Epidemiology and Economics of COVID-19: A Pedagogical Resource

Muttukrishna Sarvananthan

ORCID: 0000-0001-6443-0358

Founder and Principal Researcher

Point Pedro Institute of Development

'Shanthi Mahal'

Thambasetty, Puloly West

Point Pedro, Northern Province

Sri Lanka.

Email: sarvi@pointpedro.org

https://www.growkudos.com/projects/muttukrishna-sarvananthan-phd-offers-insights-into-the-economic-and-political-development-of-sri-lanka

Number of words: circa **4700** (including the abstract, list of references, & endnotes)

Keywords: COVID-19, Economics, Epidemiology, Pandemic

Acknowledgments

This pedagogical resource is awaiting peer-review as of July 2022.

Conflict of Interest

The author declares no competing or conflict of interest/s.

Funding

Muttukrishna Sarvananthan is a co-recipient of a British Academy grant in its Tackling Global Challenges Research Fund (TGC/200263) for a research study entitled "COVID-19 and the South Asian state: a cross-national and cross-regional comparison" undertaken by the University of Edinburgh, Scotland, UK. This article is a background paper towards the foregoing research study, and the said grant by the British Academy is gratefully acknowledged.

Author Profile

Muttukrishna Sarvananthan is the Founder cum Principal Researcher of the Point Pedro Institute of Development, Point Pedro, Northern Province, Sri Lanka. Author is a Development Economist by profession and has studied and earned degrees from four universities (Ph.D. Wales, M.Sc. Bristol, M.Sc. Salford & B.A. (Hons) Delhi) in two different countries (UK & India), and has undertaken postdoctoral research work in two universities (Monash University & George Washington University) in two different countries (Australia & USA). Moreover, to date, he has been the author or co-author of over 55 peer-reviewed publications (of which, over 30 were in international scholarly journals), and has been a peer-reviewer of over 35 articles submitted to international scholarly journals published by leading global academic publishers during 23 years of his post-doctorate scholarly career. Furthermore, he has been an external examiner of Ph.D. theses submitted to University of New South Wales in Canberra, Australia (2015), and Jawaharlal Nehru University in New Delhi, India (2006). sarvi@pointpedro.org

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Abstract

A pandemic such as the COVID-19 caused by the coronavirus has epidemiological impacts as well as socioeconomic consequences as a result of measures taken to control the spread of the virus. Therefore, there is an imperative for collaboration and cooperation between a number of academic disciplines such as epidemiology, economics, psychology, inter alia, in order to effectively eliminate the pandemic as well as mitigate the consequences of the strategies pursued therefor. This is once-in-a-lifetime unique situation in which the intersectionality of sciences is sine qua non.

However, globally there appears to be conflicting opinions among the scientific community itself (let alone the politicians) about the epidemiological responses to the pandemic as regards its benefits, costs, and effectiveness in general. The debate has been couched in a false binary of 'lives or livelihoods' metaphor, which has inspired a lot of anxiety and uncertainty among ordinary masses fuelled by the politicians in the west as well as the east; in the north as well as the south.

This piece is a short discursive analysis of the conceptual, empirical, and theoretical literature on the intersection of epidemiology and economics spurred by COVID-19. It also dissects the costs and benefits of the nonpharmaceutical interventions from an economic point of view; from both microeconomic and macroeconomic perspectives.

The overarching argument herein is that both lives and livelihoods are indispensable for countries affected by COVID-19 and countries have to pursue appropriate policies in order to minimise the loss of lives directly caused by the pandemic as well as minimise the loss of livelihoods caused by the pandemic, which may indirectly cause the loss of lives in the future (even in the immediate future).

In a nutshell, an optimal policy response would be to reduce the reproduction rate (R) of the infection to less than one; at the same time, the lives that could be potentially lost (especially of children) due to loss of livelihoods and drop in living standards among poorer households as a result of lockdowns and economic shutdowns should be less than one for every single life saved due to such lockdowns.

Epidemiology and Economics: an introduction

"We cannot let the cure be worse than the problem itself" tweeted President Donald Trump on March 23, 2020.[1]

Epidemiology is a branch of health sciences that analyses/studies the causes, incidence, spread/distribution, and potential control of communicable and non-communicable diseases (CDC, 2012; BMJ). Economic science is a study of allocation of scarce resources (natural, mineral, human, and material) for the fulfilment of human needs and wants through production, consumption, saving, and investment using market principles of demand and supply, consumer choices/preferences, and utility maximisation; latter three being the core of economic methodology or tools of economic analysis (Alfred Marshall; AEA).

There is a two-way relationship between health sciences and economic sciences. While the fundamental function/duty of health sciences is preservation of physical human life, fundamental function/duty of economic sciences is the preservation of the means of material human life. In the same vein that the preservation of physical human life is necessary for preservation of the means of material human life (Thompson, 2020), it is also necessary that preservation of the means of material human life is necessary for preservation of physical human life. Therefore, the often-touted binary of 'lives' or/versus 'livelihoods' during the COVID-19 pandemic is a false dichotomy; that is, there is no choice between lives and livelihoods because both are indispensable for human existence. Rather, it is indeed a choice between saving lives today to save the economy tomorrow, or losing lives today (in order to save the economy today) to lose the economy tomorrow (Gans, 2020; Thompson, 2020).

Thus, there cannot be a trade-off between lives and livelihoods in a pandemic; both are equally necessary for the existence of human beings. In sum, preservation of both lives and livelihoods are *sine qua non* for the existence of human race. Pandemic induced lockdowns do save lives; at the same time rob livelihoods and damage the economy. Elimination of the pandemic (mitigation of the pandemic is not enough) as well as mitigation of the damage to the economy is what the governments are expected to concurrently do, which is a delicate balancing act. Therefore, in the context of a pandemic, epidemiologists and economists cannot afford to work in silos; cooperation and collaboration between them is a must (Economist, 2020).

The healthcare responses by various governments to the COVID-19 pandemic could be categorised as preventive care, curative care, and palliative care. The preventive healthcare measures imposed were Non-Pharmaceutical Interventions (NPIs) such as enforcement of quarantine health regulations such as mandatory wearing of masks, physical/social distancing of human beings, abrupt shutting of international boundaries (such as airports, seaports, and land borders), restriction of domestic mobility (suspension or curtailment of domestic air and sea travel and suspension or curtailment of public rail and road transportation, etc), promotion of handwashing and/or use of hand

and other sanitisers, etc. In the absence of any preventive vaccine available for almost one-year and the lack of curative medicine meant the infected patients were either managed or treated in isolation of the rest of the population (in order to prevent the spread) (curative care) resulting in either being temporarily cured or put on a ventilator (palliative care) and subsequently succumbing to the viral disease.

Like health/medical sciences that adopt preventive, curative, and palliative healthcare measures to preserve physical human life, economic sciences also adopt preventive, curative, and palliative economic measures to preserve the means of material human life (Hevia and Neumeyer, 2020: 14). What these economic measures in the context of Sri Lanka will be discussed in the empirical section of this research note.

The aforementioned NPIs by governments resulted in global economic downturn (dubbed the "Great Lockdown") that could become worse than the 'Great Depression' of the 1930s (Gopinath, 2020; Hevia and Neumeyer, 2020: 4, 12). While the great depression affected primarily the industrialised countries at that time (which were far fewer than the industrialised countries of today), the current COVID-19 pandemic affected each and every country on earth (industrialised, non-industrialised, and emerging economies). Even the Spanish flu of 1918-1920 did not cause such severe economic downturn as the COVID-19 of today because of much lower urbanisation within countries, very limited mobility of people across countries of the world in general, and very limited air travel in particular, at that time (Sadler, 2020). In addition, the global economy was far less integrated at the time of the Spanish flu of the last century than it is today (aka globalisation).

Globalisation (of economies) and pandemics (globalisation of viruses, so to speak) are antithesis of each other because the former promotes global supply/value chains through trade and investment, people-to-people interactions through tourism and migration, knowledge and technology diffusion, etc, whilst the latter restricts all of the foregoing (Sadler 2020: 15).

Communicable disease, epidemic & pandemic

A communicable disease could evolve into an epidemic (virus spread throughout a country or spread among a number of countries), and then into a pandemic (virus spread throughout the world). Similarly, an economic downturn caused by the vagaries of business cycles and/or external shocks (such as a natural or human-made disaster or a pandemic) could cause an economic 'crisis', or evolve into a 'recession', and then into a 'depression' within a country, within a number of countries, or globally (among most countries) (see endnote 2 for understanding the terms, economic 'crisis', 'recession', and 'depression'). A pandemic such as COVID-19 results in a public health crisis, which in turn causes an economic crisis. Such economic crisis caused by the pandemic, if not pragmatically and prudently managed, could potentially evolve into an economic recession, and indeed into an economic depression.

Economic crisis, recession, & depression

The global economic disruption/downturn caused by the COVD-19 pandemic has already surpassed the global economic disruption/downturn caused by the global financial crisis (aka the 'great recession')[2] of 2008 and beyond (Kose and Sugawara, 2020). This is because, firstly, the global financial crisis mainly affected the financial sector and not much the real sector of the economy (at least not directly); secondly, the countries with developed financial sector and capital markets (i.e. developed or high income countries) and the emerging market economies that were considerably integrated with the global private capital markets or exposed to them (i.e. lower- & upper-middle-income countries) were the worst hit; thirdly, countries with less-developed financial and capital markets (i.e. less-developed or low-income countries) were largely unscathed by the global financial crisis of the late-2000s or the Asian financial crisis of the late-1990s. In contrast to the global financial crisis of 2008-2009 (and the Asian financial crisis of the late-1990s), the financial sector and the capital markets have remained reasonably stable (after initial turbulence) amidst the pandemic in both developed and developing countries during 2020-2021 (so far, so good).

Most affected sectors of the economy

In terms of the affected economic sectors as a result of COVID-19, probably the worst affected industrial sector (manufacturing and mining) primarily experienced supply shocks, transportation sub-sector in the services sector, for example, primarily experienced demand shocks, and other subsectors in the services sector (such as hospitality-entertainment/leisure, hotels, restaurants, & tourism) experienced both demand and supply shocks (del Rio-Chanona, et al, 2020: S95-96). The agriculture sector was relatively the least directly affected economic sector as a result of the COVID-19 pandemic.

However, the agriculture sector was indirectly affected by demand shocks due to reduced demand for agriculture produce as a result of loss of employment in other sectors and significantly reduced income in non-agricultural sectors. On a country as a whole, coronavirus inflicted multiple shocks at the same time: a public health emergency; an economic downturn; mass furlough and/or retrenchment of labour, unequally and negatively impacting informal and women workers.

A vicious cycle of public health crisis & economic crisis

Such economic crisis, recession, or depression could in turn result in an uptick of mortality caused by non-communicable diseases among the population (*ala* comorbidities) due to severe drop in living standards or quality of life (material/physical/psychological) over time. Thus, potentially there could be a vicious cycle of health crisis (communicable and/or non-communicable diseases) and economic crisis. Therefore, the current public health crisis and economic crisis are intertwined. Hence, it is imperative that this twin crises are pragmatically and prudently managed for the betterment of the physical

health of the population as well as the economic health of any country. This is the ideal scientific approach for combatting the COVID-19 pandemic caused by the coronavirus.

Variety of economic downturns

There could be a variety of economic downturns. According to Hevia and Neumeyer (2020: 12), economic recessions could be V-shaped, U-shaped, L-shaped, or W-shaped. We would like to make a distinction between the V-, U-, L-, and W-shaped economic downturns in line with our distinction of economic 'crisis', economic 'recession', and economic 'depression' noted above.

A V-shaped economic downturn is either a sharp (but gradual) decline in economic growth or a negative economic growth during 1 or 2 consecutive quarters and a sharp (but gradual) rebound in the subsequent quarters to the previous level of economic growth or beyond. This could be termed an economic crisis caused by the usual business cycles and/or an internal economic shock (drought, floods, hurricane, landslide, etc).

A U-shaped economic downturn is either a dramatic (vertical) decline in economic growth or a dramatic negative growth in a quarter, and more or less remains at that level for 1 or 2 subsequent quarters, and then dramatically (vertically) rebounds in the following quarter to the original level or beyond. This could be termed an economic recession caused by internal or external economic shocks beyond the usual business cycles.

A L-shaped economic downturn could signal an economic depression, whereby a dramatic (vertical) negative growth in a quarter would be followed by (more or less) the same level of negative growth for several consecutive quarters with no signs of a recovery for a number of years. Additionally, inflation and unemployment rates would be in double-digits and continuously rising.

A W-shaped economic downturn could reflect either an economic crisis, recession, or a depression depending on the severity of the decline in economic growth or the degree of rise in economic growth, and the severity of the rates of unemployment and inflation. These ups and downs in the severity of the declines and degree of rises could last for several quarters or even years.

Direct and indirect economic costs

Coronavirus inflicted COVID-19 causes direct and indirect economic costs to the global and national economies (Evans and Over, 2020). The direct economic costs include testing and tracing of the infected people (including random testing), treatment of the infected at healthcare centres/hospitals, and research and development of vaccine/s against the virus. The indirect costs include loss of jobs and productivity, rise in poverty and

inequality, loss of demand for goods and services, loss of supply of goods and services, disruptions to education, disruptions to transportation (air, ocean, rail, and road) and logistics, disruptions to trade and investments, disruptions to healthcare of people affected by non-communicable diseases, and other communicable diseases (such as dengue), rise in non-performing loans of financial intermediaries, rising psychological illnesses caused by self-isolation or quarantine regulation induced isolation and the consequent costs associated with them, rising domestic violence resulting in loss of productivity of women, etc (Sevilla and Smith, 2020; Evans and Over, 2020).

Hevia and Neumeyer (2020: 12-14) argue a case for targeted Non-Pharmaceutical Interventions (NPIs), as opposed to the universal NPIs such as physical/social distancing caused by curfews and/or lockdowns, universal mobility restrictions, universal quarantine regulations, etc, that were in place in most countries of the world at the initial stages of the pandemic in early- to mid-2020. The NPIs will drastically curtail the labour supply and could completely shut down large parts of the economy such as retail and wholesale trade, and travel (both domestic and international) that would result in huge loss of output (Hevia and Neumeyer, 2020: 5). Such economic costs in terms of output loss would be far greater than the world experienced during the great recession of the 2000s and the Asian financial crisis of the late-1990s (Gopinath, 2020).

No matter what, the households and firms would require money to meet their fixed costs for survival in order to finance basic consumption, pay wages for their employees respectively, and rents for their residential/business premises, *inter alia* (microeconomic costs) (Hevia and Neumeyer, 2020: 7, 14). The loss of income to households and firms alike could result in liquidity crunch thereby paving the way for mass bankruptcy followed by mass unemployment (Hevia and Neumeyer, 2020: 7-8).

Rapid and sustained capital outflows, increasing cost of external sovereign borrowings, and depreciation of domestic currencies are some of the critical indirect costs of the pandemic (Hevia and Neumeyer, 2020: 9-11). These are essentially macroeconomic costs.

Hong Kong, Iceland, Japan, Singapore, and South Korea implemented targeted isolation policies which paid-off. On the other hand, New Zealand implemented universal isolation which paid-off too (Sadler, 2020; Hevia and Neumeyer, 2020: 13). However, New Zealand has a small population as do Hong Kong, Iceland, and Singapore.

Direct costs of NPI

According to Hevia and Neumeyer (2020: 5), the direct economic costs of NPIs are:

1. Loss of Production (agriculture, manufacturing, construction, etc). Agriculture production drops because of reduced demand as a result of lower income or loss of income for consumers.

2. Reduction in Investment (drop in borrowings by businesses from banks)

3. Reduction in Consumption (measured by lower retail sales) due to layoffs, furloughs, or simply lack of work for daily wage earners and informal workers.

Indirect costs of NPIs

According to Hevia and Neumeyer (2020: 7-8), the indirect economic costs of NPIs are:

1. Business closures - mostly businesses those depend on close physical/social contact such as travel, entertainment, personal care, etc. SMEs with low working capital and limited credit sources are at risk most.

2. Firms drawing-down capital will retrench workers.

3. Worker retrenchments will reduce demand for goods and services - a vicious cycle.

4. Households and firms confronting uncertainty opt for investment in safest liquid assets.

5. The rise in demand for safer liquid assets will negatively affect the credit market. Business closures or bankruptcies will deplete the capital of banks. The greater demand for liquid cash would curtail the short-term credit markets.

6. Restrictions on the movement of people and economic activity would disrupt supply chains and production networks thereby hampering economic efficiency by increasing production costs. Working from home may also reduce efficiency (depending on the circumstances and occupations).

7. Many commodity exporting countries in Africa, Asia, and Latin America face drop in commodity prices in the global market place. This in turn could depreciate their domestic currencies resulting in a balance-of-payments crisis.

Costs and benefits of NPIs

The nonpharmaceutical interventions (NPIs) necessitated to decelerate the transmission (or control) of a communicable disease would certainly have public health benefits, whilst inflicting economic costs concurrently. Hence, there is a trade-off between economic costs and health benefits. In these circumstances, a cost-benefit analysis (an economic tool/methodology) would help formulate a pragmatic and prudent mitigation strategy by balancing the public health benefits and the economic costs.

To re-open the economy, it is *sine qua non* to control the disease because premature opening of the economy could reignite the spread of the virus necessitating even longer and stricter lockdowns subsequently as experienced by many countries around the world.

An inverted W-shaped infections rate causing a W-shaped economic crisis will cause a lot of anxiety and uncertainty in the markets thereby prolonging the economic woes of a country. While lifting severe lockdowns prematurely could cause human deaths, prolonging severe lockdowns could cause human suffering (Thompson, 2020).

A cost-benefit analysis will help determine the extent of trade-off between public health benefits and economic costs a particular government and/or a population is willing to endure or tolerate. Trade-offs are bedrock of economic decision-making because of limited resources (or scarcity of resources) in the midst of unlimited needs and wants of human beings. That is, whilst supply is limited, demand is unlimited.

A National Bureau of Economic Research (NBER) study estimates that in low-income[3] countries, every COVID-19 death prevented as a result of lockdown could potentially cause the death of 1.76 children due to drop in incomes of poor households; in lower-middle income countries the foregoing ratio falls to 0.59 and in upper-middle income countries it drops to 0.06 (Ma, 2021: 3-4). In other words, a greater number of human lives could be saved by lockdowns in upper- and lower-middle income countries, whereas in low-income countries lockdowns may cause higher number of deaths (especially among children) due to economic hardships for every life saved by the lockdowns.

Health science versus economic science of decision making

There are psychological underpinnings of decision-making by any individual or government based on trade-offs between public health benefits and economic costs. Here is where behavioural economics (normative economics) comes into play. Conventional economics assumes rational decision-making by economic agents, both individuals and institutions (rational choice theory (microeconomics) or the theory of rational expectations (macroeconomics)). Conventional economics assumes that individuals and institutions make rational choices or decisions based on available information in combination with their past experiences to fulfil their personal or institutional self-interests.

In contrast, behavioural economics modifies the rational choices/expectations of conventional economics by incorporating psychological factors (e.g. divine faiths, emotions, external influences such as peer pressures/advertisements, etc) that may influence individuals or institutions/governments to make irrational decisions that may not serve their best interests. Applying the rational choice theory in Economics, people should strictly adhere to lockdowns and remain indoors in order to avoid contracting the COVID-19 and potential loss of life. However, in many countries of the world, a considerable share of the population defies the quarantine regulations, curfews, and/or lockdowns either because of necessity to earn money (mostly in developing countries) or wilfully to protest against mobility restrictions, which they claim robs them of their right to freedom of movement (mostly in developed countries, especially in the USA and western Europe).

Similarly, throughout the world, there are significant number of people who are hesitant to get vaccinated in spite of sufficient evidence that vaccination could prevent contraction of the coronavirus and/or at least prevent severity of COVID-19 if contracted. Therefore, it is notable that people can be irrational in contravention of the conventional rational choices/expectations theory of economics.

Policy options

The elimination (as opposed to mitigation) of the pandemic is the optimal strategy to pursue for any sane government. This is known as 'flattening the curve' in epidemiological jargon, which would be more or less an L-shaped curve.

In epidemiology, R (or Reproduction rate) is the number of persons who could potentially be infected by a person who is already infected with a virus. An epidemic/pandemic could be claimed to have been defeated only when R is below 1 (Cleevely, et al, 2020: S16).

Similarly, in economic terms, pandemic-induced NPIs such as economic lockdown could be optimally beneficial if and only if the mortality caused as a result of such NPIs due to drop/loss of income of poor households is less than 1 for each life saved by the lockdown. In other words, lives saved by the lockdown/s should be greater than the number of lives that could be potentially lost due to economic hardships and hunger caused by the same lockdown/s.

Targeted lockdown is a strategy adopted to minimise the economic cost of lockdowns. However, in many countries, major parts of the respective economies are concentrated in metropolitan centres, urban agglomerations, coastal provinces, or production clusters (such as the free trade zones-FTZs or special economic zones-SEZs). These economic hubs or economic growth poles also have the highest population densities in the respective countries, which are fertile grounds for the spread of viruses including the coronavirus. While targeted lockdown of these locations would be a necessity to curb the spread of the virus, it would also strangulate major parts of the economy thereby spurring a severe trade-off. Therefore, one of the major lessons of this pandemic is that a more geophysical dispersion of a country's economy is a very serious policy for governments to pursue.

Neither price controls, import substitution policies, privatisation, public ownership, or public monopolies are panacea for combatting a pandemic-induced economic downturn. Governments cannot simply bug or plaster the cracks in the markets, instead governments should steer the markets through carrots and sticks (Mazzucato and Kattel, 2020: S263-265).

Direct cash transfers (one-off or periodic lump-sum cash payments) to informal sector workers, independent workers, and the self-employed, especially to women workers, has been a globally practiced economic policy response to the pandemic (including in developed countries such as the USA).

Bricongne and Meunier (2021) have drawn five lessons for policymakers from existing literature to date on the best epidemiological responses around the world to combat COVID-19.

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Endnotes

[1] https://www.belfercenter.org/index.php/publication/trump-says-coronavirus-cure-cannot-be-worse-problem-itself

[2] Apparently, there is no standard definition of 'recession' and 'depression' of the economy (Rodeck and Curry, 2021). Generally, the distinction between the two depends on the duration and severity of the two. For example, while single-digit negative economic (GDP) growth and rising single-digit unemployment rate during a few consecutive quarters/years could be termed an economic recession, double-digit negative economic growth and rising double-digit unemployment rate (coupled with rising inflation) during a prolonged period of time (running into several years) could be termed an economic depression. Some do define an economic recession as and when an economy records negative economic (GDP) growth for just two consecutive quarters (Shiskin, 1974). On the other hand, single-digit contraction (negative growth) of the economy along with rising single-digit unemployment rate for a few quarters (three-month periods) could be termed an economic 'crisis' as a reflection of ups and downs in business cycles and/or an external shock.

[3] Low Income Countries – Per Capita Gross National Income (GNI) equal or below US$ 1,045.
Lower-Middle Income Countries – Per Capita GNI between US$ 1,046 and 4,095.
Upper-Middle Income Countries - Per Capita GNI between US$ 4,096 and 12,695.
High Income - Per Capita GNI greater than 12,695 https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022