Economic complexity and health outcomes: A global perspective

Vu, Trung V.

Department of Economics, University of Otago

19 June 2020

June 19, 2020

Economic complexity and health outcomes: A global perspective

Trung V. Vu

Department of Economics, University of Otago, Dunedin, New Zealand

Abstract

Does a country's economic structure matter for health outcomes? This study, for the first time, examines the extent to which the mix of products a country produces and exports affects population health. For this purpose, I employ the Economic Complexity index (ECI) that relies on the sophistication of export bundles to extract information on the availability of productive capabilities within an economy. Using unbalanced panel data for up to 112 countries covering the period from 1970 to 2015, I find that countries exporting complex products have better health status than countries whose economic structure is mainly based on unsophisticated goods. To account for endogeneity concerns, I exploit regional averages of ECI in neighbouring countries to isolate the plausibly exogenous component of complexity that helps achieve a causal interpretation. The results lend credence to the main proposition that increased ECI is associated with health improvements. The main findings offers several implications for designing health and industrial development policies.

Key words: economic complexity, health outcomes, life expectancy, mortality.

JEL Classification: I15, J21, O14.

Correspondence: Trung Vu, Department of Economics, University of Otago, PO Box 56, Dunedin 9054, New Zealand. Email: trung.vu@postgrad.otago.ac.nz.

Acknowledgement: I am grateful to Dorian Owen for helpful comments and discussions. Any errors are my responsibility.

1. Introduction

A key line of inquiry in development economics attempts to investigate the relationship between economic development and health outcomes (see, for instance, Pritchett & Summers, 1996). It is well established in this strand of literature that income levels are positively associated with health improvements. On that basis, Dollar (2001) documents that an increase in trade openness and globalization is conducive to national health status, which is in part attributable to their growth-enhancing effects. Subsequent studies attend to this body of research, and find that trade openness may improve population health through affecting economic growth, poverty and inequality (Deaton, 2003; Levine & Rothman, 2006), knowledge spillovers (Owen & Wu, 2007), and public health expenditure (Kumar et al., 2013). Other scholars put a premium on the role of globalization in driving changes in nutrition that help better health status (e.g., Oberlander et al., 2017; Cuevas et al., 2019).[1]

A brief review of the literature exploring the development-health nexus reveals that a higher level of trade openness helps foster economic prosperity not only through enhancing robust growth but also through health improvements (Dollar, 2001). Nevertheless, previous studies have predominantly relied on using simple aggregate measures of trade flows (e.g., the sum of exports and imports as a proportion of total GDP) to quantitatively assess the impact of trade liberalization on health status (e.g., Owen & Wu, 2007). A key drawback of this approach is that it fails to reflect the quality or sophistication of products a country produces and exports. Recent studies emphasize that different types of products are associated with differentiated economic outcomes (Hausmann et al., 2007; Hidalgo & Hausmann, 2009; Hartmann et al., 2017; Lee & Vu, 2019). This leaves it open to debate whether the sophistication of a country's export bundle matters for health outcomes, which is the main question to be answered in this study. For this reason, a key distinguishing feature of this paper is to demonstrate that exporting a diverse range of complex products is linked to better health outcomes.

More specifically, the main inquiry of this paper is motivated by some recent contributions to the empirical growth literature that emphasize the role of a country's economic structure in affecting economic performance. Hausmann et al. (2007), for instance, propose that the mix of products embedded in countries' economic structure lies at the root of global income differences. Accordingly, countries producing sophisticated high-end manufactures,

[1] While most studies find that trade liberalization is good for population health, there exist several papers arguing that increased trade lowers health outcomes through enhancing disease spread (see, e.g., Case & Deaton, 2006; Ruhm, 2007; Oster, 2012). See also Blouin et al. (2009) for a review of related research.

such as automobiles and electronics, enjoy more robust economic growth, thus being relatively wealthier (Hausmann et al., 2007). Employing international trade data, Hidalgo and Hausmann (2009) recently develop the Economic Complexity index (ECI) that provides an internationally comparable measure of productive capabilities.[2] The underlying logic of this indicator holds that economic development is the process through which a country acquire new capabilities, including physical capital (e.g., transportation and communication systems), human capital (e.g., knowledge and skills), and institutions (e.g., legal systems) (Hidalgo & Hausmann, 2009). However, capturing such diverse and complex productive capabilities across countries appears to be difficult. Therefore, Hidalgo and Hausmann (2009) rely on countries' export bundles to quantify the set of productive capabilities that plays a key role in driving future patterns of economic growth across countries.

In other words, the availability of productive capabilities, regarded as non-tradeable inputs of production, can be captured by the capacity to produce and export a diverse range of sophisticated products (Hidalgo & Hausmann, 2009). It follows from this method that not only the volume of exports but also the sophistication level of export bundles matters for future growth and development (Hausmann & Hidalgo, 2011; Felipe et al., 2012; Hausmann et al., 2014). Furthermore, Hartmann et al. (2017) and Lee and Vu (2019) find that exporting complex products is associated with a more egalitarian distribution of income within an economy. Importantly, existing studies mainly focus on exploring the effect of ECI on economic growth and income inequality levels. By contrast, little attention is paid to understanding the extent to which economic complexity, which captures productive capabilities within a country, matters for population health. This inquiry is important because it may advance our understanding of the link between economic development and health outcomes.[3] It is also interesting to investigate whether growth based on complex products (high complexity) is associated with better health outcomes than growth induced by unsophisticated goods (low complexity). As such, the types of growth and exports are relevant for health improvements, besides growth rates and trade volumes as established in earlier studies. A better understanding of these relationships is particularly important for designing health policies, as discussed later.

[2] More details about this index are contained in Section 2 and the online Appendix.

[3] It is important to emphasize that health outcomes are key indicators of well-being, besides GDP per capita. Thus, a large number of studies attempt to explain cross-country differences in health status. It is also widely perceived that economic development is a multi-dimensional process. Thus, income per capita is an imperfect measure when it comes to explaining comparative development across the globe. Surprisingly, the literature linking economic structures and economic performance have largely overlooked the multi-faceted nature of economic development. Hence, it is crucial to investigate the link between economic structures and health outcomes.

The main hypothesis of this study postulates that exporting sophisticated products, captured by higher levels of economic complexity, is associated with better health outcomes. There are several arguments supporting the positive link between ECI and health status.

First, an increase in economic complexity reflects enhanced capacity to produce a diversified set of sophisticated products. The complexity of a country's economic structure is a key factor affecting social choices and human capabilities, which include, but are not limited to, occupational and learning opportunities (Hartmann, 2014; Hartmann et al., 2017). Therefore, an individual living in a simple economy driven by the production of limited low value-added commodities is constrained by few employment opportunities. By contrast, people living in a complex economy that produces a variety of sophisticated products are subject to more occupational choices. Importantly, it is well established that an individual's occupational status is a crucial determinant of people's health conditions (see, for instance, Morris et al., 1994; Martikainen & Valkonen, 1996; Strully, 2009).[4] Furthermore, economic growth driven by exporting complex goods with increasing returns provides sustained income and profits over prolonged periods (Reinert, 2008). High and sustained levels of income lead to health improvements by enhancing expenditure on goods and services (e.g., nutrition, clean water, improved sanitation facilities and medical services) (Pritchett & Summers, 1996; Dollar, 2001; Deaton, 2003; Levine & Rothman, 2006). For these reasons, producing sophisticated products helps improve national health status.

Second, some recent contributions to understanding the relationship between economic structure and comparative prosperity emphasize that various types of products are linked to differences in institutional quality, and the distribution of power and income within an economy. Indeed, the method of constructing ECI, as presented in Section 2, builds upon the intuition that sophisticated products, such as machinery, chemical and metals, are typically made in complex economies with inclusive institutions and high levels of human capital (Fukuyama, 1996; Hidalgo & Hausmann, 2009; Hidalgo, 2015). Khan (2010, 2013) argues that countries specializing in a limited number of simple products, like agricultural commodities, raw materials and resources, suffer from poor institutional quality because the returns from enforcing the rule of law and property rights are insufficient to cover the cost of enforcement. Indeed, previous studies have early revealed that post-colonial countries specializing in low value-added agricultural or mineral products are likely to experience an

[4] More specifically, employment status may affect health outcomes through several factors, such as social status and self-esteem, the consumption of alcohol and tobacco, and material deprivation (see, e.g., Herzer, 2017).

unbalanced power distribution, thus suffering from poor institutional quality, inadequate human capital and lower income levels (Innis, 1970; Engerman & Sokoloff, 1997; Acemoglu & Robinson, 2012).[5] Recently, Hartmann et al. (2017) point out that economic complexity co-evolves with institutional changes because the survival of firms depends on the ability to establish institutions that perform best in the industry they are operating. In this regard, institutions are generally created at the work place, which varies significantly across industries. Sophisticated products, therefore, are positively linked to the inclusiveness of institutions.

In less complex economies, a lack of diverse economic activities is associated with a more unequal power distribution and a vertical hierarchy in the occupational structure, which tend to emerge to manage a huge cadre of unskilled workers (Hartmann, 2014; Hartmann et al., 2017; Lee & Vu, 2019). Their economic structures are typically dominated by one main sector (agriculture or mineral industries) with limited social and employment choices. Hence, an economic premium tends to accrue to a few individuals with superior skills and knowledge, with the cost borne by the rest of the population. It follows from this argument that non-diverse economies mainly based on natural resources are characterized by an unequal distribution of power and income (Engerman & Sokoloff, 1997; Collier, 2008; Hartmann, 2014). Furthermore, exporting a range of sophisticated products with increasing returns helps sustain a strong tax base. Conventional wisdom in the public health literature postulates that fiscal and organizational capacity, which partly form good institutions, determines the extent to which a country can deliver an efficient tax-funded health system that helps improve population health (Besley & Kudamatsu, 2006; Fafchamps, 2006; Knowles & Owen, 2010).[6] Furthermore, it is widely acknowledged that income inequality is harmful to health outcomes (see, for instance, Pickett & Wilkinson, 2015). Therefore, economic complexity betters health outcomes through fostering inclusive institutions, and lowering inequality in income and power.[7]

[5] The relationship between economic complexity and institutions is consistent with an influential view in the comparative development literature positing the colonial origins of income differences (Acemoglu et al., 2001). In particular, extractive industries and institutions were set up in places where the disease environment made it difficult for European colonizers to settle down permanently. By contrast, inclusive institutions and non-extractive were established in areas with favour disease conditions.

[6] In particular, the quality of institutions, reflected in security of property rights, the effectiveness of governance, and the capacity to control corruption, are of importance for establishing an efficient public health system and infrastructure (Fafchamps, 2006). Furthermore, strong fiscal capacity provides resources for state provision of health services (e.g., clean water, sanitation facilities, treatment of infectious diseases), which helps achieve better health outcomes (Besley & Kudamatsu, 2006).

[7] See Hartmann et al. (2017) and Lee and Vu (2019) for discussions on the link between ECI and income inequality.

Finally, economic complexity reflects the availability of knowledge and knowhow within a country (Hidalgo & Hausmann, 2009; Hidalgo, 2015; Hartmann et al., 2017). For this reason, the capacity to produce sophisticated products critically depends on the quality of human capital and knowledge, which may be hard to find in resource-rich or less complex economies. On the one hand, knowledge and education are widely acknowledge as promoting population health. On the other hand, Wigley (2017) argues that countries whose production is mainly based on resources or unskilled labour invest less in health improvements mainly because non-tax revenues are readily available in these societies. By contrast, the government in complex or resource-poor economies tends to rely more on tax revenues, stemming mainly from high-productivity production. These sophisticated activities in turn require a healthy and well-educated population. Therefore, countries exporting complex products are more motivated to invest in health improvements, leaving them with better health status. In line with this argument, several studies find that countries specializing in agricultural products or resources have lower incentives to invest in public goods such as health or education (e.g., Cockx & Francken, 2014, 2016; Wigley, 2017). Therefore, economic complexity acts as a catalyst for investment in public health systems and infrastructure, which arguably helps achieve better health outcomes.

The above narrative suggests that economic complexity is positively associated with health outcomes. This hypothesis is empirically tested using unbalanced panel data for up to 112 countries from 1970 to 2015. To preview my main findings, the pooled OLS and two-way fixed effects estimates reveal that economic complexity helps lower infant, under-five and neonatal mortality rates, and improve life expectancy at birth. The results are largely robust to controlling for a number of key determinants of health outcomes, and unobserved country- and year-specific factors. A key threat to obtaining causal interpretations in the development-health literature is potential endogeneity concerns. To address these issues, this study constructs a time-varying instrumental variable for economic complexity based on regional averages of complexity levels. The IV-2SLS estimates lend support to the main hypothesis of this research, accounting for an extensive set of confounding factors and potential weak instrument bias. I also perform other sensitivity tests, including estimating different sub-samples and removing outliers. None of these empirical exercises alters the core results. To summarize, this paper documents a robust effect of economic complexity on health outcomes, which has been largely ignored in previous studies. Importantly, the main findings offer several implications for designing health policies as discussed in Section 5.

The rest of the study is structured as follows. Section 2 presents the baseline econometric model and descriptions of variables and data sources. Section 3 discusses main findings, followed by the results of robustness checks in Section 4. Section 5 concludes by summarizing the core results and presenting some policy implications.

2. Empirical approach

Econometric specification

To estimate the effect of ECI on health outcomes, I specify the following econometric model:

$$Health_{it} = \alpha + \beta ECI_{it} + \gamma X_{it} + \mu_i + \tau_t + \varepsilon_{it}$$

where $Health_{it}$ stands for different measures of health outcomes of country i in period t. ECI_{it} is an index of economic complexity, capturing the sophistication of a country's economic structures. β reflects the estimated effect of ECI on population health. X_{it} denotes a set of main control variables as explained below. μ_i is unobserved heterogeneity across countries. τ_t is unobserved time-specific factors. ε_{it} is an overall error term. To reduce potential measurement bias and short-run fluctuations because of business cycles, I employ data for five-year non-overlapping time intervals ($T = 10$), covering the period from 1970 to 2015.[8]

Variables and data

The main variable of interest in this paper is ECI, obtained from the MIT's Observatory of Economic Complexity (https://oec.world/en/). This indicator is constructed using international trade data from the United Nations Comtrade database to measure cross-country differences in the sophistication of economic structure, using the method of reflections (e.g., Hidalgo & Hausmann, 2009; Hausmann & Hidalgo, 2011; Hausmann et al., 2014).

More specifically, Hidalgo and Hausmann (2009) attempt to capture the complexity of countries' economic structure based on the ***diversity*** of an economy (the number of products it exports with RCA) and the ***ubiquity*** of its products (the number of countries that exports a given product with RCA).[9] The underlying logic of this approach holds that complex economies are characterized by the ability to produce and export a diverse set of sophisticated

[8] Data for health outcomes, obtained from the World Bank's World Development Indicators, are available on an annual basis based on linear interpolation. Furthermore, some control variables are provided for every five-year periods. Thus, I construct unbalanced data using five-year intervals. This approach has been widely applied in the empirical growth literature (see, e.g., Berg et al., 2018).

[9] RCA stands for the Revealed Comparative Advantage (Balassa, 1965). The main motivation of considering RCA is to account for variations in the size of countries and of product markets to obtain an internationally comparable metric across countries (Hausmann & Hidalgo, 2011).

products with low ubiquity because only a limited number of countries with enhanced productive capabilities can produce these sophisticated goods. By contrast, simpler economies possess limited productive capabilities, thus exporting a less diversified set of ubiquitous products. Felipe et al. (2012) find that the most sophisticated products are machinery, chemicals and metals while the least sophisticated goods are raw materials, agricultural products, wood, and textiles. As argued by Hidalgo and Hausmann (2009), measuring productive capabilities, which may include infrastructure systems, the quality of human capital, institutional quality, and other non-tradeable inputs of production, is challenging. For this reason, we can rely on what a country exports to extract information on its productive capacity, which plays a key role in driving future prosperity (Hidalgo & Hausmann, 2009).

The measures of *Diversity* and *Ubiquity* are computed as follows.

$$Diversity = k_{c,0} = \sum_{p=1}^{N_p} M_{cp}$$

$$Ubiquity = k_{p,0} = \sum_{c=1}^{N_c} M_{cp}$$

where c and p stands for the country and product, respectively. M_{cp} equals one if country c exports product p with RCA, and zero otherwise.

The method of reflections relies on computing jointly and iteratively the average value calculated in the preceding iteration. According to Hidalgo and Hausmann (2009), this iterative process starts with the measure of *Diversity* $(k_{c,0})$ that captures the number of products a country exports in a given year. Next, *Ubiquity* $(k_{p,0})$ is utilized to incorporate information on the ubiquity level of these products. This helps provide information on the number of products a country exports weighted by the ubiquity of these products. The process also takes into consideration the average diversity of countries exporting the same products as country c. This iterative process ends when no further information can be obtained from the previous iteration. Following Hidalgo and Hausmann (2009), the *n*th iteration can be written as follows.

$$k_{c,n} = \frac{1}{k_{c,0}} \sum_{p=1}^{N_p} M_{cp}\, k_{p,n-1}$$

where

$$k_{p,n-1} = \frac{1}{k_{p,0}} \sum_{c=1}^{N_c} M_{cp} k_{c,n-2}$$

Substituting $k_{p,n-1}$ into $k_{c,n}$, we obtain

$$k_{c,n} = \frac{1}{k_{c,0}} \sum_{p=1}^{N_p} M_{cp} \frac{1}{k_{p,0}} \sum_{c\prime=1}^{N_{c\prime}} M_{c\prime p} k_{c\prime,n-2}$$

As demonstrated by Hausmann et al. (2014), it can be re-expressed as follows.

$$k_{c,n} = \sum_{c\prime} \widetilde{M_{cc\prime}} k_{c',n-2}$$

in which

$$\widetilde{M}_{cc\prime} = \sum_{p} \frac{M_{c,p} M_{c',p}}{k_{c,0} k_{p,0}}$$

Finally, the vector of all ECI values for each country is given by.

$$ECI_c = \frac{\vec{K} - \langle \vec{K} \rangle}{std(\vec{K})}$$

in which $\vec{K}$ is the eigenvector of $\widetilde{M}_{cc\prime}$ associated with the second largest eigenvalue, as denoted by Hausmann et al. (2014). $\langle \, . \, \rangle$ and std stands for average and standard deviation, respectively.

Following the existing literature, I employ different measures of population health as dependent variables, including infant, under-five, and neonatal mortality rates, and life expectancy at birth. All data are taken from the World Bank's World Development Indicators. Using various measures of health outcomes helps reduce measurement bias. Furthermore, I incorporate a number of key determinants of national health status in the regression to reduce omitted variable bias.[10] As discussed earlier, income plays an important role in health improvements (Pritchett & Summers, 1996; Dollar, 2001). Part of my arguments presented above also suggest that ECI may foster robust economic growth through which it betters health status. To mitigate a concern that the health impact of ECI may just proxy for income levels, I include GDP per capita as a control variable. Furthermore, other studies suggest that institutional quality (Fafchamps, 2006; Rajkumar & Swaroop, 2008; Knowles & Owen, 2010;

[10] Later, I account for measurement and omitted variable bias more thoroughly by adopting plausibly exogenous sources of variation in economic complexity (Section 4).

Li et al., 2018), urban population (Li et al., 2018), trade openness (Owen & Wu, 2007), democracy (Besley & Kudamatsu, 2006), and income inequality (Pickett & Wilkinson, 2015) may exert an influence on health outcomes. These variables, therefore, are included in the set of baseline control variables. Further, a set of country and year dummies are included to control for unobserved heterogeneity across countries and over the years.[11]

3. Results

Figure 1 illustrates the correlation between economic complexity and different measures of health outcomes. Accordingly, ECI is negatively correlated with infant, under-five and neonatal mortality rates, while we can observe a positive relationship between ECI and life expectancy at birth. This is largely consistent with the main proposition of this study. However, these findings may not imply causal interpretations other than simple correlations.

To achieve causal inference on the effect of ECI on national health status, I estimate the benchmark model using pooled OLS (POLS) and two-way fixed effects (2FE) estimators. The core results are reported in Table 1. In particular, I incorporate a set of baseline control variables in all regressions to reduce omitted variable bias. To control for unobserved country- and time-specific factors, country and year dummies are added to columns (2), (4), (6) and (8). Table 1 demonstrates that the estimated coefficients of ECI have expected signs, and are statistically significant at the 1% level except in column (5). More specifically, increased economic complexity exerts a negative influence on mortality rates (columns 1-6). I also find that ECI has a statistically significant and positive impact on life expectancy at birth, ceteris paribus. These results lend support to the hypothesis that the sophistication of a country's economic structure helps improve health outcomes. The findings are broadly robust to accounting for key determinants of population health established in previous studies. The magnitude of the estimated coefficients of ECI varies significantly when I account for unobserved heterogeneity across countries and over years. Nevertheless, the baseline findings retain their signs and significance levels in all cases, controlling for these time-invariant factors. In addition, my findings are largely insensitive to using different measures of population health (Table 1).[12]

[11] More details on variables' descriptions and data sources are presented in the online Appendix.

[12] The estimated coefficients also suggest that economic complexity exerts a sizeable influence on health outcomes. For instance, the results reported in column (8) of Table 1 indicate that a one-unit increase in ECI is associated with approximately a 1.3-year increase in life expectancy, a sizeable effect. This lends support to the economic importance of economic complexity in affecting population health.

The inclusion of baseline control variables is mainly motivated by the existing literature exploring the macroeconomic determinants of health outcomes. It is important to note that controlling for these variables helps factor out the effect of ECI on health outcomes from these confounding factors. This issue can also be addressed by employing the exogenous component of economic complexity, as discussed later. The estimated coefficients of these controls are consistent with the findings of previous studies, except for income per capita and trade openness. In particular, I find that the estimated effect of income levels and trade liberalization is relatively sensitive to controlling for unobserved country- and year-specific characteristics and economic complexity.[13] As presented in Table 1, the coefficients of these variables become imprecisely estimated in some cases, and their signs are in contrast to the findings in earlier studies (see, for instance, Pritchett & Summers, 1996; Dollar, 2001; Deaton, 2003; Levine & Rothman, 2006; Owen & Wu, 2007).

For instance, trade openness is found to increase mortality rates and has no statistically significant influence on life expectancy in columns (2), (4), (6) and (8). Furthermore, GDP per capita is positively linked to infant and under-five mortality rates, and its effect on life expectancy is imprecisely estimated, as shown in columns (2), (4) and (8) of Table 1. This is because the existing literature largely fails to incorporate the sophistication of a country's products when exploring the determinants of health outcomes. My findings, therefore, suggest that economic complexity plays a more important role on health status. These results reinforces the argument that health improvements depend not only on trade flows or the rate of economic growth but also on the sophistication of exports and the types of economic growth. In this regard, economic growth mainly based on exporting less complex products (e.g., agriculture or resources) may be harmful for population health. By contrast, growth driven by exporting a diverse range of sophisticated commodities (e.g., high-technology manufactures) with increasing returns helps improve health outcomes. Therefore, the types of growth are of importance when it comes to explaining health outcomes.

Turning to other covariates, the signs of their estimated coefficients are broadly in line with expectations. In particular, the fraction of urban population is associated with better health outcomes in all cases, which is consistent with the findings of Li et al. (2018). Further, institutional quality is widely documented in the public health literature as a key determinant of health outcomes (Fafchamps, 2006; Rajkumar & Swaroop, 2008; Knowles & Owen, 2010;

[13] The inclusion of country and year FE helps account for the effect of several economic, cultural and political factors that are a key concern in cross-country studies.

Li et al., 2018). The theoretical reasoning discussed in Section 1 suggests that the quality of institutions may be one potential channel of transmission from ECI to health outcomes. However, the main findings remain precisely estimated even when I control for institutions. This suggests that my results do not merely capture the health effect of institutions established in the literature. The level of income inequality has a negative impact on health outcomes, but the estimated coefficients of this variable are statistically insignificant at conventionally accepted levels in some cases (Table 1). In line with Besley and Kudamatsu (2006), I find that democracy betters population health.

In summary, I find that increased economic complexity exerts a positive influence on population health, regardless of using any measures of national health status. The findings also remain precisely estimated after I control for an extensive set of key determinants of population health, and unobserved heterogeneity across countries and over years.[14]

4. Robustness checks

Endogeneity concerns

A major threat to identification stems from endogeneity concerns, partly induced by reverse causation running from population health to economic performance (Levine & Rothman, 2006; Owen & Wu, 2007).[15] Furthermore, omitted variable and measurement error bias may confound the main results. Addressing these issues requires isolating the exogenous component of economic complexity from which we can draw causal inference.

The present study offers a novel empirical approach to the development-health literature by exploiting the spatial distribution of economic complexity across countries to perform IV-2SLS regressions. The underlying logic of this method is that regional averages of ECI (*ECI_ravg*) are strongly correlated with a country's complexity levels. This assumption is supported by a recent paper demonstrating that a country tends to export products currently exported by a neighbouring country (Bahar et al., 2014). The explanation for this finding holds that geographic proximity fosters the diffusion of knowledge and technologies, thus driving economic complexity of neighbouring countries. In addition, economic complexity levels may

[14] The baseline estimates are largely robust to accounting for other determinants of health, such as public health expenditures, access to sanitation, and years of schooling. However, incorporating these variables in the regression constrains the feasible sample size significantly, making it difficult to obtain an overall understanding of the complexity-health relationship. This is mainly because of the scarcity of data over the period 1970-2015. For this reason, I do not include them as main controls. These results are available upon request.

[15] Health capital is a key determinant of productivity. Thus, counties with healthier workers may enjoy higher levels of economic complexity.

transcend national borders through peer pressure and imitation effects (Buera et al., 2011; Giuliano et al., 2013). These results suggest that *ECI_ravg* is not a weak instrument.[16] Recently, Acemoglu et al. (2019), and Gründler and Krieger (2016) adopt a similar approach by using regional waves of democratization as a valid instrument for a country's own democracy to estimate its causal effects on economic growth. In addition, Cherif et al. (2018) use averages of export sophistication in neighbouring countries as an instrument for a country's national export sophistication in growth regressions. Therefore, I exploit the regional averages of ECI to isolate plausibility exogenous variations in each country's complexity levels in a given year.

A key assumption is that *ECI_ravg* exerts no direct influence on a country's health outcomes, conditional on controlling for a set of covariates. It is important to emphasize that we cannot empirically test the exogeneity condition mainly because of the unobserved nature of the error term. Nevertheless, we can identify potential channels that may invalidate the instrument, and incorporate them in the regression. Acemoglu et al. (2019), in particular, control for several confounding factors to mitigate potential deviation from the exclusion restrictions. As such, the exogeneity assumption is satisfied conditional on accounting for a range of confounding factors. Countries located in the same region may share common fixed factors, like geography, climate, and cultures that arguably affect the regional dissemination of economic complexity and health outcomes. I account for this possibility by including country FE in all regressions to control for these unobserved time-invariant traits. Furthermore, health outcomes can be affected by spillover effects from proximate economies mostly through trade and capital flows, which facilitate technological transfers. I account for this mechanism by maintaining the use of trade openness as a control variable.[17] Additional controls to reduce potential deviation from the exclusion restrictions will be used later.

To construct *ECI_ravg*, I divide the sample into seven disjoint regions, following the World Bank's classifications.[18] The calculation can be expressed as follows.

$$ECI\_ravg_{it} = \frac{1}{N_{rt} - 1} \sum_{j \neq i}^{N_{rt} - i} ECI_{jt}$$

[16] Later, I also perform several tests of robust inference to weak instruments.

[17] Capital flows may be captured by FDI, which is highly correlated with trade openness. Therefore, I do not include it the same regression with trade openness. Using FDI as a control variable, however, does not alter my results (available on request). Baseline control variables are included in all IV regressions.

[18] Acemoglu et al. (2019) employ the same classifications of regions. Each country is assigned to exactly one particular region as classified by the World Bank.

where N_{rt} denotes the number of countries in region r at year t. j stands for neighbouring countries of domestic country i. For each country in a given year, I calculate the averages of economic complexity of neighbouring countries located in a particular region, excluding a country's own ECI values. A broad definition of regions tends to remove the regional variation in ECI that may directly affect domestic health outcomes, but this may reduce the correlation between *ECI_ravg* and *ECI*. By contrast, a narrower definition may increase the possibility that I include neighbouring countries that directly affect domestic health, but this can reduce weak instrument bias. Hence, a crucial issue is the choice of region classifications. For this reason, I also use a narrower definition of regions, following Gründler and Krieger (2016). More details on these are provided in the online Appendix.

According to the results shown in panel B of Table 2, ECI in neighbouring countries has a positive and statistically significant effect on a country's economic complexity. The results reveal that being proximate to countries exporting sophisticated products helps improve the sophistication of a country's own economic structure. This lends support to the findings of Bahar et al. (2014). A number of weak instrument tests are also reported in Panel C of Table 2. These results provide strong evidence that *ECI_ravg* is not a weak instrument.[19] As a final robustness check for the instrument's relevance, I report additional results in Panel D of Table 2, following Andrews et al. (2019). Specifically, Andrews et al. (2019) recommend reporting the effective first-stage F-statistic proposed by Olea and Pflueger (2013) for non-homoscedastic, serially correlated, and clustered data when testing for weak instruments. In all cases, the effective F-statistic is much larger than the rule-of-thumb of 10, which lends credence to the instrument's relevance. Furthermore, Andrews et al. (2019) suggest relying on identification-robust Anderson-Rubin confidence intervals. In the case of a single instrument, these confidence sets are efficient regardless of the strength of the instrument in the reduced-form regression. The results reveal that the zero value lies outside the 95% confidence intervals in all cases, supporting the interpretation of statistically significant findings.[20]

As represented in panel A of Table 2, the exogenous component of ECI is found to lower mortality rates and improve life expectancy. The effect is also precisely estimated at the 1%

[19] In particular, the F-statistic value of excluded instrument is much larger than the rule-of-thumb value of 10. I also obtain broadly similar results when performing the Anderson-Rubin test of robust inference to weak instrumentation. Furthermore, we can also reject the null that *ECI_ravg* is just weakly correlated with ECI when using the Cragg-Donald and Kleibergen-Paap Wald test.

[20] This method adopts test reversion instead of using point estimates and standard errors because the IV estimates are non-normally distributed under the case of weak instruments. For more details see Andrews et al. (2019).

level of significance in all cases, which is consistent with the baseline estimates. However, the magnitude of the estimated coefficients is much larger than POLS and 2FE estimates reported in Table 1. Hence, the estimated effect of ECI on health outcomes is larger when using IV regression. This may correspond to downward bias induced by failure to account for potential unobserved time-varying factors or measurement errors. The results in Table 2 are largely robust to using different classifications of regions as discussed earlier.

National health status may be affected by economic complexity levels of neighbouring countries through other potential channels, which include, but are not limited to, spillover effects and regional fixed traits. The inclusion of country FE and a measure of trade openness in the regression partly reduces this concern, as discussed earlier. In Table 3, I further address this problem by controlling for net migration and an index of globalization.[21] A measure of population size is also incorporated in the model because larger countries may be less affected by their neighbours. Following Acemoglu et al. (2019), I include regional patterns of economic growth to further capture the spillover effects that may confound the validity of the instrument.[22] This is because regional patterns of economic growth may trigger the dissemination of economic complexity and health technologies, thus invaliding the instruments. The inclusion of these additional controls nonetheless fails to alter the main findings. Overall, I attempt to control for a number of confounding factors in the IV regressions to mitigate any potential violations of the exclusion restrictions. The inclusion of these control variables also helps distinguish the regional dissemination of economic complexity from the effect of common region-specific factors, regional economic shocks, or the diffusion of economic conditions between countries in the same region through trade openness or other channels. Importantly, if the regional averages of ECI affect a country's national health status through these channels, the exclusion restrictions are still satisfied conditional on incorporating them in the regression. For this reason, I may isolate a plausibly exogenous source of variation in complexity that helps achieve causal inference.

In summary, this section exploits the plausibly exogenous component of ECI, based on knowledge diffusion, peer pressure and imitation effects, to estimate achieve causal inference.

[21] The KOF globalization index reflects the global integration of not only economic but also political and cultural activities.

[22] Acemoglu et al. (2019) postulate that regional waves of democratization may directly affect a country's economic growth through spillover effects. The authors account for this channel of influence by incorporating regional growth in the regression. In the same vein, regional patterns of economic growth may be correlated with the regional diffusion of economic complexity and health outcomes.

Compared with the baseline results, the IV estimates give larger estimated coefficients when I attempt to account for endogeneity concerns. However, my findings remain precisely estimated at the 1% level of significance across different model specifications. The results, therefore, provide evidence of a positive effect of economic complexity on population health.

Other robustness checks

I provide the results of additional sensitivity tests in the online Appendix. *First*, I test for robustness to sample selection by excluding Asia, Oceania, Africa, Europe, and America from the regression. Following Knowles and Owen (2010), I also remove countries with a communist legacy.[23] African countries are characterized by significantly poorer health, which may drive the core results. The exclusion of other continents also mitigates a concern that the core results just proxy for regional differences in economic performance and health outcomes. Nevertheless, the core findings retain their signs and significance levels (the Appendix Tables A1 and A2). *Second*, I check for robustness to removing outliers based on estimating the Cook's distance, standardized errors and robust regression weights. The results and detailed explanations are presented in the Appendix Table A3. Accordingly, the effect of economic complexity on national health status remains precisely estimated at the 1% level of significance when I estimate restricted samples excluding potential outliers.

5. Conclusion

The link between economic performance and population health is a key topic of fruitful discussions among economists and policymakers. It is widely acknowledged in this line of inquiry that increased income and trade openness lead to health improvements. Nevertheless, previous studies exploring this issue largely fail to incorporate the sophistication of a country's products, which has been linked to differentiated economic outcomes. In this regard, this paper goes beyond the current literature by postulating that countries exporting complex products enjoy lower mortality rates and longer life expectancy at birth than their counterparts exporting unsophisticated goods. Employing the Economic Complexity index, this study employs unbalanced panel data for up to 112 countries from 1970 to 2015, and finds strong evidence supporting the positive relationship between complexity and health status. My findings are largely insensitive to accounting for an extensive set of control variables and unobserved heterogeneity. I also address potential endogeneity concerns by exploiting regional averages of

[23] These countries experienced a negative health shock when they transformed themselves from socialist systems, with free healthcare, to market economies, with inadequately managed and often corrupt public health systems.

economic complexity to as an instrumental variable, which provides a valid basis for causal inference. Accordingly, the IV estimates are largely consistent with the main findings. Furthermore, the IV results are also robust to testing for weak instrument bias and controlling for a number of confounding factors.

This study reveals that the complexity of countries' economic structure, which represents the mix of products they produce and export, is highly predictive of not only economic growth but also health outcomes. Furthermore, different types of products are associated with different health outcomes, which advances our understanding of the development-health nexus. More specifically, increased trade flows or income based on exporting a diverse range of sophisticated products is more conducive to population health. For this reason, the types of growth and the quality of exports are of importance for health outcomes. Conventional wisdom in earlier research postulates that health improvements depend on the extent to which a country can provide an efficient tax-funded public health system and infrastructure, which is in turn linked to income levels and the quality of institutions (see, e.g., Pritchett & Summers, 1996; Deaton, 2003; Fafchamps, 2006; Rajkumar & Swaroop, 2008; Knowles & Owen, 2010). In this regard, my findings demonstrate that the effectiveness of health policies, based on previous studies, can be limited in less complex economies essentially because the range of products embedded in their economic structure is a key factor affecting health outcomes. I believe that these results are particularly relevant for developing economies that typically suffer from poor health and low levels of economic complexity.

References

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review, 91*(5), 1369-1401.

Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J. A. (2019). Democracy Does Cause Growth. *Journal of Political Economy, 127*(1), 47-100.

Acemoglu, D., & Robinson, J. A. (2012). *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. New York: Crown Business.

Andrews, I., Stock, J. H., & Sun, L. (2019). Weak Instruments in Instrumental Variables Regression: Theory and Practice. *Annual Review of Economics, 11*(1), 727-753.

Bahar, D., Hausmann, R., & Hidalgo, C. A. (2014). Neighbors and the Evolution of the Comparative Advantage of Nations: Evidence of International Knowledge Diffusion? *Journal of International Economics, 92*(1), 111-123.

Balassa, B. (1965). Trade Liberalisation and "Revealed" Comparative Advantage. *Manchester School, 33*(2), 99-123.

Berg, A., Ostry, J. D., Tsangarides, C. G., & Yakhshilikov, Y. (2018). Redistribution, Inequality, and Growth: New Evidence. *Journal of Economic Growth, 23*(3), 259-305.

Besley, T., & Kudamatsu, M. (2006). Health and Democracy. *American Economic Review, 96*(2), 313-318.

Blouin, C., Chopra, M., & van der Hoeven, R. (2009). Trade and Social Determinants of Health. *Lancet, 373*(9662), 502-507.

Buera, F. J., Monge-Naranjo, A., & Primiceri, G. E. (2011). Learning the Wealth of Nations. *Econometrica, 79*(1), 1-45.

Case, A., & Deaton, A. (2006). *Health and Well-Being in Udaipur and South Africa*: University of Chicago Press.

Cherif, R., Hasanov, F., & Wang, L. (2018). Sharp Instrument: A Stab at Identifying the Causes of Economic Growth. IMF Working Paper WP/18/117.

Cockx, L., & Francken, N. (2014). Extending the Concept of the Resource Curse: Natural Resources and Public Spending on Health. *Ecological Economics, 108*, 136-149.

Cockx, L., & Francken, N. (2016). Natural Resources: A Curse on Education Spending? *Energy Policy, 92*, 394-408.

Collier, P. (2008). *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It*. Oxford, UK: Oxford University Press.

Cuevas , S. G.-D., Cornselsen, L., Smith, R., & Walls, H. (2019). Economic Globalization, Nutrition and Health: A Review of Quantitative Evidence. *Globalization and Health, 15*, 1-19.

Deaton, A. (2003). Health, Inequality, and Economic Development. *Journal of Economic Literature, 41*(1), 113-158.

Dollar, D. (2001). Is Globalization Good for Your Health? *Bulletin of the World Health Organization, 79*, 827-833.

Engerman, S. L., & Sokoloff, K. L. (1997). Factor Endowments, Institutions, and Differential Paths of Growth among New World Economies. In S. H. Haber (Ed.), *How Latin America Fell Behind* (pp. 260-304). Stanford, CA: Stanford University Press.

Fafchamps, M. (2006). Development and Social Capital. *Journal of Development Studies, 42*(7), 1180-1198.

Felipe, J., Kumar, U., Abdon, A., & Bacate, M. (2012). Product Complexity and Economic Development. *Structural Change and Economic Dynamics, 23*(1), 36-68.

Fukuyama, F. (1996). *Trust: Human Nature and the Reconstitution of Social Order*. New York: Free Press.

Giuliano, P., Mishra, P., & Spilimbergo, A. (2013). Democracy and Reforms: Evidence from a New Dataset. *American Economic Journal: Macroeconomics, 5*(4), 179-204.

Gründler, K., & Krieger, T. (2016). Democracy and Growth: Evidence from a Machine Learning indicator. *European Journal of Political Economy, 45*, 85-107.

Hartmann, D. (2014). *Economic Complexity and Human Development: How Economic Diversification and Social Networks Affect Human Agency and Welfare*. New York: Routledge.

Hartmann, D., Guevara, M. R., Jara-Figueroa, C., Aristarán, M., & Hidalgo, C. A. (2017). Linking Economic Complexity, Institutions, and Income Inequality. *World Development, 93*, 75-93.

Hausmann, R., & Hidalgo, C. A. (2011). The Network Structure of Economic Output. *Journal of Economic Growth, 16*(4), 309-342.

Hausmann, R., Hidalgo, C. A., Bustos, S., Coscia, M., Simoes, A., & Yildirim, M. A. (2014). *The Atlas of Economic Complexity: Mapping Paths to Prosperity*. Cambridge, MA: The MIT Press.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What You Export Matters. *Journal of Economic Growth, 12*(1), 1-25.

Herzer, D. (2017). The Long-Run Relationship between Trade and Population Health: Evidence from Five Decades. *World Economy, 40*(2), 462-487.

Hidalgo, C. A. (2015). *Why Information Grows: The Evolution of Order, from Atoms to Economies*. New York: Basic Books.

Hidalgo, C. A., & Hausmann, R. (2009). The Building Blocks of Economic Complexity. *Proceedings of the National Academy of Sciences, 106*(26), 10570-10575.

Innis, H. A. (1970). *The Fur Trade in Canada: An Introduction to Canadian Economic History*. Toronto, Canada: University of Toronto Press.

Khan, M. H. (2010). *Political Settlements and the Governance of Growth-Enhancing Institutions*. London: SOAS, University of London.

Khan, M. H. (2013). Political Settlements and the Design of Technology Policy. In J. E. Stiglitz, J. L. Yifu, & E. Patel (Eds.), *The Industrial Policy Revolution II: Africa in the 21st Century* (pp. 243-280). London: Palgrave Macmillan UK.

Knowles, S., & Owen, P. D. (2010). Which Institutions Are Good for Your Health? The Deep Determinants of Comparative Cross-Country Health Status. *Journal of Development Studies, 46*(4), 701-723.

Kumar, K., Ram, F., & Singh, A. (2013). Public Health Spending on Infant and Child Mortality in India During the Years 1980–2006. *Lancet, 381*, 17-19.

Lee, K.-K., & Vu, T. V. (2019). Economic Complexity, Human Capital and Income Inequality: A Cross-Country Analysis. *Japanese Economic Review*, forthcoming.

Levine, D. I., & Rothman, D. (2006). Does Trade Affect Child Health? *Journal of Health Economics, 25*(3), 538-554.

Li, Q., An, L., Xu, J., & Baliamoune-Lutz, M. (2018). Corruption Costs Lives: Evidence from a Cross-Country Study. *European Journal of Health Economics, 19*(1), 153-165.

Martikainen, P. T., & Valkonen, T. (1996). Excess Mortality of Unemployed Men and Women During a Period of Rapidly Increasing Unemployment. *Lancet, 348*(9032), 909-912.

Morris, J. K., Cook, D. G., & Shaper, A. G. (1994). Loss of Employment and Mortality. *British Medical Journal, 308*(6937), 1135-1139.

Oberlander, L., Disdier, A.-C., & Etilé, F. (2017). Globalisation and National Trends in Nutrition and Health: A Grouped Fixed-Effects Approach to Intercountry Heterogeneity. *Health Economics, 26*(9), 1146-1161.

Olea, J. L. M., & Pflueger, C. (2013). A Robust Test for Weak Instruments. *Journal of Business & Economic Statistics, 31*(3), 358-369.

Oster, E. (2012). Routes of Infection: Exports and HIV Incidence in Sub-Saharan Africa. *Journal of the European Economic Association, 10*(5), 1025-1058.

Owen, A. L., & Wu, S. (2007). Is Trade Good for Your Health? *Review of International Economics, 15*(4), 660-682.

Pickett, K. E., & Wilkinson, R. G. (2015). Income Inequality and Health: A Causal Review. *Social Science & Medicine, 128*, 316-326.

Pritchett, L., & Summers, L. H. (1996). Wealthier Is Healthier. *Journal of Human Resources, 31*(4), 841-868.

Rajkumar, A. S., & Swaroop, V. (2008). Public Spending and Outcomes: Does Governance Matter? *Journal of Development Economics, 86*(1), 96-111.

Reinert, E. S. (2008). *How Rich Countries Got Rich and Why Poor Countries Stay Poor*. New Delhi: Anthem Press.

Ruhm, C. J. (2007). A Healthy Economy Can Break Your Heart. *Demography, 44*(4), 829-848.

Strully, K. W. (2009). Job Loss and Health in the U.S. Labor Market. *Demography, 46*(2), 221-246.

Wigley, S. (2017). The Resource Curse and Child Mortality, 1961–2011. *Social Science & Medicine, 176*, 142-148.

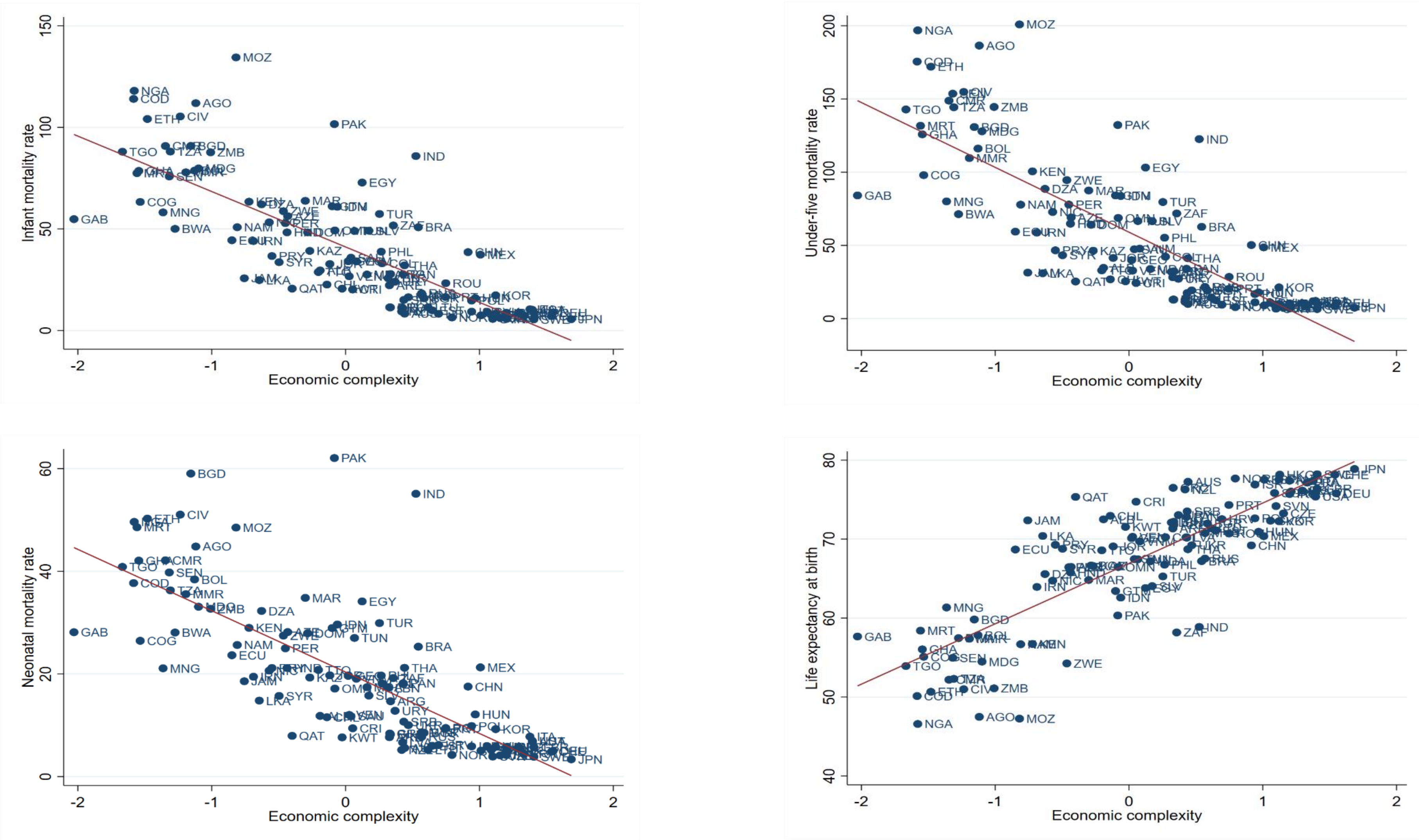

Figure 1. Economic complexity and health outcomes, averaged between 1970 and 2015

Table 1. Main results

Dependent variables	Infant mortality rate (*Mort_inf*)		Under-five mortality rate (*Mort_five*)		Neonatal mortality rate (*Mort_neo*)		Life expectancy at birth (*Lifexp*)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ECI	**-4.440***	**-10.777***	**-10.507***	**-19.363***	**-1.050**	**-4.613***	**2.028***	**1.282***
	[1.335]	[2.407]	[2.263]	[3.964]	[0.713]	[1.201]	[0.378]	[0.465]
Log of GDP per capita	-4.098***	4.702*	-3.415	11.179**	-4.799***	-2.550**	0.858**	0.185
	[1.430]	[2.852]	[2.207]	[4.623]	[0.753]	[1.236]	[0.355]	[0.562]
Urban population	-0.293***	-0.512***	-0.548***	-0.747***	-0.093***	-0.117*	0.104***	0.066***
	[0.057]	[0.165]	[0.091]	[0.261]	[0.026]	[0.063]	[0.017]	[0.024]
Institutional quality	-6.014***	-4.075***	-8.775***	-6.441***	-2.421***	-1.654***	1.736***	0.608***
	[0.791]	[0.769]	[1.272]	[1.209]	[0.381]	[0.320]	[0.198]	[0.145]
Trade openness	-6.906***	10.330***	-8.634***	16.264***	-4.029***	3.289***	0.336	-0.325
	[1.698]	[2.998]	[2.613]	[4.793]	[0.931]	[1.175]	[0.391]	[0.427]
Polity2	-0.751***	-0.583***	-1.085***	-0.969***	-0.293***	-0.215***	0.091**	0.041
	[0.180]	[0.141]	[0.275]	[0.224]	[0.090]	[0.061]	[0.040]	[0.026]
Income inequality	0.251**	0.385*	0.293*	0.390	-0.041	0.193*	-0.136***	-0.078*
	[0.105]	[0.222]	[0.157]	[0.345]	[0.060]	[0.106]	[0.031]	[0.040]
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Country FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	656	656	656	656	648	648	657	657
R-squared	0.693	0.928	0.665	0.917	0.695	0.946	0.708	0.966

Notes: This table represents the baseline estimates for the effect of economic complexity on health outcomes. A set of country and year dummies are included in columns (2), (4), (6), and (8) to perform two-way fixed effects regressions. The remaining columns report pooled OLS estimates. Variables' descriptions and data sources are also provided in the online Appendix. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2. IV-2SLS estimates

Dependent variables	Regional averages of ECI (the World Bank's classification)				Regional averages of ECI (a narrower definition)			
	Mort_inf	Mort_five	Mort_neo	Lifexp	Mort_inf	Mort_five	Mort_neo	Lifexp
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Second-stage estimates								
ECI	**-36.386*** **	**-61.983*** **	**-13.868*** **	**5.583*** **	**-29.036*** **	**-48.725*** **	**-9.655*** **	**6.895*** **
	[7.130]	[11.419]	[3.387]	[1.324]	[7.519]	[11.927]	[3.341]	[1.784]
Log of GDP per capita	11.993***	23.315***	0.508	-1.067	9.901**	19.540***	-0.884	-1.449*
	[3.860]	[6.191]	[1.671]	[0.717]	[3.954]	[6.236]	[1.653]	[0.806]
Urban population	-0.051	0.021	0.042	-0.011	-0.183	-0.218	-0.030	-0.034
	[0.187]	[0.302]	[0.081]	[0.032]	[0.170]	[0.271]	[0.073]	[0.039]
Institutional quality	-3.752***	-5.903***	-1.435***	0.551***	-3.844***	-6.071***	-1.534***	0.534***
	[0.857]	[1.343]	[0.337]	[0.152]	[0.797]	[1.243]	[0.306]	[0.163]
Trade openness	17.986***	29.007***	6.120***	-1.611***	15.789***	25.043***	4.831***	-2.003***
	[3.919]	[6.433]	[1.637]	[0.620]	[3.681]	[5.952]	[1.456]	[0.739]
Polity2	-0.386**	-0.640**	-0.132*	0.008	-0.442***	-0.742***	-0.170***	-0.002
	[0.172]	[0.271]	[0.069]	[0.030]	[0.161]	[0.251]	[0.066]	[0.035]
Income inequality	0.408*	0.428	0.208*	-0.081**	0.401*	0.417	0.201**	-0.083**
	[0.238]	[0.379]	[0.109]	[0.039]	[0.223]	[0.350]	[0.101]	[0.042]
Panel B. First-stage estimates. Dependent variable is ECI								
ECI_ravg	**0.532*** **	**0.532*** **	**0.516*** **	**0.532*** **	**0.323*** **	**0.323*** **	**0.302*** **	**0.324*** **
	[0.079]	[0.079]	[0.079]	[0.079]	[0.063]	[0.063]	[0.064]	[0.063]
Panel C. Additional information								
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic of excluded instruments	44.21	44.21	44.82	42.60	26.44	26.44	22.18	26.47
Cragg-Donald Weak Identification	63.35	63.35	58.76	60.68	34.83	34.83	29.48	34.93

test								
Kleibergen-Paap Wald test	44.21	44.21	41.82	42.60	26.44	26.44	22.18	26.47
Anderson-Rubin Wald test [p-value]	37.22 [0.000]	37.22 [0.000]	17.62 [0.000]	20.22 [0.000]	10.12 [0.002]	10.12 [0.002]	5.44 [0.020]	17.88 [0.000]
Observations	656	656	648	657	656	656	648	657
First-stage R-squared	0.957	0.957	0.958	0.957	0.955	0.955	0.956	0.955

Panel D. Further evidence on instrument relevance

Effective first-stage F-statistics	44.208	44.208	41.821	42.604	26.442	26.442	22.178	26.468
Anderson-Rubin confidence intervals	[-52.619,-24.388]	[-87.981,-42.767]	[-21.579, -8.169]	[3.355, 8.597]	[-44.665,-14.896]	[-73.519,-26.292]	[-16.601,-3.371]	[3.892, 11.311]

Notes: This table reports IV-2SLS estimates for the effect of economic complexity on health outcomes. Country and time dummies are included in all regressions. Baseline control variables are also incorporated in the first-stage regressions but are omitted for brevity. These results are available on request. Panel C contains several diagnostic tests for weak instruments. The null hypothesis of the Anderson-Rubin Wald test is that the estimated effect of ECI on health outcomes in the structural equation equals zero. The null hypothesis of Kleibergen-Paap Wald test is that the instrument is weakly correlated with the endogenous regressor. Furthermore, the rejection of the null of this test should be based on Stock and Yogo's critical values as follows: 16.38 (10% maximal IV size), 8.96 (15% maximal IV size), 6.66 (20% maximal IV size), 5.53 (25% maximal IV size). Panel D presents the results of additional tests for detecting weak instruments, as suggested by Andrews et al. (2019). In particular, the effective F-statistic provides valid inference on weak instrument even when data are non-homoscedastic, serially correlated, and clustered. In the case of a single endogenous regressor, the identification-robust Anderson-Rubin confidence sets provide efficient estimates regardless of the strength of the instrument in the reduced-form equation (Andrews et al., 2019). The classifications of regions are contained in the online Appendix. Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3. IV-2SLS estimates, additional controls

	Regional averages of ECI (the World Bank's classification)				Regional averages of ECI (a narrower definition)			
Dependent variables	Mort_inf	Mort_five	Mort_neo	Lifexp	Mort_inf	Mort_five	Mort_neo	Lifexp
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Second-stage estimates								
ECI	**-35.040*****	**-64.580*****	**-6.190***	**3.729****	**-27.621*****	**-47.166*****	**-5.623**	**7.640*****
	[9.722]	[16.818]	[3.311]	[1.796]	[7.639]	[12.309]	[3.748]	[2.170]
Net migration	0.007	0.010	0.005	-0.005**	0.012	0.021*	0.006	-0.003
	[0.008]	[0.014]	[0.004]	[0.002]	[0.007]	[0.012]	[0.004]	[0.002]
Globalization	0.607***	1.184***	-0.000	-0.129***	0.443**	0.863***	-0.013	-0.200***
	[0.193]	[0.338]	[0.061]	[0.038]	[0.177]	[0.295]	[0.074]	[0.053]
Population	-0.010***	-0.017***	-0.006***	0.000	-0.009***	-0.015***	-0.006***	0.000
	[0.001]	[0.002]	[0.000]	[0.000]	[0.001]	[0.002]	[0.001]	[0.000]
Regional growth	6.551	13.988	-0.657	0.500	7.653**	11.159**	-0.057	0.789
	[6.116]	[10.138]	[2.461]	[0.956]	[3.092]	[5.047]	[1.423]	[0.816]
Panel B. First-stage estimates. Dependent variable is ECI								
ECI_ravg	**0.515*****	**0.515*****	**0.487*****	**0.515*****	**0.264*****	**0.264*****	**0.239*****	**0.264*****
	[0.109]	[0.109]	[0.109]	[0.109]	[0.062]	[0.062]	[0.062]	[0.062]
Panel C. Other information								
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic of excluded instrument	22.36	22.36	20.11	22.36	18.15	18.15	14.75	18.15
Observations	655	655	648	655	655	655	648	655
First-stage R-squared	0.959	0.959	0.960	0.959	0.958	0.958	0.958	0.958

Notes: Additional control variables, baseline controls, country and time dummies are included in all regressions. Other IV diagnostics as reported in Table 2 remain largely unchanged. However, they are omitted for brevity. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. See also notes to Tables 1 and 2.