050) | (0.077) | (0.513) | (1.592) |
| Discovery, t-7  | 1.996\* | -0.045 | -0.094 | -0.146 | -3.151\* |
|  | (1.139) | (0.056) | (0.086) | (0.557) | (1.805) |
| Discovery, t-8 | 2.400\* | -0.016 | -0.024 | 0.139 | -4.041 |
|  | (1.437) | (0.057) | (0.089) | (0.555) | (2.977) |
| Discovery, t-9 | 2.973\* | 0.005 | -0.002 | -0.390 | -5.153 |
|  | (1.696) | (0.088) | (0.144) | (0.714) | (4.065) |
| Discovery, t-10 | 3.134\* | -0.060 | -0.106 | -0.430 | -4.271\* |
|  | (1.769) | (0.109) | (0.166) | (0.923) | (2.312) |
| Obs. | 6,386 | 6,774 | 4,466 | 6,774 | 3,099 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables are the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects. Robust standard errors clustered at the country level are reported in parentheses.

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| Table A13. The Impact of oil discoveries: controlling for pre-trends in discovery countries |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Female/Male Tertiary School Enrollment |
| indep var\sample | all | all | no Africa | all | all |
| Discovery, t  | 1.884\* | 0.079 | 0.230\*\*\* | 3.796\* | -3.207\*\* |
|  | (0.988) | (0.122) | (0.085) | (2.186) | (1.518) |
| Discovery, t-1  | 2.737\*\*\* | 0.080 | 0.180\*\*\* | 2.881\* | -0.834 |
|  | (1.043) | (0.081) | (0.063) | (1.495) | (1.144) |
| Discovery, t-2 | 2.364\*\* | 0.033 | 0.080 | 1.956\*\* | -2.724 |
|  | (1.045) | (0.051) | (0.049) | (0.851) | (1.777) |
| Discovery, t-3  | 2.341\* | 0.057 | 0.117\*\*\* | 2.113\*\*\* | -0.899 |
|  | (1.245) | (0.036) | (0.037) | (0.685) | (1.955) |
| Discovery, t-4  | 2.139\* | -0.020 | -0.019 | 1.811\*\*\* | -1.609 |
|  | (1.166) | (0.061) | (0.081) | (0.631) | (1.679) |
| Discovery, t-5 | 2.107\* | -0.018 | -0.034 | 0.772 | -1.969 |
|  | (1.207) | (0.045) | (0.068) | (0.540) | (1.258) |
| Discovery, t-6  | 1.829\* | 0.011 | -0.020 | -0.002 | -3.225\* |
|  | (1.053) | (0.037) | (0.063) | (0.675) | (1.688) |
| Discovery, t-7  | 1.870 | -0.031 | -0.073 | -0.224 | -3.469\* |
|  | (1.132) | (0.045) | (0.076) | (0.678) | (1.836) |
| Discovery, t-8 | 1.889 | 0.015 | 0.015 | -0.574 | -4.587 |
|  | (1.271) | (0.047) | (0.075) | (0.651) | (2.811) |
| Discovery, t-9 | 2.213 | 0.048 | 0.056 | -1.445\* | -5.437 |
|  | (1.516) | (0.080) | (0.131) | (0.859) | (3.757) |
| Discovery, t-10 | 2.385 | -0.013 | -0.039 | -1.445 | -4.790\*\* |
|  | (1.666) | (0.106) | (0.170) | (0.979) | (2.159) |
| Obs. | 6,386 | 6,774 | 4,466 | 6,774 | 3,099 |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables are the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, differential pre-trends, and country and year fixed effects. Robust standard errors clustered at the country level are reported in parentheses.

We consider the possibility of a mean group estimator and report some results in Appendix Table A14 below. We use Stata xtpmg developed by Blackburne and Frank (2007). The estimated effects are included below for the cases we could run the pooled mean group model (Pesaran, Shin, and Smith 1999). The caveat is that, as Baltagi, Griffin and Xiong (2000) note, Pesaran-Smith (1995) type average estimator does not perform well when there is parameter instability of the individual unit regressions. In our case there is a wide range of individual country estimates. We conclude that panel data estimators perform better than those based on time series variation in this setting.

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| Table A14. Oil and Gender: Pool Mean Group Estimation |  |  |
|   | Teen Births | Male/Female age 2 | Infant Mortality | Life Expectancy |
| indep var\sample | all | all | no Africa | all | Male | Female |
| SR | -0.018 | 0.066 | 0.070 | 0.006 | 0.008 | 0.006 |
|  | (0.056) | (0.046) | (0.069) | (0.017) | (0.009) | (0.008) |
| LR | 1.373 | 0.066 | 0.723\* | 0150 | -5.342\*\*\* | -2.498\*\* |
|  | (1.738) | (0.137) | (0.391) | (0.363) | (1.548) | (0.417) |
| Obs | 1,608 | 1,771 | 1,141 | 1,771 | 1,771 | 1,771 |
| SR=short-run; LR=long-run. |  |  |  |  |

The sample includes only countries that did not make any giant discoveries between 1935 and 1950. The independent variables are the number of discoveries in a country-year. All regressions control for lag population, lag GDP per capita, lag economic growth, lag democracy, war, and country and year fixed effects.

References

Baltagi, Badi H., James M. Griffin, and Weiwen Xiong (2000) To pool or not to pool: homogenous versus heterogenous estimators applied to cigarette demand. *Review of Economics and Statistics* 82(1): 117-126.

Blackburne III, Edward F. and Mark W. Frank (2007) Estimation of nonstationary heterogenous panels. *The Stata Journal* 7(2): 197-208.

Pesaran, M. Hashem, Y. Shin, and R. P. Smith (1999) Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94: 621–634.

Demographic Health Surveys (DHS)

We use the DHS data individual-level data for Colombia and Indonesia to investigate the relationship between oil discoveries and gender specific outcomes. The countries were retained based on data availability. These countries made a known (i.e. before 2010) giant oil discovery during the years available in DHS datasets and there are data for more than one year pre-discovery and more than one year post-discovery.

Colombia made two giant discoveries in 1992 and 1993. We use the DHS data for Colombia years 1986, 1990, 1995, 2000, 2005. DHS also has the 2010 data, but Colombia made another giant oil discovery in 2008. For a cleaner analysis, given that we do not have much post-2008 data, the results reported do not use the 2010 data for Colombia. The results are however identical when we do include 2010 in our analysis.

We perform a separate analysis using DHS years 1991, 1994, 1997, 2002-2003, 2007 Indonesian data. During this period Indonesia made a giant oil discovery in 1996.

We assign treatment to women living in the regions closest to the location of the discovery. Colombia made giant discoveries in 1992 (Cusiana) and 1993 (Cupiagua) both in the LLanos basin. Of the 6 Colombian regions identified in DHS (Atlantic, Pacifica, Central, Oriental, Bogota, and Territorios Nacionales) only 5 regions are represented in the pre-discovery years[[3]](#footnote-3), thus our analysis uses data for women and their children living in the regions: Atlantic, Pacifica, Central, Oriental, Bogota. We assign treatment to the regions closest to the Llanos basin: Oriental and Bogota (please see pictures below).

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| --- | --- |
| Map  Description automatically generatedLocation map of the Llanos Basin Figure 2. Stratigraphic Column & Petroleum System-Llanos basin, Velandia et al. (2018) | Map  Description automatically generated |

Velandia, Mauricio, Andres Mora, Mario Nold (2018). Pitfalls in seismic interpretation Arrays of transtensional conjugate steeply dipping en-echelon normal faults and their impact on the exploration of hydrocarbons in the Colombian Eastern Llanos Basin.

Indonesia made a giant offshore oil discovery (West Seno Complex) in the Kutei basin (identified in the left picture below). We assign treatment to the regions of East Kalimatan and South Kalimatan.

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| Map  Description automatically generatedSource: https://en.wikipedia.org/wiki/Kutai\_Basin | Map  Description automatically generatedSource: https://sites.google.com/a/richland2.org/tran\_indoniesia/ |

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| Table A15. Giant oil discoveries and parental investment – children 2 years old or younger |
|   | Breastfed | Vaccinated | Diarrhea  | Diarrhea treatment | Fever treatment |
|  | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female |
|  | Colombia |
| Discovery 1992, 1993 | -0.452 | 0.314 | -0.020 | 0.019 | 0.047\* | 0.056\*\* | 0.106 | 0.159\*\* | -0.012 | 0.086\* |
| (0.491) | (0.483) | (0.032) | (0.037) | (0.027) | (0.027) | (0.071) | (0.067) | (0.056) | (0.052) |
|  |  |  |  |  |  |  |  |  |  |  |
| Obs | 7,082 | 6,785 | 2,241 | 2,138 | 7,034 | 6,772 | 1,479 | 1,367 | 3,448 | 3,188 |
|  | Indonesia |
| Discovery 1996 | -0.523 | -1.360\*\*\* | -0.091\*\*\* | -0.117\*\*\* | 0.048 | -0.030 | -0.156\*\* | -0.112\*\* | -0.067\*\* | -0.031 |
| (0.356) | (0.376) | (0.017) | (0.028) | (0.040) | (0.043) | (0.074) | (0.042) | (0.026) | (0.033) |
|  |  |  |  |  |  |  |  |  |  |  |
| Obs | 22,068 | 20,751 | 7,953 | 7,551 | 20,871 | 19,817 | 3,061 | 2,619 | 8,540 | 7,682 |

These regressions use data from Demographics and Health Surveys (DHS) for Colombia (years 1986, 1990, 1995, 2000, 2005) and Indonesia (years 1991, 1994, 1997, 2002-2003, 2007). During this period Colombia made giant oil discoveries in 1992 and 1993 and Indonesia made a giant oil discovery in 1996. The independent variable is a dummy equal to 1 in the regions closest to the discovery after the discovery, and zero otherwise. All regressions control for woman's age, urban residence, region FE, and year FE. All regressions are weighted using the sampling weights provided by DHS. All regressions report robust standard errors. In the case of Indonesia there are more than 20 different regions, and thus the standard errors are clustered at region level. Given the small number of regions (5) in Colombia, the standard errors are not clustered.

1. Seton Hall University, Stillman School of Business, Department of Economics and Legal Studies, South Orange, NJ 07079, contact author: anca.grecu@shu.edu ORCID ID: 0000-0003-3028-254X [↑](#footnote-ref-1)
2. Seton Hall University, Stillman School of Business, Department of Economics and Legal Studies, South Orange, NJ 07079 [↑](#footnote-ref-2)
3. Territorios Nacionales becomes represented in DHS in 2005. [↑](#footnote-ref-3)