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# Public Health and Labor Policy

*Charlotte Justine Diokno-Sicat, Valerie Gilbert T. Ulep,  
Robert Hector G. Palomar, Ricxie B. Maddawin,  
and Mark Gerald C. Ruiz*



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# Public Health and Labor Policy

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## **Abstract**

The COVID-19 pandemic, and lockdown measures taken to control its spread, brought economies to a halt, turning the public health crisis into an economic one. Though government responses, such as labor and social welfare protection programs, were similar for recent economic crises like the Global and Asian Financial Crises, the origin of the current crisis being public health rather than financial markets, put the spotlight on the health sector and the need for its strengthening both to manage COVID-19 and ensure sustainable economic recovery.

This study examines the relationship between health spending and labor productivity. Will the COVID-19 pandemic crisis trigger more meaningful public investments in health? How can we build back better health policy for labor productivity?

Answering these questions requires establishing that health policy and indicators are associated with measures of labor productivity. If there is such evidence, there is a need to examine pre-pandemic public health expenditures and policies and compare these to health policies of comparable countries with better health outcomes. This would provide policy makers guidance in improving health sector outcomes and overall productivity.

This sought evidence of the association of health policy and indicators with labor productivity on two levels, across: (1) comparable ASEAN countries and (2) Philippine regions. The results showed that public health expenditures were robust and significant for GDP per capita (across ASEAN countries) and regional GDP per worker (RGDP, Philippine regional estimations). This suggests that increased public health spending is associated with increased labor productivity. For the cross-country results, life expectancy and gross capital investments were also found to be positively significant, indicating increased productivity with a longer life (i.e., a healthier population), and with physical capital/tools and infrastructure (consistent with neoclassical growth theory or NGT). For Philippine regional regressions, only the proportion of the working age population was found to be significant but negative, possibly suggesting that a bigger work force is associated with lower productivity (*ceteris paribus*, this is consistent with NGT and the law of diminishing marginal product).

**Keywords:** labor demand, labor supply, neoclassical growth theory

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# Public Health Policy and Labor Productivity

***Charlotte Justine Diokno-Sicat, Valerie Gilbert T. Ulep,  
Robert Hector G. Palomar, Ricxie B. Maddawin, and Mark Gerald C. Ruiz***

## 1. Introduction

The COVID-19 pandemic, and lockdown measures taken to control its spread, brought economies to a halt, turning the public health crisis into an economic one. Though government responses, such as labor and social welfare protection programs, were similar for recent economic crises like the Global and Asian Financial Crises, the origin of the current crisis being public health rather than financial markets, put the spotlight on the health sector and the need for its strengthening both to manage COVID-19 and ensure sustainable economic recovery.

In the Philippines, with the increased number of vaccinated citizens and the economy opening up again, policymakers are set on economic recovery and attaining sustainable economic growth. The endogenous growth theory (EGT) proposes that sustainable economic growth can be explained by continuous investments in human capital, which leads to increased productivity (Barro & Sala-i-Martin 2004; Mankiw 2022). Though traditional human capital investments are related to knowledge, such as education and training, some pieces of economic literature have examined and shown evidence of the association of investments in health and its indicators to human capital productivity (Grossman 1972; Barro & Sala-i-Martin 2004; V. Raghupathi & W. Raghupati 2020; Bhargava et al. 2001).

Furthermore, the theory of labor demand suggests that the demand for workers depends on their productivity (Mankiw 2022). But what makes an impact on labor productivity? As mentioned above, it is, primarily, human capital investment and education, and then health (Rivera & Currais 1999; Barro & Sala-i-Martin 1995). As for the theory of labor supply, health benefits and compensating wages/policies (i.e., hazard pay, regulations) affect the decision of a worker to participate and, consequently, to be a productive member of an economy (Ehrenberg & Smith 2009).

Though spending on the Philippine health sector increased in response to the COVID-19 pandemic, prior to this global scare, there was evidence of underspending and challenges in the implementation of the Universal Health Care Law (Uy et al. 2022). Philippine Gross Domestic Product (GDP) rapidly increased in recent years (5.0 to 6.0% GDP growth), but the country has experienced only modest improvements in health outcomes compared to its neighboring countries. The slow progress could be attributed to a variety of reasons but is largely due to chronic underinvestment in health. For example, Philippine public spending on health is half (USD 50 per capita in 2018) of what upper middle-income and ASEAN (Association of Southeast Asian Nations) countries (USD 100) spend. Many of these countries are already implementing universal health care.

This study examines the relationship between health spending and labor productivity. Will the COVID-19 pandemic crisis trigger more meaningful public investments in health? How can we build back better health policy for labor productivity?

Answering these questions would first require seeing if there is evidence that health policy and indicators are associated with measures of labor productivity. If such evidence exists, there is

a need to examine pre-pandemic public health expenditures and policies and compare these to health policies of comparable countries with better health outcomes. Doing so would provide policy makers guidance in improving health sector outcomes and overall productivity.

Generating evidence to establish the association of health policy and indicators with labor productivity was done on two levels, across: (1) comparable ASEAN countries and (2) Philippine regions. The results showed that public health expenditures were robust and significant for GDP per capita (across ASEAN countries) and regional GDP per worker (RGDP, Philippine regional estimations). This suggests that increased public health spending is associated with increased labor productivity. For the cross-country results, life expectancy and gross capital investments were also found to be positively significant, indicating increased productivity with a longer life (i.e., a healthier population), and with physical capital/tools and infrastructure (consistent with neoclassical growth theory or NGT). For Philippine regional regressions, only the proportion of the working age population was found to be significant but negative, possibly suggesting that a bigger work force is associated with lower productivity (*ceteris paribus*, this is consistent with NGT and the law of diminishing marginal product).

The next section presents literature providing empirical evidence on health policy and labor productivity as well as a brief discussion of the Philippine COVID-19 response and increased public health expenditures. Section 3 lays out the methodological approach, data requirements and limitations of this study. Section 4 presents the results of the ASEAN cross-country and Philippine regional regressions. Section 5 discusses, and compares with other countries, current trends in Philippine health expenditures and indicators. The last section provides the summary and recommendations.

## **2. Related Literature**

### ***2.1. Evidence on health policy and labor productivity***

Economic growth theory proposes that growth can be attained with investments in both physical capital (i.e., neoclassical growth theory or NGT) and human capital (i.e., endogenous growth theory or EGT) (Barro & Sala-i-Martin 2004; Mankiw 2022; Bhargava et al. 2001). In addition, according to NGT, population growth and labor-augmenting technological progress negatively and positively affect GDP per worker, respectively (Mankiw 2022). That is, rapid population growth reduces output per worker because of the increased need for physical capital, whereas labor-augmenting technological progress makes workers more productive (Barro & Sala-i-Martin 2004). Extensions of both NGT and EGT have looked at the relationship of different measures of human capital investments and indicators for education and health. They have established a positive association between them on measures of labor productivity and economic growth.

Table 1 highlights studies providing empirical evidence of the relationship between health and labor productivity. Rivera and Currais (1999) proposed that a country would not be able to maintain a state of continuous growth without a labor force with minimum levels of education and health. The authors developed an extension of the augmented NGT Solow model to identify the role of health care in economic growth and discuss the effect between health and income, using sets of instruments as exogenous determinants of health. The augmented model showed that a nation's health affects its economic growth positively and provided evidence of a strong and positive relationship between productivity and health.



Another study by Knowles and Owen (1995) used the Mankiw-Romer-Weil (MRW) model, which augments the Solow growth model by empirically including human capital (as proxied by school enrollment). The authors reported a strong and relatively robust relationship between life expectancy (as a proxy for health capital stock) and income per capita, which suggests further theoretical and empirical investigation of the importance of the health aspect of human capital for growth and development.

Bloom et al. (2001) attempted to test for the existence of the true effect of health on labor productivity and to measure its strength. The study also constructed macroeconomic measures of health and work experience to examine their ability to explain economic growth. The study estimated that health has a positive and statistically significant effect on economic growth, which is similar with the results of Rivera and Currais (1999) and Knowles and Owen (1995). Furthermore, the study suggests that with a one-year improvement in the population's life expectancy, there is a 4.0 percent increase in output.

Finally, Bhargava et al. (2001) estimated static random effects models for GDP growth rates containing endogenous regressors. Examining time-varying (lagged) total fertility, investment-to-GDP ratios, adult survival rates (ASR or life expectancy), and GDP, they found a significant association between ASR and economic growth rates for low-income countries.

**Table 1. Empirical evidence of health policy/indicator and measures of labor productivity**

Article	Conceptual framework	Data	Results
Rivera and Currais (1999)	<ul style="list-style-type: none"> <li>Theory: Mankiw, Romer, and Weil (1991): Assumes an expanded Solow growth model</li> <li>Estimating equation: <math>Y=f</math> (public health expenditures, etc.), OLS Huber's heteroskedasticity-consistent covariance estimation</li> </ul> $\ln \ln \left( \frac{y(t)}{y(0)} \right) = \ln \ln y(t) - \ln \ln y(0)$ $= (1 - e^{-\lambda t}) \frac{\alpha}{\mu + \beta} \ln \ln s_k + (1 - e^{-\lambda t}) \frac{\beta}{\mu + \beta} \ln \ln e^* + (1 - e^{-\lambda t}) \frac{\eta}{\mu + \beta} - (1 - e^{-\lambda t}) \frac{1 - \mu - \beta}{\mu + \beta} \ln \ln (n + g + \delta) - (1 - e^{-\lambda t}) \ln \ln y(0)$	<ul style="list-style-type: none"> <li>Log difference GDP per worker (Dependent Var)</li> <li>Public health expenditure (explanatory var)</li> <li>Panel (24 OECD countries for sample period 1960-90)</li> </ul>	Positive association with GDP per capita and health expenditures
Knowles and Owen (1995)	<ul style="list-style-type: none"> <li>MRW Model: Explicitly include the "health capital" and "educational capital" components of human capital</li> </ul> $Y_{it} = K_{it}^{\alpha} E_{it}^{\beta} X_{it}^{\psi} (A_{it} L_{it})^{1-\alpha-\beta-\psi}$ <ul style="list-style-type: none"> <li>OLS estimation/Wald's Test</li> </ul>	<ul style="list-style-type: none"> <li><math>Y</math> = real output</li> <li><math>K</math> = stock of physical output</li> <li><math>E</math> = stock of educational</li> </ul>	Strong and relatively robust relationship between life expectancy as a proxy for

Article	Conceptual framework	Data	Results
	$\ln \ln \left( \frac{Y_{it}}{L_{it}} \right) - \ln \ln \left( \frac{Y_{i0}}{L_{i0}} \right)$ $= \theta \ln \ln A_0 + gt$ $+ \frac{\theta\alpha}{1-\alpha} [\ln \ln (s_{ki}) - \ln \ln (n_i + g + \delta)_t] + \frac{\theta\beta}{1-\alpha} \ln \ln (e_i^*)$ $+ \frac{\theta\psi}{1-\alpha} \ln \ln (x_i^*) - \theta \ln \ln \left( \frac{Y_{i0}}{L_{i0}} \right)$ $\ln \ln \left( \frac{Y_{it}}{L_{it}} \right) - \ln \ln \left( \frac{Y_{i0}}{L_{i0}} \right)$ $= \theta \ln \ln A_0 + gt + \frac{\theta\alpha}{1-\alpha-\beta}$ $\ln \ln (s_{ki}) + \frac{\theta\beta}{1-\alpha-\beta} \ln \ln (s_{ei})$ $- \frac{\theta(\alpha+\beta)}{1-\alpha-\beta} \ln \ln (n_i + g + \delta)_t$ $+ \frac{\theta\psi}{1-\alpha-\beta} \ln \ln (x_i^*) - \theta \ln \ln \left( \frac{Y_{i0}}{L_{i0}} \right)$	<p>human capital</p> <ul style="list-style-type: none"> <li>• X = stock of health capital</li> <li>• L = labor input</li> <li>• A = labor augmenting level of technology</li> </ul>	<p>health capital stock and income per capita</p>
Bloom et al. (2001)	<ul style="list-style-type: none"> <li>• Model output as a function of inputs and technology</li> </ul> $Y = AK^\alpha L^\beta e^{\phi_1 s + \phi_2 \exp + \phi_3 \exp^2 + \phi_4 h}$ $a_{it} = +v_{it}, \text{ where } v_{it} = \rho v_{i,t-1} + \varepsilon_{it}$ <p>Total Factor Productivity (TFP):</p> $\Delta y_{it} = \Delta a_t + \alpha \Delta k_{it} + \beta \Delta l_{it} + \phi_1 \Delta s_{it} + \phi_2 \Delta \exp_{it}$ $+ \phi_3 \Delta \exp_{it}^2 + \phi_4 \Delta h_{it}$ $+ (1-\rho)(a_{i,t-1} + \alpha k_{i,t-1} + \beta l_{i,t-1}$ $+ \phi_1 s_{i,t-1} + \phi_2 \exp_{i,t-1} + \phi_3 \exp_{i,t-1}^2$ $+ \phi_4 h_{i,t-1} - y_{i,t}) + \varepsilon_{it}$ <p>This equation decomposed into four components: the growth of the world TFP; growth of inputs; TFP gap; and idiosyncratic shock</p>	<ul style="list-style-type: none"> <li>• Total output = real per capita GDP measured international PPP (chain index) x national population</li> <li>• Labor supply = size of economically active population</li> <li>• Life expectancy = used as a proxy for the health of the workforce</li> </ul>	<ul style="list-style-type: none"> <li>• Health is significant and is positively related to aggregate output.</li> <li>• Work experience does not have much effect on economic growth due to small variation across countries.</li> </ul>
Bhargava et al. (2001)	<ul style="list-style-type: none"> <li>• Estimation of statistic random effects models containing endogenous regressors</li> </ul> $Y_{it} = \sum_{j=1}^m z_{ij} Y_j + \sum_{j=1}^{n_1} x_{1ijt} \beta_j + \sum_{j=n_1+1}^n x_{2ijt} \beta_j$ $+ u_{it} \quad (i = 1, \dots, N; t = 1, \dots, T)$	<ul style="list-style-type: none"> <li>• Penn World Table (PWT)</li> <li>• World Development Indicators (WDI)</li> <li>• GDP series in PWT and WDI</li> </ul>	<ul style="list-style-type: none"> <li>• For low-income countries, adult survival rates have significant effects on</li> </ul>

Article	Conceptual framework	Data	Results
	<p>Time-varying regressors consist of (lagged) total fertility rate, investment/GDP ratio, ASR, interaction between ASR and GDP, and GDP</p> <ul style="list-style-type: none"> <li>• Wald type test for parameter stability outside the sample period</li> </ul> $W = (b^* - b)' = [V(b^*, b^*)]^{-1}(b^* - b)$	<ul style="list-style-type: none"> <li>• PWT GDP series involves estimation of the PPP</li> <li>• Total fertility rate, life expectancy, and population</li> <li>• Life expectancy = adult survival rates (ASR) (probability of surviving the 60<sup>th</sup> birthday after the age 15 years)</li> </ul>	<p>GDP growth rates.</p> <ul style="list-style-type: none"> <li>• The study suggests that indicators of cognitive function among different age groups may be useful in analyzing economic performance.</li> </ul>

Source: Authors' compilation

## 2.2. *Philippine fiscal response*

As it did in other countries, the COVID-19 pandemic affected not only the health sector in the Philippines but also many others. Workers in the labor market could not participate because of the implementation of travel restrictions and lockdowns (Department of Labor and Employment 2021). The unemployment rate doubled from 5.1 percent in 2019 to 10.3 percent in 2020. Similarly, registered labor force participation rate decreased from 61.3 percent in 2019 to 59.5 percent in 2020 (Philippine Statistics Authority [PSA] 2020).

Social protection systems play a huge role in recovery and resilience and can thus be seen as economic and social stabilizers in these types of crises (International Labor Organization [ILO] 2020a). According to the ILO (2020a), appropriate policy responses should focus on (1) health protection measures and (2) employment and income support to stimulate the economy and labor demand. The efforts of the Philippine government shortly after the start of the pandemic are in line with the recommendations of the ILO.

On 27 March 2020, the Philippine Inter-Agency Task Force on Emerging Infectious Diseases (IATF) created the Technical Working Group on Anticipatory and Forward Planning (IATF-TWG for AFP) to assess the impact of the pandemic and offer recommendations as the country adapts to the “new normal” (Department of Health [DOH] 2021). These recommendations were reflected on the IATF-TWG’s (2020) “We Recover as One” report, which details the process of responding to the pandemic, mitigating its effects, and transitioning to the new normal. According to the report, the response phase deals with limiting the transmission of the virus and providing health care, while the mitigation and transition phases deal with ensuring food and financial security for vulnerable groups and coming up with measures for social and economic activities to proceed (IATF-TWG for AFP 2020).

In relation to this, the “Bayanihan to Heal as One Act” (Bayanihan I), the country’s initial fiscal response to the pandemic, was passed. Aside from the focus on preventing the spread of COVID-19, one of Bayanihan I’s objectives was to reduce its impact on the Filipinos’ socioeconomic well-being through different forms of socioeconomic relief.

On the basis of Presidential Proclamation No. 922, which declared a state of public health emergency, Bayanihan I gave the President the power to adopt temporary emergency measures. This included the provision of an emergency subsidy, ranging from PHP 5,000 to PHP 8,000, to 18 million low-income households. Bayanihan I was also the basis for the Small Business Wage Subsidy (SBWS) Program. The SBWS Program had an approved budget of PHP 50.8 billion for the provision of subsidies, which also ranged from PHP 5,000 to PHP 8,000, for eligible workers in micro, small, and medium enterprises (MSME) (Department of Finance [DOF], 2020).

Shortly after the expiration of Bayanihan I, the “Bayanihan to Recover as One Act” (Bayanihan II) was passed. Bayanihan II maintained the same focus on the health and social protection of the people and continued the efforts to provide emergency subsidies along with its other salient points. Bayanihan II was also the basis for the appropriation of an additional PHP 3.5 billion as support to local government units (LGUs). Out of this PHP 3.5 billion, PHP 1.5 billion was for the Local Government Support Fund and PHP 1 billion each to the Land Bank of the Philippines and the Development Bank of the Philippines. As of 31 December 2021, Bayanihan I and II have jointly obligated PHP 575.9 billion and disbursed PHP 558.8 billion (Table 2).

**Table 2. COVID-19 budget utilization reports as of December 31, 2021, in billion pesos**

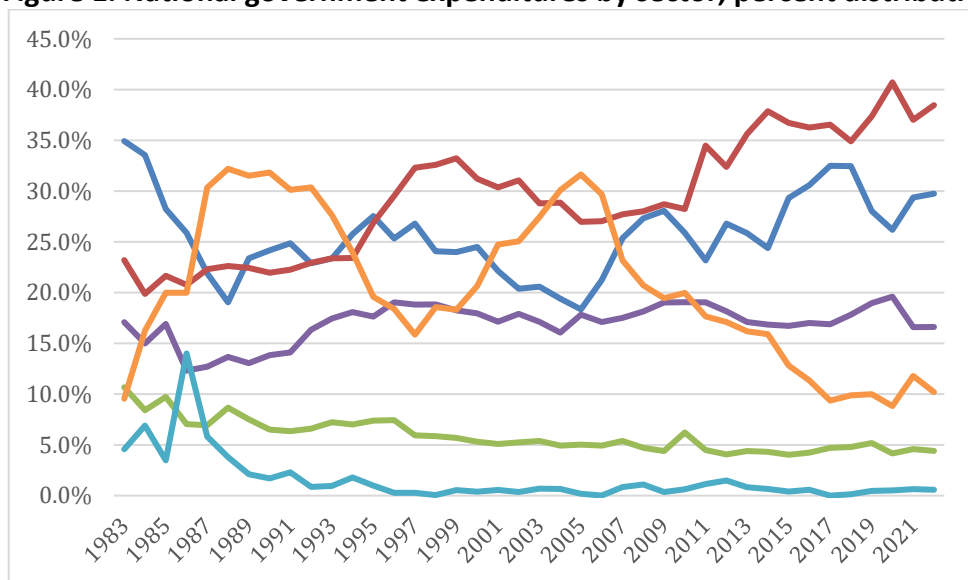
Particulars	Allotment (amount)	Obligations	Disbursements
Total <sup>1</sup>	602.2	575.9	558.8
<i>Bayanihan I</i>	387.9	371.6	363.2
<i>Bayanihan II</i>	214.2	204.3	195.6

Source: Department of Budget and Management (DBM)

In connection with government response to the pandemic, the overall outlook for national government expenditures throughout the years has shown a recent increase in the social services sector (Figure 1), especially in social security, welfare, and employment and in health (Figure 2). For LGUs, there was also an increase in spending on social welfare in 2020 at the expense of the education sector (Figure 3).

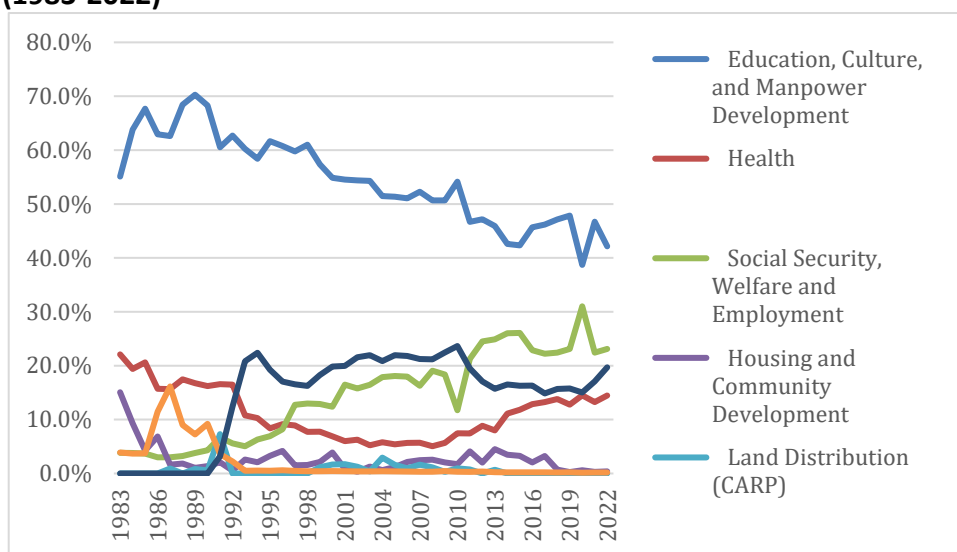
<sup>1</sup> Numbers do not add up due to rounding off

**Figure 1. National government expenditures by sector, percent distribution (1983-2022)**



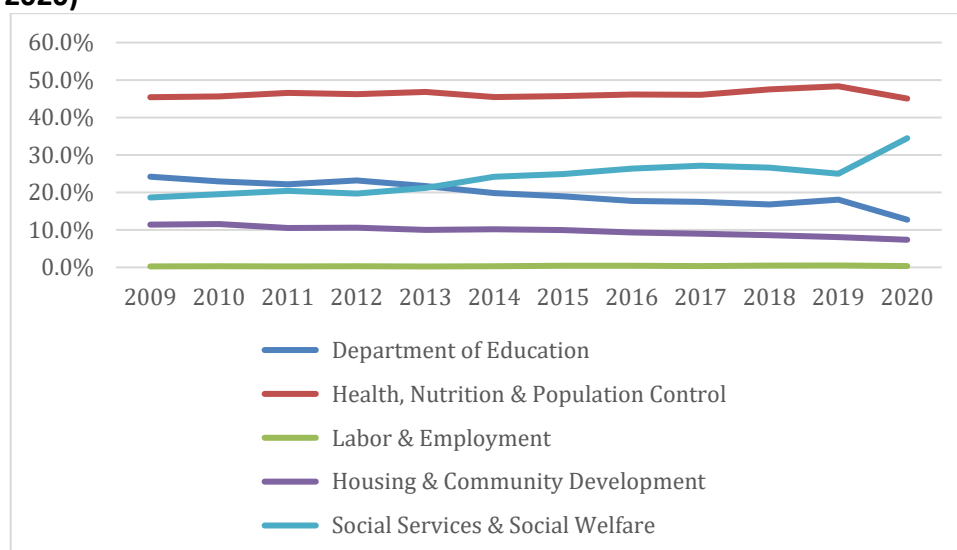
Source: DBM (various years)

**Figure 2. National government expenditures, social services sector, percent distribution (1983-2022)**



Source: DBM (various years)

**Figure 3. Local government expenditures, social welfare sector, percent distribution (2009-2020)**



Source: DBM (various years)

However, the increased prioritization of the health and social services sectors was an emergency measure that was not intended to make up for underinvestment in the health sector pre-COVID-19. For example, in 2019, Republic Act (RA) No. 11223, also known as the Universal Health Care (UHC) Act, was passed. It sought to realize universal health care in the country and ensure guaranteed equitable access to quality and affordable health care, which also protects against financial risk. To continue the attainment of the goals specified in the UHC Act despite the pandemic, the DOH introduced the UHC Catch-up Plan. The UHC Catch-up Plan focuses on: (1) integrating health systems to strengthen the capacity of LGUs, (2) improving health system capacities, (3) institutionalizing streamlined and digital processes and mechanisms, (4) maximizing multi-sectoral engagement, and (5) instilling more responsible community behavior (DOH 2021).

Though the health sector had number one priority during the pandemic in terms of reforms and, to an extent, budgetary allocations, continued investment is necessary for sustainable economic growth.

### 3. Conceptual framework, methodology, and data

#### 3.1. Conceptual framework

Primarily grounded on economic growth theories discussed above, this study will also be based on the neoclassical theory of distribution that explains how national income is divided among factors of production. Alternatively, this captures the contribution of factors of production to national income and the capacity of an economy to produce goods and services or aggregate supply (Mankiw 2022). For the aggregate supply theory, factors of production (i.e., land, labor, and capital) and the existing technology that is used to transform these factors/inputs into goods and services are what determine the productive capacity of an economy.

What, in turn, explains the demand and supply of these factors of production? In the case of labor, firm demand depends on the perceived marginal productivity of labor represented by

real wage (Mankiw 2022). Real wage measures the additional output that an additional unit of labor will produce. Labor productivity, in turn, is affected by human capital investments such as education, training, and health. For health, the Grossman model (Grossman 1972, p. 223) proposes that “health can be viewed as a durable capital stock that produces an output of healthy time. It is assumed that individuals inherit an initial stock of health that depreciates with age and can be increased by investment.”

What, then, determines the decision for supply factors of production in the market? The theory of labor supply suggests that the choice of an individual to work (accept a job) depends on substitution and income effects. In this model, individuals are faced with two choices: to work or not (engage in leisure). As wages increase, the opportunity cost of not working increases, therefore, the individual will substitute work for leisure. However, as wages increase, the employed worker will feel richer and will therefore work less. The question on which of the effects is stronger is empirical and cannot be predetermined, but evidence shows that at lower wage levels, the substitution effect is larger than the income effect (Mankiw 2022; Ehrenberg & Smith 2009).

In more recent years, compensation packages extend beyond wage. For jobs that have occupational hazards, compensation packages include health insurance, company health expenditures on workers, paid sick days, mental wellness/health activities, organizational safety and health standards (OSH), and other non-pecuniary means of compensation factor into the worker’s decision to supply labor (Ehrenberg & Smith 2009). These contribute to the decision of whether to work or not. Based on this framework, this study tries to examine any association/correlation between public health expenditures or health outcomes and measures of labor participation and productivity.

### 3.2. Methodology, data, and scope

#### 3.2.1. Methodology and approach

Before empirically testing the relationship between health policy and indicators and labor productivity, causality tests were run to provide basis for subsequent testing. Based on the discussion in the previous section of empirical models linking health sector outputs/outcomes and measures of labor productivity (such as GDP per capita/income), the study, primarily following Bhargava et al. (2001), will use the unobserved effects model for panel data (unless the robustness checks indicate the use of either pooled or simple ordinary least squares methods). The Bhargava equation is:

$$Y_{it} = \sum_{j=1}^m z_{ij}Y_j + \sum_{j=1}^{n_1} x_{1ijt}\beta_j + \sum_{j=n_1+1}^n x_{2ijt}\beta_j + u_{it} \quad (i = 1, \dots, N; t = 1, \dots, T)$$

Eqn. 1

Where  $z$  is time invariant variables,  $x_1$  and  $x_2$  the exogenous and endogenous time-varying variables,  $N$  the number of observed countries in time  $T$  periods, and  $u_{it}$  the error. This equation is used for estimating static random effects models for situations where GDP growth rates have endogenous explanatory variables.

This equation will be tested at two different levels of data: (1) cross-country, across the ASEAN region, and (2) within the regions of the Philippines.

a) Cross-country for ASEAN comparable countries: Philippines, Vietnam, Indonesia, Thailand, and Malaysia—the study used the World Bank Data for cross-country estimation.

- Two independent variables will be used as the measure of a country's performance or the country's economic output—GDP per capita and annual GDP growth rate.
- Models will be generated using the identified measurement of a country's economic growth and other factors that might influence the independent variables through national spending and some health outcomes.
- The following model for estimation, which is a reduced form equation similar to Bhargava (2001), will be used:

$$Y_{ij} = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2ij} + \cdots + \beta_5 X_{5ij} + \epsilon_{ij}$$

Eqn. 2

where,

$Y_1 = \text{GDP per capita}$  and  $Y_2 = \text{annual GDP growth}$

$X_1 = \text{Public health expenditure}$

$X_2 = \text{Private health expenditure}$

$X_3 = \text{Mortality rate under five}$

$X_4 = \text{Life expectancy at birth (total years)}$

$X_5 = \text{Fertility rate}$

$\epsilon_{ij} = c_i + u_{ij}$

$c_i = \text{unobserved heterogeneity}$  and  $u_{ij} = \text{idiosyncratic error term}$

$i = \text{country}$  and  $j = \text{year}$

As per the World Bank (n.d.), GDP refers to the gross value of products and services from residents summed with the value of product taxes but excluding subsidies outside its value. The gross computation disregards the deductions for the depreciation of assets or damage to natural resources. GDP per capita is based on purchasing power parity (PPP). PPP GDP is GDP converted to international dollars using PPP rates. The data used are in constant 2017 international dollars, whereas the annual percentage growth rate of GDP at market prices is based on constant local currency. Aggregates are based on constant 2015 prices expressed in US dollars. The public expenditure on health from domestic sources per capita is expressed in international dollars at PPP, and the current private expenditures on health per capita are expressed in international dollars at PPP.

For health outcomes, which are all based on the definitions by the World Bank (n.d.), mortality rate under five refers to the likelihood that one out of 1,000 newborns will die before the age of five. Life expectancy at birth is the expected number of years that a newborn will live (provided that patterns of mortality will remain consistent throughout their lifetime), and fertility rate refers to the number of children expected to be borne from a woman who will live past her ability to bear children. For both mortality rate under five and fertility rate, the rates are specific to the rates of the specified years.



b) Across regions in the Philippines

The regressand to be used across regions in the Philippines is labor productivity, which is computed as GDP per worker. Model estimates are generated to analyze the relationship of health outcomes and, more importantly, public health spending on labor productivity. As such, the model specification is as follows:

$$Y_{ij} = \beta_0 + \beta_1 X_{1ij} + \beta_2 X_{2ij} + \cdots + \beta_5 X_{5ij} + \epsilon_{ij}$$

Eqn. 3

where,

$$\begin{aligned} Y_1 &= \text{labor productivity} \\ X_1 &= \text{public health spending per capita} \\ X_2 &= \frac{\text{gross capital formation}}{\text{GDP}} \\ X_3 &= \text{fertility rate} \\ X_4 &= \text{infant mortality rate} \\ X_5 &= \text{age} \\ \epsilon_{ij} &= c_i + u_{ij} \\ c_i &= \text{unobserved heterogeneity and } u_{ij} = \text{idiosyncratic error term} \\ i &= \text{region and } j = \text{year} \end{aligned}$$

The age variable is defined as the proportion of the population who are 15 years old and over. From the definition of labor productivity, which is RGDP per worker, more workers that do not reflect an adequate increase in output will result in a lower and less productive workforce. Hence, this variable may be negatively related with labor productivity.

According to Bhargava et al. (2001), high fertility rates (especially in developing countries) negatively affect investments in human capital, which lead to reduced physical work capacity. The expectation is the same in this study where fertility rates may be negatively associated with labor productivity. Infant mortality is a health outcome that has also been used in literature as an indication of the health of the population. Furthermore, previous literature has delved on its relationship with economic output where higher GDP and growth is related to a lower infant mortality (Baird et al. 2011; Erdogan et al. 2013; O'Hare et al. 2013). Thus, it is expected that higher infant mortality means lower productivity.

Previous literature has included capital to models that estimate worker productivity (Siddique et al. 2020). Also, as factors of production, increasing capital may make laborers/employed persons more efficient and productive. In the same way, gross capital formation per GDP across the regions may improve the model in this paper and is expected to have a positive relationship with labor productivity.

The government spends on health with the expectation that this will improve the health of the population. Workers are then more equipped with better human capital to be productive at work. In theory, it is expected that health spending will increase worker productivity.

### 3.2.2. *Data, scope, and limitations*

For the cross-country estimations, the data from 2010 to 2020 were sourced from the World Bank Databank. For the regional Philippine data, the data for the same period were taken primarily from government sources such as the Philippine Statistics Authority (PSA, Family Income and Expenditure Survey/Labor Force Survey) and the Bureau of Local Government and Finance of the DOF.

The Philippine regional regressions investigate the effect of public health spending on labor productivity across the regions in the Philippines. Other relevant articles in the literature have analyzed labor productivity, which is defined as output per hour (Raghupathi et al. 2020). However, the paper only makes use of labor productivity computed as RGDP per worker. The demographic characteristics are specific to the various regions, as such, the results would only be applicable to the country. Also, the results reflect the data gathered only from 2010 to 2020. This study is subject to the limitations of the available data on health outcomes, annual estimates of the labor force, public health spending, and other related variables. With this, the Autonomous Region in Muslim Mindanao (ARMM) is not included in the estimation. Unlike the Philippine regional data, the cross-country data are more controllable as the data of each country are obtained only from one databank. However, there would have been other explanatory variables to be included in the model, but the reporting years are not consistent in each country.

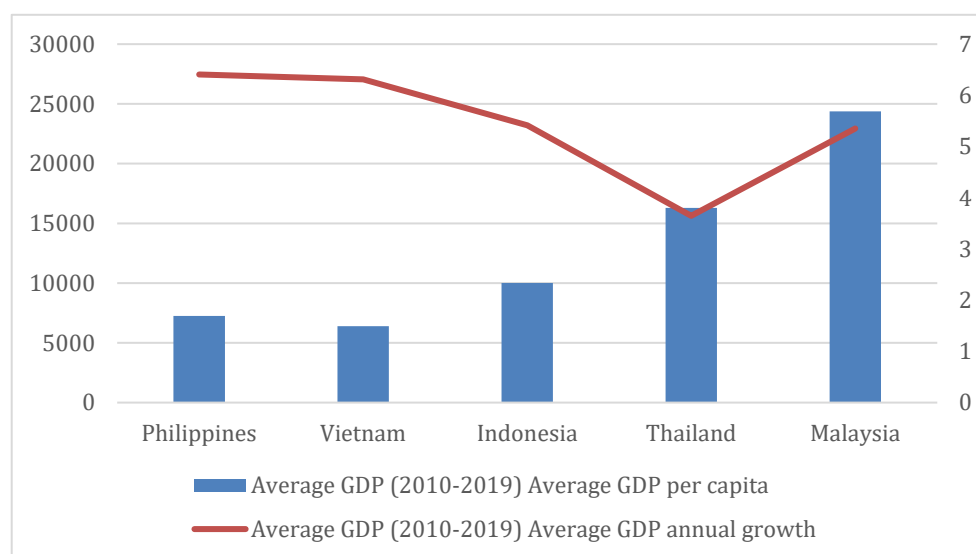
## 4. **Regression results**

This section presents the results of estimations to establish evidence of correlation/association of health outcomes/public health spending with measures of labor productivity. Preliminary diagnostic causality tests showed evidence that suggests that, across Philippine regions, there might be a causal relationship between public health expenditures and labor productivity. There was no such evidence of causality for comparable ASEAN countries, though studies have shown robust association (Annex 1.1). This is consistent with empirical evidence in the literature and is basis for proceeding with estimations.

### 4.1. *Cross-country regressions*

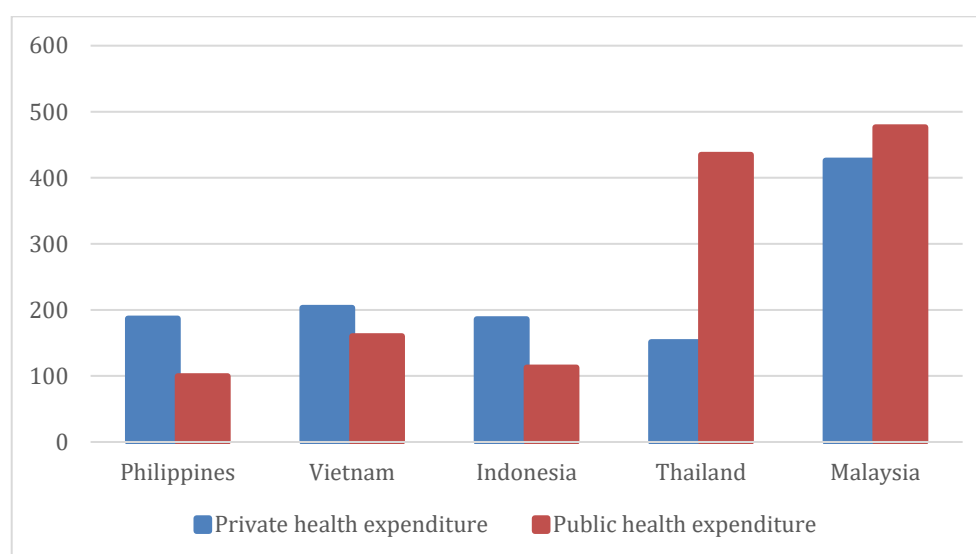
The next several figures and tables show a comparison of the Philippines to selected ASEAN countries in the region. Figure 4 shows that the Philippines' average GDP per capita is second to the lowest among the selected developing countries even though its average annual GDP growth was the highest (The World Bank Databank, 2010-2020). Figure 5 shows that the Philippines also lags behind in terms of public health expenditures per capita. The descriptive statistics for these figures are in Table 3.

**Figure 4. Average GDP per capita and annual growth rate by country (2010-2019)**



Source: The World Bank Databank

**Figure 5. Average private and public health expenditure per capita (2010-2019)**



Source: The World Bank Databank

**Table 3. Descriptive statistics for cross-country regressions**

Variable (Obs=10)	Country									
	Philippines		Indonesia		Thailand		Vietnam		Malaysia	
	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev
GDP per capita	7251.01	1043.28	10010.52	1164.35	16293.52	1399.95	6391.82	985.28	24371	2691.61
GDP growth annual	6.41	0.98	5.42	0.53	3.65	2.27	6.31	0.63	5.35	0.90

Variable (Obs=10)	Country									
	Philippines		Indonesia		Thailand		Vietnam		Malaysia	
	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev	Mean	StdDev
Private health expenditure	186.90	21.74	185.97	15.29	151.18	36.23	202.94	53.64	425.96	75.00
Public health expenditure	99.51	30.83	112.74	43.14	434.63	60.91	160.10	46.11	476.41	72.26
Mortality rate under 5 per 1,000 live births	29.67	1.51	25.43	3.12	11.15	1.55	21.94	0.61	8.16	0.21
Life expectancy at birth (total years)	70.55	0.48	70.56	0.85	75.82	1.01	75.10	0.18	75.35	0.57

Source: The World Bank Databank

The Hausman test results identified the fixed effects model as the proper method to control for unobserved effects within each country (Table 4a). The results of the regressions, with GDP per capita (at PPP constant 2017) as the dependent variable, suggest that, after five years, every unit increase in public and private health expenditures will increase the GDP per capita by 0.202 and 0.235, respectively (Table 4b). These findings are in line with those of Rivera and Currais (1999), which found that health expenditures were positively associated with GDP per capita. Also, for the health outcomes variables, life expectancy was found to be positively associated with GDP per capita, similar to Knowles and Owen (1995). An interesting finding that is consistent with NGT is the positive association of lagged investment (gross capital formation per capita) with GDP per capita. The presence of more physical capital such as infrastructure and equipment is associated with higher productivity.

**Table 4a. Results of the Hausman diagnostic test for fixed effects**

	(b) Fixed	(B) random	(b-B) Difference
Public health expenditure	0.2019	0.4693	-0.2674
Private health expenditure	0.2349	0.2381	-0.0032
Mortality rate	0.0065	-0.0228	0.0293
Life expectancy	0.0295	-0.13801	0.1675
Fertility rate	-0.0618	-0.0939	0.0321
Gross capital formation	0.1120	0.1817	-0.0697

*b* = consistent under  $H_0$  and  $H_a$ ; obtained from *xtreg*

*B* = inconsistent under  $H_a$ , efficient under  $H_0$ ; obtained from *xtreg*

Test:  $H_0$ : difference in coefficients not systematic

$$chi2(5) = (b - B)'[(V_b - V_B)^{-1}](b - B)$$

$$= 479.65$$

$$Prob > chi2 = 0.0000$$

( $V_b - V_B$  is not positive definite)

**Table 4b. Regression results, dependent variable, GDP per capita, at PPP constant 2017**

Variables	(1) GDP per capita	(2) GDP per capita	(3) GDP per capita	(4) GDP per capita	(5) GDP per capita	(6) GDP per capita
Lag public health expenditure	0.418*** (0.0205)	0.240*** (0.0200)	0.233*** (0.0208)	0.179*** (0.0265)	0.183*** (0.0275)	0.202*** (0.0272)
Lag private health expenditure		0.248*** (0.0219)	0.235*** (0.0248)	0.256*** (0.0245)	0.242*** (0.0325)	0.235*** (0.0312)
Lag mortality rate			−0.00210 (0.00186)	0.00361 (0.00259)	0.00270 (0.00298)	0.00649** (0.00318)
Lag life expectancy				0.0321*** (0.0106)	0.0294** (0.0115)	0.0295*** (0.0110)
Lag fertility rate					−0.0255 (0.0411)	−0.0618 (0.0416)
Lag investment						0.112*** (0.0417)
Constant	7.260*** (0.0971)	6.885*** (0.0665)	7.033*** (0.146)	4.742*** (0.772)	5.064*** (0.932)	5.156*** (0.891)
Observations	75	75	75	75	75	75
R-squared						
Within	0.857	0.950	0.951	0.957	0.958	0.962
Between	0.850	0.907	0.886	0.752	0.751	0.741
Overall	0.832	0.844	0.839	0.704	0.715	0.702
Number of country code	5	5	5	5	5	5

Standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1; Note: Y=ln(GDP per capita) Lag investment (Gross capital formation)

Another round of regressions was run using the annual GDP growth rate as the dependent variable. The results showed that public health expenditures were negatively associated with GDP growth rate (Annex 1.2.b; more detailed results may be requested from the authors). Private health spending and life expectancy were positive and significantly related to GDP growth.

#### 4.2. *Philippine regional regressions*

This section shows the results of estimations done looking at variations across regions in the Philippines. Table 5 shows the summary statistics of the variables to be used in the regressions. It should be noted that fertility rate has less observations as the data for this variable is only until 2019. Thus, the regression results would only reflect data from 2010 to 2019. Fertility rate has a mean of about 6.9, a minimum value of about 4.0, and a maximum value of 9.5.

Meanwhile, infant mortality rate has an average of 11.3, and a maximum value of 18.4. Public health spending per capita has a minimum value of 284.2 and a maximum value of about 7667.3.

**Table 5. Descriptive statistics**

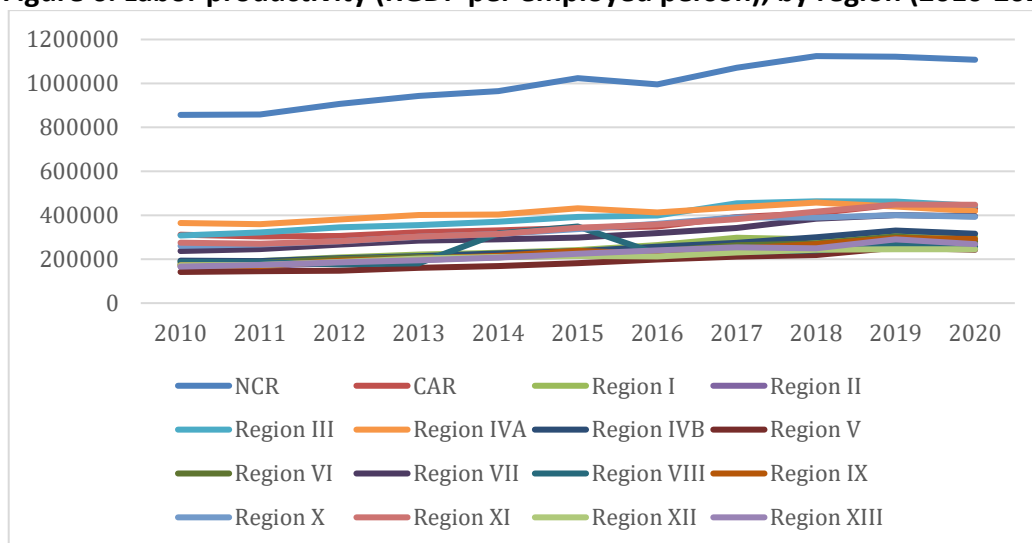
Variable	Obs	Mean	Std. dev.	Min	Max
RGDP, constant 2018 (in million PhP)	176	930489.31	1179757.3	163468	6224134.5
Total employed persons (in million PhP)	176	2.371	1.347	0.673	6.443
Labor productivity (in PhP)	176	325149.29	193586.21	141831.92	1124424.6
Labor productivity growth rate (in percent)	176	4.461	7.676	-35.469	75.572
Age (proportion of population that are 15 years and over)	176	0.67	0.04	0.384	0.74
Education (proportion of employed that at least graduated from college)	176	0.149	0.039	0.076	0.277
Fertility rate (live births per 100 female population)	160	6.87	0.835	4	9.5
Infant mortality rate (infant deaths per 1,000 live births)	176	11.294	2.673	6.801	18.4
Gross capital formation, constant 2018 (in million PhP)	176	211702.29	283761.76	23041.977	1640251.5
Gross capital formation/RGDP, constant 2018 (in PhP)	176	0.23	0.079	0.079	0.455
Public health spending <sup>2</sup> per capita (in PhP)	176	1192.212	858.125	284.221	7667.283
Population (in million)	176	6.035	3.659	1.62	16.057

To see the regional variations, Figure 6 shows the RGDP per worker (in PHP) in each region in the Philippines for 2010 to 2020. Over the years, NCR has been the region with the highest RGDP per worker by a considerable gap from the other regions.

From 2010 to 2016, the Cordillera Administrative Region (CAR) has the highest public health spending per capita (in PHP) among the regions outside NCR as seen in Figure 7. After 2016, a steep increase in public health spending per capita can be seen for NCR.

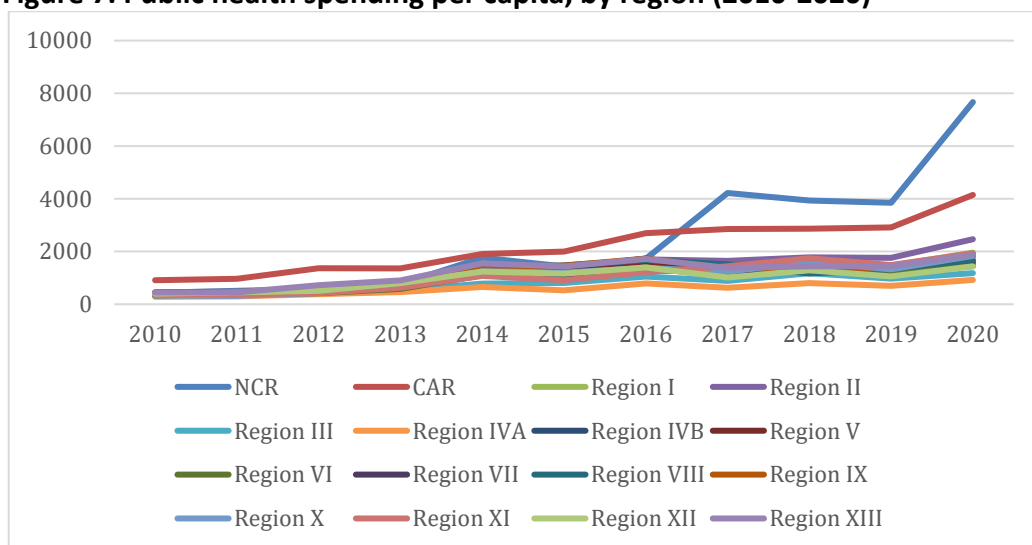
<sup>2</sup> Sum of health, nutrition, and population control expenditures of LGUs (provinces, cities, and municipalities) and the regional allocation of the expenditure program of the Department of Health (BESF).

**Figure 6. Labor productivity (RGDP per employed person), by region (2010-2020)**



Source: Philippine Statistics Authority (PSA) regional data on gross regional domestic product and employment

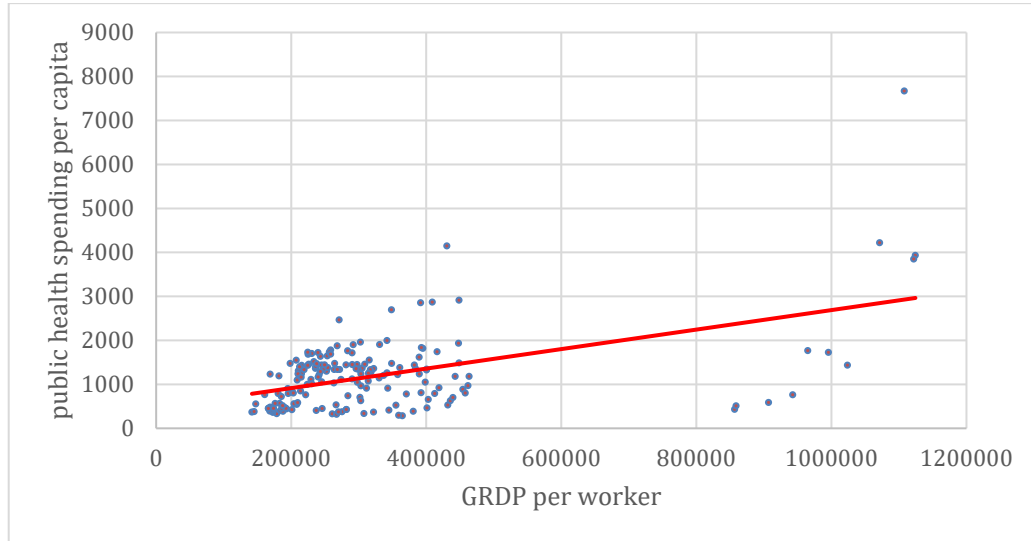
**Figure 7. Public health spending per capita, by region (2010-2020)**



Source: DOF-BLGF, BESF, and PSA data on population by region.

Figure 8 shows a scatterplot and the linear relationship between public health spending per capita and labor productivity. The positive relationship between the two variables shows that an increase in public health spending can be associated with an increase in labor productivity.

**Figure 8. Public health spending per capita with labor productivity (2010-2020)**



Similar to that of the cross-country regressions, public health spending, gross capital formation/RGDP, and health outcomes are lagged five years. In addition, to make the variables consistent for analysis, monetary variables are normalized and so labor productivity, gross capital formation/RGDP, and public health spending per capita are transformed to their natural logarithmic form. The regression model is as follows:

$$\begin{aligned}
 \ln(\widehat{\text{labor productivity}})_{ij} &= \beta_0 + \beta_1(\ln(\text{public health spending per capita lagged 5 years})_{ij}) \\
 &+ \beta_2(\ln(\text{gross capital formation/GRDP lagged 5 years})_{ij}) \\
 &+ \beta_3(\text{fertility rate lagged 5 years}_{ij}) \\
 &+ \beta_4(\text{infant mortality rate lagged 5 years}_{ij}) + \beta_5(\text{age}_{ij}) + \mu_{ij}
 \end{aligned}$$

Table 6a shows the results of the regressions with labor productivity (RGDP per employed person) as the dependent variable. In the model, public health spending per capita is positively associated with labor productivity. A 1.0 percent increase in public health spending per capita may be related to an increase of about 15.1 to 17.9 percent in labor productivity in five years. This is consistent with the theory that higher investments/spending in health may be related to better productivity. This is also similar to the cross-country regression results in Table 4b with GDP per capita as the dependent variable, as well as the findings from previous literature linking health expenditure with output and productivity (V. Raghupathi & W. Raghupathi 2020; Rivera & Currais 1999).

Fertility rate and infant mortality rate are statistically insignificant. Although this contradicts the findings of Bhargava et al. (2001), this result may be supported by the argument of Rivera and Currais (1999) that health outcomes like mortality rates might not be “sensitive indicators to improvements in quality of life” (p. 260) (which prompted their use of health expenditure as the proxy variable for health status). The age variable, defined as the proportion of the population that are 15 years or over, is significant and negatively associated with labor productivity. This may mean that solely increasing laborers decreases productivity. Finally, gross capital formation/RGDP lagged five years is insignificant and negative, suggesting that



the lagged gross capital formation/RGDP ratio does not explain the difference in levels of labor productivity across regions. This is contrary to the expectation of a positive relationship with productivity. The Hausman test in Tables 6b and 6c shows that the random effects model is appropriate for this model.

For this data, improved (or worse) health outcomes do not appear to be related to labor productivity in five years. However, public health spending is important and the positive association between lagged public health spending and labor productivity may show that government spending in the health sector is worth increasing with respect to further improving productivity, especially for the employed.

**Table 6a. Regional regression results**

Variables	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)
ln (total public health spending per capita lagged 5 years)	0.151*** (0.0239)	0.157*** (0.0288)	0.152*** (0.0419)	0.161*** (0.0350)	0.179*** (0.0139)
ln (gross capital formation/RGDP lagged 5 years)		−0.0395 (0.0565)	−0.0378 (0.0578)	−0.0454 (0.0490)	−0.0591 (0.0370)
Fertility rate lagged 5 years			−0.0133 (0.0463)	−0.0107 (0.0422)	0.00824 (0.0143)
Infant mortality rate lagged 5 years				0.0171 (0.0135)	0.00660 (0.0112)
Age (proportion of working age)					−1.518*** (0.144)
Constant	11.72*** (0.204)	11.62*** (0.292)	11.75*** (0.631)	11.46*** (0.541)	12.34*** (0.275)
Observations	96	96	96	96	96
Number of regions	16	16	16	16	16
Within R-squared	0.5421	0.5448	0.5470	0.5471	0.8012
Between R-squared	0.0004	0.0005	0.0008	0.3245	0.0536
Overall R-squared	0.0214	0.0273	0.0283	0.2216	0.0879

Robust standard errors in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6b. Results of the Hausman (sigmamore) diagnostic test for fixed effects**

	(b) fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b- V_B)) S.E.
ln (total public health spending per capita lagged 5 years)	0.1765616	0.1786411	-0.0020795	0.0014388
ln (gross capital formation/RGDP lagged 5 years)	-0.0553124	-0.0590656	0.0037531	0.0044932
Fertility rate lagged 5 years	0.0081973	0.0082414	-0.0000441	0.0017305
Infant mortality rate lagged 5 years	0.0027342	0.0065966	-0.0038623	0.0014938
Age (proportion of working age)	-1.527849	-1.517723	-0.010126	0.0065065

*b = consistent under Ho and Ha; obtained from xtreg*

*B = inconsistent under Ha, efficient under Ho; obtained from xtreg*

*Test: Ho: difference in coefficients not systematic*

$$chi2(5) = (b - B)'[(V_b - V_B)^{-1}] (b - B)$$

$$= 7.86$$

$$Prob > chi2 = 0.1640$$

**Table 6c. Breusch and Pagan Lagrangian multiplier test for random effects**

	Var	sd = sqrt(Var)
ln (labor productivity)	0.1535295	0.3918284
E	0.0022181	0.0470971
U	0.122735	0.3503356

*Test: Var(u) = 0*

$$\frac{chibar2(01)}{Prob > chibar2} = 196.41$$

$$= 0.0000$$

Note: If we fail to reject the null hypothesis, the random effects model is not appropriate to use.

## 5. Health spending trends in the Philippines

The previous section provides empirical evidence on the role of health spending on labor productivity and participation. However, critical policy questions such as these remain: What is the country's health spending compared with regional and aspirational peers? What level of health spending does the country need? This section provides a deep-dive analysis of health spending in the Philippines, which could be used to guide the government in making medium- and long-term.

In the Philippines, the health economy has consistently grown faster than the overall economy. From 2014 to 2019, it has grown in real terms at an average annual rate of 9.0 percent compared to 5.0 percent with GDP. The rapid growth in health spending in the last decade could be attributed to the sustained growth in government health spending. In a growth accounting model, the increases in public spending are driven by these three factors: (1) macro-economic growth, that is, increases in real GDP per capita; (2) higher fiscal resources, that is, increases in aggregate public spending because of new policy actions, such as an expansion of earmarked consumption or income taxes; and (3) re-prioritization of health, that is, increases in the share of public spending on health budget to the total government budget (Tandon et al. 2018). All these factors positively contributed to the increases in public health spending in the Philippines in the recent decade. The Philippines GDP per capita (in real terms) grew by almost 4.7 percent

from 2010 to 2019, while aggregate health spending increased by 7.4 percent annually during the same period. This could be attributed to the government's newly found revenue streams, such as the landmark earmarking of excise taxes in 2013 (see RA 10351). In the recent decade, the government has prioritized social services leading to higher spending in key social sectors, such as the Department of Social Welfare and Development, DOH, and Department of Education, to fund key programs such as the conditional cash transfer and social health insurance (PhilHealth) subsidies. In 2020, during the first year of the pandemic, public spending on health further improved because of increasing aggregate public spending and the re-prioritization of public resources to the health sector to finance the pandemic response.

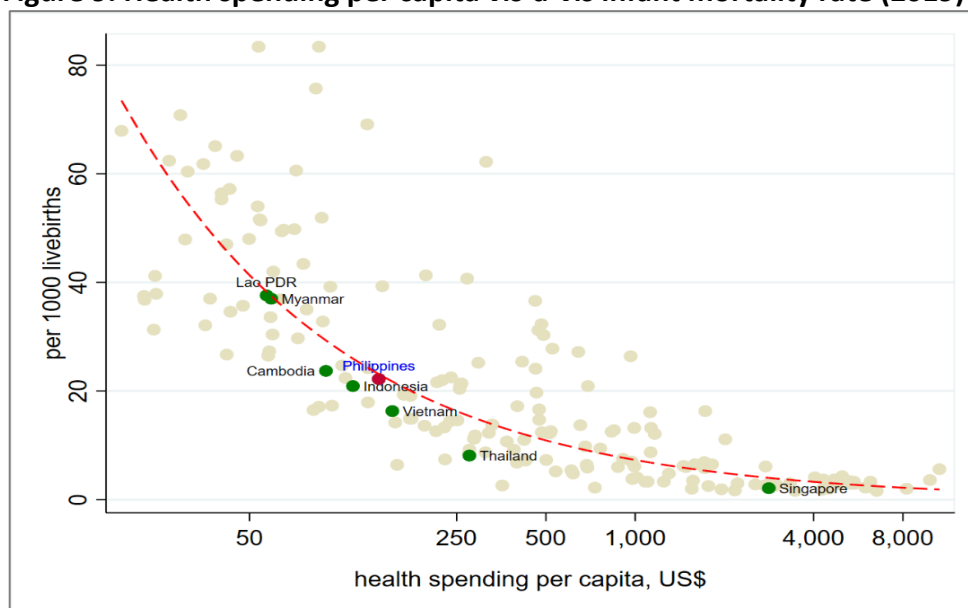
Despite the increase in health spending in the Philippines, it remains low compared to regional and aspirational peers. While public spending is increasing, private out-of-pocket (OOP) spending still accounts for almost half of the total health spending in the country. The World Health Organization (WHO) discourages the widespread use of OOP, which is a regressive form of health financing that limits access to health services and increases the risk of incurring catastrophic health expenditure, pushing more Filipinos into poverty. The subsequent section examines the pattern and distribution over time and the different financing sources.

### *5.1. Population health and health spending*

Infant mortality rate (IMR), which is the most sensitive marker for population health, has improved in recent decades. IMR declined almost threefold from 1960 to 2019. Despite progress, the country has plenty of room for improvement. IMR remains below average for upper middle-income countries (UMIC), the projected level of economic development of the Philippines by 2023. The country has had the slowest decline in IMR compared to its regional ASEAN peers.

Health spending remains a critical component in improving health outcomes, which is the ultimate goal of any health system. Figure 9 shows the positive linear relationship of health spending per capita and infant mortality. The magnitude of association of health spending and population health outcomes (e.g., infant mortality rates) is fraught with possible bias because of uncontrolled factors such as social determinants of health and disease prevalence. However, health expenditure consistently predicts health outcomes and an important measure of the nation's level of health investment.

**Figure 9. Health spending per capita vis-à-vis infant mortality rate (2019)**



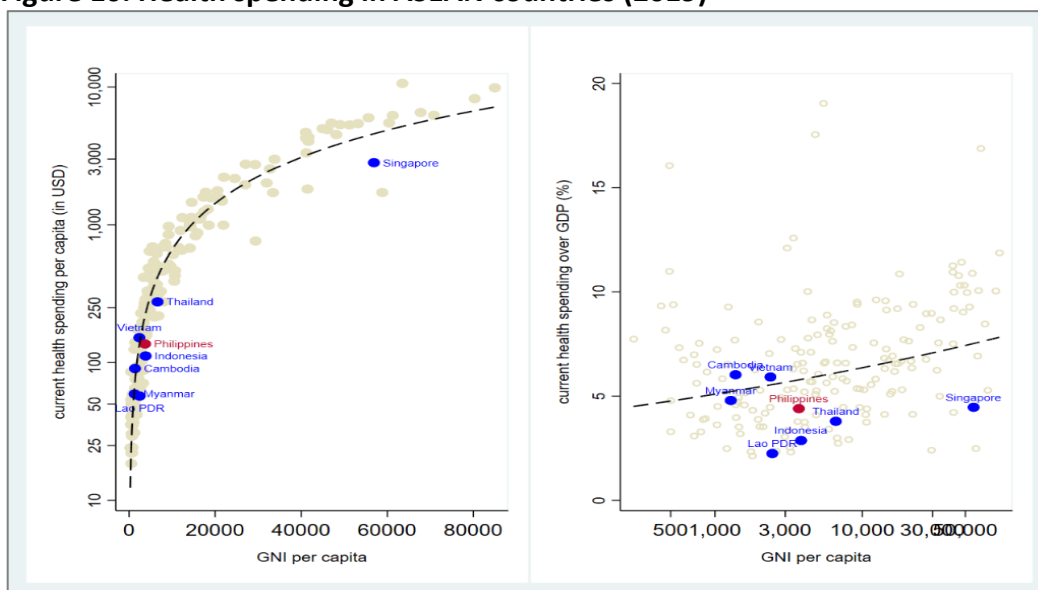
Source: Analysis of World Development Indicators

## 5.2. Health spending trends in the Philippines

Health spending in the Philippines remains low compared to aspirational peers. In 2019, the Philippines spent PHP 885 billion or USD 150 per capita. While the country's health spending is relatively higher than lower middle-income countries, it is considered low compared to Thailand (USD 296 per capita), for instance, which is one of the countries that have successfully implemented universal health care. In connection to this, the Philippines is in the bottom of the pack when compared to upper middle-income countries (USD 500 per capita) (see Figure 10).

In examining health spending, it is critical to observe the pattern of different sources. The way health care is financed varies considerably across countries. In general, the sources of health spending are classified as either public or private (e.g., household out-of-pocket or OOP and voluntary private insurance). To improve efficiency and equity, public spending should be the major source of financing (WHO 2018).

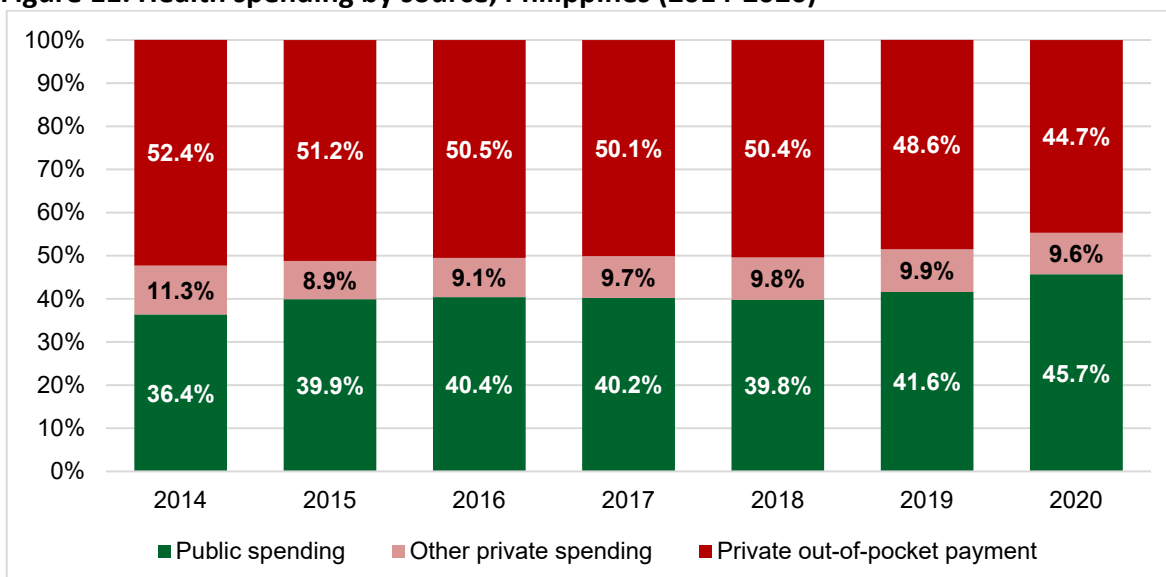
**Figure 10. Health spending in ASEAN countries (2019)**



Source: Analysis of Global Health Expenditure Database

In health systems that have achieved UHC, public spending is the major source of health financing with minimal OOP spending. In Thailand, for instance, 80.0 percent of health spending are accounted for by public sources and the rest are by private OOP. In recent years, the share of OOP spending has been declining, whereas public spending has been increasing. This pattern follows the concept of a health financing transition observed globally, in which as countries become richer, the share of OOP spending declines and public spending increases (Fan & Savedoff 2014). Figure 11 shows the share of different sources of health spending.

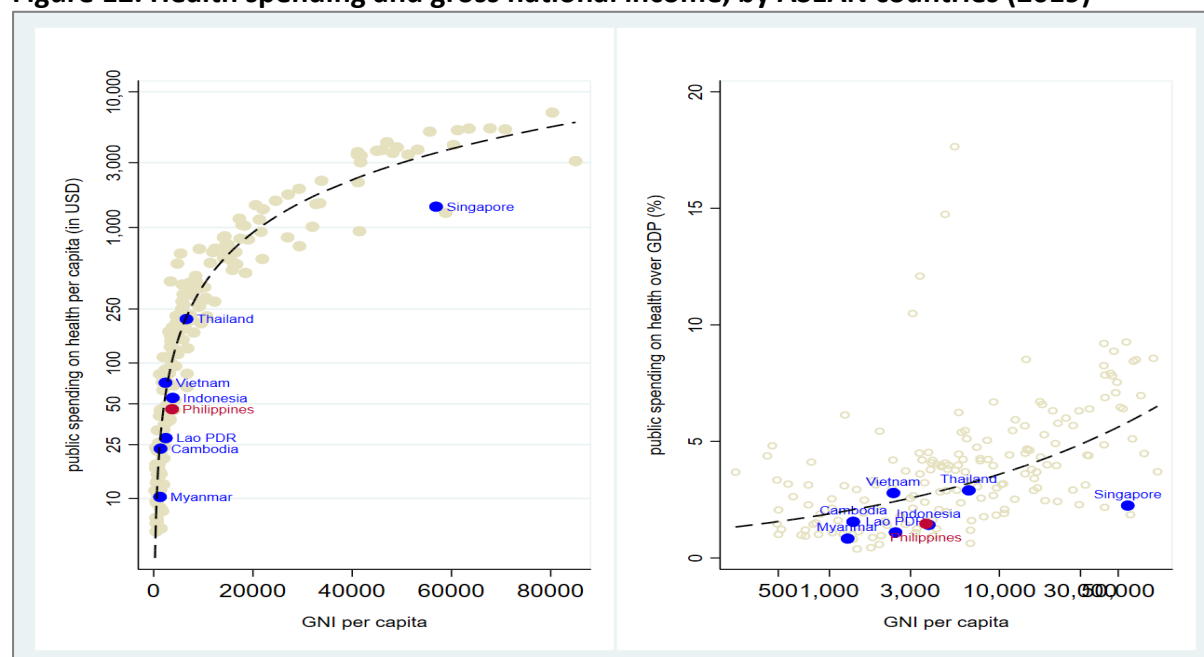
**Figure 11. Health spending by source, Philippines (2014-2020)**



Public spending on health has vastly improved in the Philippines. In the recent decade, public spending on health per capita has increased from USD 32 in 2010 to USD 60 in 2019 (in 2019 constant). This is largely attributed to the increase in the budget allocated to the health sector

from earmarked sin tax revenues starting in 2013, which was used to finance key sectoral programs (e.g., Health Facilities Enhancement Program, PhilHealth premium subsidy). Also, the improvement of the country's macro-fiscal environment and a robust economic growth have catapulted public spending on health. The sustained increase in public spending on health in recent years has resulted in a decline in the share of OOP spending. However, despite these improvements, public spending on health remains low compared to other countries in the region. Thailand and Malaysia spent four times more than the Philippines in 2019 (see Figure 12). The country's public spending on health accounts for about 1.5 percent of GDP, which is significantly lower than that of Thailand, Vietnam, Singapore, and Malaysia (WHO, 2022).

**Figure 12. Health spending and gross national income, by ASEAN countries (2019)**



Source: Analysis of Global Health Expenditure Database

The COVID-19 pandemic has promoted the government to spend more on health to strengthen the country's public health response. As shown in Figure 11, the share of public spending on health has increased to 46.0 percent in 2020 from 40.0 percent in the previous years. The pandemic could be an important catalyst for the government to further increase fiscal space for health. Also, the government's commitment to UHC, which is an important political agenda, would set off more budget allocation in the health sector. However, critical questions remain. Can the government truly sustain more public spending in the medium- to long-term? At what expense? The pandemic has unfortunately severed the country's economic output, which resulted in lower tax revenues and higher budget deficits and government debt.

Curative care accounts for the majority of health care spending in the country. Data from the National Health Accounts (NHA) show that from 2014 to 2019, almost half (41.0 to 43.0 percent) of current health spending in the country are spent on hospitals (Table 7). This is followed by spending on retailers and other providers of medical goods (around 30.0 to 33.0 percent of health spending), which include drug stores and other sellers of medical goods. Spending for primary preventive care does not even account for 10.0 percent of the total health spending. Even if this is combined with the share of ambulatory health care (which are mostly outpatient in nature), the highest total share would only be 13.0 percent (PSA 2022; Uy et al. 2022).

**Table 7. Percent distribution of total health care expenditures, by health care provider (2014-2019)**

Health care provider	2014	2015	2016	2017	2018	2019
Total expenditure (PhP billion)	489.1	543.6	598.5	655.7	714.8	792.6
Hospitals	41.0	43.0	41.2	41.2	42.1	43.6
Public general hospitals	15.9	17.4	16.7	16.7	18.0	19.0
Private general hospitals	16.7	17.4	16.6	16.2	15.7	16.1
Specialized hospitals (other than mental health hospitals)	2.4	2.7	2.5	2.4	2.6	2.6
Other hospitals	6.0	5.5	5.5	5.9	5.9	5.8
Preventive health care	8.0	8.7	9.1	9.2	7.1	7.3
Ambulatory health care	4.2	4.5	4.3	4.2	4.3	4.4
Retailers and other providers of medical goods	33.1	32.4	32.1	31.7	32.2	30.3
Other providers	13.6	11.5	13.3	13.7	14.2	14.3

Sources: PSA 2020; Uy et al. 2022

## 6. Summary and policy recommendations

Our findings suggest that, in general, there is a positive association between health spending and the economic indicators of labor productivity. In terms of per capita GDP, public and private health expenditures are found to be positively related to this measure of labor productivity for both cross-country and across Philippine region regressions. For ASEAN country estimations, life expectancy and investments (as measured by gross capital formation) are also found to be positively associated with GDP per capita. These are consistent with the theory that a longer life expectancy is associated with longer time of productivity, whereas, NGT predicts that investment in physical capital leads to economic growth.

For the regional results, the only other significant variable is the proportion of those of working age, which is negatively associated with RGDP per worker. That is, as the proportion of those who are of working age increases, all else remaining the same, RGDP is expected to decrease. This is consistent with the idea in NGT that, as population increases more rapidly, workers will have reduced productivity if investments in capital do not keep up to equip the expanding workforce.

Overall, the study contributes to the growing literature on health care expenditure and economic performance. The results reinforce the need for the government to allocate resources in key areas (i.e., the health sector) that can stimulate economic growth while also improving population well-being. In light of the potential benefits of health care to the economy, the government should consider the following policy recommendations:

a) Facilitate the implementation of the UHC Act. Under the UHC Act, the government aims to increase public spending on health (both nationally and locally) to provide health care access to all Filipinos regardless of socioeconomic status. Given the findings of this study, the implementation of the UHC Act should not be considered a health sectoral agenda alone, but

also part and parcel of the country's policy to improve economic productivity. While the UHC Act provides the legal framework, critical components of the law have yet to be implemented, including mobilization of health resources and reforms to the PhilHealth.

b) Spend on cost-effective interventions. While the level of public spending on health matters, the type of spending is critical. The government should invest more on improving primary and preventive care, which is more efficient and effective on improving health outcomes compared to curative or hospital-based care. Studies have shown that robust primary care is more likely to lead to healthier employees (e.g., reduced absenteeism) and a healthier population, in general.

c) Invest in strategic physical capital (infrastructure). The ASEAN cross-country regressions showed that lagged investments (gross capital formation) make an impact on labor productivity. This would provide the infrastructure needed to encourage businesses and equip workers with the necessary equipment/tools/technology to be more productive.



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## Annex 1

### Annex 1.1.a. Granger causality test across countries

Equation	Excluded	Chi <sup>2</sup>	df	Prob > chi <sup>2</sup>
ln (GDP per capita)	ln (public health expenditure per capita)	0.000	5	1.000
	ln (private health expenditure per capita)	0.000	5	1.000
	ALL	0.000	10	1.000
ln (public health expenditure per capita)	ln (GDP per capita)	0.000	4	1.000
	ln (private health expenditure per capita)	0.000	5	1.000
	ALL	0.008	9	1.000
ln (private health expenditure per capita)	ln (GDP per capita)	0.000	4	1.000
	ln (public health expenditure per capita)	0.000	5	1.000
	ALL	0.004	9	1.000

### Annex 1.1.b. Granger causality test across countries with annual GDP growth as the dependent variable

Equation	Excluded	Chi <sup>2</sup>	df	Prob > chi <sup>2</sup>
Annual growth rate	ln (public health expenditure per capita)	4.614	5	0.465
	ln (private health expenditure per capita)	1.694	5	0.890
	ALL	6.979	10	0.727
ln (public health expenditure per capita)	Annual growth rate	4.670	5	0.457
	ln (private health expenditure per capita)	4.107	5	0.534
	ALL	6.749	10	0.749
ln (private health expenditure per capita)	Annual growth rate	7.389	5	0.193
	ln (public health expenditure per capita)	8.670	5	0.123
	ALL	15.483	10	0.115



### Annex 1.1.c. Granger causality test across Philippine regions

Equation	Excluded	Chi <sup>2</sup>	df	Prob > chi <sup>2</sup>
ln (labor productivity)	ln (total public health spending per capita)	35.189	5	0.000
	ALL	35.189	5	0.000
ln (total public health spending per capita)	ln (labor productivity)	31.831	5	0.000
	ALL	31.831	5	0.000

$H_0$  = Excluded variable does not Granger – cause Equation variable

$H_a$  = Excluded variable Granger – causes Equation variable

### Annex 1.1.d. Granger causality test across Philippine regions with labor productivity growth rate as the dependent variable

Equation	Excluded	Chi <sup>2</sup>	df	Prob > chi <sup>2</sup>
Labor productivity growth rate	ln (total public health spending per capita)	2.693	5	0.747
	ALL	2.693	5	0.747
ln (total public health spending per capita)	Labor productivity growth rate	0.873	5	0.972
	ALL	0.873	5	0.972

$H_0$  = Excluded variable does not Granger – cause Equation variable

$H_a$  = Excluded variable Granger – causes Equation variable

### Annex 1.2.a. Test between fixed effects or random effects (Hausman test)

	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V <sub>b</sub> -V <sub>B</sub> )) S.E.
Public health expenditure	-0.3054326	-1.58921	1.283777	1.044321
Private health expenditure	1.193934	1.750039	-0.5561046	1.281627
Mortality rate	0.0054456	0.036462	-0.0310165	0.1319196
Life expectancy	-0.1931847	0.2851886	-0.4783733	0.4687552
Fertility rate	-0.2115507	-0.1006974	-0.1108533	1.801088
Gross capital formation				

Dependent variable: GDP growth rate ( $Y = \text{GDP annual growth rate}$ )

$b$  = consistent under  $H_0$  and  $H_a$ ; obtained from xtreg

$B$  = inconsistent under  $H_a$ , efficient under  $H_0$ ; obtained from xtreg

Test:  $H_0$ : difference in coefficients not systematic

$$\chi^2(5) = (b - B)'[(V_b - V_B)^{-1}](b - B)$$

$$= 2.37$$

$$\text{Prob} > \chi^2 = 0.8827$$

( $V_b - V_B$  is not positive definite)

### Annex 1.2.b. Regression results, dependent variable: Annual GDP growth rate

Variables	(1) Annual GDP growth	(2) Annual GDP growth	(3) Annual GDP growth	(4) Annual GDP growth	(5) Annual GDP growth	(6) Annual GDP growth	RE Annual GDP growth
Public health expenditure	−0.826*** (0.236)	−1.398*** (0.293)	−1.756*** (0.501)	−1.434*** (0.517)	−1.308** (0.593)	−1.589** (0.635)	−1.589** (0.635)
Private health expenditure		1.502*** (0.498)	1.458*** (0.501)	1.584*** (0.495)	1.498*** (0.535)	1.750*** (0.572)	1.750*** (0.572)
Lag mortality rate			−0.0295 (0.0335)	0.0472 (0.0507)	0.0545 (0.0536)	0.0365 (0.0555)	0.0365 (0.0555)
Lag life expectancy				0.274* (0.138)	0.310* (0.161)	0.285* (0.162)	0.285* (0.162)
Lag fertility rate					0.194 (0.440)	−0.101 (0.502)	−0.101 (0.502)
Lag investment						−1.417 (1.173)	−1.417 (1.173)
Constant	9.108*** (1.129)	4.431** (1.884)	7.050** (3.521)	−16.63 (12.42)	−20.04 (14.68)	−19.05 (14.65)	−19.05 (14.65)
Observations	75	75	75	75	75	75	75
R-squared	0.144	0.240	0.248	0.288	0.290	0.305	0.305

Standard errors in parentheses: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Regression for (1)-(6) OLS, (7) random effects model

### Annex 1.2.c. Diagnostic test using Breusch Pagan test

	Var	sd = sqrt(Var)
GDP growth rate	3.334685	1.826112
e	2.582334	1.606964
u	0	0

Test:  $Var(u) = 0$

$\frac{chibar2(01)}{Prob > chibar2} = 0.00$   
=1.0000

Note: If we failed to reject the null hypothesis, then random effects is not appropriate to use.

## Annex 2

### Annex 2a. Results of the Hausman (sigmamore) diagnostic test for fixed effects

	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b- V_B)) S.E.
ln (total public health spending per capita lagged 5 years)	0.2000805	0.195157	0.0049236	0.0017591
ln (gross capital formation/RGDP lagged 5 years)	-0.052383	-0.0595584	0.0071754	0.0056794
Fertility rate lagged 5 years	0.0093043	0.009027	0.0002773	0.0021569
Infant mortality rate lagged 5 years	-0.0003107	0.0069506	-0.0072613	0.0020168
Age (proportion of working age)	-1.602296	-1.559836	-0.0424595	0.0116214
Education (percent share of employed that are at least college graduates)	-1.193857	-0.7715342	-0.422323	0.0933768

*b = consistent under Ho and Ha; obtained from xtreg*

*B = inconsistent under Ha, efficient under Ho; obtained from xtreg*

*Test: Ho: difference in coefficients not systematic*

$$\chi^2(6) = (b - B)'[V_b - V_B^{-1}](b - B) = 21.28$$

$$Prob > \chi^2 = 0.0016$$

### Annex 2b. Philippine regional regression with an education variable

Variables	(1) ln (labor productivity)	(2) ln (labor productivity)	(3) ln (labor productivity)	(4) ln (labor productivity)	(5) ln (labor productivity)	(6) ln (labor productivity)
ln (total public health spending per capita lagged 5 years)	0.151*** (0.0240)	0.157*** (0.0293)	0.151*** (0.0427)	0.156*** (0.0384)	0.177*** (0.0150)	0.200*** (0.0207)
ln (gross capital formation/RGDP lagged 5 years)		-0.0362 (0.0591)	-0.0347 (0.0603)	-0.0379 (0.0565)	-0.0553 (0.0393)	-0.0524 (0.0443)
Fertility rate lagged 5 years			-0.0132 (0.0471)	-0.0116 (0.0448)	0.00820 (0.0150)	0.00930 (0.0118)
Infant mortality rate lagged 5 years				0.00858 (0.0124)	0.00273 (0.0108)	-0.000311 (0.00978)
Age (proportion of working age)					-1.528*** (0.142)	-1.602*** (0.0969)
Education (percent share of employed that are at least						-1.194***

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)	ln (labor productivity)
college graduates)						(0.403)
Constant	11.72*** (0.156)	11.62*** (0.264)	11.76*** (0.647)	11.61*** (0.573)	12.41*** (0.255)	12.52*** (0.218)
Observations	96	96	96	96	96	96
Number of regions	16	16	16	16	16	16
Within R-squared	0.5421	0.5448	0.5470	0.5509	0.8020	0.8246
Between R-squared	0.0004	0.0004	0.0006	0.1480	0.0090	0.3711
Overall R-squared	0.0214	0.0268	0.0279	0.1148	0.0543	0.0252

Robust standard errors in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Annex 3

#### Annex 3a. Results of the Hausman (sigmamore) diagnostic test for fixed effects

	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
ln (total public health spending per capita lagged 5 years)	0.6539724	-0.6421563	1.296129	1.370628
ln (gross capital formation/RGDP lagged 5 years)	-6.170997	-2.917183	-3.253814	4.642971
Fertility rate lagged 5 years	4.839818	1.547819	3.291999	1.846261
Infant mortality rate lagged 5 years	-0.304037	-0.2304344	-0.0736093	0.974511
Age (proportion of working age)	-56.6649	-26.35711	-30.30779	11.2921

$b = \text{consistent under } H_0 \text{ and } H_a; \text{ obtained from } xtreg$

$B = \text{inconsistent under } H_a, \text{ efficient under } H_0; \text{ obtained from } xtreg$

Test:  $H_0$ : difference in coefficients not systematic

$$\chi^2(5) = (b - B)'[(V_b - V_B)^{-1}](b - B) = 9.55$$

$$Prob > \chi^2 = 0.0889$$

#### Annex 3b. Breusch and Pagan Lagrangian multiplier test for random effects

	Var	sd = sqrt(Var)
Labor productivity growth rate	45.81395	6.768601
e	43.86835	6.623319
u	0	0

Test:  $Var(u) = 0$

$$\frac{\chi^2(01)}{Prob > \chi^2} = \frac{0.00}{1.0000}$$

Note: If we failed to reject the null hypothesis, then random effects is not appropriate to use.

### Annex 3c. Philippine regional regressions using labor productivity growth rate as the dependent variable

Variables	(1) OLS Labor productivity growth rate	(2) OLS Labor productivity growth rate	(3) OLS Labor productivity growth rate	(4) OLS Labor productivity growth rate	(5) OLS Labor productivity growth rate	(6) RE Labor productivity growth rate
In (total public health spending per capita lagged 5 years)	–1.600 (1.342)	–1.285 (1.593)	–0.869 (1.628)	–1.018 (1.641)	–0.642 (1.741)	–0.642 (1.350)
In (gross capital formation/RGDP lagged 5 years)		–2.091 (3.291)	–1.893 (3.286)	–2.009 (3.284)	–2.917 (3.474)	–2.917 (3.018)
Fertility rate lagged 5 years			1.514** (0.700)	1.599** (0.705)	1.548** (0.702)	1.548*** (0.480)
Infant mortality rate lagged 5 years				–0.189 (0.182)	–0.230 (0.186)	–0.230 (0.194)
Age (proportion of working age)					–26.36** (11.54)	–26.36*** (9.232)
Constant	14.43 (8.816)	9.029 (14.42)	–4.217 (16.34)	–1.909 (16.79)	12.81 (12.95)	12.81 (9.789)
Observations	96	96	96	96	96	96
Number of regions	16	16	16	16	16	16
R-squared	0.015	0.025	0.054	0.059	0.079	
Within R-squared						0.1479
Between R-squared						0.0238
Overall R-squared						0.0788

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Annex 4

### Annex 4a. Results of the Hausman (sigmamore) diagnostic test for fixed effects

	(b) Fixed	(B) Random	(b-B) Difference	sqrt(diag(V_b- V_B)) S.E.
In (total public health spending per capita lagged 5 years)	1.553574	0.019127	1.534447	1.594347
In (gross capital formation/RGDP lagged 5 years)	–6.058946	–3.19299	–2.865957	4.64141
Fertility rate lagged 5 years	4.882161	1.454176	3.427984	1.846861

Infant mortality rate lagged 5 years	-0.4205146	-0.0482069	-0.3723077	0.96221282
Age (proportion of working age)	-59.51251	-25.85779	-33.65471	11.85984
Education (percent share of employed that are at least college graduates)	-45.66519	-20.12088	-25.5443	52.52164

$b = \text{consistent under } H_0 \text{ and } H_a; \text{ obtained from xtreg}$

$B = \text{inconsistent under } H_a, \text{ efficient under } H_0; \text{ obtained from xtreg}$

Test:  $H_0$ : difference in coefficients not systematic

$$\chi^2(6) = (b - B)'[V_b - V_B \wedge (-1)](b - B) = 11.73$$

$$\text{Prob} > \chi^2 = 0.0683$$

#### Annex 4b. Breusch and Pagan Lagrangian multiplier test for random effects

	Var	sd = sqrt(Var)
labor productivity growth rate	45.81395	6.768601
e	44.08584	6.639717
u	0	0

Test:  $\text{Var}(u) = 0$

$$\frac{\text{chibar2}(01)}{\text{Prob} > \text{chibar2}} = \frac{0.00}{1.0000}$$

Note: If we failed to reject the null hypothesis, then random effects is not appropriate to use.

#### Annex 4c. Philippine regional regressions using labor productivity growth rate as dependent variable and with education variable

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) RE
Variables	Labor productivity growth rate	Labor productivity growth rate	Labor productivity growth rate	Labor productivity growth rate	Labor productivity growth rate	Labor productivity growth rate	Labor productivity growth rate
ln (total public health spending per capita lagged 5 years)	-1.600 (1.342)	-1.285 (1.593)	-0.869 (1.628)	-1.018 (1.641)	-0.642 (1.741)	0.0191 (1.768)	0.0191 (1.419)
ln (gross capital formation/RGDP lagged 5 years)		-2.091 (3.291)	-1.893 (3.286)	-2.009 (3.284)	-2.917 (3.474)	-3.193 (3.419)	-3.193 (2.918)
fertility rate lagged 5 years			1.514** (0.700)	1.599** (0.705)	1.548** (0.702)	1.454** (0.700)	1.454*** (0.452)
infant mortality rate lagged 5 years				-0.189 (0.182)	-0.230 (0.186)	-0.0482 (0.272)	-0.0482 (0.218)
age (proportion of working age)					-26.36**	-25.86**	-25.86***

Variables	(1) OLS Labor productivity growth rate	(2) OLS Labor productivity growth rate	(3) OLS Labor productivity growth rate	(4) OLS Labor productivity growth rate	(5) OLS Labor productivity growth rate	(6) OLS Labor productivity growth rate	(7) RE Labor productivity growth rate
					(11.54)	(11.57)	(9.457)
education (% share of employed that are at least college graduates)						−20.12	−20.12
						(19.83)	(12.84)
Constant	14.43 (8.816)	9.029 (14.42)	−4.217 (16.34)	−1.909 (16.79)	12.81 (12.95)	9.440 (13.05)	9.440 (10.56)
Observations	96	96	96	96	96	96	96
Number of regions	16	16	16	16	16	16	16
R-squared	0.015	0.025	0.054	0.059	0.079	0.086	
Within R-squared							0.1542
Between R-squared							0.0698
Overall R-squared							0.0858

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1