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Globalisation, technology and global health

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Abstract

This study explored whether globalisation and technology are harmful to health for a global panel dataset of 52 countries for the period of 1990–2019. The study focused on four continents: Africa, the Americas, Asia/Oceania, and Europe. We used four advanced econometric methodologies, which include the standard panel fixed effect (FE), Arellano-Bover/Blundell-Bond dynamic panel analysis, Hausman-Taylor specification, and Two-Stage Least Squares (FE-2SLS)/Lewbel-2SLS approach. Our empirical evidence highlights the significance of globalisation and technology in promoting global health. Our findings are not only of interest because it suggests that globalisation has varied impact on global health indicators, but they indicate that technology is useful in tracking, monitoring, and promoting global health. In addition, our empirical evidence indicates that a truly health-centered process of globalisation and technological innovation can only be realised by ensuring that the interests of countries and vulnerable populations to health risks are adequately considered in international decision-making regarding global economic integration. We suggest that achieving the aspiration of global health will entail the use of globalisation and information technology to extend human activities and provide equal access to global health.

Keywords: globalisation; technology; global health
JEL Classification: C52, O38, O40, O55, P37

1. Introduction

This study explores whether globalisation and technology are to blame for global health problems and provide information to guide policy makers in their efforts to address the problem. The continuous quest for globalisation has sparked concern about environmental issues, exposing the global health crisis. Globalisation reflects rising economic and social interdependence among countries (Romer, 2010; Cornia et al., 2009; Abbott & Coenen, 2008; Schrecker, 2020; Baier et al., 2019; Asongu et al., 2014). Similarly, global health refers to health problems that spread across geographical boundaries or regions and require the collective effort of the global community to provide solutions for reducing the impacts on the global population (Schrecker, 2020; Jogenson & Burns, 2004; Barbash, 2010, Deaton, 2003; Grossman, 1972). Some studies argue that globalisation exposes the global population to health risks due to poor regulation and institutional quality (Shobande & Ogbeifun, 2021; Tavares, 2020; Singhania & Saini, 2021; Achim &Vaidean, 2022). Few studies have shown that globalisation and technology spillover can help improve the health of the population (Woodward et al., 2001; Romer, 2010; Abid, 2017; Honmas & Yoshida, 2020; Asongu et al., 2018). Honmas and Yoshida (2020) and Massaro (2021) suggest that globalisation can provide access to the technology needed to reduce air pollution, which helps improve the health of the population. On the contrary, the proponents of the pollution haven hypothesis argue that globalisation increases pollution, causing greater health problems (Dollar, 2001; Shobande, 2021; Asongu et al., 2020; Barlow, 2018). Clearly, there are conflicting reactions to the mechanism that explains the impact of globalisation and technology on health (Dollar et al., 2001; Acemoglu & Frinkelstein, 2008; Acemoglu & Linn, 2004). While empirical literature remains unsettled on whether globalisation is to be blamed for global health crises, policymakers need a clear understanding of the problem to provide regulatory mechanisms that would allow globalisation and technology to be used effectively and efficiently to promote global health.

Several factors motivatethe need to investigate whether globalisation and technology constitute a threat to global health. First, the traditional analysis of globalisationfocused on the economic performance of countries with little evidence of global health effects. Second, development strategies argue that globalisation and technological advancementare important factors for sustainable growth but took for granted their implications on global health problems (Wang et al., 2021; Goddeeris, 1984; Newhouse, 1992; Viscusi, 1993; Lee & Lee, 2021; Yan et al., 2021). For example, some studies suggest that globalisation can improve

technology innovation needed to reduce air pollution and improve the health system (Woodward et al., 2001; Romer, 2010; Fisher, 2003; Abdel-Basset et al., 2021; Pereira et al., 2019). On the contrary, other studies have argued that globalisation can lead to the spread of harmful technology that can negatively impact health. While technologies such as social media and mobile devices are meant to assist people in forming communities and increasing support in the health system, they can also cause psychological and physical health issues (Shaygan & Daim, 2021; Shobande & Ogbeifun, 2021; Asongu et al., 2018; Asongu & Nwachukwu, 2019). For example, technology spreads with globalisation, causing major health risks, such as eyestrain, depression, and anxiety (Deaton, 2004; Becker et al., 2005). Third, globalisation provides individuals with access to a wide selection of products, allowing them to make choices, but little effort has been made to regulate the quality of these products, raising concerns about their impact on health (Frischer, 2003; Becker et al., 2005; Attaran, 2004; Wilkinson, 2000; Owen & Wu, 2007). Fourth, there is an urgent need for international regulations that can help make the most effective and efficient use of globalisation and technology to promote health.

Following the research by Deaton (2004), Abbott and Coenen (2008) and Foster et al. (2020), this study makes the following contributions to the literature. First, it investigates whether globalisation and technology are harmful to health in a global panel of 52 countries for the period of 1990–2019. Second, inferences are made using four advanced econometric methodologies: (a) fixed effect, (b) Arellano-Bover/Blundell-Bond dynamic panel, (c) Hausman-Taylor (H-T) correction for endogeneity, and (d)Two-Stage least squares (FE-2SLS)and Lewbel-2SLS approach.

Thestudy has three main results. First, our empirical evidence indicates that globalisation is harmful to health, while technology improves health across the continents examined. Second, our empirical evidence corroborates with previous findings by Dollar (2001) and Deaton (2004) as well as a recent study by Foster et al. (2020), all of which suggest that globalisation has adverse effect on health.Third, our empirical evidence highlights the importance of monitoring the effects of globalisation and technology on health, which is essential for effective and efficient decision-making at the national and international levels. Fourth, our empirical evidence departs from previous research as it offers technology as a solution to global health issues driven by globalisation.

The study provides theoretical insights that complement recent empirical evidence on the impact of globalisation and technology on global health, asdiscussed in Section 2. Section 3 describes the data and research methodology. Section 4 presents and discusses the empirical results, and Section 5 concludes the paper with policy and future areas of research.

2. Literature Review

This section explores the theoretical and empirical literature on the causal link between globalisation, technology, and health. It begins by exploring the empirical contributions of scholars, their merits, and flaws. It then formulates a testable hypothesis for this study.

2.1 Theory and Evidence on Effect of Globalisationon Health

Numerous theoretical and empirical studies on the impact of globalisation on health remain controversial and inconclusive.For example, studies suggest that globalisation can accelerate the transmission of infectious diseases through trade openness andcauses global health risk (Deaton, 2004; Markel & Stem, 2002; Becker et al., 2005; Dollar, 2001). Deaton (2004) shows that infectious diseases transported through goods and people are identified as a key source of global health problems (e.g., HIV, SARs, and pandemics). Barlow (2018) tested whether globalisation leads to lower child mortality in lower-and middle-income countries for the period of 1963–2005 and reported that globalisation has no impact on child mortality. Owen and Wu (2007), examines the relationship between openness to international trade and several health outcomes for a panel of 219 countries and find evidence that globalisation improves child health. Foster et al. (2020) explored the impact of globalisation on health equity in a panel of 137 developing countries for the period of 1980–2014 and reported that globalisation has lower health access and increases neonatal mortality. Labonte and Schrecker (2017) explored the link between globalisation and health covering the period of 1987–2005 and reported that globalisation can create health inequality. Using cross-national comparisons between 208 countries during the period of 1990–1997, Jorgenson and Burns (2004) assessed the causal link between globalisation, environment, and infant mortality and reported that export concentration increases pollution and infant mortality. Abbott et al. (2008) observed that globalisation and advances in information and communication technology (ICT) have a positive impact on nursing and the global health system. Cornia et al. (2009) examined the impact of globalisation on health status in 10 regions of the world for the period of 1980–2000 using the eclectic econometric model and reported that globalisation has a negative effect on health. Frenk and Gomez-Dantes (2002) indicated that globalisation

affects health and all human activities. Dollar (2001) shows that globalisation can have adverse effects on health through the transmission of infection diseases, but practical solutions lie in health policy and proper regulatory mechanisms.

2.2 Theory and Evidence on Technology and Health

Numerous theoretical and empirical studies have explored the causal link between ICT and health but have reported mixed findings. The first group of studies focused on the impact of ICT on health behaviour. For example, Tavares (2020) explored the effect of internet use on self-assessed health among older people in Europe using an ordered logistic regression analysis and reported that the internet improved the health status of older generations. Ma et al. (2021) observed whether ICT proficiency weakens the effect of ICT in China through a survey of 304 elderly participants in China and reported that ICT usage reduced mental health through social engagements and community interactions. In contrast, Nguyen et al. (2021) observed that internet usage can lead to health risks, such as higher depression and anxiety, in 678 participants in northern Vietnam. Lin et al. (2016) indicated that ICT usage is positively correlated with depression among younger and older generations. Castellacci and Tveito (2018) examined the impact of ICT on the healthcare domain and found a positive link between ICT and well-being. Achim and Vaidean (2022) assessed the impact of ICT on physical health in 184 countries and reported that ICT can be harmful and bring low health benefit. Shareef et al. (2021) examined the role of new healthcare system enabled machine intelligence on the health of 159 elderly persons in Canada and reported that technology can help improve the health of the elderly people in the absence of human support, especially during retirement life.

The second group of studies assessed the impact of ICT on public health and reported mixed evidence (Zhang et al., 2020; Doos et al., 2016; Tomas et al., 2004). For example, Zhang et al. (2022) examined the impact of ICT on public health for a panel of Chinese provinces covering the period of 2001–2016 and reported that ICT diffusion improved health. Doos et al. (2016) assessed how investment in technology can have long-term potential in predicting future health within 3–20 years and reported that health technologies can be useful in promoting well-being. Tomasi et al. (2004) explored the link between health information technologies in primary health in developing countries for the period of 1992–2002 and reported that information technology has helped improve primary healthcare services.

Alotaibi and Federico (2017) suggested that health information technology is a valuable factor for enhancing healthcare quality and safety. Frenk and Gomez-Dantes (2002) suggested that aspiration for a global healthy population will require globalisation and information technology to expand human activities and create opportunities for accessing equal global health systems. Chandra and Skinner (2012) explores the link between technology growth and expenditure in health care and shows that healthcare productivity depends on the effectiveness of medical technology. Okunade and Murthy (2001) investigate the role of technology as a major driver of healthcare costs in the United States for the period 1960 – 1997 and reported that technology change is a major escalator of health care expenditure. Using Medicare data for 2.8 million patients from 1986 to 2004, Skinner and Staiger (2015) investigated the impact of technology diffusion and productive growth in health care and reported that effective technology causes a variation in health services across hospitals.

2.3 Theory and Evidence on Effect of Globalisation and Pollution on Health

The pollution haven hypothesis (hereafter, PHH) explains the link between globalisation and pollution on global health. The PHH posits that globalisation causes polluting activities which have severe implications for health (Bogmans & Withagen, 2009; Arguedas, 2008). The hypothesis contends that globalisation can reduce polluting activities and improve health only through a stronger and more stringent environmental policy (Singhania & Kantor, 2003; Singhania & Saini, 2021). Singhania and Saini (2021) assessed the PHH and foreign direct investment (FDI) for a panel of 21 developed and developing countries over the period 1990–2016, using the system generalised method of moments (GMM) and reported that FDI has a meaningful impact on environmental quality. They also found evidence of the PHH in a panel of countries. Antweiler et al. (2001) assessed how openness to international goods markets affect health through pollution concentration and find that international trade creates relatively small pollution, and that trade is good to the environment and health outcome.

2.4 Research Questions

From the review, three key questions arise:

(a) To what extent has globalisation been the cause of global health problems?

(b) Has ICT improved global health?

(c) Is regulatory quality associated with globalisation and global health problems?

Obviously, the failure to account for the key mechanism that explains the causal link between globalisation, technology, and health has limited efforts to answer this question. First,some studies have suggested that globalisation has the potential to increase air pollution and expose populations to greater health risks (Hall & Jones, 2007). These studies identified air pollution as a mechanism that explains the link between globalisation, technology, and health (Woodward et al., 2001; Romer, 2010). Second, globalisation boosts energy use and economic activity, but elevates pollution, which has a negative effect on health (Bauman et al., 2008; Shobande & Ogbeifun, 2021). Third, poor governance and institutional quality have been identified as other mechanisms through which globalisation and technological innovation can affect health (Arguedas, 2008; Hatzipanayotou et al., 2008). Some studies suggest that globalisation reduces trade barriers and facilitates integration into the global economy, but it comes at the cost of weak governance, which has serious health implications (Waldkirch & Gopinath, 2008; Ehrhart et al., 2008; Desrocher, 2008; Shobande, 2020;Asongu et al., 2020). For example, poor regulatory quality can encourage the importation of non-standard products, which can have adverse effects on health. On the contrary, stringent regulations can reduce access to health services and increase the cost of pharmaceutical products. This is because globalisation can help in the provision of cost-effective and efficient medical supplies such as vaccines, medications, and lifesaving technology. Using Medicare data for 2.8 million patients for the period of 1986–2004, Skinner and Staiger (2015) investigated the impact of technology diffusion and productive growth in healthcare and reported that effective technology causes a variation in health services across hospitals.

2.5 Research Hypotheses

Following this review, the hypotheses formulated and tested are stated as follows:

Hypothesis 1

Globalisation is harmful to global health

Testing this hypothesis is vital to provide a proper understanding of whether globalisation is harmful to global health. Some studies have shown that globalisation is a driver of long-term growth and can assist countries in attaining their developmental goals but ignoring its health

implications. For example, a study by Barlow (2018) finds no evidence of a link between globalisation and health. On the contrary, Foster et al. (2020) showed that globalisation is harmful to health. Labonte and Schrecker (2017) suggest that globalisation causes health inequality. However, the international community needs clear evidence on the mechanism that explains the impact of globalisation on health, which could be useful in policymaking.

Hypothesis 2

ICT improves global health

Scholars and empirical research are divided on whether technological innovation may help people live longer. For example, Doos et al. (2016) indicates that investment in ICT forecast the future health of the population. Shareef et al. (2021) show that technology is beneficial to the health of the elder population. On the contrary, Achim and Vaidean (2022) show that ICT can be harmful to health in a panel of 184 countries comprising of developed and developing countries. Consistently, Nguyen et al. (2021) suggests that internet usage can expose the population to serious health problems. Therefore, reassessing the link between ICT and health can provide more information that can be used in public policy. Massaro (2021) indicates that digital transformation in healthcare through blockchain technology can help promote global health.

Hypothesis 3

Strong regulatory quality explains the effect of globalisation and technology on global health

The evidence that strong environmental policies can promote globalisation and health is inconclusive. Yet, the quest for globalisation continues to increase the spread of diseases through goods and people. Many studies suggest that the threat to global health from globalisation can be addressed through strong institutions. Deaton (2004) argues that globalisation can help improve global health if proper regulation and rapid transmission of health technologies are spread across the globe. On the contrary to Antweiler et al. (2001), globalisation produces minimal pollution and strict environmental policies can only impede global health access. Thus, it is critical to investigate the premise whether strong institutions are beneficial to health in order to provide more evidence to policy makers.

3. Data

This study uses panel data for 52 countries from Africa, the Americas, Asia, Europe, and Oceania to explore whether globalization and technology are harmful to health from 1990-2019. The data are obtained from four primary sources: (i) World Development Indicators (WDI); (ii) World Governance Indicators (WGI) both World Bank; (iii) KOF Swiss Economic Institute and (iv) the United Nations Conference on Trade and Development (UNCTAD).

The dependent variable is health, which is captured by three key indicators. The first is overall mortality, measured by the death rate per 1,000 people. The second indicator is infant mortality which is measured by infant mortality rate per 1,000 live births. The third indicator is life expectancy, measured by life expectancy at birth. The study uses three variables to capture globalization: (i) trade openness measured by trade as a percentage of GDP, (ii) foreign direct investment, and (iii) globalization index. Also, the study uses the percentage of the population using the internet to capture technology.

Following existing literature, four control variables and two governance indicator variables are included in the model to prevent variable omission bias. The control variables include economic growth, carbon emission, education, and inflation, whereas the governance indicators are political stability and regulatory quality (See Acheampong et al., 2021; Asongu and Le Roux, 2017; Shobande & Ogbeifun, 2021). Appendix 1 provides more information on the definitions of variables and their corresponding sources, while Appendix 2 presents the countries used for the study.

Table 1-4 summarises descriptive statistics of the variables across the groups of countries and their respective continents. Table 1 provides the descriptive statistics for the African continent. The mean and corresponding standard deviation of overall death rate (DR), 9.8 (4.1); infant mortality (IM), 55 (30.1), and life expectancy (LE) is 60 (9.1). Other variables like trade openness (TO), 58.8 (25.3); internet users (IUI), 10.0 (15.6), among others.

[Insert Table 1]

Table 2 presents the descriptive statistics for the American continent. The mean and corresponding standard deviation of overall mortality (DR), 6.3 (1.18); infant mortality (IM),

16.9 (11.1), and life expectancy (LE) is 74.8 (3.3). Other variables like trade openness (TO), 43.2 (25.3); internet users (IUI), 29.4 (28.8), among others.

[Insert Table 2]

Table 3 presents the descriptive statistics for the Asian/Oceania continent. The mean and corresponding standard deviation of overall mortality (DR), 6.5 (1.5); infant mortality (IM), 20.4 (18.5), and life expectancy (LE) is 73.7 (5.9). Other variables like trade openness (TO), 54.9 (25.6); internet users (IUI), 29.9 (32.2), among others.

[Insert Table 3]

Table 4 presents the descriptive statistics for the European continent. The mean and corresponding standard deviation of overall mortality (DR), 9.5 (1.73); infant mortality (IM), 5.0 (2.8), and life expectancy (LE) is 78.3 (3.5). Other variables like trade openness (TO), 81.6 (35.2); internet users (IUI), 46.6 (35.2), among others.

[Insert Table 4]

Comparing Table 1-4 shows that Africa has a higher average death rate and infant mortality than the rest of the continents. Likewise, life expectancy is higher in the American and European continents but relatively low in Africa. On average, globalisation through trade openness is higher in Europe compared to the other continents. On average, internet users are more in Europe with less users in Africa.

4. Methodology

Motivation

The choice of the empirical strategy and the four advanced econometric methodologies used are motivated by several factors. It started with a standard panel fixed-effects specification, then employed the Arellano-Bover/Blundell-Bond dynamic panel to address the potential problem of endogeneity. However, the approach uses the correct lag of health indicators, which is unlikely to be a valid instrument if there is an observed cross-panel correlation among the variables. The study further addressed the endogeneity problem using an internal

instrument approach suggested by Hausman-Taylor (H-T) (1981). However, the endogeneity problem remains with H-T because an internal instrument is unlikely to be sufficient in correcting for cross-panel correlation. To resolve this problem, an external instrument, and Two-Stage Least Squares (2SLS) methodology was implemented. To ensure the robustness and validity of the analysis, the study employed the Lewbel-2SLS (2012) methodology, which combines both internal and external instruments.

Empirical Model

Our empirical model is specified as follows.

$$H = f(G, T, X) \quad (1)$$

Where the dependent variable H is health; independent variables: G is globalisation , T is technology; X is the vector of control variables for each state and a time trend.

Equation (1) is respecified econometrically as follows.

$$H_{jt,} = X_{j,t}\eta + G_{j,t}\phi + T_{j,t}\delta + s_j + v_{j,t} \quad (2)$$

Where $j$stands for country and t, time .$H$is depicts health indicators (overall mortality, infant mortality and life expectancy), X is a vector of control variables and time trend (income per capita, energy consumption, education, $CO_2\ emission$, inflation, political stability and absence of violence, and regulatory quality), G is a vector of globalisation (trade openness and foreign direct investment), T is technology in each state (internet users). The two terms $s\ and\ v$, are unobserved components of the error term and the former is specific to a state.

5. Estimation and Inference

This section presents the results of the estimated model and discusses the findings. It begins with the results of the standard panel fixed effects model, before proceeding with the dynamic panel analysis. It presents two additional robustness checks for correcting endogeneity and ends with discussion of the findings.

A. Basic Specification

We begin the analysis with the standard empirical panel specification assuming that the unobserved state component of the error term is constant with the dependent variable. Table 5 presents the estimates of the fixed effects specification for Africa.

[Insert Table 5]

Column (1-4) of Table 5 is the fixed effect regression results which suggests that increased globalisation through trade openness increases overall mortality, while increase in internet usage decreases overall mortality. On average, a 1% rise in globalisation through trade openness is related to a 28% increase in overall mortality, whereas a 1% increase in internet usage decreases overall mortality by 2%. Column (5-8) of Table 5 presents the fixed effect regression results on the effects of globalisation and technology on infant mortality. The results also reveal that globalisation through trade openness may increase infant mortality though at a rate lower than overall mortality. Also, increase in internet usage is negatively associated with lower infant mortality. On average, a 1% rise in globalisation through trade openness is associated with a 1.5% increase in infant mortality, whereas a 1% increase in internet usage decreases infant mortality by 5%. The results are consistent with Deaton (2004) which argues that transmission of health technology (including related knowledge) is crucial for child health. The consistent use of internet can improve child health through factors such as knowledge on vaccine production, and better medical treatment for children. Column (9-11) of Table 5 assessed the effect of globalisation and technology on life expectancy. The results in Column (9-12) suggest that globalisation through trade openness reduces life expectancy, whereas internet usage improves it. On average, a 1% increase in globalisation through trade openness is associated with 8.4% decrease in life expectancy, whereas a 1% increase in internet usage increases life expectancy by 8.2%. Other control factors, such as regulatory quality, have a negative impact on overall and infant mortality, implying that strict environmental regulation can contribute to health. The findings support Dollar (2001) hypothesis that increased international cooperation and sound environmental policy can help mitigate the threat to global health.

Table 6 presents the estimates of the fixed effects specification for the American continent.

[Insert Table 6]

In column (1-4) of Table 6, the fixed effect regression results indicate that globalisation and technology can help reduce overall and infant mortality in America. On average, a 1% rise in globalisation through trade openness is associated with a 3.8% decrease in overall mortality, whereas a 1% increase in internet usage decreases overall mortality by 1.7%. Column (5-8) of Table 6 presents the regression results on the effects of globalisation and technology on infant mortality. The results suggest that a 1% rise in globalisation through trade openness is associated with 30% decrease in infant mortality, whereas a 1% increase in internet usage decreases infant mortality by 5.9%. In column (9-12), the fixed effect regression results suggest that globalisation reduces life expectancy through trade openness, whereas internet usage increases it. On average, a 1% increase in globalisation is associated with 7.9% decrease in life expectancy, whereas a 1% increase in internet usage increases life expectancy by 4.6%. Other control factors, indicates that regulatory quality has no significant impact on the health indicators in America.

Table 7 presents the estimates of the fixed effects specification for the Asian/Oceania continent.

[Insert Table 7]

In column (1-4) of Table 7, the fixed effect regression results suggest that globalisation through trade openness increases overall mortality, whereas internet usage decreases it. On average, a 1% rise in globalisation through trade openness is associated with a 10.9% increase in overall mortality, whereas a 1% increase in internet usage decreases overall mortality by 2.6%. In column (5-8), similar evidence is obtained. However, the marginal effect on overall mortality appears to be higher than the infant mortality effect. In column (9-12), there is no evidence that globalisation through trade openness has an impact on life expectancy; however increased internet usage has an impact on life expectancy. Other control factors indicate that regulatory quality has significant impact on the health indicators in Asian/Oceania continent.

Table 8 presents the estimates of the fixed effects specification for the Asian/Oceania continent.

[Insert Table 8]

In column (1-4), the fixed effect regression results indicate that increased globalisation through trade openness raises overall mortality, whereas increased internet use lowers overall mortality. In column (5-8), the results suggest that increase in trade openness and internet usage reduces infant mortality. In column (9-12), increase in trade openness and internet usage is associated with improved life expectancy in Europe. The results in Column (9-11) of Table 8, suggest that globalisation through trade openness reduces life expectancy, whereas internet usage improves it. Other control factors such as regulatory quality significantly promote health.

B. Dynamic Panel Estimates:

While the fixed effect (FE) remains the standard methodology, it suffers from several well-known shortcomings. First, it assumed that state effects are fixed, which is a strong assumption if state health policies have changed over time. Second, the time invariant is subsumed making it difficult to economically interpret dynamic relationships among the variables. The alternative formulation for dealing with the perceived shortcomings would be to assume thats_j is a random effect (RE), which has its own set of problems. This is because it assumed that

$$E\left(s_j\middle|X_j\middle|G_j \mid T_j\right) = 0, \qquad (3)$$

This is quite unlikely to the case,

To resolve the conflict in FE and RE estimator, Bover and Arellano (1997) offer a simple two step within group compromise which includes the lag of dependent variable, other endogenous explanatory variables, and unobserved individual effects. This approach treats lag of the dependent variable as endogenous, implying that the pattern of correlation in the errors is unrestricted. The approach is further extended and empirically tested using Monte Carlo study by Blundell and Bond (1998).

We specified this approach in equation (4 - 5)

$$H_{jt} = \alpha H_{jt-1} + s_j + v_{j,t} \quad (4)$$

Respecified as:

$$H_{jt} = \alpha H_{jt-1} + (1-\alpha)\ s_j + v_{j,t} \quad (5)$$

For $j = 1, 2, \ldots . N$ and $t = 2, 3, \ldots . T$, where each case of s_j and $v_{j,t}$ are drawn as mutually independent and identically distributed $N(0, 1)$ random variable. In model 5, the time invariant component of the error term becomes less important as the autoregressive parameter increases.

This implies initial condition stated as:

$H_{jt} = {}^{s_j}/_{1-\alpha} + u_{j,t}$,

Where $u_{j,t}$ is normally distributed and remains independent of both s_j and $v_{j,t}$ with variable of $u_{j,t}$ fulfilled stationarity condition. Table (9-12) summarises the results of the Arellano – Bover/Blundell–Bond dynamic panel data estimations across the continents.

[Insert Table 9]

[Insert Table 10]

[Insert Table 11]

[Insert Table 12]

The results of Table (9-12) are close to the familiar fixed effects specification, albeit with marginal increase in the coefficient of the variables and improved efficiency. In addition, there is evidence of convergence among the variables in Africa, America, Europe, and Asia. Our analysis indicates that instruments available for the first differenced equations are only weakly correlated with the explanatory variables in the first differences.

C. Robustness Check 1: Hausman – Taylor Estimates

To further strengthen our analysis, we consider the Hausman and Taylor (hereafter, H-T) (1981) which helps to retrieve the estimates of the time variant variable and properly correct for potential problems of endogeneity. Several studies such as those by Egger and Pfaffermayr (2004) and Serelenga and Shin (2007) have applied Montel Carlo simulation to empirically validate the potential of the H-T approach in addressing potential endogeneity problems. Here, we have used as internal instrument and analysis the H-T in Table 13.

[Insert Table 13]

From the results in Table 13, the statistical significance of trade openness and internet users on the health indicators has slightly increased across the continents. However, the signs of the results appear to be similar to those of the fixed effect regression. The most important changes are the marginal increase in size of the coefficients of the variables.

D. Robustness Check 2: 2SLS Estimates

Another common method for dealing with measurement errors and endogeneity is to use instrumental variables. The nature of the measurement error implies that the instrument predicts a long run to satisfy exclusion conditions. Thus, the Lewbel (2012) 2SLS is implemented. This strategy allows for identification when the exclusion criteria for available instruments are unknown or traditional instruments are insufficient. The Lewbel (2012) method has the advantage of addressing the measurement error or endogeneity problem by combining both internal and external instrumental variables.

While the Lewbel (2012) appears sensitive to the choice of instrumental variables, we further exploit the typical FE-2SLS approach which relies on external IVs. The motivation for this approach stems from a growing body of research supporting the use of multiple IVs in treatment and drawing causal inferences among variables. For example, Angrist and Imbens (1995) offer a rationale for utilising 2SLS with multiple IVs, one which they interpreted as a positive weighted average of local average treatment effects for a subpopulation whose treatment status is influenced by the instrument. While the results of the 2SLS with multiple IVs is empirically supported, the monotonicity condition must be satisfied, which raises several questions. The first is whether the choice of numerous IVs is satisfied; the second is if

the causal interpretation of 2SLS, which allows for unobserved heterogeneity in both treatment effects and behaviour choice, is still valid. Mogstad et al. (2021) show that using multiple IVs is still sufficient given the 2SLS remains valid.

As earlier noted, we further strengthen the empirical strategy by controlling for endogeneity using FE-2SLS approach. Equation (2) can be represented in the following 2SLS equations (6-7).

$$H_{j,t} = \phi_0 + \phi_1 \hat{G}_{j,t} + \phi_2 X_{j,t} + s_j + v_{j,t} \quad (6)$$

$$\hat{G}_{j,t} = \beta_0 + \beta_1 X_{j,t} + \beta_2 Gindex_{j,t} + \wedge_j + \mu_{j,t} \quad (7)$$

Where $Gindex_{j,t}$ shows the globalisation index in j state at time t. The other variables are well defined in Equation (2). The data on the globalisation index is a composite index that measures the economic, social, and political perspective of globalisation (Dreher, 2006). We find that the globalisation index is positively correlated with globalisation and satisfies the relevancy condition of a valid instrument, notably: First, it satisfies the traditional condition that requires $Gindex_{j,t}$to be exogenous with regards to the outcome. Second, it requires $Gindex_{j,t}$ being independent and exogenous with respect to potential treatment as well. Table (14 - 17) present the combined results of the FE-2SLS and the Lewbel-2SLS estimator for the continents.

[Insert Table 14]

[Insert Table 15]

[Insert Table 16]

[Insert Table 17]

From the results in Table (14-17), the panel FE-2SLS and Lewbel 2SLS estimation coefficients are quite similar, with only a slight marginal change. The results of the FE-SLS and the Lewbel-2SLS also appear to be higher in coefficient than that of the standard fixed effect regressions across the continents. The difference between the 2SLS and the FE is shown in higher marginal changes in coefficients and improved statistical significance of variables, but the signs do not change.

Discussion of findings

The paper tested whether globalisation and technology are harmful to global health in a global panel of 52 countries across four continents (Africa, America, Asia/Oceania, and Europe) for the period 1990–2019. Following the literature, we formulated and tested hypotheses using four advanced econometric methodologies. (i) standard panel fixed effects specification, (ii) Arellano-Bover/Blundell-Bond dynamic panel approach, (iii) Hausman–Taylor (H-T), and (iv) FE-2SLS and Lewbel-2SLS methodology. Our results indicate that globalisation through trade and technologies have varied impacts on the global health indicators across the continents examined. Our results corroborate with a number of previous studies (Dollar 2001, Deaton 2004, Labonte & Schrecker, 2007; Foster et al., 2020, Mossaro, 2021).

The findings have several policy implications. Evidence from hypothesis H_1, confirmed that globalisation is directly or indirectly harmful to health in most of the continents examined. While overall mortality and infant mortality appear to have the largest impacts, policies regarding trade openness and restrictions should be examined to reduce the impact of globalisation on global health. Evidence from hypothesis H_2, suggests that technology through internet use is useful in promoting global health. This implies that improved technology can help in diffusion of new knowledge about medical treatments and improve pharmaceutical products that could help improve the health of both the old and younger generation. Overall evidence from hypothesis H_3, indicates that the institutional variable is crucial in promoting global health. The evidence confirmed that good institutional and regulatory qualities are vital strategies for maintaining and improving global health.

6. Conclusion and Policy Implications

The study provides theoretical and empirical evidence on the effects of globalisation and technology on global health. It utilised a global panel of 52 countries across four continents

(Africa, America, Asia/Oceania, and Europe) for the period of 1990–2019. Four advanced econometric methodologies were used: (i) standard panel fixed effects specification, (ii) Arellano-Bover/Blundell-Bond dynamic panel approach, (iii) Hausman–Taylor (H-T), and (iv) Two-Stage Least Squares (2SLS). The findings indicate that globalisation negatively affects global health, while ICT improves health. The mechanisms through which globalisation and technology can affect health have been identified as air pollution and poor governance. Our findings show that a truly health-centred process of globalisation and technological innovation can only be realised by guaranteeing that the interests of countries and vulnerable populations in health risks are adequately considered in international decision-making. We suggest that successful and efficient decision-making at the national and international levels require careful monitoring of the effects of globalisation andtechnological innovation on global health. We recommend that globalization should be controlled in such a way that negative health impacts are minimised and opportunities for living a healthy lifestyle are advanced. This requires formulation and implementation of a research agenda that focuses on globalisation and technology trends at the local level, as well as advocating for international policy that benefits global health.

Future research can focus on the use of biometrics and facial recognition in promoting global health, and information from such studies could extend our present findings.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: This article does not contain any studies with human participants or animals performed by the authors.

Data availability: the data for this research are available upon request.

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Tables

Table 1: Descriptive Statistics for Africa

Variable	Obs	Mean	Std. Dev.	Min	Max
IM	420	55.428	30.199	9.9	131.4
LE	406	60.855	9.132	45.201	76.693
DR	406	9.826	4.143	4.527	19.555
GDP	420	3104.106	4117.569	208.112	25156.299
GI	420	50.292	10.308	22.282	70.479
TO	389	58.866	25.368	6.57	152.547
CO2	378	2.003	2.869	0	9.998
FDI	420	20719.898	32780.524	124.41	179564.81
SCH	307	66.943	26.526	8.403	109.444
IUI	397	10.039	15.661	0	74.376
INF	420	37.891	277.486	-25.313	4800.532
EC	330	882.908	809.252	64.663	3353.528
PS	336	-.756	.75	-2.568	.833
RQ	336	-.597	.573	-2.347	.804

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; GI counts for Globalization index; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality.

Table 2: Descriptive Statistics for Americas

Variable	Obs	Mean	Std. Dev.	Min	Max
IM	270	16.986	11.014	4.2	56.7
LE	261	74.819	3.334	66.165	81.949
DR	261	6.3	1.18	4.689	8.8
GDP	270	15766.185	16013.505	2637.959	60700.893
GI	270	64.316	11.031	41.678	84.253
TO	270	43.212	17.314	13.753	83.042
CO2	243	5.948	6.263	.889	20.179
FDI	270	512549.05	1248463.9	1330	9398404
SCH	217	88.34	15.55	53.659	114.124
IUI	262	29.416	28.82	0	91.16
INF	270	71.646	472.515	-26.3	6261.24
EC	229	2644.38	2822.676	404.347	8455.547
PS	216	-.183	.794	-2.374	1.275
RQ	216	.483	.866	-1.296	1.89

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; GI counts for Globalization index; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality.

Table 3: Descriptive Statistics for Asia/Oceania

Variable	Obs	Mean	Std. Dev.	Min	Max
IM	330	20.04	18.517	1.8	88.6
LE	319	73.7	5.919	57.865	84.211
DR	319	6.559	1.506	3.407	11
GDP	330	15768.07	14830.104	538.34	53914.642
GI	330	62.025	12.003	27.505	81.378
TO	330	54.93	25.615	15.506	140.437
CO2	297	7.185	5.246	.709	20.402
FDI	330	145023.76	231456.75	1656.81	1769486
SCH	228	82.701	26.438	28.518	157.168
IUI	326	29.905	32.202	0	96.158
INF	330	8.911	15.625	-16.909	105.215
EC	280	2742.017	1841.745	350.076	6905.756
PS	264	-.15	.993	-2.095	1.595
RQ	264	.317	.941	-1.72	2.092

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; GI counts for Globalization index; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality.

Table 4: Descriptive Statistics for Europe

Variable	Obs	Mean	Std. Dev.	Min	Max
IM	540	5.046	2.855	1.9	18.6
LE	522	78.354	3.569	64.467	83.754
DR	523	9.526	1.739	5	16.4
GDP	538	37313.927	17756.984	4552.049	88217.812
GI	540	80.853	7.949	47.075	90.906
TO	535	81.66	35.22	26.257	239.215
CO2	486	8.389	2.374	3.896	24.398
FDI	537	288840.07	349261.55	109	2045059.3
SCH	505	110.293	17.05	59.851	163.935
IUI	539	46.461	35.233	0	98.046
INF	538	8.855	76.29	-4.478	1490.418
EC	467	3934.792	1209.557	1680.962	7134.854
PS	410	.671	.754	-1.626	1.76
RQ	410	1.325	.555	-.579	2.098

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; GI counts for Globalization index; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality.

Table 5: Fixed effects panel data estimations for Africa, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	1.942*** (0.000)	1.424*** (0.000)	2.167*** (0.013)	0.954 (0.252)	5.328*** (0.000)	4.456*** (0.000)	10.22*** (0.000)	9.858*** (0.000)	4.103*** (0.000)	4.264*** (0.000)	3.158*** (0.000)	3.637*** (0.000)
TO_t	0.293*** (0.000)	0.281*** (0.000)	0.184*** (0.001)	0.129** (0.014)	0.190*** (0.000)	0.122*** (0.000)	0.0502 (0.247)	0.0456 (0.257)	–0.0897*** (0.000)	–0.0841*** (0.000)	–0.0370*** (0.000)	–0.0198 (0.225)
FDI_t	–0.108*** (0.000)	–0.0431*** (0.002)	–0.0622*** (0.004)	–0.0908*** (0.000)	–0.259*** (0.000)	–0.127*** (0.000)	–0.0227 (0.185)	–0.0541*** (0.000)	0.0415*** (0.000)	0.0203*** (0.000)	0.0128* (0.054)	0.0223*** (0.000)
IUI_t		–0.0214*** (0.000)	–0.0055 (0.319)	–0.018*** (0.009)		–0.0454*** (0.000)	–0.0249*** (0.000)	–0.0188** (0.000)		0.0082*** (0.000)	0.0007 (0.662)	0.0054** (0.013)
SCH_t			–0.0974 (0.145)	–0.0431 (0.482)			–0.174*** (0.001)	–0.130*** (0.006)			0.0525** (0.011)	0.0239 (0.211)
GDP_t			–0.0402 (0.720)	–0.102 (0.329)			–0.444*** (0.000)	–0.476*** (0.000)			0.0969*** (0.006)	0.0564* (0.084)
EC_t			0.0867 (0.288)	0.148* (0.063)			–0.346*** (0.000)	–0.164*** (0.008)			0.0027 (0.914)	–0.0310 (0.208)
INF_t			0.0004 (0.125)	0.0005** (0.045)			–0.0002 (0.411)	0.0004* (0.062)			–0.0001* (0.092)	–0.0002** (0.010)
$CO2_t$			–0.0392 (0.398)	–0.0432 (0.294)			0.0277 (0.456)	0.0076 (0.881)			–0.0060 (0.673)	–0.0001 (0.994)
PS_t				–0.0136 (0.520)				0.0267 (0.101)				0.0043 (0.513)
RQ_t				–0.0054 (0.908)				0.172*** (0.000)				–0.0136 (0.348)
Obs.	375	306	189	176	389	311	189	176	375	306	189	176
F	131.0	67.30	13.20	17.85	508.9	382.7	124.8	125.1	198.0	110.0	24.51	30.47

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita;TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 6: Fixed effects panel data estimations for Americas, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	2.093*** (0.000)	1.318*** (0.000)	1.241*** (0.006)	1.231*** (0.007)	6.951*** (0.000)	4.836*** (0.000)	10.99*** (0.000)	10.32*** (0.000)	3.983*** (0.000)	4.154*** (0.000)	3.721*** (0.000)	3.762*** (0.000)
TO_t	–0.0417** (0.023)	0.038** (0.034)	0.0323 (0.126)	0.0494** (0.023)	–0.343*** (0.000)	–0.103* (0.063)	–0.168*** (0.000)	–0.171*** (0.000)	0.0079** (0.044)	–0.0101** (0.013)	–0.0050 (0.141)	–0.0045 (0.196)
FDI_t	–0.0102*** (0.006)	0.0348*** (0.000)	0.0452*** (0.000)	0.0545*** (0.000)	–0.267*** (0.000)	–0.149*** (0.000)	–0.0355 (0.109)	–0.0521* (0.055)	0.0265*** (0.000)	0.0165*** (0.000)	0.0474*** (0.004)	0.0055*** (0.006)
IUI_t		–0.0176*** (0.000)	–0.0228*** (0.00)	–0.0256*** (0.000)		–0.0596*** (0.000)	–0.0385*** (0.000)	–0.0502*** (0.000)		0.0048*** (0.000)	0.0046*** (0.000)	0.0047** (0.000)
SCH_t			0.0977*** (0.002)	0.194*** (0.00)			–0.368*** (0.000)	–0.209** (0.011)			0.0036 (0.473)	–0.0099 (0.103)
GDP_t			–0.120** (0.015)	–0.185*** (0.001)			–0.356*** (0.001)	–0.381*** (0.002)			0.0662*** (0.000)	0.0752*** (0.000)
EC_t			0.0887 (0.101)	0.0970* (0.088)			–0.346*** (0.000)	–0.164*** (0.008)			–0.0084 (0.338)	–0.0192** (0.038)
INF_t			0.00016 (0.683)	0.00063 (0.173)			–0.00024 (0.776)	0.00038 (0.708)			0.0001 (0.110)	0.00002 (0.833)
$CO2_t$			0.00178 (0.966)	–0.0436 (0.287)			0.0601 (0.509)	0.0281 (0.754)			–0.0120* (0.075)	–0.0063 (0.343)
PS_t				–0.00795 (0.486)				0.0156 (0.534)				0.00044 (0.811)
RQ_t				0.0151 (0.346)				0.0346 (0.325)				–0.0045* (0.074)
Obs.	261	241	174	150	270	246	174	150	375	306	189	176
F	15.09	22.13	8.397	6.534	639.6	478.6	226.2	139.2	198.0	110.0	24.51	30.47

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita;TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 7: Fixed effects panel data estimations for Asia/Oceania, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	1.888*** (0.000)	1.665*** (0.000)	–0.923*** (0.011)	0.592* (0.075)	5.941*** (0.000)	4.951*** (0.000)	13.81*** (0.000)	12.59*** (0.000)	3.958*** (0.000)	4.037*** (0.000)	3.781*** (0.000)	3.535*** (0.000)
TO_t	0.109*** (0.000)	0.121*** (0.000)	–0.0274 (0.208)	–0.0617*** (0.001)	0.0857 (0.135)	0.0921* (0.089)	0.0167 (0.723)	0.0418 (0.408)	0.0004 (0.938)	–0.0028 (0.555)	0.0089 (0.129)	0.0066 (0.249)
FDI_t	–0.0421*** (0.000)	–0.0261*** (0.001)	–0.0598*** (0.000)	–0.0563*** (0.000)	–0.339*** (0.000)	–0.249*** (0.000)	–0.0806*** (0.000)	–0.0752*** (0.000)	–0.0308*** (0.000)	0.0247*** (0.000)	0.0189*** (0.000)	0.0164*** (0.000)
IUI_t		–0.0026 (0.414)	–0.0059** (0.013)	–0.0025 (0.399)		–0.0381*** (0.000)	–0.0078 (0.125)	–0.0201** (0.019)		0.0023*** (0.000)	0.0011* (0.083)	0.0020** (0.033)
SCH_t			0.129*** (0.000)	0.0264 (0.425)			–0.0027 (0.968)	0.128 (0.172)			–0.0063 (0.445)	0.0016 (0.875)
GDP_t			–0.0808** (0.014)	–0.0833** (0.012)			–0.395*** (0.000)	–0.612*** (0.000)			0.0399*** (0.000)	0.0572*** (0.000)
EC_t			0.534*** (0.014)	0.379*** (0.000)			–1.05*** (0.000)	–0.655*** (0.000)			–0.0016 (0.914)	0.0105 (0.558)
INF_t			0.0017*** (0.000)	0.0011*** (0.000)			0.0039*** (0.000)	0.0033*** (0.000)			–0.0004*** (0.000)	–0.0002*** (0.003)
$CO2_t$			–0.217*** (0.000)	–0.0902** (0.021)			0.483*** (0.000)	0.365*** (0.001)			–0.0130 (0.673)	–0.0297** (0.019)
PS_t				–0.0252*** (0.002)				0.0416* (0.072)				–0.00004 (0.989)
RQ_t				0.114*** (0.000)				0.0314 (0.526)				–0.0143** (0.013)
Obs.	319	294	177	146	330	302	177	146	319	294	177	146
F	30.13	12.36	43.04	38.07	748.9	521.6	317.4	171.3	829.6	585.6	209.9	136.8

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita;TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 8: Fixed effects panel data estimations for Europe, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	2.585*** (0.000)	2.327*** (0.000)	1.083*** (0.080)	0.888 (0.232)	5.668*** (0.000)	4.118*** (0.000)	10.94*** (0.000)	9.176*** (0.000)	4.972*** (0.000)	4.045*** (0.000)	3.820*** (0.000)	3.910*** (0.000)
TO_t	0.0381** (0.058)	0.0743*** (0.001)	0.122*** (0.000)	0.160*** (0.000)	–0.336*** (0.000)	–0.152*** (0.0010	-0.0133 (0.765)	0.0474 (0.339)	0.0409*** (0.000)	0.0319*** (0.000)	0.0111*** (0.007)	0.00596 (0.249)
FDI_t	–0.0437*** (0.000)	–0.0330*** (0.000)	–0.0204*** (0.001)	–0.0260*** (0.001)	–0.230** (0.000)	–0.153*** (0.000)	–0.155*** (0.000)	–0.126*** (0.000)	0.0181*** (0.000)	0.0146*** (0.000)	0.0118*** (0.000)	0.0106*** (0.000)
IUI_t		–0.0085*** (0.000)	–0.0126*** (0.000)	–0.0103* (0.089)		–0.0577*** (0.000)	–0.0377*** (0.000)	–0.0478** (0.000)		0.00263*** (0.000)	0.00232*** (0.000)	0.00471*** (0.000)
SCH_t			0.0456 *0.163)	0.0108 (0.789)			–0.329*** (0.000)	–0.232*** (0.001)			0.0121** (0.029)	0.0265*** (0.000)
GDP_t			–0.169*** (0.000)	–0.113** (0.027)			–0.0684 (0.300)	–0.209** (0.014)			0.0173*** (0.005)	0.0181** (0.041)
EC_t			0.307*** (0.0000	0.258*** (0.002)			–0.806*** (0.000)	–0.525*** (0.000)			0.0281** (0.027)	0.0110 (0.453)
INF_t			–0.00037*** (0.000)	–0.0026*** (0.000)			–0.0009*** (0.000)	0.00024 (0.840)			0.000066*** (0.000)	0.000197 (0.112)
$CO2_t$			–0.0439 (0.383)	–0.0180 (0.733)			0.640*** (0.000)	0.665*** (0.000)			–0.0578*** (0.000)	–0.0555*** (0.000)
PS_t				0.0444*** (0.0010				0.0234 (0.295)				–0.0019 (0.424)
RQ_t				–0.0068 (0.723)				–0.0475 (0.143)				–0.00136 (0.687)
Obs.	515	512	439	341	532	529	439	341	514	511	439	341
F	139.7	98.89	54.27	22.34	1184.5	1062.8	549.2	216.1	1174.3	826.6	427.4	173.3

Note: IM counts for Infant mortality; LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita;TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 9: Arellano–Bover/Blundell–Bond dynamic panel data estimations for Africa, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	-0.0477*** (0.000)	-0.0210*** (0.000)	–0.524*** (0.013)	–0.252*** (0.252)	–0.00002 (0.999)	–0.0295* (0.050)	–0.254*** (0.000)	–0.323*** (0.000)	–0.0426*** (0.000)	0.0199*** (0.007)	–0.0164 (0.546)	–0.0532* (0.083)
H_{t-1}	0.972*** (0.000)	0.962*** (0.000)	1.017*** (0.000)	1.005*** (0.000)	1.022*** (0.000)	1.037*** (0.000)	1.048*** (0.000)	1.040*** (0.000)	0.993*** (0.000)	0.982*** (0.000)	1.024*** (0.000)	1.014*** (0.000)
TO_t	0.0147*** (0.000)	0.0098*** (0.000)	0.0124*** (0.000)	0.0183** (0.000)	0.0307*** (0.000)	0.0324*** (0.000)	0.0362*** (0.000)	0.0255*** (0.000)	0.0108*** (0.000)	0.0116*** (0.000)	0.0128*** (0.000)	0.0135*** (0.000)
FDI_t	–0.0066*** (0.000)	–0.0013*** (0.000)	–0.0281*** (0.000)	–0.0276*** (0.000)	0.0011* (0.061)	–0.0016** (0.021)	–0.0075*** (0.000)	–0.0099*** (0.000)	0.0038*** (0.000)	0.0013*** (0.000)	0.0068*** (0.000)	0.0065*** (0.000)
IUI_t		–0.00036*** (0.000)	–0.0012*** (0.001)	–0.0008 (0.154)		-0.0027*** (0.000)	-0.0016*** (0.000)	0.0014** (0.023)		0.0012*** (0.000)	0.0017*** (0.000)	0.0012*** (0.000)
SCH_t			0.0237*** (0.00)	0.0114** (0.017)			0.0170** (0.025)	0.0231*** (0.008)			–0.0065*** (0.000)	–0.0041** (0.048)
GDP_t			–0.0301*** (0.000)	–0.0093 (0.172)			–0.00245 (0.750)	–0.0077 (0.370)			–0.0029 (0.198)	0.0042 (0.127)
EC_t			0.0689*** (0.000)	0.0672*** (0.000)			0.0295*** (0.000)	0.0246*** (0.001)			–0.0218*** (0.000)	–0.0203*** (0.000)
INF_t			–0.00002 (0.426)	–0.00002 (0.370)			0.00002 (0.540)	0.00002 (0.623)			–0.00001 (0.100)	–0.00001 (0.195)
$CO2_t$			–0.0024 (0.349)	0.0105*** (0.003)			–0.0111*** (0.002)	–0.0181*** (0.000)			–0.0018* (0.090)	–0.0063*** (0.000)
PS_t				–0.0112*** (0.000)				–0.0243*** (0.000)				–0.0038*** (0.000)
RQ_t				–0.0125*** (0.000)				0.0219*** (0.000)				0.00297** (0.026)
Obs.	335	282	171	159	348	286	171	159	335	282	171	159
Wald chi2	976779.82	731239.48	160978.52	104575.17	966358.93	557358.65	178291.84	149634.80	584020.82	456471.20	141693.12	97432.84

Note: H is the dependent variable (Overall mortality counts for death rate; Infant mortality; Life expectancy); LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 10: Arellano–Bover/Blundell–Bond dynamic panel data estimations for Americas, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	–0.0766*** (0.000)	–0.0705*** (0.000)	–0..256*** (0.000)	–0.412*** (0.000)	0.105*** (0.001)	–0.0161 (0.679)	0.0944 (0.387)	0.0690 (0.637)	0.0868*** (0.000)	0.239*** (0.000)	0.145*** (0.000)	0.160*** (0.000)
H_{t-1}	0.980*** (0.000)	0.980*** (0.000)	0.974*** (0.000)	0.971*** (0.000)	0.968*** (0.000)	0.973*** (0.000)	0.987*** (0.000)	0.975*** (0.000)	0.982*** (0.000)	0.947*** (0.000)	0.967*** (0.000)	0.964*** (0.000)
TO_t	0.0133*** (0.000)	0.0124*** (0.000)	0.0153*** (0.000)	0.0128** (0.002)	–0.0130*** (0.001)	-0.0038 (0.430)	-0.0023 (0.574)	0.0101* (0.052)	-0.0002 (0.592)	–0.0014*** (0.000)	–0.0015*** (0.005)	0.0016** (0.011)
FDI_t	0.0055*** (0.000)	0.0508*** (0.000)	0.0010 (0.555)	–0.00019 (0.935)	–0.0064 (0.656)	0.0036** (0.035)	0.0059*** (0.004)	0.0012 (0.666)	–0.0007*** (0.000)	–0.0003*** (0.000)	–0.0011*** (0.002)	–0.0013*** (0.001)
IUI_t		0.0033 (0.346)	–0.0041 (0.593)	0.00023 (0.861)		–0.0016*** (0.000)	0.00084 (0.131)	–0.00004 (0.737)		0.00038*** (0.000)	0.00027*** (0.005)	0.00032** (0.031)
SCH_t			0.0450*** (0.00)	0.0617*** (0.000)			–0.0357*** (0.001)	–0.0251* (0.076)			–0.0024 (0.113)	–0.0016 (0.340)
GDP_t			0.0218** (0.034)	0.0312*** (0.006)			–0.0011 (0.915)	–0.00218 (0.876)			0.0059*** (0.000)	0.0054*** (0.001)
EC_t			–0.0231** (0.036)	–0.0182 (0.104)			–0.00296 (0.719)	–0.0024 (0.799)			–0.0034** (0.014)	–0.0033** (0.029)
INF_t			–0.0001 (0.346)	–0.00002 (0.851)			0.00009 (0.223)	–0.00005 (0.641)			0.000001 (0.927)	0.000003 (0.869)
$CO2_t$			0.0026 (0.778)	–0.0128 (0.183)			0.0113 (0.110)	0.0116 (0.144)			–0.0009 (0.392)	–0.0006 (0.563)
PS_t				–0.0078*** (0.009)				–0.0100*** (0.000)				0.00088** (0.010)
RQ_t				0.0076* (0.053)				0.0278 (0.418)				–0.00029 (0.469)
Obs.	252	239	173	150	261	244	173	150	252	239	173	150
Wald chi2	37413.60	34025.03	23691.46	22700.44	696179.40	630264.62	1050544.22	863752.37	662576.84	571246.93	208464.49	155931.65

Note: H is the dependent variable (Overall mortality counts for death rate; Infant mortality; Life expectancy); LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 11: Arellano–Bover/Blundell–Bond dynamic panel data estimations for Asia/Oceania, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	0.0096 (0.747)	0.0340 (0.373)	0.298* (0.052)	0.427** (0.039)	0.250*** (0.000)	0.184*** (0.000)	0.168 (0.148)	0.261** (0.035)	0.192*** (0.000)	0.178*** (0.000)	0.213*** (0.000)	0.267*** (0.000)
H_{t-1}	0.965*** (0.000)	0.978*** (0.000)	0.924*** (0.000)	0.906*** (0.000)	0.961*** (0.000)	0.965*** (0.000)	0.949*** (0.000)	0.961*** (0.000)	0.953*** (0.000)	0.958*** (0.000)	0.943*** (0.000)	0.926*** (0.000)
TO_t	–0.0043 (0.451)	–0.0038 (0.540)	-0.00327 (0.714)	-0.0034 (0.732)	–0.0168*** (0.000)	–0.0127*** (0.000)	–0.0225*** (0.000)	–0.0174*** (0.000)	0.0017*** (0.003)	0.0005 (0.435)	0.00035 (0.701)	–0.0003 (0.753)
FDI_t	0.0062*** (0.000)	0.0015 (0.427)	–0.0022 (0.457)	–0.0012 (0.728)	–0.0118*** (0.000)	–0.0081*** (0.000)	–0.0032*** (0.009)	–0.0068*** (0.000)	0.0006*** (0.000)	0.00036** (0.025)	0.00082*** (0.004)	0.0007** (0.018)
IUI_t		0.0017** (0.031)	0.0013 (0.266)	–0.00012 (0.962)		–0.0010*** (0.009)	0.0007* (0.097)	0.0018** (0.018)		0.00016*** (0.007)	0.0001 (0.345)	0.000295 (0.100)
SCH_t			–0.0287 (0.113)	–0.0339 (0.174)			–0.0473 (0.518)	0.0194** (0.048)			0.0038** (0.023)	0.00396* (0.073)
GDP_t			0.0274** (0.026)	0.0215 (0.305)			–0.0098 (0.169)	–0.0288*** (0.002)			0.00026 (0.865)	0.00152 (0.421)
EC_t			–0.0385 (0.205)	–0.0438 (0.196)			0.0347*** (0.007))	0.0191 (0.142)			0.00078 (0.776)	0.00202 (0.469)
INF_t			0.0001 (0.652)	0.000045 (0.801)			0.00016** (0.019)	0.00012* (0.095)			0.000003** (0.036)	0.00035 (0.868)
$CO2_t$			0.0131 (0.552)	0.0190 (0.443)			–0.0719*** (0.000)	–0.0287*** (0.002)			–0.0003 (0.876)	–0.00035 (0.868)
PS_t				0.0021 (0.747)				–0.0035 (0.149)				–0.00089* (0.082)
RQ_t				0.0094 (0.457)				0.0291*** (0.000)				–0.000094 (0.932)
Obs.	308	291	176	146	319	299	176	146	308	291	176	146
Wald chi2	7996.2	6990.5	2017.2	1691.0	862691.4	716030.2	378101.0	294317.7	399578.6	37898.8	146864.5	125453.4

Note: H is the dependent variable (Overall mortality counts for death rate; Infant mortality; Life expectancy); LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality.* $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 12: Arellano–Bover/Blundell–Bond dynamic panel data estimations for Europe, yearly data (1990–2019).

	Overall Mortality				Infant Mortality				Life Expectancy			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	0.0346 (0.564)	–0.0235 (0.715)	–0.370* (0.079)	–0.240 (0.300)	–0.152*** (0.000)	–0.155*** (0.000)	–0.838*** (0.000)	–0.553*** (0.000)	0.101*** (0.003)	0.109*** (0.001)	0.466*** (0.000)	0.490*** (0.000)
H_{t-1}	0.924*** (0.000)	0.915*** (0.000)	0.889*** (0.000)	0.875*** (0.000)	0.949*** (0.000)	0.947*** (0.000)	0.980*** (0.000)	0.978*** (0.000)	0.983*** (0.000)	0.983*** (0.000)	0.898*** (0.000)	0.885*** (0.000)
TO_t	0.0521*** (0.000)	0.0608*** (0.000)	0.0397*** (0.001)	0.0331** (0.011)	0.0739*** (0.000)	0.0745*** (0.000)	0.0262*** (0.002)	0.0156 (0.109)	–0.0102*** (0.000)	–0.0113*** (0.000)	–0.0046*** (0.007)	–0.00452** (0.019)
FDI_t	–0.0078*** (0.000)	–0.0036 (0.117)	–0.00262 (0.426)	0.00157 (0.674)	–0.0106*** (0.000)	–0.0101*** (0.000)	–0.0317 (0.168)	–0.0740*** (0.008)	0.00179*** (0.000)	0.00136*** (0.000)	0.00105** (0.021)	0.00114** (0.034)
IUI_t		–0.00357** (0.017)	–0.0034* (0.090)	–0.00238 (0.522)		–0.0079 (0.238)	0.00218* (0.056)	0.0065*** (0.002)		0.00034** (0.047)	0.00051** (0.025)	–0.00029 (0.536)
SCH_t			0.0310 (0.155)	0.0231 (0.329)			0.0225** (0.040)	0.0473*** (0.000)			–0.00293 (0.274)	–0.00466 (0.141)
GDP_t			–0.00899 (0.435)	–0.0167 (0.339)			0.0178** (0.0260	0.0188* (0.053)			0.00605*** (0.000)	0.00971*** (0.000)
EC_t			0.0654** (0.023)	0.0627** (0.043)			0.0673*** (0.000)	0.0242 (0.219)			–0.00741** (0.035)	–0.00578* (0.091)
INF_t			0.00011*** (0.001)	0.000674 (0.120)			0.000053** (0.017)	–0.00045* (0.075)			–0.000026*** (0.000)	–0.00021*** (0.000)
$CO2_t$			–0.0520** (0.010)	–0.0454** (0.031)			–0.0455*** (0.000)	–0.0362** (0.010)			–0.00136 (0.652)	–0.00386 (0.211)
PS_t				0.0170*** 90.008)				0.0107*** (0.007)				–0.0017* (0.051)
RQ_t				–0.00762 (0.476)				0.000345 (0.957)				–0.000992 (0.497)
Obs.	499	498	426	341	516	515	426	341	498	497	426	341
Wald chi2	3891.5	3911.8	2739.9	2575.3	30964.6	309922.0	151750.3	97967.2	46957.4	46587.1	31427.1	26047.1

Note: H is the dependent variable (Overall mortality counts for death rate; Infant mortality; Life expectancy); LE counts for life expectancy; DR counts for overall death rate; GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; FDI counts for foreign direct investment inflows; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption; PS counts for Political Stability and Absence of Violence; RQ counts for Regulatory Quality. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 13: Hausman Taylor estimation yearly data (1990–2019).

	Africa			Americas			Asia/Oceania			Europe		
	Overall Mortality	Infant Mortality	Life Expectancy	Overall Mortality	Infant Mortality	Life Expectancy	Overall Mortality	Infant Mortality	Life Expectancy	Overall Mortality	Infant Mortality	Life Expectancy
Constant	2.689***(0.001)	10.25*** (0.000)	3.106*** (0.000)	0.285 (0.495)	11.19*** (0.000)	3.680*** (0.000)	–0.156 (0.723)	14.70*** (0.000)	3.533*** (0.000)	1.757*** (0.002)	15.10*** (0.000)	2.495*** (0.000)
TO_t	0.167*** (0.001)	0.0439 (0.285)	–0.0334** (0.037)	0.0104 (0.627)	–0.159*** (0.000)	–0.0064* (0.060)	–0.0527** (0.048)	–0.0391 (0.441)	0.0212*** (0.005)	0.109*** (0.000)	–0.0215 (0.682)	0.0138*** (0.003)
IUI_t	–0.0123** (0.014)	–0.0274*** (0.000)	0.0022 (0.149)	–0.0152*** (0.000)	–0.0455*** (0.000)	0.0055*** (0.000)	–0.0094*** (0.001)	–0.0155*** (0.004)	0.0028*** (0.000)	–0.0147*** (0.000)	–0.0608*** (0.000)	0.0041*** (0.000)
SCH_t	–0.132** (0.036)	–0.187*** (0.000)	0.0590*** (0.002)	0.108*** (0.001)	–0.372*** (0.000)	0.0042 (0.410)	0.116*** (0.002)	–0.0290 (0.691)	–0.00085 (0.938)	0.0515 (0.113)	–0.224*** (0.001)	0.00423 (0.496)
GDP_t	–0.188* (0.053)	–0.498*** (0.000)	0.127*** (0.000)	0.0520 (0.131)	–0.476*** (0.000)	0.0826*** (0.000)	–0.197*** (0.000)	–0.526*** (0.000)	0.0707*** (0.000)	–0.247*** (0.000)	–0.597*** (0.000)	0.0586*** (0.000)
EC_t	0.0969 (0.216)	–0.343*** (0.000)	–0.0005 (0.984)	0.0811 (0.131)	–0.261** (0.020)	–0.0150* (0.083)	0.493*** (0.000)	–1.038*** (0.000)	0.0099 (0.602)	0.293*** (0.000)	–0.964*** (0.000)	0.0397*** (0.005)
INF_t	0.0004 (0.161)	–0.0002 (0.342)	–0.00013* (0.098)	–0.0004 (0.305)	0.0002 (0.840)	0.0001 (0.455)	0.0022*** (0.000)	0.0046*** (0.000)	–0.0006*** (0.000)	–0.00029*** (0.000)	–0.000114 (0.172)	0.000018** (0.018)
$CO2_t$	–0.0152 (0.730)	0.0372 (0.282)	–0.0109 (0.416)	–0.0518 (0.219)	0.0777 (0.377)	–0.0150** (0.025)	–0.219*** (0.000)	0.508*** (0.000)	–0.01666 (0.322)	–0.0177 (0.718)	0.899*** (0.000)	–0.0772*** (0.000)
$Dummy$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	189	189	189	174	174	174	177	177	177	440	440	440
Wald ch2	102.91	1089.30	205.42	51.84	1811.5	2365.0	161.9	2079.4	887.4	424.2	2909.8	2504.4

Note: GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 14: IV 2SLS and Lewbel-2SLS estimations for Africa, yearly data (1990–2019).

	IV 2SLS						Lewbel 2SLS					
	Overall Mortality		Infant Mortality		Life Expectancy		Overall Mortality		Infant Mortality		Life Expectancy	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	0.0303 (0.628)	1.663* (0.073)	4.043*** (0.000)	9.050*** (0.000)	4.597*** (0.000)	3.578*** (0.000)	0.762 (0.564)	1.904** (0.019)	1.153 (0.0547)	3.338*** (0.000)	4.796*** (0.000)	4.637*** (0.000)
TO_t	0.415*** (0.000)	0.422*** (0.002)	–0.0793 (0.397)	-0.192* (0.059)	–0.104*** (0.000)	–0.120*** (0.003)	0.356 (0.284)	0.164** (0.034)	0.676 (0.160)	0.172** (0.042)	–0.174 (0.176)	–0.0492* (0.063)
IUI_t	–0.0345*** (0.000)	–0.0173** (0.002)	–0.0767*** (0.000)	–0.0034*** (0.000)	0.0138*** (0.000)	0.0046** (0.010)	–0.0520*** (0.000)	0.00035 (0.972)	–0.120*** (0.000)	–0.0463*** (0.000)	0.0231*** (0.000)	0.00434 (0.201)
SCH_t		–0.135** (0.042)		–0.194*** (0.000)		0.0610*** (0.003)		–0.0759 (0.268)		–0.175** (0.019)		0.0059 (0.802)
GDP_t		–0.159 (0.113)		–0.437*** (0.000)		0.107*** (0.001)		–0.451*** (0.000)		–0.267** (0.032)		0.107*** (0.006)
EC_t		0.0600 (0.456)		–0.317*** (0.000)		0.00396 (0.876)		0.522*** (0.000)		0.401*** (0.000)		–0.182** (0.000)
INF_t		0.0003 (0.395)		–0.0002 (0.321)		–0.0001 (0.262)		0.00217*** (0.005)		0.0017** (0.047)		–0.0008*** (0.000)
$CO2_t$		–0.0175 (0.227)		0.0440 (0.226)		–0.0118 (0.414)		–0.191*** (0.001)		–0.308*** (0.000)		0.104*** (0.000)
Obs.	306	189	311	189	306	189	306	189	311	189	306	189
Wald chi2/ F	144.94	90.28	800.22	964.97	257.54	177.18	10.64	15.59	28.34	28.23	13.41	20.96

Note: GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption. Heteroscedasticity robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 15: IV 2SLS and Lewbel-2SLS estimations for Americas, yearly data (1990–2019).

	IV 2SLS						Lewbel 2SLS					
	Overall Mortality		Infant Mortality		Life Expectancy		Overall Mortality		Infant Mortality		Life Expectancy	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	–1.086 (0.433)	–0.802 (0.170)	17.77*** (0.008)	13.58*** (0.000)	3.077*** (0.000)	3.659*** (0.000)	–6.376 (0.155)	–1.976*** (0.000)	20.83** (0.023)	15.38*** (0.000)	2.774*** (0.000)	3.678*** (0.000)
TO_t	0.814** (0.035)	0.151* (0.052)	–4.171** (0.026)	–0.839*** (0.000)	0.341** (0.043)	0.0312** (0.019)	-2.281* (0.068)	–0.0942*** (0.000)	–7.780** (0.039)	–0.625*** (0.000)	0.424** (0.031)	0.0508*** (0.000)
IUI_t	–0.0498** (0.021)	–0.0252*** (0.000)	0.118 (0.260)	–0.0084 (0.553)	–0.0093 (0.322)	0.0038*** (0.000)	–0.104 (0.125)	–0.0326*** (0.000)	0.233 (0.259)	–0.0094 (0.426)	–0.0096 (0.372)	0.0036*** (0.000)
SCH_t		0.101** (0.011)		–0.318*** (0.003)		–0.0005 (0.947)		0.312*** (0.000)		–0.493*** (0.0001)		–0.0015 (0.882)
GDP_t		0.0915** (0.029)		–0.505*** (0.000)		0.0777*** (0.000)		0.523*** (0.000)		–1.029*** (0.000)		0.0600*** (0.000)
EC_t		0.128** (0.036)		–0.271* (0.095)		–0.0219** (0.039)		–0.262*** (0.000)		0.106 (0.459)		–0.0112 (0.228)
INF_t		–0.00099* (0.081)		–0.00304** (0.045)		–0.00011 (0.257)		0.0014** (0.042)		0.0039** (0.036)		–0.00016 (0.180)
$CO2_t$		–0.0968* (0.064)		0.194 (0.169)		–0.0148 (0.110)		–0.0706 (0.145)		0.379*** (0.003)		–0.0162* (0.051)
Obs.	241	174	246	174	241	174	241	174	246	174	241	174
Wald chi2/ F	6.734	53.90	53.83	768.7	41.86	1265.3	1.713	143.1	4.132	212.6	6.168	197.2

Note: GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption. Heteroscedasticity robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 16: IV 2SLS and Lewbel-2SLS estimations for Asia/Oceania, yearly data (1990–2019).

	IV 2SLS						Lewbel 2SLS					
	Overall Mortality		Infant Mortality		Life Expectancy		Overall Mortality		Infant Mortality		Life Expectancy	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	1.816*** (0.000)	–0.116 (0.802)	6.686*** (0.000)	14.39*** (0.000)	3.817*** (0.000)	3.654*** (0.000)	–0.545 (0.704)	–0.248 (0.580)	21.71*** (0.005)	10.42*** (0.000)	2.634*** (0.000)	3.997*** (0.000)
TO_t	-0.0087 (0.864)	–0.146** (0.013)	–1.032*** (0.000)	–0.382*** (0.001)	0.121*** (0.000)	0.086*** (0.000)	0.625* (0.093)	0.0657* (0.074)	–4.897** (0.0015)	–0.281*** (0.000)	0.426** (0.017)	0.0364*** (0.000)
IUI_t	–0.0059** (0.040)	–0.0037 (0.297)	–0.0708*** (0.000)	–0.0086 (0.198)	0.0048*** (0.000)	0.00071 (0.548)	–0.0308* (0.054)	–0.0212*** (0.000)	–0.0197 (0.822)	–0.0144* (0.064)	0.0013 (0.867)	0.0023** (0.010)
SCH_t		0.135*** (0.002)		–0.0782 (0.351)		0.0118 (0.947)		0.452*** (0.00)		–0.0322 (0.810)		0.0077 (0.627)
GDP_t		–0.149*** (0.000)		–0.452*** (0.000)		0.0550*** (0.000)		0.0569** (0.042)		–0.384*** (0.000)		0.0389*** (0.000)
EC_t		0.490*** (0.000)		–0.865*** (0.000)		–0.0356 (0.149)		–0.0176 (0.821)		–0.429*** (0.000)		–0.0419*** (0.003)
INF_t		0.0025*** (0.000)		0.0059*** (0.000)		–0.0008*** (0.000)		–0.0011* (0.064)		0.00895*** (0.000)		–0.00059*** (0.000)
$CO2_t$		–0304*** (0.000)		0.478*** (0.000)		0.0146 (0.448)		–0.327*** (0.000)		0.0811 (0.360)		0.0568*** (0.000)
Obs.	249	177	302	177	294	177	294	177	302	177	294	177
Wald chi2/ F	11.08	124.4	431.2	1631.0	358.0	596.1	1.844	37.62	12.28	513.1	11.60	262.5

Note: GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption. Heteroscedasticity robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Table 17: IV 2SLS and Lewbel-2SLS estimations for Europe, yearly data (1990–2019).

	IV 2SLS						Lewbel 2SLS					
	Overall Mortality		Infant Mortality		Life Expectancy		Overall Mortality		Infant Mortality		Life Expectancy	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Constant	2.303*** (0.000)	1.741*** (0.006)	11.72*** (0.000)	13.07*** (0.000)	3.357*** (0.000)	3.369*** (0.000)	2.335*** (0.000)	1.941*** (0.000)	6.514*** (0.000)	6.366*** (0.000)	3.676*** (0.000)	3.976*** (0.000)
TO_t	–0.00435 (0.960)	-0.108 (0.196)	–2.359*** (0.000)	–1.679*** (0.000)	0.2333*** (0.000)	0.137*** (0.000)	–0.0105 (0.856)	–0.0951** (0.028)	–1.112*** (0.000)	–0.0586 (0.299)	0.157*** (0.000)	0.00633 (0.309)
IUI_t	–0.0167*** (0.000)	–0.0149*** (0.000)	–0.0058 (0.786)	_0.0137 (0.392)	–0.0017 (0.421)	–0.00053 (0.681)	–0.0191*** (0.000)	–0.00666* (0.084)	–0.0723*** (0.000)	–0.0908*** (0.000)	0.00219 (0.223)	0.00521*** (0.000)
SCH_t		0.0552 (0.120)		–0.239* (0.087)		0.0206* (0.058)		–0.0221 (0.753)		–0.451*** (0.000)		0.0459*** (0.000)
GDP_t		–0.243*** (0.000)		–0.0158 (0.887)		0.0285*** (0.003)		–0.155*** (0.000)		–0.227*** (0.000)		0.0468*** (0.000)
EC_t		0.286*** (0.000)		–0.414** (0.034)		0.00642 (0.730)		0.316*** (0.000)		–0.0751* (0.077)		–0.0338*** (0.000)
INF_t		–0.00029*** (0.000)		0.00111*** (0.000)		–0.000081*** (0.001)		–0.000036 (0.970)		0.000057 (0.644)		–0.000015 (0.284)
$CO2_t$		–0.0130 (0.826)		0.205 (0.177)		–0.0217 (0.143)		–0.0813** (0.017)		0.363*** (0.000)		–0.0391*** (0.000)
Obs.	513	440	530	440	512	440	513	440	530	440	512	440
Wald chi2/ F	180.1	419.8	407.1	673.5	338.4	891.2	13.83	35.53	139.1	209.2	68.72	209.2

Note: GDP counts for GDP per capita; TO counts for trade openness; CO2 counts for carbon emissions; SCH counts for school enrolment (secondary, % gross); IUI counts for individual using internet; INF counts for inflation; EC counts for energy consumption. Heteroscedasticity robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.001$.

Appendix 1: Definition and source of variables

Variables	Signs	Definition	Source
Dependent Variable			
Infant Mortality	IM	Mortality rate, infant (per 1,000 live births)	WDI
Overall Mortality	OM	Death rate, crude (per 1,000 people)	WDI
Life Expectancy	LE	Life expectancy at birth, total (years)	WDI
Independent Variables			
Trade openness	TO	Trade (% of GDP)	WDI
Foreign direct investment	FDI	Foreign direct investment inflows (US dollars at current prices in millions)	UNCTAD
Globalization index	GI	The KOF Globalization Index	KOF Swiss Economic Institute
Technology	IUI	Individuals using the Internet (% of population)	WDI
Control Variables			
Education	SCH	School enrollment, secondary (% gross)	WDI
Inflation	INF	Inflation, GDP deflator (annual %)	WDI
Economic growth	GDP	Gross domestic product: Total and per capita, current, and constant (2015) prices, annual	UNCTAD
Pollution	CO2	CO2 emissions (metric tons per capita)	WDI
Energy consumption	EC	Energy use (kg of oil equivalent per capita)	WDI
Political stability	PS	Political stability	WGI
Regulatory quality	RQ	Regulatory quality	WGI

Appendix 2: List of countries

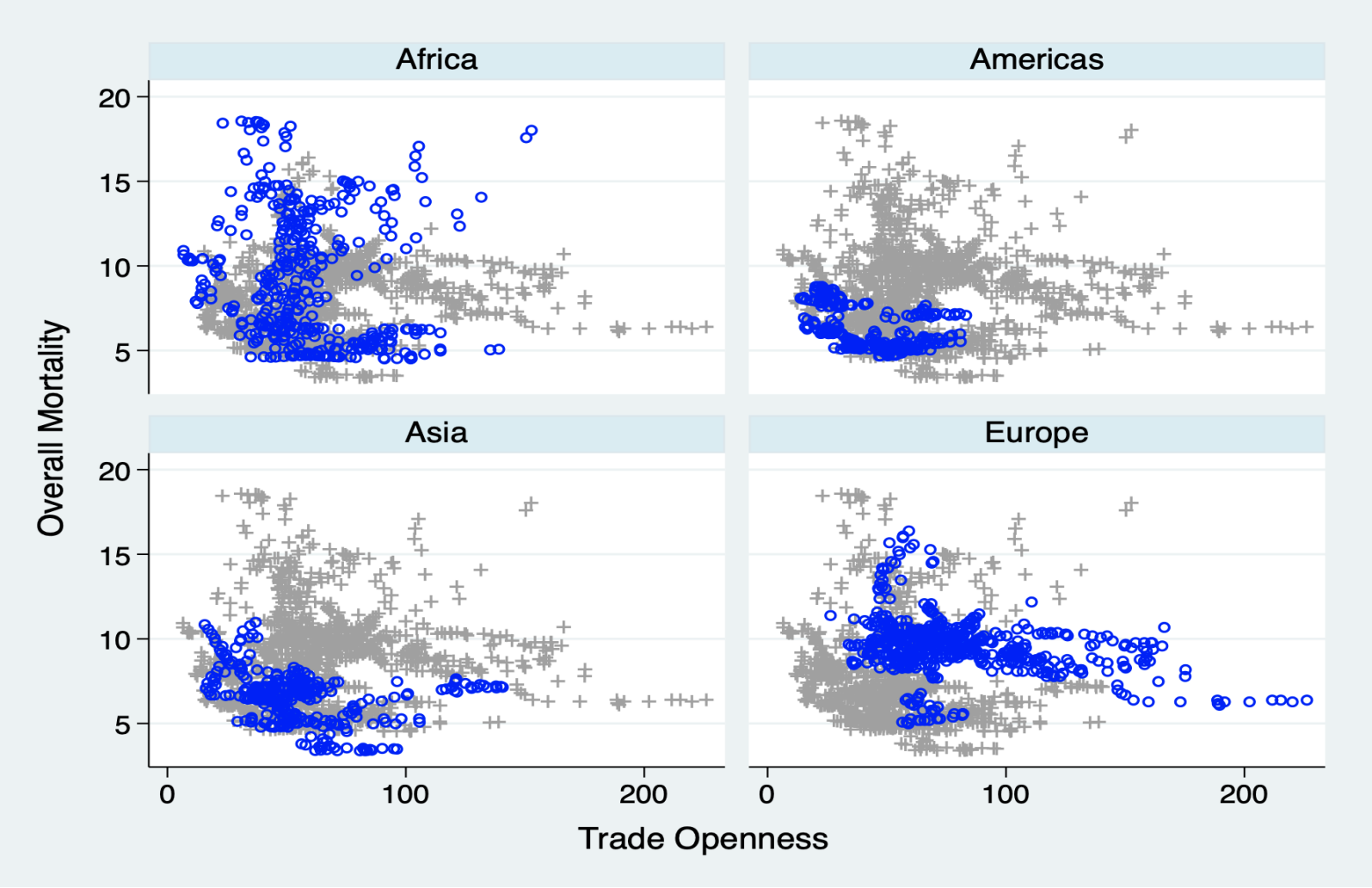
Africa: Algeria, Angola, Cameroon, Cote d'ivoire, Egypt, Ethiopia, the Gambia, Ghana, Kenya, Libya, Morocco, Nigeria, Tunisia, and South Africa.

Americas: Argentina, Brazil, Canada, Chile, Colombia, Peru, Ecuador, Mexico, and the United States of America.

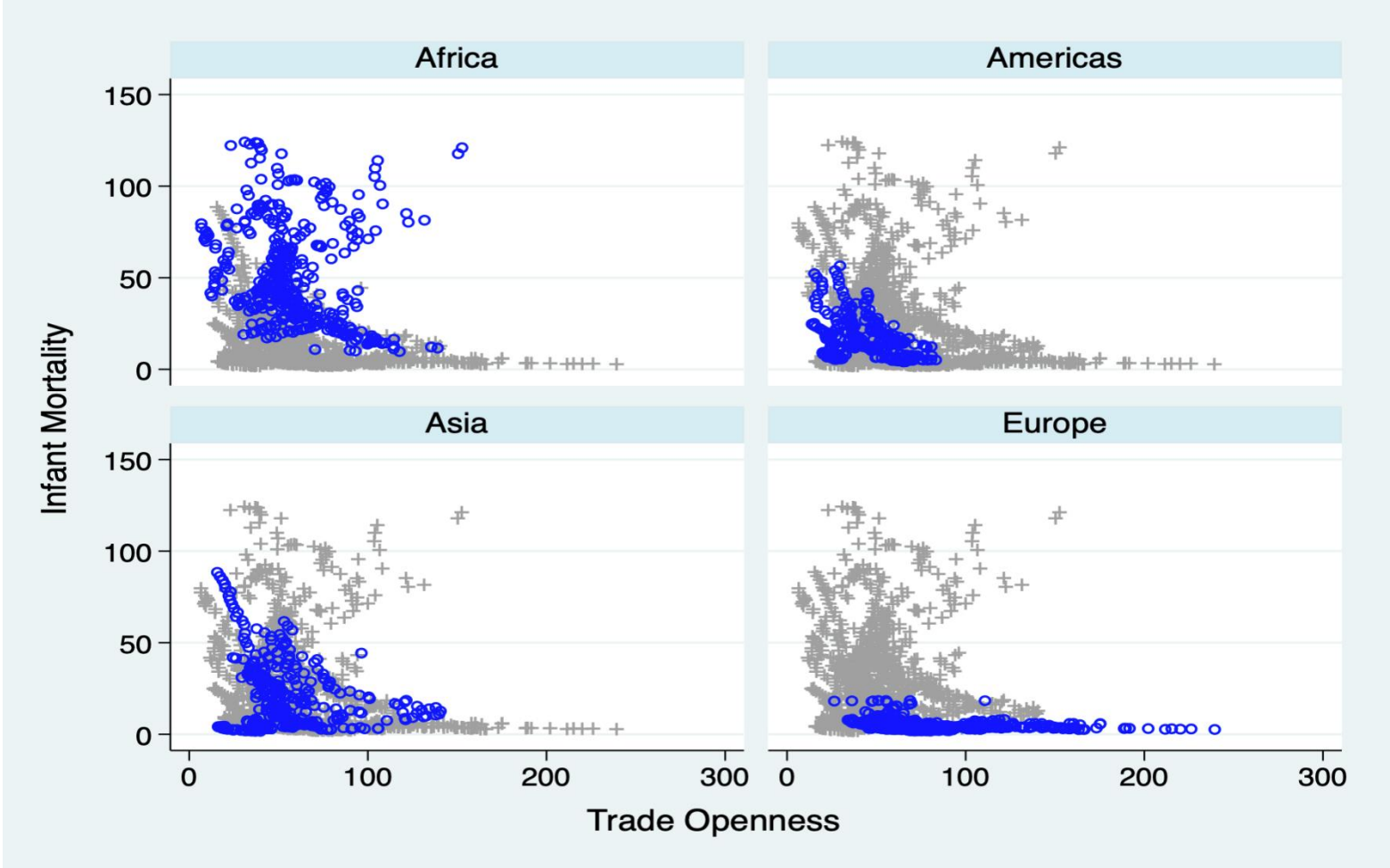
Asia/Oceania: China, Japan, India, South Korea, Indonesia, Iran, Saudi Arabia, Turkey, Thailand, Australia, and New Zeeland.

*Europe:*Israel, Germany, U.K., France, Italy, Russia, Spain, Netherland, Switzerland, Poland, Sweden Belgium, Ireland, Austria, Norway, Denmark, Finland, and Portugal.

Appendix 3: Scatter plot between overall mortality and trade openness



Appendix 4: Scatter plot between infant mortality and trade openness



Appendix 5: Scatter plot between life expectancy and trade openness