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CAN INNOVATION SAVE US?

Understanding the role of innovation in mitigating the COVID-19 pandemic in ASEAN-5 economies

Introduction

The novel coronavirus (COVID-19) pandemic raises the question of whether innovation can save humanity. Indeed, innovation is the path towards finding solutions such as vaccines, treatments and policies that mitigate the further spread of the virus. Since the announcement of a global pandemic on March 12, 2020, countries with relatively high levels of innovation remain high on the world rankings on new cases and deaths while countries considered relatively lower in innovation are not. We test the relationship between innovation systems and the ability of its pre-epidemic state to address the pandemic. We use a two-step System Generalized Method of Moments (GMM) to test this relationship using cases from the ASEAN-5 economies and their respective levels of innovation as reported in the Global Innovation Index. We find that the relationship between the level of innovation and a country's ability to respond to the crisis to be significant and positive. We also find that search interest, an indicator of market response within an innovation context, to have a significant negative relationship with crisis management. We provide some preliminary analyses and insights on these two key findings as well as policy recommendations on building resilience through innovation systems.

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Countries with a well-functioning national innovation system as forged by the synergy among university, government and industry, or the Triple Helix, can be expected to respond to health crises relatively better than others that do not. Intuitively, an active Triple Helix is likely to have better institutional preparedness, requisite scientific knowledge, and favourable economic conditions to minimize loss of life in a pandemic. Yet, the novel coronavirus (COVID-19) pandemic continues to hit countries that are ranked higher in the Global Innovation Index 2019 the hardest while countries with lower innovation levels remain, likewise, relatively lower on all critical indicators on the Worldometers Coronavirus Pandemic global tracker (Dutta, Lavin, Wunsch-Vincent, 2019; Worldometers, 2020).

We ask whether innovation can help mitigate the continued loss of many lives to COVID-19 by looking at the relationship between innovation and COVID-19 outcomes in the Association of Southeast Asian Nations founding member states (ASEAN-5) namely Indonesia, Malaysia, Philippines, Singapore, and Thailand.

The Global Innovation Index (GII) provides a starting point for showing the relative performance of countries in terms of innovation inputs and outcomes. Inputs to innovation are institutions, human capital and research, infrastructure, market sophistication, and business sophistication. On the other hand, outputs consider knowledge and technology and creative outputs. The GII provides each country with an overall innovation score based on the performance of its innovation inputs and outputs. We take the GII scores of each ASEAN-5 member state to represent their level of innovation. We find that the determinants of the GII score are also consistent with the empirical study of Afzal, Mansur and Sulong (2017) on the Triple Helix and national innovation systems in the ASEAN-5. Assuming that determinants of the GII score which include institutional considerations, knowledge and human capital, and the ability to turn useful knowledge into innovations are well-functioning, it would be logical to expect countries with high scores to manage the pandemic well.

Discussion

To understand how well a country performs in its handling of COVID-19 cases, we track the rate of change in the ratio between the rate of recovery and growth rate of new cases, and the rate of change in new deaths relative to the growth rate of new cases. Simplified, we get a ratio of new recovered cases and new deaths and denote it as COVIDRatio, tracked bi-weekly. A higher ratio is favorable as it would indicate that more lives have been saved (i.e., higher recovered cases) or that fewer lives are likely to be lost to COVID-19. (i.e., lower death cases). We use raw data from Worldometers Coronavirus global tracker and confirm discrepancies, if any, with official sources of data including ministries of health using web scrubbing protocols.

Finally, we take the search interest of COVID-19-related keywords for each country in the ASEAN-5 to determine

the level of demand-side activity through what is known as infodemiology (Mavragani, 2020). We denote this variable as SearchInterest. Searches on Google can be considered as an innovation outcome as users have the appropriate device, connectivity, and knowledge on how to use the internet to achieve specific tasks (i.e., in this case, to get information). Search activity also indicates participation in the innovation economy. Table 1 shows the keywords used for tracking search interest via Google Trends Coronavirus Feature (Google, 2020).

Both the COVID-19 ratio and Google Search Interest data are from February 15 to April 15, 2020, tracked bi-weekly, processed using three-day averages to minimize erratic changes seen in daily data. This gives us six time periods for each country from the declaration of a pandemic by WHO in ASEAN-5.

Both the COVID-19 ratio and Google Search Interest data are from February 15 to April 15, 2020, tracked bi-weekly, processed using three-day averages to minimize erratic changes seen in daily data.

Table 1
Keywords used for tracking Search Interest on Google

Disease/Situation	Solution	Sources
Covid	Medicine	Updates
Coronavirus	Treatment	President/Prime Minister
Covid-19	Vaccine	Ministry/Department of Health
Pandemic	Symptoms	
Emergency	Hospitals	
Virus	Clinic	

Source: Authors' representation.

Note: Some words in English were translated to Bahasa or Thai

We use the Generalized Method of Moments (GMM) given the presence of endogeneity within the model and relatively few and shorter periods under study. We formalize our empirical model:

$$\begin{aligned}
 COVIDRatio_{it} = & \phi COVIDRatio_{it-1} & (1) \\
 & + \beta_1 GII_{it} \\
 & + \beta_2 SearchInterest_{it} \\
 & + \eta_i
 \end{aligned}$$

ϕ determines the speed of how countries adjust with the COVID-19 pandemic.

β_1 and β_2 shows the marginal contribution of GII and Search Interest on the recovery-death ratio.

η_i captures some unobserved variables.

In a two-step GMM, we set *GII* and its lag as internal instruments and set *SearchInterest* and bi-weekly dummies as external instruments.

We regress the *COVIDRatio_{it}* with its lagged variable, with *GII_{it}* as the predetermined variable and *SearchInterest_{it}* as an explanatory variable. We have also identified the lagged variable of *COVIDRatio_{it}* and *GII_{it}* as internal instruments, while *SearchInterest_{it}* is used as an external instrument. The threshold for significance is put at a standard level of 0.05.

Table 2 shows a significant positive effect of innovation and the lagged dependent variable and a significant negative effect of search on the *COVIDRatio*. This outcome implies that countries adapt to the crisis relatively well given their level of innovation, which ultimately may result in either an increase in the recovery rate, decrease in death rate, or both.

Table 2
Two-Step SysGMM Results with COVID Recovery-Death Ratio as the dependent variable

Variables	Two-Step SysGMM
L_COVIDRatio	.0749187 (0.068) *
GII	3.378037 (0.019) **
Search Interest	-4.44315 (0.032) **
Biweekly Dummies	Yes
Number of Observations	14
F Statistic	94.17
AR (2)	0.476
Hansen Statistic	1.0000

Note: ***, **, and * are statistically significant at 1%, 5%, and 10%, respectively.

Source: Authors' calculations

This significant positive effect of the level of innovation on the recovery/death ratio confirms our a priori expectation that a well-functioning innovation system indeed fosters health outcomes. This implies that if a country is higher in the GII rankings before the crisis, it is likely more equipped to maintain a high recovery rate and keep death rates low.

One of the seemingly counterintuitive findings is the significant negative effect of search on the recovery-death ratio. One possibility is that as more individuals search online, they are likely to interact with unreliable content which may lead to more inappropriate responses to the pandemic. We cannot account for this possibility in this study, neither theoretically nor empirically.

However, search interest likely grows as cases reported on media serving as a trigger to look for more information via search, as seen in Figure 1. Search interest reacts well with events like the declaration of a pandemic by WHO and whenever cases spike. We find that market reaction through search is a relevant innovation indicator in the context of a pandemic.

Policy Recommendations

This paper established a preliminary assessment of the relationship between national innovation systems and the ability of a country to mitigate a health crisis. The empirical investigation of the matter reveals a significant and positive relationship between innovation level and the ability to manage an emergency exists, which in this case was the early onset of a viral outbreak.

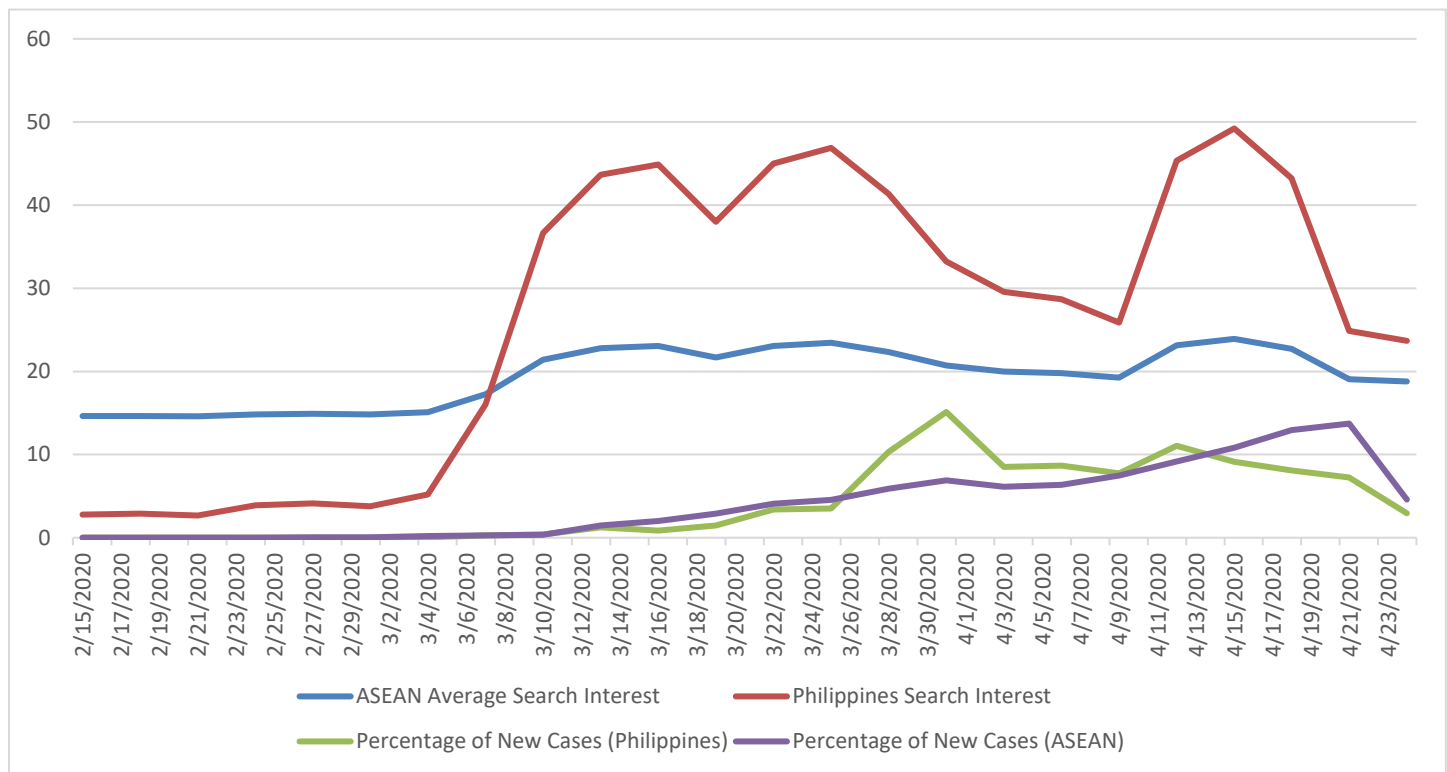
National innovation systems embodied mostly in the healthy functioning of the interactions between university, government and the private sector along with an efficient allocation of resources on inputs to innovation and optimized processes and incentives to innovate (e.g., patent, trademark and copyright). Countries that do well in all these dimensions of innovation systems perform relatively better than others that do not.

The social and economic imperative to build the ability to manage shocks to the economy is increasing the level of innovation in an economy. The overall level of innovation in the economy also serves to reinforce economic resilience to shocks, especially of this type which has persistent and devastating effects.

In considering increasing the level of innovation in an economy, efforts must be invested in improving the overall quality of the inputs to innovation: institutions, human capital and research, infrastructure, and market and business sophistication (Dutta et al., 2019). Where industry leaders and policymakers can have the most

Figure 1

Search Interest and three-day rate of change average in new Covid-19 cases in the ASEAN-5 and Philippines as of Apr 24, 2020



practical impact are in human capital, infrastructure and market and business sophistication. On the other hand, reforming institutions to optimize innovation outcomes may take a whole-of-society approach which individuals or groups may not be able to address efficiently on their own.

Human capital, learning and education

Policymakers need to address the potential gaps in basic and higher education that social distancing measures (so long as no vaccines or cures are in place) create as students have differential access to connectivity and devices that facilitate their continued learning. While flexible learning countermeasures are better than a total absence of learning mechanisms, policymakers need to be mindful of the gap between those who have access and those whose learning may unnecessarily be delayed because of poverty which limits the liquidity necessary to purchase connectivity requirements.

There is an opportunity for the Triple Helix actors--universities, government and private sector--to collaborate in providing scalable solutions that maximize the reach of learning programs, especially for the poor and marginalized. The private sector can provide the necessary capitalization for an ambitious project to make flexible learning accessible, particularly in getting more families connected to the internet and providing them with the appropriate device for remote learning. Furthermore, universities and private basic education providers can contribute by making their content available to the public school system and collaborating with the government by sharing their academic expertise. This interaction can be facilitated through the provision of an efficient e-governance module that builds national professional learning communities that encourage expert participation and contribution to content and pedagogy for use in flexible learning.

The government can provide the relevant incentive framework that encourages private companies and universities to collaborate on addressing the learning gap which social distancing measures create. Incentives like time-bound tax benefits to companies investing in public basic and higher education can provide corporate leadership with the strategic motivation to participate and collaborate. If the action in the area of learning is anemic, we can expect a slower rate and lower levels of innovation in the years to come, which in our analysis makes an economy less resilient to health shocks of catastrophic proportions.

Research and route to market

Universities, both private and public, should drive their research capabilities and efforts forward, raising research productivity even in a time of a pandemic. In a global slowdown, research work in all areas of inquiry can continue to thrive. Research and development, on its own, may be a function that is resilient to shocks and may not be as negatively affected by prolonged social distancing. Shocks to research productivity may be lower relative to other contact-intensive sectors. Increasing the overall research productivity in universities ensures that the production of knowledge, a prerequisite to innovation, continues even when other sectors remain constrained.

On the other hand, the private sector can help in knowledge creation through partnerships with the academe. It is an essential source of capital which may be considered as an investment in future innovations. Research has high upfront fixed costs which the private sector may have a commercial interest to support, mainly if outputs include future technologies that could be used as new sources of competitive advantages when the economy recovers. Furthermore, university-private sector partnerships help to shorten the commercialization of ideas and inventions where the private sector can provide capabilities to bring ideas to market, a necessary step in the innovation process.

Firms can also drive the innovation process forward by providing internal programs that encourage the creation of new ideas and organizational learning. Companies on a digital transformation journey rely heavily on idea generation and agile processes to bring new products and services to market faster and at lower costs, subject to some constraints given limited mobility and continued

subdued productivity. The route to market should also be on the innovation agenda of executives as conventional trade, and distribution approaches may no longer work in the new normal. Ultimately, e-commerce and logistics innovations help address these new challenges to an innovation's route to market.

Access to capital

Finally, access to credit and capitalization must be a top policy priority for both the government and the private sector as innovation is highly dependent on funding. Financing innovations must be a top corporate priority while policies that ease up access to credit should be long-term policy consideration of the central bank. Easing up constraints in access to credit not only serves as a safety net for businesses whose balance sheets are highly compromised during the pandemic but also allows for new capital to flow for innovative activity. Without the necessary access to capital, innovation production is likely to retard amid a recession that urgently needs new forms of economic activity.

Raising innovative activity is a shared responsibility among the private sector, university and the government. The dynamism of the innovation system is reflected in the orchestration of policies at various levels of the economy that promote innovation outcomes.

Optimizing processes that promote innovation outputs

As knowledge is used and processed into inventions, then to a commercialized state as innovation, systems and processes that facilitate the protection of intellectual property must be optimized to ensure the timely provision of the incentives to innovate. Weak intellectual property rights (IPR) systems with slow bureaucratic processes impede innovation as firms and inventors have lower incentives to internalize the risk of innovation.

Governments should ensure that processes that protect IPR (e.g., patents, copyright, trademark, utility design) are accessible even during a pandemic. Inventors and firms might be pursuing innovations but may not have the economic impetus to bring their creations to market because of a lack of protection which presents losses both on the part of the inventor or firm and society as a whole. Slow processes and weakly promoted intellectual property rights yield lower participation in the production

of innovations, which ultimately leads to lower levels of innovation in the economy.

Furthermore, the government, private sector and universities should promote online creativity and entrepreneurship that is protected by policies and laws. In a time of a pandemic, online creativity can flourish if entrepreneurial activities are protected and have the appropriate incentives to commercialize new ideas.

The combination of upgrading inputs to innovation and optimizing the process and policy infrastructure for better innovation outcomes addresses the goal of increasing innovative activity. On the one hand, it must be a policy priority, but on the other, a managerial imperative. These are the actors and institutions responsible for the readiness of society to handle the outbreak of a crisis as they are necessarily also among the first that must respond to pandemics to protect both the welfare of the people they serve and their economic interests.

Concluding Remarks

Innovation systems serve a purpose in society. A well-functioning innovation system boosts the readiness of a country for a pandemic. Measures to improve inputs to innovation including institutions, human capital, market and business sophistication will only enhance the ability of a country to respond to a pandemic efficiently and effectively, minimizing the profound loss of human lives. We find that innovation systems affect a country's ability to promote better health outcomes, which may be true not only in the time of coronavirus but also in better days. Innovation can save lives—only now we need it more urgently than ever.

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