**Online Appendix B**

**B1. Robustness check**

**B1.1. Alternative measures of trade openness**

To check the robustness of the results, we use two alternative measures of trade openness: exports and imports. Tables B1 and B2 represent the empirical findings of the impact of oil rent on economic growth interacting with the two alternative measures of trade openness. From both tables, we find that the coefficient of oil rent is negative and significant, indicating that economic growth decreases with the increase of oil rent. Conversely, the positive coefficient of log in exports indicates that economic growth increases with the increase of exports. The coefficient of the interaction term between log in export and log in oil rent is positive and significant, indicating that the negative impact of oil rent on economic growth reduces with the increase of exports. The government’s total income will increase with the increase in export that increases real GDP per capita.

**Table B1**: Change in real GDP per capita and oil rent in terms of export (1980-2017)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: | | | | | |
|  | Cross-section and period fixed  (1) | PLS  (2) | Cross-section fixed  (3) | Cross-section random  (4) | Period fixed  (5) | Period random  (6) |
|  | 0.40\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.36\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] |
|  | –0.03\*\*\*  (0.009)  [0.01] | –0.01\*\*  (0.005)  [0.008] | –0.03\*\*\*  (0.01)  [0.01] | –0.01\*\*  (0.005)  [0.008] | –0.01\*\*\*  (0.004)  [0.007] | –0.01\*\*\*  (0.004)  [0.007] |
|  | –0.0005  (0.001)  [0.003] | 0.0007  (0.001)  [0.001] | –0.0004  (0.001)  [0.003] | 0.0007  (0.001)  [0.001] | 0.0001  (0.0009)  [0.001] | 0.0001  (0.0009)  [0.001] |
|  | –0.003  (0.005)  [0.004] | 0.002  (0.005)  [0.004] | 0.004  (0.006)  [0.004] | 0.002  (0.005)  [0.004] | –0.003  (0.005)  [0.004] | –0.003  (0.005)  [0.004] |
|  | –0.12\*\*\*  (0.03)  [0.04] | –0.06\*\*\*  (0.02)  [0.03] | –0.11\*\*\*  (0.03)  [0.05] | –0.06\*\*\*  (0.02)  [0.03] | –0.07\*\*\*  (0.02)  [0.03] | –0.07\*\*\*  (0.02)  [0.03] |
|  | –0.01\*\*\*  (0.003)  [0.004] | –0.002\*  (0.001)  [0.001] | –0.01\*\*\*  (0.003)  [0.004] | –0.002\*  (0.001)  [0.001] | –0.001  (0.001)  [0.001] | –0.001  (0.001)  [0.001] |
|  | 0.01\*\*\*  (0.004)  [0.004] | 0.002\*\*\*  (0.0008)  [0.001] | 0.01\*\*\*  (0.002)  [0.002] | 0.002\*\*\*  (0.0008)  [0.001] | 0.001\*\*  (0.0008)  [0.0009] | 0.001\*\*  (0.0008)  [0.0009] |
|  | 0.004  (0.003)  [0.004] | 0.003\*\*  (0.001)  [0.001] | 0.009\*\*  (0.003)  [0.004] | 0.003\*\*  (0.001)  [0.001] | 0.002\*\*  (0.001)  [0.001] | 0.002\*\*  (0.001)  [0.001] |
| \* | 0.01\*\*\*  (0.002)  [0.003] | 0.004\*\*\*  (0.001)  [0.002] | 0.01\*\*\*  (0.002)  [0.004] | 0.004\*\*\*  (0.001)  [0.002] | 0.003\*\*\*  (0.001)  [0.002] | 0.003\*\*\*  (0.001)  [0.002] |
| R2 | 0.31 | 0.26 | 0.17 | 0.26 | 0.42 | 0.42 |
| Periods | 38 | 38 | 38 | 38 | 38 | 38 |
| Countries | 95 | 95 | 95 | 95 | 95 | 95 |
| Observations | 2,499 | 2,499 | 2,499 | 2,499 | 2,499 | 2,499 |

Note: indicates log in exports (% of GDP). Standard errors are presented below the corresponding coefficients in the bracket. \*\*\*, \*\* and \* indicate the significance at the 10%, 5%, and 1% level respectively. Cluster standard errors are presented in square brackets.

We observe a similar pattern in results when we look at Table B2, where we use imports as an alternative measure of trade openness. Economic growth increases with the increase of imports and the negative impact of oil rent on economic growth decreases with the increase of imports. A country can hire new technologies and high-tech products by allowing import openness. Moreover, import helps to increase efficiency in the managerial level by exchanging advanced knowledge between economies.

**Table B2**: Change in real GDP per capita and oil rent in terms of import (1980–2017)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: | | | | | |
|  | Cross-section and period fixed  (1) | PLS  (2) | Cross-section fixed  (3) | Cross-section random  (4) | Period fixed  (5) | Period random  (6) |
|  | 0.41\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.36\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] |
|  | –0.02\*\*\*  (0.009)  [0.01] | –0.01\*\*  (0.006)  [0.007] | –0.02\*\*  (0.01)  [0.01] | –0.01\*\*  (0.006)  [0.007] | –0.01\*\*\*  (0.005)  [0.006] | –0.01\*\*\*  (0.005)  [0.006] |
|  | –0.0006  (0.001)  [0.003] | 0.0008  (0.001)  [0.001] | –0.0005  (0.001)  [0.003] | 0.0008  (0.001)  [0.001] | 0.0002  (0.0009)  [0.001] | 0.0002  (0.0009)  [0.001] |
|  | –0.002  (0.005)  [0.004] | 0.002  (0.005)  [0.004] | 0.005  (0.006)  [0.003] | 0.002  (0.005)  [0.004] | –0.003  (0.005)  [0.004] | –0.003  (0.005)  [0.004] |
|  | –0.02  (0.03)  [0.05] | –0.01  (0.02)  [0.03] | 0.01  (0.03)  [0.05] | –0.01  (0.02)  [0.03] | –0.03  (0.02)  [0.03] | –0.03  (0.02)  [0.03] |
|  | –0.01\*\*\*  (0.003)  [0.004] | –0.002\*  (0.001)  [0.001] | –0.02\*\*\*  (0.003)  [0.005] | –0.002\*  (0.001)  [0.001] | –0.001  (0.001)  [0.001] | –0.001  (0.001)  [0.001] |
|  | 0.01\*\*\*  (0.004)  [0.004] | 0.002\*\*\*  (0.0008)  [0.001] | 0.01\*\*\*  (0.002)  [0.002] | 0.002\*\*\*  (0.0008)  [0.001] | 0.001\*\*  (0.0008)  [0.0009] | 0.001\*\*  (0.0008)  [0.0009] |
|  | 0.007\*\*  (0.003)  [0.006] | 0.003\*\*\*  (0.001)  [0.001] | 0.01\*\*\*  (0.004)  [0.006] | 0.003\*\*\*  (0.001)  [0.001] | 0.002\*\*  (0.001)  [0.001] | 0.002\*\*  (0.001)  [0.001] |
| \* | 0.008\*\*\*  (0.002)  [0.003] | 0.005\*\*\*  (0.001)  [0.002] | 0.009\*\*\*  (0.002)  [0.003] | 0.005\*\*\*  (0.001)  [0.002] | 0.004\*\*\*  (0.001)  [0.001] | 0.004\*\*\*  (0.001)  [0.001] |
| R2 | 0.31 | 0.26 | 0.16 | 0.26 | 0.42 | 0.42 |
| Periods | 38 | 38 | 38 | 38 | 38 | 38 |
| Countries | 95 | 95 | 95 | 95 | 95 | 95 |
| Observations | 2,499 | 2,499 | 2,499 | 2,499 | 2,499 | 2,499 |

Note:indicates log in imports (% of GDP). Standard errors are presented below the corresponding coefficients in the bracket. \*\*\*, \*\* and \* indicate the significance at the 10%, 5%, and 1% level respectively. Cluster standard errors are presented in square brackets.

**B1.2. Alternative measures of resource abundance**

We use natural resource rent instead of oil rent to check the resource curse hypothesis and the impact of trade openness on economic growth. Table B3 presents the empirical findings of the nexus between natural resource rent and economic growth interacting with trade openness with different dynamic panel data models. The coefficient of natural resource rent is negative, indicating that economic growth decreases with the increase of natural resource rent and the estimated elasticity is –0.05. All other things being equal, a one per cent increase in natural resource rents is associated with a significant decrease in the economic growth of over 0.05 per cent. This negative association between economic growth and natural resource rents provides evidence of the resource curse.

The coefficient of the interaction term between trade openness and natural resource rent is also positive, indicating that a more open trade regime lessens the negative impact of natural resource rent on economic growth. These results are significant (*p* = 0.01) and consistent with different time and country fixed effect and random effect models. Tables B4 and B5 show the impact of natural resource rent on economic growth in terms of exports and imports and find that both export and import reduce the resource course.

**Table B3**: Change in real GDP per capita and natural resource rent in terms of trade openness (1980-2017)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: | | | | | |
|  | Cross-section and period fixed  (1) | PLS  (2) | Cross-section fixed  (3) | Cross-section random  (4) | Period fixed  (5) | Period random  (6) |
|  | 0.40\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.36\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] |
|  | –0.05\*\*\*  (0.01)  [0.02] | –0.01\*\*  (0.006)  [0.008] | –0.05\*\*\*  (0.01)  [0.02] | –0.01\*\*\*  (0.006)  [0.007] | –0.01\*\*\*  (0.005)  [0.007] | –0.01\*\*\*  (0.005)  [0.007] |
|  | –0.0006  (0.001)  [0.003] | 0.0007  (0.001)  [0.001] | –0.0006  (0.001)  [0.003] | 0.0007  (0.001)  [0.001] | 0.00009  (0.0009)  [0.001] | 0.00009  (0.0009)  [0.001] |
|  | –0.003  (0.005)  [0.004] | 0.002  (0.005)  [0.004] | 0.005  (0.006)  [0.004] | 0.002  (0.005)  [0.004] | –0.003  (0.005)  [0.004] | –0.003  (0.005)  [0.004] |
|  | –0.06\*\*  (0.03)  [0.04] | –0.03  (0.02)  [0.03] | –0.03  (0.03)  [0.04] | –0.03  (0.02)  [0.02] | –0.05\*\*  (0.02)  [0.02] | –0.05\*\*  (0.02)  [0.02] |
|  | –0.01  (0.003)  [0.004] | –0.002  (0.001)  [0.001] | –0.01\*\*\*  (0.003)  [0.004] | –0.002  (0.001)  [0.001] | –0.001  (0.001)  [0.001] | –0.001  (0.001)  [0.001] |
|  | 0.01\*\*\*  (0.004)  [0.004] | 0.002\*\*\*  (0.0009)  [0.001] | 0.01\*\*\*  (0.002)  [0.002] | 0.002\*\*\*  (0.0009)  [0.001] | 0.001\*\*  (0.0008)  [0.001] | 0.001\*\*  (0.0008)  [0.001] |
|  | 0.002  (0.004)  [0.005] | 0.002  (0.001)  [0.002] | 0.01\*\*  (0.004)  [0.005] | 0.002\*  (0.001)  [0.002] | 0.002  (0.001)  [0.002] | 0.002  (0.001)  [0.002] |
| \* | 0.01\*\*\*  (0.002)  [0.004] | 0.004\*\*\*  (0.001)  [0.001] | 0.01\*\*\*  (0.003)  [0.004] | 0.004\*\*\*  (0.001)  [0.001] | 0.003\*\*\*  (0.001)  [0.001] | 0.003\*\*\*  (0.001)  [0.001] |
| R2 | 0.31 | 0.26 | 0.17 | 0.26 | 0.42 | 0.42 |
| Periods | 38 | 38 | 38 | 38 | 38 | 38 |
| Countries | 95 | 95 | 95 | 95 | 95 | 95 |
| Observations | 2,499 | 2,499 | 2,499 | 2,499 | 2,499 | 2,499 |

Note: indicates log in natural resource rent (% of GDP). Standard errors are presented below the corresponding coefficients in the bracket. \*\*\*, \*\* and \* indicate the significance at the 10%, 5%, and 1% level respectively. Cluster standard errors are presented in square brackets.

**Table B4**: Change in real GDP per capita and natural resource rent in terms of export (1980-2017)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: | | | | | |
|  | Cross-section and period fixed  (1) | PLS  (2) | Cross-section Fixed  (3) | Cross-section Random  (4) | Period fixed  (5) | Period random  (6) |
|  | 0.40\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.36\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] |
|  | - 0.04\*\*\*  (0.009)  [0.01] | - 0.01\*\*  (0.004)  [0.007] | - 0.04\*\*\*  (0.01)  [0.01] | - 0.01\*\*  (0.004)  [0.007] | - 0.01\*\*\*  (0.004)  [0.006] | - 0.01\*\*\*  (0.004)  [0.006] |
|  | - 0.0003  (0.001)  [0.003] | 0.0007  (0.001)  [0.001] | - 0.0002  (0.001)  [0.003] | 0.0007  (0.001)  [0.001] | 0.0001  (0.0009)  [0.001] | 0.0001  (0.0009)  [0.001] |
|  | - 0.003  (0.005)  [0.004] | 0.002  (0.005)  [0.004] | 0.004  (0.006)  [0.004] | 0.002  (0.005)  [0.004] | - 0.003  (0.005)  [0.004] | - 0.003  (0.005)  [0.004] |
|  | - 0.12\*\*\*  (0.03)  [0.04] | - 0.06  (0.02)  [0.03] | - 0.11\*\*\*  (0.03)  [0.05] | - 0.06  (0.02)  [0.03] | - 0.07\*\*\*  (0.02)  [0.03] | - 0.07\*\*\*  (0.02)  [0.03] |
|  | - 0.01  (0.003)  [0.004] | - 0.002  (0.001)  [0.001] | - 0.01\*\*\*  (0.003)  [0.004] | - 0.002  (0.001)  [0.001] | -0.001  (0.001)  [0.001] | -0.001  (0.001)  [0.001] |
|  | 0.01\*\*  (0.004)  [0.004] | 0.002\*\*\*  (0.0009)  [0.001] | 0.01\*\*\*  (0.002)  [0.002] | 0.002\*\*\*  (0.0009)  [0.001] | 0.001\*\*  (0.0008)  [0.001] | 0.001\*\*  (0.0008)  [0.001] |
|  | -0.002  (0.003)  [0.005] | 0.002  (0.001)  [0.002] | 0.002  (0.004)  [0.005] | 0.002  (0.001)  [0.002] | 0.001  (0.001)  [0.002] | 0.001  (0.001)  [0.002] |
| \* | 0.01\*\*\*  (0.002)  [0.004] | 0.004\*\*\*  (0.001)  [0.002] | 0.01\*\*\*  (0.002)  [0.004] | 0.004\*\*\*  (0.001)  [0.002] | 0.003\*\*\*  (0.001)  [0.001] | 0.003\*\*\*  (0.001)  [0.001] |
| R2 | 0.30 | 0.26 | 0.18 | 0.26 | 0.42 | 0.42 |
| Periods | 38 | 38 | 38 | 38 | 38 | 38 |
| Countries | 95 | 95 | 95 | 95 | 95 | 95 |
| Observations | 2499 | 2499 | 2499 | 2499 | 2499 | 2499 |

Note: Standard errors are presented below the corresponding coefficients in the bracket. The asterisks \*\*\*, \*\* and \* indicate the significance at the 10%, 5%, and 1% level, respectively. Cluster standard errors are presented in [].

**Table B5**: Change in real GDP per capita and natural resource rent in terms of import (1980-2017)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variable: | | | | | |
|  | Cross-section and period fixed  (1) | PLS  (2) | Cross-section Fixed  (3) | Cross-section Random  (4) | Period fixed  (5) | Period random  (6) |
|  | 0.41\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.36\*\*\*  (0.01)  [0.03] | 0.46\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] | 0.51\*\*\*  (0.01)  [0.03] |
|  | - 0.02\*\*\*  (0.009)  [0.01] | - 0.01\*\*  (0.005)  [0.005] | - 0.02\*\*  (0.01)  [0.01] | - 0.01\*\*  (0.005)  [0.005] | - 0.01\*\*\*  (0.004)  [0.005] | - 0.01\*\*\*  (0.004)  [0.005] |
|  | - 0.0005  (0.001)  [0.002] | 0.0006  (0.001)  [0.001] | - 0.0002  (0.002)  [0.003] | 0.0006  (0.001)  [0.001] | 0.00003  (0.0009)  [0.001] | 0.00003  (0.0009)  [0.001] |
|  | - 0.002  (0.005)  [0.004] | 0.002  (0.005)  [0.004] | 0.005  (0.006)  [0.004] | 0.002  (0.005)  [0.004] | - 0.003  (0.005)  [0.004] | - 0.003  (0.005)  [0.004] |
|  | - 0.01\*\*\*  (0.03)  [0.05] | - 0.003  (0.02)  [0.03] | 0.03  (0.03)  [0.05] | - 0.003  (0.02)  [0.03] | - 0.02  (0.02)  [0.03] | - 0.02  (0.02)  [0.03] |
|  | - 0.01\*\*\*  (0.003)  [0.004] | - 0.002\*  (0.001)  [0.001] | - 0.01\*\*\*  (0.003)  [0.005] | - 0.002\*  (0.001)  [0.001] | -0.001  (0.001)  [0.001] | -0.001  (0.001)  [0.001] |
|  | 0.01\*\*  (0.004)  [0.005] | 0.002\*\*\*  (0.0008)  [0.001] | 0.01\*\*\*  (0.002)  [0.002] | 0.002\*\*\*  (0.0008)  [0.001] | 0.001\*  (0.0008)  [0.001] | 0.001\*  (0.0008)  [0.001] |
|  | 0.002  (0.004)  [0.007] | 0.003\*  (0.001)  [0.002] | 0.01  (0.004)  [0.007] | 0.003\*  (0.001)  [0.002] | 0.002  (0.001)  [0.002] | 0.002  (0.001)  [0.002] |
| \* | 0.0\*\*\*  (0.002)  [0.003] | 0.003\*\*\*  (0.001)  [0.001] | 0.008\*\*\*  (0.002)  [0.003] | 0.003\*\*\*  (0.001)  [0.001] | 0.003\*\*\*  (0.001)  [0.001] | 0.003\*\*\*  (0.001)  [0.001] |
| R2 | 0.30 | 0.26 | 0.17 | 0.26 | 0.42 | 0.42 |
| Periods | 38 | 38 | 38 | 38 | 38 | 38 |
| Countries | 95 | 95 | 95 | 95 | 95 | 95 |
| Observations | 2499 | 2499 | 2499 | 2499 | 2499 | 2499 |

Note: Standard errors are presented below the corresponding coefficients in the bracket. The asterisks \*\*\*, \*\* and \* indicate the significance at the 10%, 5%, and 1% level, respectively. Cluster standard errors are presented in [].