Appendix



**Figure A 1**. Trends of average labour productivity growth rates by income group

Source: Author’s calculations based on (Dieppe, 2021).



**Figure A 2**. Trends of average TCI by income group 1990-2017

Source: Author’s calculations based on data from global productivity report 2020, World Bank Development indicators.



**Figure A 3**. Trends of labour productivity growth rates by regions 1990-2017

Source: Author’s calculations based on (Dieppe, 2021).



**Figure A 4**. Trends of average TCI by regions 1990-2017

Source: Author’s calculations based on data from global productivity report 2020, World Bank Development indicator

**Table A 1**. Estimation of the quadratic relationship between labour productivity growth and economic development

|  |  |
| --- | --- |
| VARIABLES | Dependent variable: labour productivity growth rate (%) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|  |  |  |  |  |  |  |  |  |  |  |
| Arable land (% of land area) | 0.012 | 0.019 | 0.019 | 0.022 | 0.022 | -0.090\* | -0.103\*\* | -0.103\*\* | -0.099\*\* | -0.098\*\* |
|  | (0.042) | (0.044) | (0.044) | (0.044) | (0.044) | (0.048) | (0.050) | (0.050) | (0.050) | (0.050) |
| Institution | 0.016 | 0.048 | 0.048 | 0.039 | 0.039 | -0.008 | -0.004 | -0.004 | -0.010 | -0.011 |
|  | (0.037) | (0.038) | (0.038) | (0.038) | (0.038) | (0.040) | (0.041) | (0.041) | (0.040) | (0.040) |
| Domestic credit to private sector by banks (% of GDP) | -0.020\*\*\* | -0.020\*\*\* | -0.020\*\*\* | -0.019\*\*\* | -0.019\*\*\* | -0.022\*\*\* | -0.026\*\*\* | -0.026\*\*\* | -0.026\*\*\* | -0.026\*\*\* |
|  | (0.005) | (0.005) | (0.005) | (0.005) | (0.005) | (0.006) | (0.006) | (0.006) | (0.006) | (0.006) |
| Population growth (annual %) | -0.280\*\*\* | -0.315\*\*\* | -0.315\*\*\* | -0.302\*\*\* | -0.303\*\*\* | -0.021 | -0.037 | -0.037 | -0.038 | -0.038 |
|  | (0.099) | (0.103) | (0.103) | (0.103) | (0.103) | (0.108) | (0.111) | (0.111) | (0.111) | (0.111) |
| Trade Openness | -0.685 | 0.057 | 0.057 | -0.034 | -0.027 | -0.509 | 0.100 | 0.100 | 0.052 | 0.061 |
|  | (0.594) | (0.605) | (0.605) | (0.602) | (0.602) | (0.642) | (0.656) | (0.656) | (0.653) | (0.653) |
| Foreign direct investment, net inflows (%GDP) | 0.016\* | 0.013 | 0.013 | 0.015\* | 0.015\* | 0.022\*\*\* | 0.019\*\* | 0.019\*\* | 0.020\*\* | 0.020\*\* |
|  | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.008) | (0.009) | (0.009) | (0.009) | (0.009) |
| Gdpc (log) |  |  |  |  |  | 12.446\*\*\* | 13.203\*\*\* | 13.203\*\*\* | 13.278\*\*\* | 13.293\*\*\* |
|  |  |  |  |  |  | (2.278) | (2.348) | (2.348) | (2.339) | (2.338) |
| Gdpc2 (log) |  |  |  |  |  | -0.647\*\*\* | -0.706\*\*\* | -0.706\*\*\* | -0.712\*\*\* | -0.713\*\*\* |
|  |  |  |  |  |  | (0.133) | (0.134) | (0.134) | (0.133) | (0.133) |
| Human capital index | -2.536\*\*\* | -0.196 | -0.196 | -0.165 | -0.179 |  |  |  |  |  |
|  | (0.976) | (0.566) | (0.566) | (0.565) | (0.565) |  |  |  |  |  |
| Constant | 9.784\*\*\* | 3.147\*\* | 3.147\*\* | 3.108\*\* | 3.140\*\* | -53.691\*\*\* | -55.692\*\*\* | -55.692\*\*\* | -55.879\*\*\* | -55.911\*\*\* |
|  | (2.565) | (1.442) | (1.442) | (1.440) | (1.442) | (10.406) | (10.011) | (10.011) | (9.971) | (9.970) |
|  |  |  |  |  |  |  |  |  |  |  |
| Observations | 2,101 | 2,101 | 2,101 | 2,101 | 2,101 | 2,036 | 2,036 | 2,036 | 2,036 | 2,036 |
| R-squared | 0.232 | 0.173 | 0.173 | 0.162 | 0.163 | 0.267 | 0.212 | 0.212 | 0.202 | 0.202 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country Year FE | Yes | No | No | No | No | Yes | No | No | No | No |
| Time trend | No | Yes | No | No | No | No | Yes | No | No | No |
| Time2 trend | No | No | Yes | No | No | No | No | Yes | No | No |
| Region-specific time trend | No | No | No | Yes | No | No | No | No | Yes | No |
| Region-specific time2 trend | No | No | No | No | Yes | No | No | No | No | Yes |
|  |  |  |  |  |  |  |  |  |  |  |

*Note:* The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Source: Author’s calculation

**Table A 2**. GMM-system estimation of TCI effect on labour productivity growth 2007-2012

|  |  |
| --- | --- |
| VARIABLES | Dependent variable: labour productivity growth rate (%) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|  |  |  |  |  |  |  |  |
| Lpxr (lag) | -1.528\*\*\* | -1.528\*\*\* | -1.283\*\* | -1.137\*\* | -1.141\*\* | -1.100\* | -1.256 |
|  | (0.558) | (0.562) | (0.531) | (0.490) | (0.493) | (0.590) | (0.789) |
| TCI | -0.557 | -0.976 | 0.708 | 0.501 | 0.938 | 0.539 | 0.349 |
|  | (1.081) | (2.202) | (2.039) | (1.861) | (1.973) | (2.023) | (2.278) |
| TCI2 |  | 0.152 | -0.226 | -0.068 | -0.190 | -0.018 | -0.049 |
|  |  | (0.585) | (0.575) | (0.532) | (0.582) | (0.579) | (0.579) |
| Institution |  |  | 0.071\* | 0.004 | -0.003 | -0.009 | 0.006 |
|  |  |  | (0.042) | (0.053) | (0.055) | (0.060) | (0.072) |
| Population growth (annual %) |  |  |  | -0.286\*\* | -0.292\* | -0.307\* | -0.284 |
|  |  |  |  | (0.141) | (0.152) | (0.158) | (0.176) |
| FDI |  |  |  |  | 0.024 | 0.028 | 0.028 |
|  |  |  |  |  | (0.026) | (0.029) | (0.028) |
| Trade Openness |  |  |  |  |  | -0.397 | -0.292 |
|  |  |  |  |  |  | (0.542) | (0.645) |
| Arable land (% of land area) |  |  |  |  |  |  | 0.006 |
|  |  |  |  |  |  |  | (0.022) |
| Constant | 18.185\*\* | 18.444\*\* | 14.545\*\* | 13.807\*\* | 13.468\*\* | 13.642\*\* | 15.150 |
|  | (6.960) | (7.210) | (6.467) | (5.829) | (5.861) | (6.628) | (9.188) |
|  |  |  |  |  |  |  |  |
| Observations | 612 | 612 | 582 | 582 | 580 | 574 | 574 |
| Number of countries | 102 | 102 | 97 | 97 | 97 | 97 | 97 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| AR(1) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) | 0.413 | 0.414 | 0.497 | 0.534 | 0.507 | 0.505 | 0.495 |
| Hansen | 0.485 | 0.486 | 0.475 | 0.452 | 0.506 | 0.559 | 0.623 |
| Number of Instruments | 33.000 | 34.000 | 35.000 | 36.000 | 37.000 | 38.000 | 39.000 |

*Note:* The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Source: Author’s calculation

**Table A 3**. Extension Analysis estimating the TCI effect and labour productivity growth rates 1990-2017, regional level

|  |  |
| --- | --- |
| VARIABLES | lp\_growth |
| (1) | (2) |
|  |  |  |
| lprx (lag) | -7.353\*\*\* | -6.414\*\*\* |
|  | (1.981) | (1.706) |
| TCI\*East Asia & Pacific | -3.878\* | 17.288\*\* |
|  | (2.175) | (8.512) |
| TCI\*Europe & Central Asia | 4.532\* | 21.253\*\* |
|  | (2.484) | (8.308) |
| TCI\*Latin America & Caribbean | -6.595\*\* | 6.545 |
|  | (2.674) | (7.126) |
| TCI\*Middle East & North Africa | -1.007 | 24.205 |
|  | (2.145) | (15.271) |
| TCI\*North America | 7.162\*\* | 33.259\*\*\* |
|  | (3.013) | (10.767) |
| TCI\*South Asia | -10.340\*\*\* | -2.605 |
|  | (3.848) | (8.729) |
| TCI\*Sub-Saharan Africa | -6.670\*\*\* | -2.105 |
|  | (2.218) | (3.119) |
| TCI2\*East Asia & Pacific |  | -11.869\*\* |
|  |  | (5.303) |
| TCI2\*Europe & Central Asia |  | -10.814\*\* |
|  |  | (5.013) |
| TCI2\*Latin America & Caribbean |  | -6.025 |
|  |  | (4.647) |
| TCI2\*Middle East & North Africa |  | -16.579 |
|  |  | (10.687) |
| TCI2\*North America |  | -21.172\*\*\* |
|  |  | (6.938) |
| TCI2\*South Asia |  | -1.099 |
|  |  | (5.285) |
| TCI2\*Sub-Saharan Africa |  | -0.376 |
|  |  | (0.633) |
| Institution | 0.437\*\* | 0.376\*\* |
|  | (0.178) | (0.168) |
| Population growth (annual %) | -0.382 | -0.194 |
|  | (0.453) | (0.373) |
| FDI | -0.006 | 0.002 |
|  | (0.012) | (0.017) |
| Trade Openness | 2.305\* | 1.815\* |
|  | (1.245) | (1.029) |
| Arable land (% of land area) | -0.132\*\* | -0.098\* |
|  | (0.061) | (0.053) |
| Constant | 79.618\*\*\* | 63.169\*\*\* |
|  | (21.063) | (16.973) |
|  |  |  |
| Observations | 2,235 | 2,235 |
| Number of countries | 97 | 97 |
| Year FE | Yes | Yes |
| AR(1) | 0.000 | 0.000 |
| AR(2) | 0.345 | 0.354 |
| Hansen | 0.604 | 0.543 |
| Number of Instruments | 44.000 | 51.000 |

*Note:* The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. The reference point for the regional dummy variable is East Asia & Pacific. Source: Author’s calculation

**Table A 4**. Extension Analysis estimating the TCI effect and labour productivity growth rates 1990-2017, income level

|  |  |
| --- | --- |
| VARIABLES | lp\_growth |
| (1) | (2) |
|  |  |  |
| lpxr (lag) | -8.101\*\*\* | -4.754\*\*\* |
|  | (2.277) | (1.311) |
| TCI\*High income | 13.473\*\*\* | 25.119\*\*\* |
|  | (4.134) | (7.558) |
| TCI2\*High income |  | -12.281\*\*\* |
|  |  | (4.151) |
| TCI\*Low income | -6.421\*\*\* | -2.232 |
|  | (2.284) | (2.441) |
| TCI2\*Low income |  | 0.223 |
|  |  | (0.444) |
| TCI\*Lower middle income | -4.307\*\* | 2.796 |
|  | (1.901) | (3.042) |
| TCI2\*Lower middle income |  | -1.310 |
|  |  | (0.839) |
| TCI\*Upper middle income | 1.720 | 12.611\*\* |
|  | (1.754) | (5.942) |
| TCI2\*Upper middle income |  | -6.102\* |
|  |  | (3.197) |
| Institution | 0.174 | 0.041 |
|  | (0.118) | (0.065) |
| Population growth (annual %) | -0.540 | -0.324 |
|  | (0.404) | (0.257) |
| FDI | 0.019 | 0.017 |
|  | (0.017) | (0.033) |
| Trade Openness | 1.430 | 0.645 |
|  | (0.867) | (0.483) |
| Arable land (% of land area) | -0.071 | -0.030 |
|  | (0.050) | (0.028) |
| Constant | 82.567\*\*\* | 44.699\*\*\* |
|  | (22.781) | (12.474) |
|  |  |  |
| Observations | 2,235 | 2,235 |
| Number of countries | 97 | 97 |
| Year FE | Yes | Yes |
| AR(1) | 0.000 | 0.000 |
| AR(2) | 0.297 | 0.279 |
| Hansen | 0.504 | 0.100 |
| Number of Instruments | 41.000 | 45.000 |

*Note:* The variables lprx (lag), TCI are presented in log. Robust standard errors in parentheses. Significance level at \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. The reference point for the income dummy variable is High income. Source: Author’s calculation

**Table A 5**. Variable description and sources

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| No. | Variables | Label | Definition | Sources |
| 1 | Labor productivity growth aggregate | lp\_growth | Labor productivity measured as real GDP in US dollars measured in 2010 prices and exchange rates, divided by employment. | Word Bank Global Productivity report 2020 (Dieppe et al., 2020). |
| 2 | Labor productivity level | lprx | Labor productivity (2011 international PPP exchange rate), divided by sectoral employment | Word Bank Global Productivity report 2020 (Dieppe et al., 2020). |
| 3 | Technology Choice Index | TCI | Computed based on the formula in methods section.  | Authors based on WDI |
| 4 | Foreign Direct Investment | FDI | Foreign direct investment net inflows (BoP current US$) | WDI 2020 |
| 5 | Institution | Institution | The Quality of Government measured by the revised combined Polity Score | Basic Dataset, University of Gothenburg |
| 6 | Trade Openness | openness | Export plus imports divided by total GDP (all in current US$) | Computed based on WDI |
| 7 | Human Capital | HCI | Human capital index, based on years of schooling (Barro & Lee, 205. and assumed returns, based on Mincer equation estimates around the world. | Robert J. Barro and Jong-Wha Lee: http://www.barrolee.com/ (WDI) |
| 8 | Arable land | A\_land | Defined by FAO as land under temporary crops or also known as cultivable land (% of land area). | WDI 2020 |
| 9 | Population growth (annual %) | pop | Annual population growth rates. Population is based on the facto definition, which count all residents regardless of legal status or citizenship. | WDI 2020 |
| 10 | GDP per capita | gdpc  | GDP per Capita, PPP (current international US$) | WDI 2020 |
| 11 | Financial Development | Findev\_1 | Domestic credit to private sector by banks (% of GDP) | WDI 2020 |

**Table A 6**. Descriptive statistics and correlation matrix of variables

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Mean | S.D. | Min | Max | lp\_growth | lpxr (log) | TCI (log) | A\_land | FINDEV\_1 | institution | HCI | pop | openness | FDI | gdpc (log) |
| lp\_growth | 1.99 | 3.94 | -48.84 | 35.54 | 1 |  |  |  |  |  |  |  |  |  |  |
| lpxr (log) | 10.33 | 1.45 | 6.46 | 12.76 | -0.108\* | 1 |  |  |  |  |  |  |  |  |  |
| TCI (log) | 1.13 | 0.52 | 0.29 | 4.22 | 0.017 | -0.586\* | 1 |  |  |  |  |  |  |  |  |
| A\_land | 16.64 | 14 | 0.32 | 72.1 | 0.105\* | -0.088\* | -0.094\* | 1 |  |  |  |  |  |  |  |
| FINDEV\_1 | 53.68 | 44.69 | 0 | 308.98 | -0.051 | 0.628\* | -0.360\* | -0.059 | 1 |  |  |  |  |  |  |
| institution | 5.34 | 5.88 | -10 | 10 | -0.074\* | 0.498\* | -0.351\* | 0.161\* | 0.298\* | 1 |  |  |  |  |  |
| HCI | 2.52 | 0.69 | 1.03 | 3.97 | -0.047 | 0.811\* | -0.525\* | 0.008 | 0.591\* | 0.581\* | 1 |  |  |  |  |
| pop | 1.29 | 1.4 | -9.08 | 17.51 | -0.107\* | -0.356\* | 0.320\* | -0.225\* | -0.262\* | -0.429\* | -0.502\* | 1 |  |  |  |
| openness | 0.83 | 0.57 | 0.13 | 4.43 | 0.012 | 0.291\* | -0.177\* | -0.124\* | 0.342\* | 0.017 | 0.260\* | -0.049 | 1 |  |  |
| FDI | 4.84 | 12.29 | -58.32 | 280.13 | 0.028 | 0.132\* | -0.106\* | -0.05 | 0.301\* | 0.062 | 0.098\* | -0.047 | 0.317\* | 1 |  |
| gdpc (log) | 9.07 | 1.19 | 5.65 | 11.86 | -0.082\* | 0.958\* | -0.658\* | -0.067 | 0.653\* | 0.478\* | 0.835\* | -0.334\* | 0.358\* | 0.162\* | 1 |

**Table A 7**. List of countries contained in the full sample

|  |
| --- |
| List of countries in the study |
| **East Asia & Pacific** |  | **Europe & Central Asia** |  | **North America** |
| No | country |  |  | No | country |  |  | No | country |  |
| 1 | Australia | High income |  | 39 | Slovenia | High income |  | 75 | Canada | High income |
| 2 | China, Hong Kong SAR |  | 40 | Spain |  | 76 | United States |
| 3 | Japan |  | 41 | Sweden |  |  |  |  |
| 4 | New Zealand |  | 42 | Switzerland |  | **South Asia** |
| 5 | Republic of Korea |  | 43 | United Kingdom |  | No | country |  |
| 6 | Singapore |  | 44 | Azerbaijan | Upper middle income |  | 77 | Bangladesh | Lower middle income |
| 7 | China | Upper middle income |  | 45 | Bulgaria |  | 78 | India |
| 8 | Fiji |  | 46 | Montenegro |  | 79 | Pakistan |
| 9 | Malaysia |  | 47 | Romania |  | 80 | Sri Lanka |
| 10 | Thailand |  | 48 | Russian Federation |  | 81 | Nepal | Low income |
| 11 | Indonesia | Lower middle income |  | 49 | Serbia |  |  |  |  |
| 12 | Lao People's Dem Rep |  | 50 | Turkey |  | **Sub-Saharan Africa** |
| 13 | Mongolia |  | 51 | Georgia | Lower |  | No | country |  |
| 14 | Philippines |  |  |  |  |  | 82 | Botswana | Upper middle income |
| 15 | Viet Nam |  | **Latin America & Caribbean** |  | 83 | Mauritius |
|  |  |  |  | No | country |  |  | 84 | Namibia |
| **Europe & Central Asia** |  | 52 | Argentina | High income |  | 85 | South Africa |
| No | country |  |  | 53 | Chile |  | 86 | Angola | Lower middle |
| 16 | Austria | High income |  | 54 | Uruguay |  | 87 | Cameroon |
| 17 | Belgium |  | 55 | Belize | Upper middle income |  | 88 | Eswatini |
| 18 | Croatia |  | 56 | Brazil |  | 89 | Ghana |
| 19 | Cyprus |  | 57 | Colombia |  | 90 | Kenya |
| 20 | Czech Republic |  | 58 | Costa Rica |  | 91 | Lesotho |
| 21 | Denmark |  | 59 | Dominican Republic |  | 92 | Nigeria |
| 22 | Estonia |  | 60 | Ecuador |  | 93 | Zambia |
| 23 | Finland |  | 61 | Guatemala |  | 94 | Burkina Faso | Low income |
| 24 | France |  | 62 | Jamaica |  | 95 | Ethiopia |
| 25 | Germany |  | 63 | Mexico |  | 96 | Malawi |
| 26 | Greece |  | 64 | Paraguay |  | 97 | Mozambique |
| 27 | Hungary |  | 65 | Saint Lucia |  | 98 | Rwanda |
| 28 | Iceland |  | 66 | St. Vincent and the Grenadines |  | 99 | Senegal |
| 29 | Ireland |  | 67 | Bolivia | Lower middle income |  | 100 | Sierra Leone |
| 30 | Italy |  | 68 | Honduras |  | 101 | Uganda |
| 31 | Latvia |  |  |  |  |  | 102 | Republic of Tanzania |
| 32 | Lithuania |  | **Middle East & North Africa** |  |  |  |  |
| 33 | Luxembourg |  | No | country |  |  |  |  |  |
| 34 | Netherlands |  | 69 | Qatar | High income |  |  |  |
| 35 | Norway |  | 70 | Algeria | Upper middle income |  |  |  |  |
| 36 | Poland |  | 71 | Iran |  |  |  |  |
| 37 | Portugal |  | 72 | Jordan |  |  |  |  |
| 38 | Slovakia |  | 73 | Egypt | Lower middle income |  |  |  |  |
|  |  |  |  | 74 | Morocco |  |  |  |  |

*Note*: Income group classification is base