

ECONOMIST
IMPACT

Understanding the future economic consequences of the covid-19 pandemic

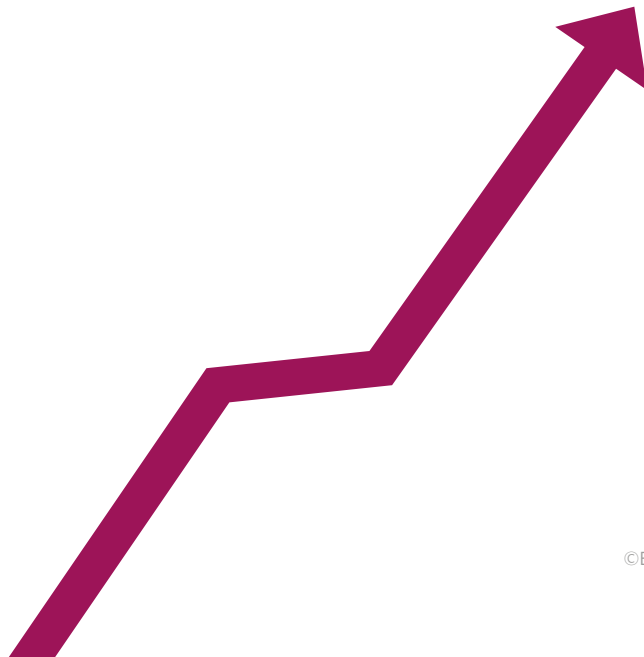


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About this report

“Understanding the future economic consequences of the covid-19 pandemic” is a white paper by Economist Impact, commissioned by Pfizer. The report focuses on the future economic implications of the sustained spread of SARS-CoV-2 across four distinct country archetypes.

The white paper presents the findings of a research programme that explored the potential future economic impact of the covid-19 pandemic focusing on productivity and economic losses. It provides a thematic review of the economic impact of covid-19, including how countries responded to initial pandemic shocks, the potential effects on productivity and financial losses through 2025 and a discussion of unique country-level contexts that may contribute to, or mitigate, the impacts of covid-19.

While this report was written by Economist Impact, we could not have developed the research without the input and support of key opinion leaders in this field (listed alphabetically):

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Executive summary



The covid-19 pandemic cannot be seen solely as a global health crisis; the impact on the health, livelihoods and functioning of individuals and global economies deems it a humanitarian and economic crisis. It is estimated that an additional half a billion people have fallen into poverty due to the pandemic¹. In addition to the significant loss of life—the number of deaths has reached over 6.7m—the destruction of industries and broadscale impacts on healthcare systems globally demonstrates the extensive impact of the pandemic at all levels of society².

Transmission of SARS-CoV-2 (the virus which causes covid-19) across communities persists despite significant efforts and investment to stop the virus in its tracks. By the end of November 2022, over US\$ 4trn had been invested in response and recovery packages in the US alone, through the Coronavirus Aid, Relief and Economic Security (CARES) Act, supplemental legislation and the American Rescue Plan Act³. Alongside direct medical costs, indirect costs attributed to the spread of the virus include disruption to millions of children's education, unemployment, lost earnings and lost economic output⁴. The pandemic has resulted in global economic shifts, responsible for one of the largest global recessions since the second world war. In addition to the 2020 stock market crash (the largest stock market decline since the financial crisis of 2007-08), economies faced a global supply-chain crisis, global panic buying and price gouging⁵.

While many reports have highlighted the current and historic economic consequences of the pandemic to date, fewer studies have explored potential future impacts of covid-19 from a global perspective. Estimating the potential future impact of persistent covid-19 in a global context will enable governments, multilateral organisations, individuals and civil society to better prepare and take action to minimise the consequences of ongoing covid-19 challenges and other future health emergencies. The aim of this study is to quantify the future economic implications of ongoing covid-19 transmission by considering the following research questions:

- What is the future economic impact of persistent transmission of SARS-CoV-2 as a result of mortality and morbidity within the working-age population?
- How does sustained covid-19 infection impact different labour markets?
- How do labour market disruptions as a result of covid-19 feed into broader economic impacts (for example, economic output and gross domestic product—GDP)?
- What factors influence the magnitude of covid-19 at a country level?

Through an evidence review, model and series of in-depth interviews, this study explores the estimated economic impact of covid-19 in a future where the virus persists globally. It focuses on the impact of covid-induced mortality or morbidity to the working-age population. Recognising that the virus has varying effects on countries driven by a series of country-specific factors, Economist Impact has identified four distinct country archetypes to assess the potential impacts across a range of countries. The model forecasts impacts for each archetype under three hypothetical scenarios: a baseline scenario which assumes that 2022 infection rates will continue through 2025, and optimistic and pessimistic scenarios where 2022 covid-19 infection rates decrease or increase, respectively, by 10% in 2023 and remain at that level through 2025.^a

The research gives rise to several key findings:

- **Countries characterised by both high infection rates and high productivity levels are likely to experience the greatest economic losses.** For a reference country characterised by high infection rates and high productivity levels, this analysis forecasts potential GDP losses in 2025 between 0.76% in the base case scenario and 0.84% in a pessimistic scenario. In a country the size of the UK, this could imply a loss of up to US\$ 25bn. Comparatively, a reference country with low infection rates and productivity levels might lose between 0.019% to 0.023% of its GDP (around US\$ 1bn for an economy the size of the UK).
- **Without measures in place to suppress infection rates, SARS-CoV-2 infection could continue to have substantial impacts on economies.** Even in an optimistic scenario, some groups of countries (those with high infection rates and high productivity rates) could see GDP loss of over 0.75% in 2025, suppressing economic growth and development. This analysis sheds light on these potential impacts highlighting the need for continued action and efforts by governments and policymakers. In addition, country-specific factors, such as productivity rate, adherence to control measures, extent of mitigation efforts and the implementation of fiscal support programmes, strongly influence the economic impact of sustained covid-19 infection rates.
- **Measures to reduce the severity of illness caused by the infection can play an important role in minimising the economic consequences across all countries, but particularly those with higher infection rates.** The model forecasts the loss to GDP based on the productive hours of work that are lost due to covid-19 infection. The findings from the literature review suggest that the majority of work hours lost to covid-19 are associated with acute symptomatic covid-19 infection and the post-acute sequelae of SARS-CoV-2 infection (long covid) rather than covid-related deaths and exit from the workforce. Therefore, global and national measures to reduce the severity of illness from levels that force people infected by covid-19 temporarily out of work can help to mitigate against some of the potential economic impacts of persistent infection.

This study seeks to quantify how the virus may continue to impact global economies, and explores how actions to mitigate economic impact and control infection alter the overall economic impact of sustained infection rates. The report offers considerations for governments and policymakers to reduce the economic and societal impact of future health emergencies by considering actions to boost resilience and reduce the vulnerabilities of economic systems, all critical components for stronger responses to future global emergencies.

^a 2022 Infection rates were sourced from covid-19 estimates modelled by the Institute for Health Metrics and Evaluation (IHME). IHME forecasts country infection rates, among other indicators, using a hybrid model that is "grounded in real-time data."

Introduction



Background

Covid-19 is caused by a coronavirus called SARS-CoV-2. The virus transmission was declared a public health emergency by the World Health Organization (WHO) on 30 January 2020, and was subsequently characterised as a pandemic on 11 March 2020⁶. As with all health emergencies, the consequences extend beyond health, impacting areas such as labour markets, international trade, supply chains and productivity. Countries continue to face pandemic-driven economic disruption and uncertainty as transmission impacts communities across the globe. Quantifying these effects and their implications at regional, national and global levels is complex. However, an accurate measure of the impact of covid-19 is essential for governments, multilateral organisations, and civil society to understand the long-term consequences of covid-19 to build stronger, more resilient societies in anticipation of future health emergencies.

Since the first cases of covid-19 began in December 2019, more than 661m covid-19 cases have been confirmed globally, representing 8.3% of the world's population². It is likely that this figure is much lower than the true number of cases, owing to initial limited testing capacity

and inconsistent global reporting mechanisms². Over 6.7m deaths have been recorded due to the virus, representing a huge social and economic cost. The case-fatality ratio (the proportion of people who have died in relation to the number of cases) is estimated to be 1% and the crude mortality rate (the proportion of deaths attributable to covid-19 in relation to the total population) is estimated at 0.08%^{2, b,c}. A study conducted in Turkey estimated that of the 29,290 deaths recorded in the country during the first year of the pandemic, 205,177 (67.6%) years of life were lost by men and 125,330 (32.4%) were lost by women. These losses represented a total cost of over US\$ 227m: the cost of a premature death was estimated at US\$ 14,187 and the cost of any year of life lost was estimated to be US\$ 1,261²⁴.

In response, governments and other stakeholders across sectors have leveraged a variety of suppression measures to mitigate the impacts of the highly infectious virus. These measures have varied across countries and ranged from partial to full lockdowns incorporating business, school and university closures, the introduction of isolation measures and travel restrictions. In addition, global investments coupled with the mobilisation of the healthcare industry led to the development

^b The case-fatality ratio is calculated by dividing the number of deaths by the number of observed cases.

^c The crude mortality rate is calculated by dividing the number of deaths by the total population.

of vaccines, which were made available before the end of 2020. By the end of 2022, more than 69% of the world's population had received at least one dose of a vaccine against covid-19, and it is estimated that vaccinations prevented at least 14.4m deaths from covid-19 in 185 countries in their first year⁷.

“It is impossible to ignore that the pandemic’s health consequences and economic consequences are inextricably intertwined.”

Mark Jit, London School of Hygiene and Tropical Medicine

The pandemic has had widespread economic impacts on the global market and labour force. A study using the capital, labour, energy, materials and service (KLEMS) dataset covering eight Latin American countries and a separate dataset for 16 OECD countries estimated that economic labour productivity across these economies decreased by 3.5% in 2020⁸. This equates to a monetary loss of over US\$ 2trn¹⁰⁵. This figure varies across countries within the region due to differing sociocultural and microeconomic factors such as the strength and speed of policy responses and health system capacity⁹. In 2020 European countries experienced a 7.4% average reduction in GDP; losses were highly correlated with reduction in employment rates and particularly impacted countries that had vast tourism sectors such as Italy and Spain, which respectively saw declines of 9.1% and 11.3% in annual real GDP in 2020^{9,10}. In Italy, the 9.1% drop in annual real GDP in 2020 is notable when compared to the typical year-over-year increases in GDP of less than 1%, as seen in 2018 and 2019 before the start of the pandemic¹¹. A study by the Bank of International Settlements examining the effects of covid-19 on specific countries in 2020 found that the fall in output in terms of GDP ranged from 3% in countries with low infection rates to more than 10% in countries with much greater rates of infection¹².

The impact of covid-19 mortality and morbidity on labour markets

Covid-19 directly affects labour markets both by reducing the size of the labour force and by reducing the intensity of work for those who remain in the labour force. The latter could be the result of a combination of absenteeism caused by sickness and reduced productivity.¹³

The virus impacts labour markets through related deaths within the working-age population and through the implications of experiencing symptoms which result in short- and long-term labour force disruptions. A proportion of those infected by the virus experience asymptomatic infection; on average 60% of covid-19 cases among the global tested population are symptomatic, according to a meta-analysis of covid-19 studies conducted between January 2020 and February 2021¹⁴. Among symptomatic patients, some may experience minor symptoms while others may require hospitalisation. Symptomatic patients may experience cough, fever, fatigue and more serious conditions such as pneumonia, requiring ventilation, all of which could result in work absences¹⁵.

Covid-19 can also result in long-term health implications known as long covid, which can impact productivity. The working definition of long covid developed by WHO describes it as “the continuation or development of new symptoms three months after the initial SARS-CoV-2 infection, with symptoms lasting for at least two months with no other explanation”¹⁶. Although variations to the definition exist, there is broad alignment; the US Centers for Disease Control and Prevention (CDC) and the Singapore Infectious Disease Clinical Research Network refer to long covid as “the term used to describe the signs and symptoms thought to be due to acute viral infection, though these persist or emerge after the first four weeks”¹⁷. According to the CDC, those who suffer from long covid can experience tiredness or fatigue, fever, brain fog, headaches, shortness of breath,

heart palpitations, depression, and other general, respiratory, heart, neurological and digestive symptoms¹⁸.

Various measures have been used to quantify the impact of covid-19 on the workforce. These include Disability-adjusted life years (DALYs), Years of life lost (YLL), Years of potential life lost (YPLL) and the Cost of lost productivity (CPL)^{2,19,20}. Existing estimates are all likely to be conservative in terms of the true toll of covid-19 on the workforce. In addition to direct work hours lost due to illness and potential time-to-recovery after hospitalisation, absence due to factors such as family or other household member illness and mental health impacts have been cited as contributing to absenteeism, losses in productivity and reductions in employment²¹.

Work hours lost due to covid-19 lead to reductions in output and productivity that are associated with a cost to both employers and society. A study in the US estimated costs arising from lost work hours related to covid-19 between March 2020 and February 2021 to be US\$ 138bn²². Furthermore, a study reported that the first four months of the covid-19 pandemic (January-April 2020) in Italy resulted in a total loss of 2.01 DALYs per 1000 persons, with a total permanent productivity loss of €300m (US\$ 322m) and a temporary productivity loss of €100m²³.

Several factors, including age, gender, industry and type of employment, impact absenteeism-related costs in different ways. A study examining pandemic frontline occupational differences in sickness-related absences in the US between March and June 2020 found that the transportation, food-related, personal-care

and service occupation industries within the healthcare frontline had experienced a significant increase in such absences in comparison to non-healthcare professions. Unsurprisingly, the rise was said to have been largest in industries with limited potential to work remotely and those where workers are required to work in close capacity to others, which are typically lower paid roles²⁵. In addition, in Kerala, India, CPL for premature mortality through November 2020 was highest among workers aged 40-49. For absenteeism, this age cohort also accounted for the highest CPL²⁶. Loss of income taxes, the cost of recruitment and training of substitute workers, and other indirect costs such as caregivers and disability income, are likely to further impact the economic situation²⁷.

The impact of long covid on labour force and productivity losses

An estimated 64m-128m^{*d} people may have been affected by long covid through December 2022, based on the assumption that 10-20% of covid-19 patients experience lingering symptoms^{6,16}. Estimating the impact of long covid on the labour force is less straightforward, as it requires assumptions around average duration of symptoms and severity, which vary and are often difficult to accurately measure at a population level. For example, according to a study conducted by the UK's Office for National Statistics, by November 2022, 2.1m people (3.4% of the population) in the UK had experienced self-reported long covid. The study found that 1.6m people (73%) had experienced a negative impact on their day-to-day activities and 330,000 people (16%) reported that their ability to undertake their day-to-day activities had been severely limited²⁸.

Further, there is a scarcity of reliable data estimating the number of people across geographies who have been temporarily absent or stopped working permanently due to the effects of long covid. This increases the difficulty in quantifying the impact of long covid

“The problem with the surveys about long covid is that there is no control group or baseline for comparison.”

Ziyad Al-Aly, Washington University in St Louis

^d Calculation is based on data showing that by 6 December 2022 there had been over 640m confirmed cases of covid-19¹⁵



on the labour force and productivity losses. A 2021 study conducted between September and November 2020 reported that “by seven months, many patients have not yet recovered (mainly from systemic and neurological/ cognitive symptoms), have not returned to previous levels of work, and continue to experience significant symptom burden.” The study found that 45.2% of participants required a reduced work schedule after contracting covid-19, and an additional 22.3% were not working at the time of survey due to prolonged symptoms²⁹.

Data from the US show that younger adults are more likely to experience long covid than older adults. The evidence published in June 2022 found that adults aged 50-59 had long covid more than those aged 80 and over³⁰. Furthermore, a UK based study examining the effects of long covid up until March 2022 found that since the first cases of covid-19 had emerged, cumulatively 7% of the working-age population had experienced lasting symptoms, resulting in a rise in economic inactivity due to long-term illness. The study also estimated that

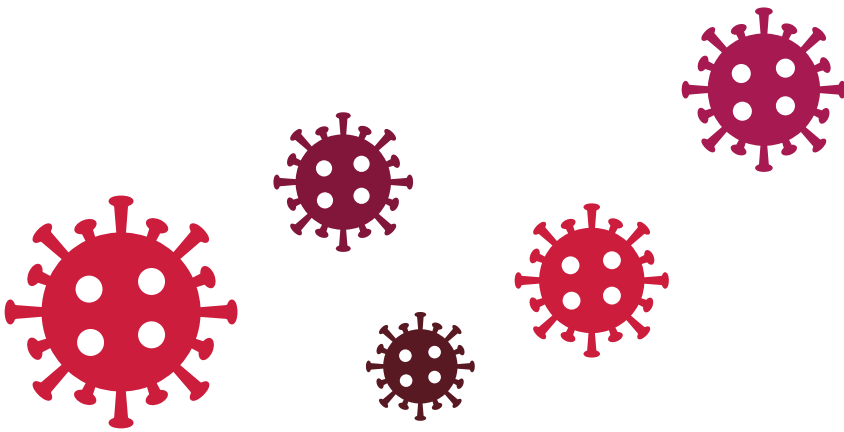
80,000 people had left the workforce as a result of long covid³¹. A US-based study found that between June and July 2022, 8% of the working-age population was suffering from long covid and between 1.8m and 4.1m had left the labour force. Translating the impact into costs, the study estimated that lost earnings due to long covid were between US \$168bn and US\$ 230bn during that time period³².

Consistent with patterns of existing inequalities in health outcomes across demographic groups, the prevalence of self-reported long covid was greatest in people aged 35 to 69 years, females, people living in more deprived areas, those working in social care, those aged 16 years or over who were not working and not looking for work, and those with other activity-limiting health conditions or disabilities²⁸.

The impact of pandemic suppression measures on productivity

Between 2020 and 2022, governments around the world implemented various restrictions to limit the spread of the virus, such as lockdowns, business closures and social distancing mandates. In addition, closure of academic institutions resulting in delayed completion of educational programs has been cited as a cause for delayed entry into the workforce for young professionals. Evidence shows that these measures were effective in slowing the progression of the pandemic, reducing infections and, ultimately, premature death³³. However, the indirect consequences of the measures such as the interruption to livelihoods, closure of workplaces and disruptions to healthcare systems should not be ignored³⁴.

Pandemic suppression measures had various indirect impacts on the labour market, particularly in terms of productivity and employment rates³⁵⁻³⁷. A study investigating the short-term impact of social distancing measures on the US labour market found that changes in the restrictiveness of social distancing mandates negatively affected employment two to four weeks later, with a hastened and



greater impact when measures were tightened compared to when they were relaxed³⁸. Given that suppression measures resulted in slower transmission of the virus and prevention of premature death in the short and long term, short-term productivity losses should not be evaluated without considering the long-term economic and health effects.

Clearly evaluating the impact of suppression measures, in light of their immediate economic impacts, can be difficult. Although lockdowns and social distancing generally had negative short-term economic consequences, results from multiple studies suggest that the benefits of these measures in reducing transmission may have led to positive economic effects overall. Using an out-of-equilibrium economic model, a 2020 study was able to theoretically estimate the cost of covid-19 lockdowns at 9% of global GDP, and that the cost incurred increases linearly with the duration of a given lockdown³⁹. Another 2020 study released by the IMF used cross-country economic indicators to point towards a robust negative relationship between lockdowns and both traditional economic measures and other proxies for economic activities, such as job posting data. The analysis concluded that the medium-term gains of viral suppression are likely to have offset short-term economic consequences and may have led to overall positive overall effects on the economy⁴⁰.

Research Objectives

Labour markets in particular have been affected in two distinct ways: through the direct impact of covid-19 related mortality and morbidity on the working-age population, and, indirectly, through the impacts of pandemic suppression

measures such as lockdowns. The former is characterised by reduced labour supply resulting from lost working days for the working population due to sickness, absences and reductions in productivity. The latter is driven by business closures and reduced economic activity as a result of suppression measures, which lead to reduced employment and labour demand.

To better understand the economic consequences of persistent covid-19 transmission in the future, this study models the potential economic impact of sustained spread of the virus by focussing on the direct labour-market losses resulting from covid-19 mortality and morbidity. The research includes four distinct country archetypes—differentiated based on covid-19 infection rates experienced over the past year and underlying labour productivity—to explore how impacts might differ across different economy types. This archetypal approach allows the model's projections to be extended to countries with similar characteristics in terms of infection rates and productivity levels. Through the discussion, the report explores contextual and cultural factors that may drive differences between countries within the same archetype to highlight how these factors may alter (increase or decrease) the economic impact of the virus. This study contributes to the existing body of research on the economic consequences of covid-19 by exploring the future impact of persistent transmission.

The first section of this report introduces the study and examines existing evidence around covid-19 mortality, morbidity and pandemic suppression measures, and their impact on labour markets and productivity losses. The second outlines the research focus, variables and methodology used in this study. This is followed by the results from the model and a discussion that focuses on contextual and cultural factors that alter the overall economic impact. The report concludes with high-level recommendations, based on the findings of this research, for consideration during future health emergencies.

Modelling approach

“As more people get vaccinated, the world is now thinking about living with covid-19 [...] If we are looking at living with covid-19, we have to think about the acceptable level of risk: what level of hospitalisation and death can societies absorb. In order to think about that, we should also think about the economic implications of covid-19.”

Shuhei Nomura, Keio University Department of Health Policy and Management, The Tokyo Foundation for Policy Research, Japan

Approach overview

To establish the modelling methodology, this study utilised an in-depth evidence review, created a bespoke model framework, and validated the research approach through a series of expert interviews.

To better understand differential impacts across specific economies, four distinct country-level archetype profiles were developed and analysed using a pre-selected reference country within each archetype. This approach allows for a theoretical mapping of all countries to one of the four archetypes, and therefore an extension of the findings to the countries within each group.

For each archetype, the underlying model assesses economic impacts (captured as the change in GDP forecast for 2025). The model calculates the total working hours lost across the population and estimates the GDP cost of these lost work hours. This evaluation is repeated across three alternative hypothetical scenarios for covid-19 infection rates:

- **Baseline:** assumes that infections rates in each year between 2023 and 2025 remain the same as those observed in 2022
- **Pessimistic:** assumes a 10% increase on the baseline infection rate in 2023 that is maintained through 2025
- **Optimistic:** assumes a 10% decrease on the baseline rate in 2023 that is maintained through 2025

For a detailed overview of the study methodology, including the literature review process, representative country selection and modelling approach, please refer to Appendix A.

Establishing country archetypes

The four archetypes are defined by two key drivers of economic impact due to sustained covid-19 infection in the population. These are productivity (measured as GDP per hour worked) and covid-19 infection rates within the population (measured as annual infections as a percentage of the total population).^e

^e Cut-offs for each archetype were decided based on average productivity levels and infection rates among countries.

The archetype characteristics are defined below:

Archetype 1: High infection and high productivity—countries with a productivity level above US\$ 38/hour and an infection rate of 19% or above.

Archetype 2: Low Infection and high productivity—countries with a productivity level above US\$ 38/hour and an infection rate below 19%.

Archetype 3: High infection and low productivity—countries with a productivity

level below US\$ 38/hour and an infection rate of 19% or above.

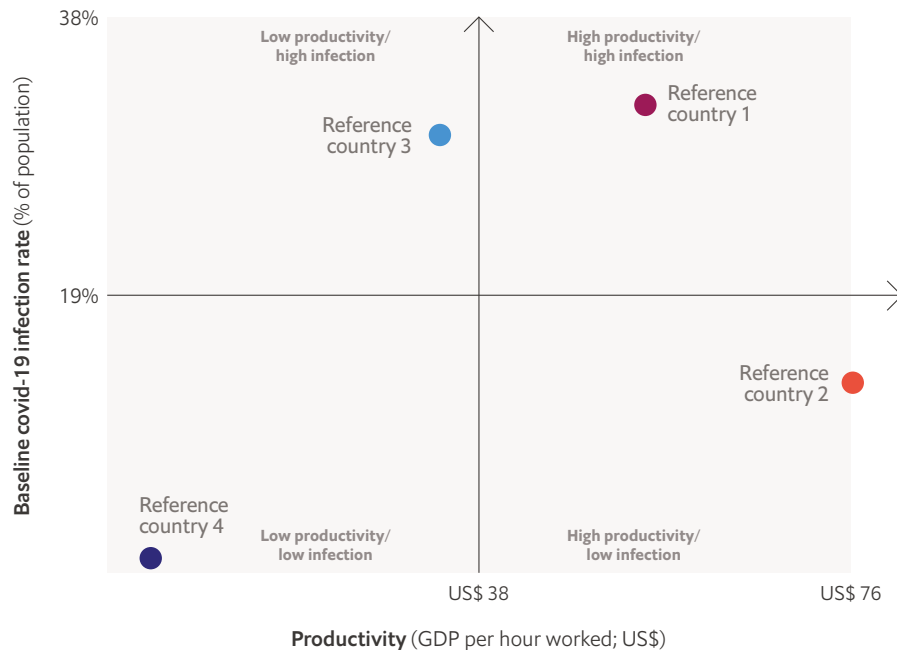
Archetype 4: Low infection and low productivity—countries with a productivity level below US\$ 38/hour and an infection rate below 19%.

Table 1 and Figure 1 outline the specific productivity and infection levels used for the four representative countries. See Appendix C for a list of countries classified by archetype.

Table 1: Infection rates and productivity levels (GDP per hour worked) for the modelled representative country across each archetype

	Archetype 1	Archetype 2	Archetype 3	Archetype 4
Baseline infection rate (% population)	32%	13%	30%	1%
Average GDP per hour worked (USD), 2022-25	US\$ 55	US\$ 77	US\$ 34	US\$ 5

Figure 1: Mapping chosen representative countries within the spectrum of criteria that define the four archetypes.



Results

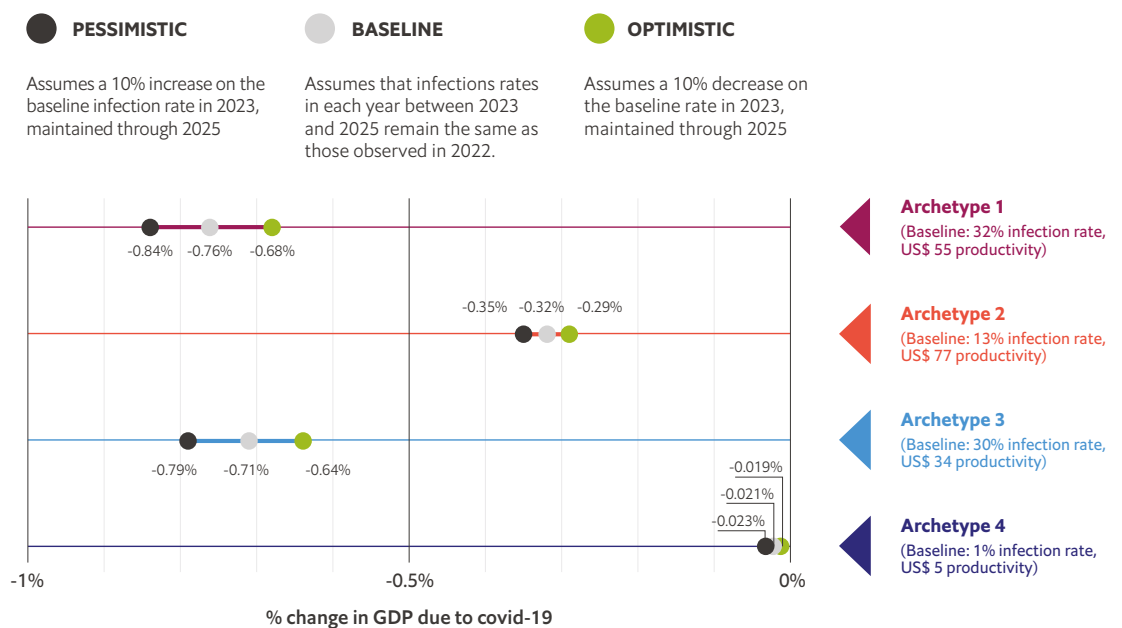
In terms of work hours lost, unsurprisingly the model shows that countries with high infection rates (countries within archetypes 1 and 3) will incur the largest losses. Of these losses, the majority of hours lost due to covid-19 for all archetypes are driven by time taken off due to initial illness (roughly 85%), long-covid symptoms (<9%), and exit from the labour force for covid-related reasons other than death (6%). The remaining lost hours (<1%) are made up of employees leaving the labour force due to death from covid-19.

The impact would be dependent on productivity levels in each country. As a result, countries falling within archetype 1 (those

with high infection rates and high productivity levels) are forecasted to suffer the greatest. Countries in this archetype are more vulnerable than those in archetypes that experience a lower rate of GDP loss (because of lower rates of infection), and also a lower absolute loss (due to a lower value for GDP per hour worked in those countries).

Figure 2 below summarises the forecasts of the model for the specific reference countries assessed, highlighting the estimated impact on GDP in 2025 (in terms of the percentage difference relative to EIU GDP forecasts of GDP in 2025) for each archetype for all three infection rate scenarios.

Figure 2: Estimated impact on 2025 GDP (% relative to forecast GDP) for representative countries under alternative assumptions of covid-19 infection rates



Countries may be indirectly affected by spill-over effects from neighbouring or closely related countries. Therefore, even countries with lower levels of infection and productivity are expected to be impacted, despite the smaller direct effects. This could, for example, be a result of supply-chain disruptions, trade restrictions and disruptions to travel and migration. Given that these indirect impacts are not captured within the modelling exercise, analysis is likely to offer a conservative estimate of the economic impact of ongoing infection.

**Archetype 1:
High infection, high productivity**

Archetype 1 includes countries with high levels of productivity and high rates of covid-19 infection. The reference country for this archetype has a baseline infection rate of 32% and GDP per hour worked (as a measure of productivity) is US\$ 55. Countries within this archetype that have higher infection rates and higher productivity levels are expected to have greater losses. Countries that fall within this group include the UK, Singapore, Italy and Japan.

Loss of work hours

Economist Impact estimates that work hours lost due to covid-19 for the reference country in

2025 would range from 0.68% (in an optimistic infection scenario) to 0.83% (in a pessimistic infection scenario). Of this total, less than 1% is expected to be driven by covid-19-related deaths, 5% from the exit of individuals from the labour force (for reasons other than death), and the vast majority (94%) would be the result of lost time at work, including for long-covid symptoms. The magnitude of loss depends on the specific infection rate within the country and the size of the economy; for the reference country chosen, this could translate into an estimated loss of more than 325m hours of work in 2025.

Loss of GDP

For the reference country within archetype 1, Economist Impact estimates that GDP loss in 2025 would range from 0.68% (under an optimistic infection scenario) to 0.84% (under a pessimistic infection scenario). For the modelled country this would translate into a loss of US\$ 15-19bn in 2025; however, the absolute impact would vary by country.

Summary of impacts by scenario

Table 3 summarises the changes in GDP and work hours lost across all three scenarios (baseline, pessimistic and optimistic) for the representative country within archetype 1.

Figure 3: Loss of work hours (%) due to covid-19 for reference country in archetype 1

Archetype 1: Loss of work hours due to covid-19

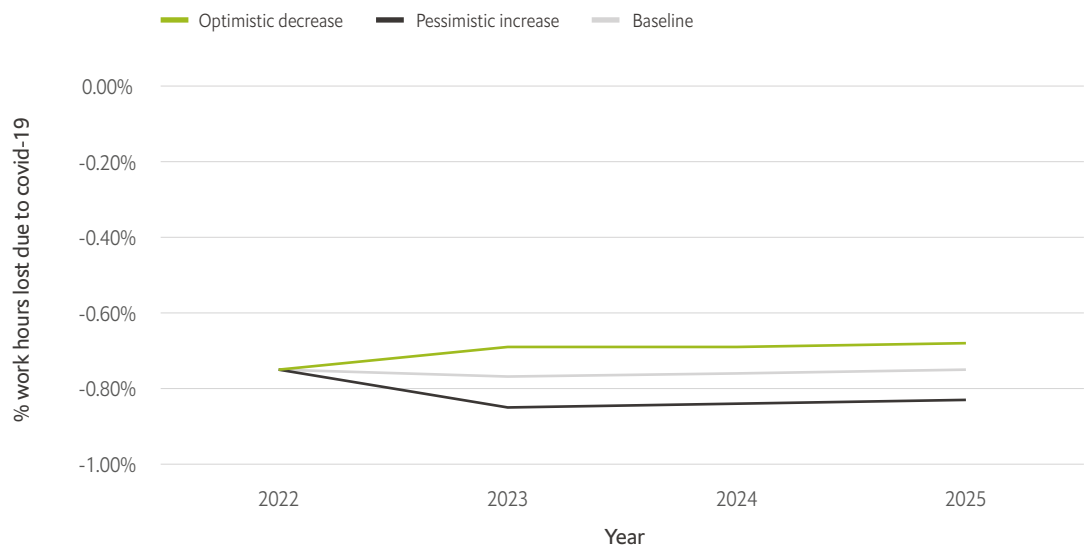


Figure 4: Loss of GDP (%) due to covid-19 for reference country in archetype 1

Archetype 1: Loss of GDP due to covid-19

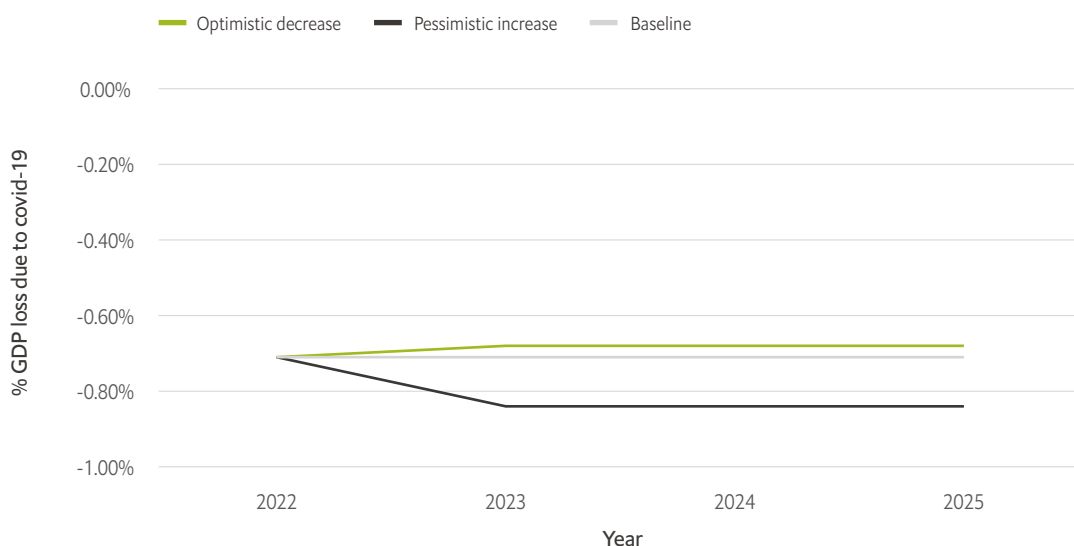


Table 3: Estimates for archetype 1 reference country by infection rate scenario

Archetype 1 scenarios			
	Baseline infection rate	Pessimistic infection rate	Optimistic infection rate
Assumed infection rate	The covid-19 infection rate is 32% and remains at this level through 2025.	The covid-19 infection rate increases from 32% to 35% in 2023 and remains at this level through 2025.	The covid-19 infection rate decreases from 32% to 29% in 2023 and remains at this level through 2025.
Estimated loss of work hours	Approximately 0.75% of work hours are lost due to covid-19. For the representative country, this equates to 496m hours of lost work.	Approximately 0.83% of work hours are lost due to covid-19. For the representative country, this equates to 326m hours of lost work.	Approximately 0.68% of work hours are lost due to covid-19. For the representative country, this equates to 267m hours of lost work.
Estimated loss of GDP	Approximately 0.76% of GDP is lost due to covid-19 in 2025. For the representative country, this translates to a loss of US\$ 17bn.	Approximately 0.84% of GDP is lost due to covid-19 in 2025. For the representative country, this translates to a loss of US\$ 19bn.	Approximately 0.68% of GDP is lost due to covid-19 in 2025. For the representative country this translates to a loss of US\$ 15bn.

**Archetype 2:
Low infection, high productivity**

Archetype 2 represents countries with high productivity and low covid-19 infection rates. This archetype is modelled using a country with a baseline infection rate of 13% and baseline productivity (GDP per hour worked) of US\$ 77. Countries in this group include Sweden and the United Arab Emirates.

Loss of work hours

For the modelled reference country within archetype 2, Economist Impact estimates that work hours lost due to covid-19 in 2025 would range between 0.29% (in an optimistic infection scenario) and 0.36% (in a pessimistic infection scenario). Of this, it is estimated that less than 1% would be driven by covid-19-related deaths, 6% from the exit of individuals from the labour force (for reasons other than death) and 94% from lost time at work, including for long-covid

symptoms. The magnitude of loss depends on the specific infection rate within the country and the size of the economy—for the modelled country, this loss could translate into almost 30m lost hours of work in 2025.

Loss of GDP

For the representative country within archetype 2, Economist Impact estimates GDP loss in 2025 ranging from 0.29% (under an optimistic infection scenario) to 0.35% (under a pessimistic infection scenario). Although the absolute impact varies by country, for the modelled economy the impact translates into a loss of US\$ 2bn-2.4bn in 2025.

Summary of impacts by scenario

Table 4 summarises the changes in GDP and work hours lost across all three scenarios (baseline, pessimistic and optimistic) for the representative country within archetype 2.

Figure 5: Loss of work hours (%) due to covid-19 for reference country in archetype 2

Archetype 2: Loss of work hours due to covid-19

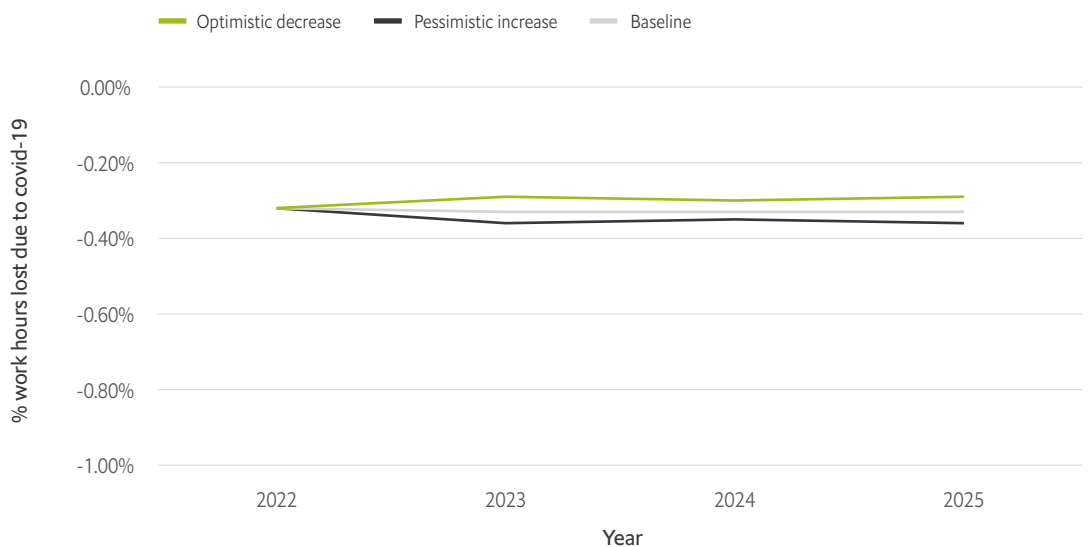


Figure 6: Loss of GDP (%) due to covid-19 for reference country in archetype 2

Archetype 2: Loss of GDP due to covid-19

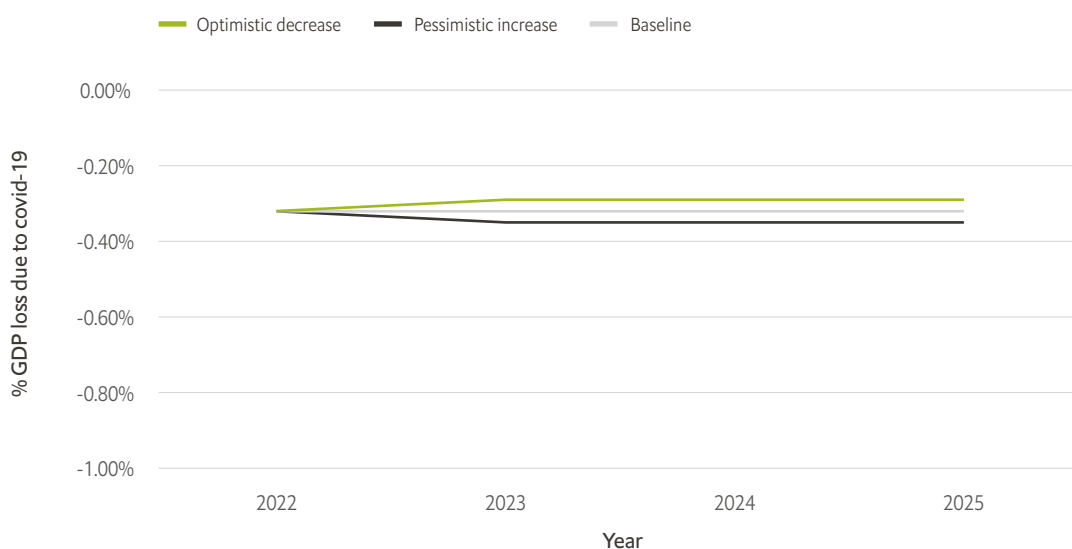


Table 4: Estimates for archetype 2 reference country by infection rate scenario

Archetype 2 scenarios			
	Baseline infection rate	Pessimistic infection rate	Optimistic infection rate
Assumed infection rate	The covid-19 infection rate is 13% and remains at this level through 2025.	The covid-19 infection rate increases from 13% to 15% in 2023 and remains at this level through 2025.	The covid-19 infection rate decreases from 13% to 12% in 2023 and remains at this level through 2025.
Estimated loss of work hours	Approximately 0.33% of work hours are lost due to covid-19 in 2025. For the representative country, this equates to 27m hours of lost work.	Approximately 0.36% of work hours are lost due to covid-19 in 2025. For the representative country, this equates to 30m hours of lost work.	Approximately 0.29% of work hours are lost due to covid-19 in 2025. For the representative country, this equates to 24m hours of lost work.
Estimated loss of GDP	Approximately 0.32% of GDP is lost due to covid-19 in 2025. For the representative country, this translates to a loss of US\$ 2.2bn.	Approximately 0.35% of GDP is lost due to covid-19 in 2025. For the representative country, this translates to a loss of US\$ 2.4bn.	Approximately 0.29% of GDP is lost due to covid-19 in 2025. For the representative country, this translates to a loss of US\$ 2bn.

Archetype 3: High infection, low productivity

Archetype 3 represents countries with low productivity and high covid-19 infection rates. This archetype is modelled using a country with a baseline infection rate of 30% and GDP per hour worked of US\$ 34. Countries in this group include Hong Kong, South Korea and the Czech Republic.

Loss of work hours

For a representative country within archetype 3, Economist Impact estimates that work hours lost in 2025 due to covid-19 would range between 0.64% (in an optimistic infection scenario) and 0.79% (in a pessimistic infection scenario). Of this, it is estimated that less than 1% would be driven by covid-19-related deaths, 6% by the exit of individuals from the labour force (for reasons other than death) and the vast majority (94%) would result from lost time at work, including time off for long-covid symptoms. The magnitude of loss depends on the specific

infection rate within the country and the size of the economy—in the representative country this loss could translate into over 64m lost hours of work in a single year. Higher percentage losses are to be expected in countries with higher infection rates.

Loss of GDP

For the representative country within archetype 3, Economist Impact estimates the GDP loss in 2025 would range from 0.64% (under an optimistic infection scenario) to 0.79% (under a pessimistic infection scenario). The absolute impact would vary by country. For the representative country, this translates to a projected loss of US\$ 1.9-2.4bn in 2025.

Summary of impacts by scenario

Table 5 summarises the changes in GDP and work hours lost across all three scenarios (baseline, pessimistic and optimistic) for the modelled representative country within archetype 3.

Figure 7: Loss of work hours (%) due to covid-19 for reference country in archetype 3

Archetype 3: Loss of work hours due to covid-19

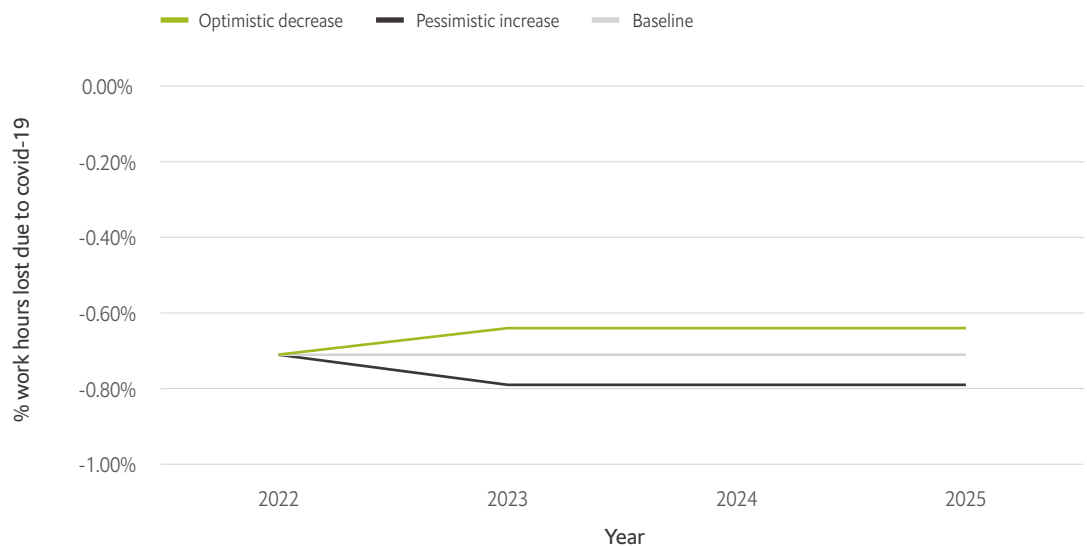


Figure 8: Loss of GDP (%) due to covid-19 for reference country in archetype 3

Archetype 3: Loss of GDP due to covid-19

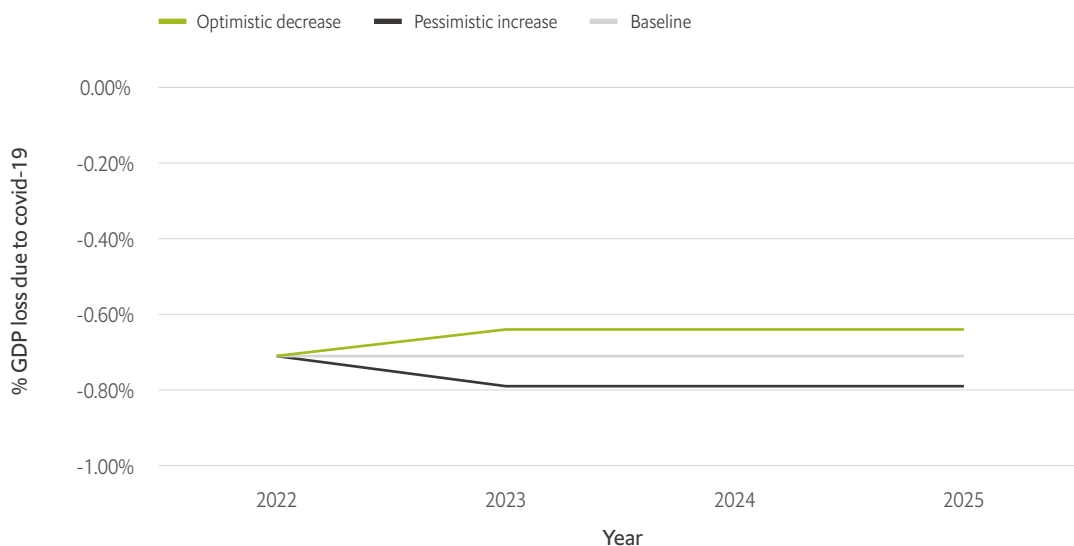


Table 5: Estimates for archetype 3 reference country by infection rate scenario

Archetype 3 scenarios			
	Baseline infection rate	Pessimistic infection rate	Optimistic infection rate
Assumed infection rate	The covid-19 infection rate is 30% and remains at this level through 2025.	The covid-19 infection rate increases from 30% to 33% in 2023 and remains at this level through 2025.	The covid-19 infection rate decreases from 30% to 27% in 2023 and remains at this level through 2025.
Estimated loss of work hours	Approximately 0.71% of work hours are lost due to covid-19. For the representative country, this equates to 58m hours of lost work.	Approximately 0.79% of work hours are lost due to covid-19. For the representative country, this equates to 64m hours of lost work	Approximately 0.64% of work hours are lost due to covid-19. For the representative country, this equates to 52m hours of lost work
Estimated loss of GDP	% of GDP lost due to covid-19 is approximately 0.71% in 2025. For the representative country, this translates to a loss of US\$ 2.1bn.	% of GDP lost due to covid-19 is approximately 0.79% in 2025. For the representative country, this translates to a loss of US\$ 2.4 bn.	% of GDP lost due to covid-19 is approximately 0.64% in 2025. For the representative country, this translates to a loss of US\$ 1.9bn.

**Archetype 4:
Low infection, low productivity**

Archetype 4 represents countries with low productivity and low covid-19 infection rates. This archetype is modelled using a country with a baseline infection rate of 0.89% and baseline productivity (GDP per hour worked) of US\$5. Countries in this group include Indonesia, Vietnam and Poland.

Loss of work hours

For a representative country within archetype 4, Economist Impact estimates work hours lost in 2025 due to covid-19 to be between 0.019% (in an optimistic infection scenario) and 0.023% (in a pessimistic infection scenario). Of this, less than 1% is expected to be driven by covid-19-related deaths, 6% by the exit of individuals from the labour force (for reasons other than death) and the vast majority (94%) by the result of lost time at work, including

for long-covid symptoms. The magnitude of loss would depend on the specific infection rate within the country and the size of the economy. For the modelled representative country, this loss could translate into over 65m lost hours of work in 2025. For countries with higher infection rates, higher percentage losses would be expected.

Loss of GDP

For a representative country within archetype 4, Economist Impact estimates GDP loss in 2025 to range from 0.019% to 0.023%. The absolute impact would vary by country; for the modelled economy this translates to a loss of US\$ 0.28bn-0.34bn in 2025.

Summary of impacts by scenario

Table 6 summarises the changes in GDP and work hours lost across all three scenarios (baseline, pessimistic and optimistic) for the modelled country in archetype 4.

Figure 9: Loss of work hours (%) due to covid-19 for reference country in archetype 4

Archetype 4: Loss of work hours due to covid-19

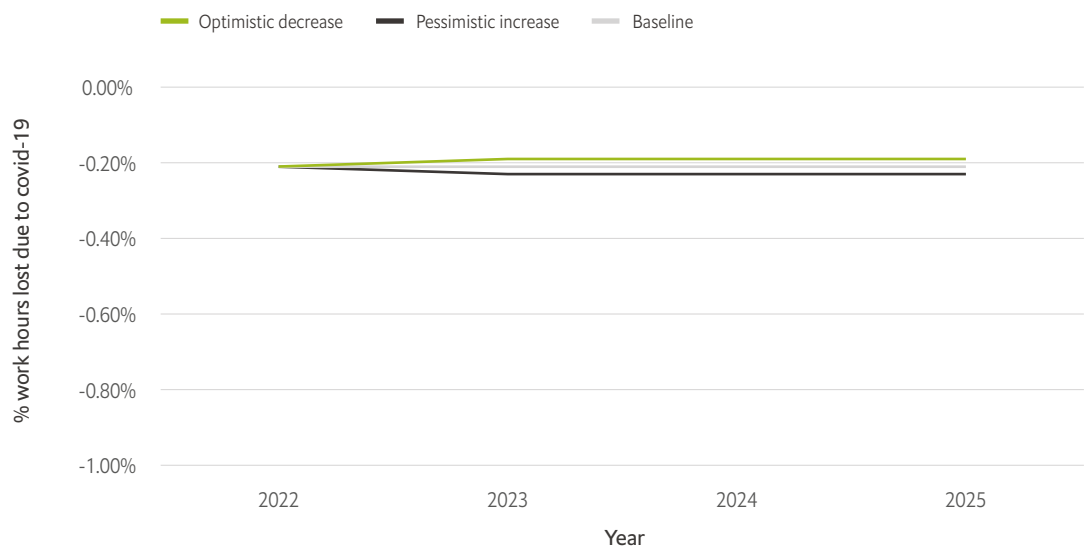


Figure 10: Loss of GDP (%) due to covid-19 for reference country in archetype 4

Archetype 4: Loss of GDP due to covid-19

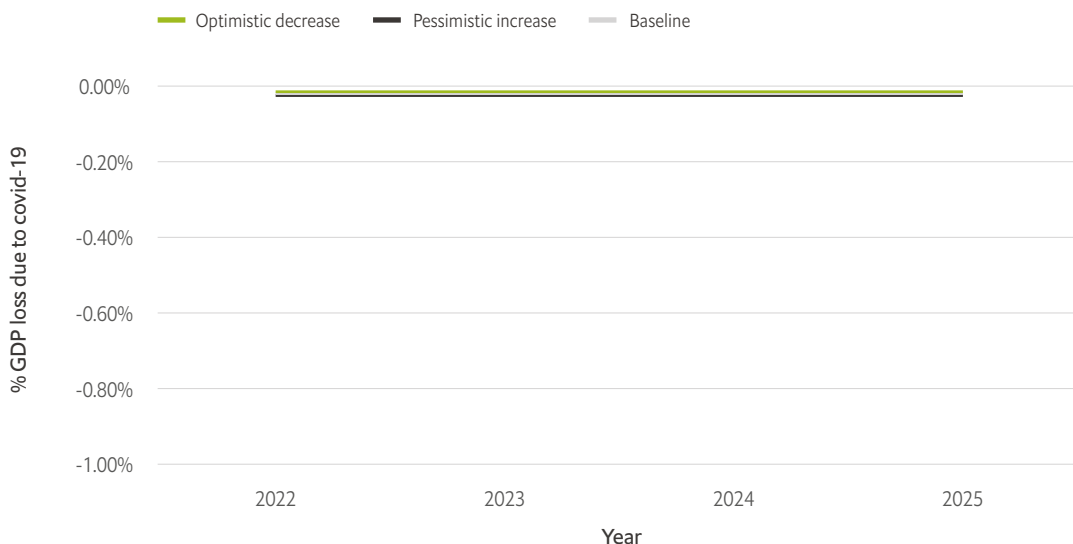


Table 6: Estimates for archetype 4 reference country by infection rate scenario

	Archetype 4 scenarios		
	Baseline infection rate	Pessimistic infection rate	Optimistic infection rate
Assumed infection rate	The covid-19 infection rate is 0.89% and remains at this level through 2025.	The covid-19 infection rate increases from 0.89% to 0.97% in 2023 and remains at this level through 2025.	The covid-19 infection rate decreases from 0.89% to 0.80% in 2023 and remains at this level through 2025.
Estimated loss of work hours	Approximately 0.021% of work hours lost are due to covid-19. For the representative country, this equates to 60m hours of lost work	Approximately 0.023% of work hours lost are due to covid-19. For the representative country, this equates to 65m hours of lost work.	Approximately 0.019% of work hours lost are due to covid-19. For the representative country, this equates to 53m hours of lost work.
Estimated loss of GDP	Approximately 0.021% of GDP is lost due to covid-19 in 2025. For the representative country, this could translate into a loss of US\$ 0.31bn.	Approximately 0.023% of GDP is lost due to covid-19 in 2025. For the representative country, this could translate to a loss of US\$ 0.34bn.	Approximately 0.019% of GDP is lost due to covid-19 in 2025. For the representative country, this could translate to a loss of US\$ 0.28bn.

Discussion



The uncertainty around the future of the covid-19 pandemic remains a threat; the potential economic consequences of a future wave of a novel variant may continue to redefine economies across the globe. Therefore, the cost of inaction is large.

Although the model produces a forecast for a representative country within each archetype, it is important to recognise that various political and sociocultural factors such as health system capacity, demographics, and societal and cultural norms play a significant role in the overall economic impact of covid-19. Countries within each group have similarities,

but also many differences in the pattern of covid infection rates, country responses to the pandemic and, ultimately, the overall impact of the pandemic on their economies. This section highlights the various factors at country level that impact the economic costs explored by this study and what can be done to alleviate these effects. Factors discussed throughout this section are non-exhaustive and not always unique to each archetype; given that a range of countries fall into each segment, cross-cutting themes are to be expected.

Archetype 1: High productivity, high infection

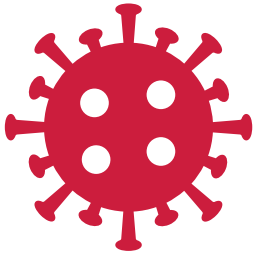
Countries defined by high productivity and high infection rates include Austria, Denmark, France, Italy, Israel, Japan, New Zealand, Singapore and the UK. These are predominantly high-income countries with large formal workforces. This research estimates that for the representative country within this archetype, if the covid-19 infection rate continued at the same level as 2022, 0.76% of GDP would be lost in 2025. For the modelled representative country this equates to potential loss of roughly 300m working hours and about US\$ 17bn in 2025. GDP loss is greater in the pessimistic infection rate scenario and lower in the optimistic infection rate scenario. There are several reasons why the economic impact could differ between countries, some of which are discussed below.



Despite travel restrictions, social distancing measures, introduction of vaccination passes and national/subnational lockdowns, these countries experienced high rates of infection; however the long-term economic implications of the pandemic varied owing to differences in the duration and rigidity of control measures. For example, Italy experienced the highest initial rates of covid-19 infection and responded with a stringent lockdown to reduce the spread of the pandemic. However this was short, lasting just two months and nine days. In 2020, Italy experienced unprecedented economic fallout—GDP fell by 8.9% compared with an average 6.2% decrease across the European Union (EU)⁴¹. Comparatively, New Zealand’s restrictions were some of the longest lasting, with borders fully opening in July 2022⁴². Having pursued a covid-19 elimination strategy, New Zealand effectively ended its first wave of the covid-19 pandemic in 103 days⁴³ and managed to maintain one of the lowest covid-19 mortality rates globally (2). One study found that New Zealand had a lower increase in unemployment than the OECD average between the last quarter of 2019 and the second half of 2020⁴⁴.

Similarly, differential approaches to mask wearing were common across countries.

Although the majority of countries introduced mandatory mask wearing, differences in practices were found between countries, which could have impacted the success in reducing transmission. Dr Shinya Tsuzuki, chief of Applied Epidemiology Division of the Disease Control and Prevention Center at Japan’s National Center for Global Health and Medicine, notes that mask mandates were never implemented in Japan because citizens respected and followed recommendations from the Ministry of Health at least until the end of 2022². Dr Tsuzuki explains that masking in Japan is more typical than in western nations: “In Japan, almost all people wear face coverings outside of the home, due to social norms, but our feeling about face coverings is a kind of mixed one. Some of us do not feel like taking masks outside; though, the proportion of people wearing masks seems higher than that in other parts of the world”⁴⁵. For example, masks have regularly been worn in several East and South-East Asian countries to prevent the spread of airborne pathogens and protection from air pollution even prior to the pandemic⁴⁶. In contrast, in many other nations, particularly in Europe (e.g., Denmark and Sweden), mask wearing was a new concept, which led to lower levels of consistent usage⁴⁷.



Key insight: Countries listed within Archetype 1 implemented various pandemic control measures, including border closure or travel restrictions⁴⁸. However, variation in length and rigidity of suppression measures was common. Countries should recognise that long-term economic consequences can be mitigated by forgoing the short-term gains obtained by implementing poorly enforced control measures or measures enforced for short durations of time, in addition to maintaining an adequate stock of effective vaccines and treatments. By prioritising the integrity of pandemic control measures like lockdowns, implementing mandatory mask wearing, social distancing and travel restrictions countries may minimise infection and mitigate long-term reductions in GDP.

As countries introduced policies and schemes to mitigate the impacts of the pandemic on their populations, many also experienced ongoing fiscal challenges such as a deterioration in public finances and rising government debt⁴⁹. Most countries within this archetype introduced job retention or furlough schemes to allow employees to claim a proportion of the wages for their workers who were unable to work owing to lockdowns⁵⁰⁻⁵³. For example, in the UK the government introduced the Coronavirus Job Retention Scheme, which allowed employers to claim 80% of employees' wages if they could not work as a result of lockdowns⁵⁰. A study from the UK Institute for Government found that the Coronavirus Job Retention Scheme was successful in protecting more than 9m jobs from May 2020 and is credited with returning employment rates to pre-covid levels by July 2021. However, the scheme was costly: as of November 2021 the overall cost of the retention scheme was £ 70bn (US\$ 84bn)⁵⁴. In Singapore, a country with a large migrant worker population, the government implemented a job retention scheme and visa extensions that included migrant workers on work visas during border lockdowns in 2020⁵⁵. Other government

interventions included support for businesses and households through reductions in taxes or tax holidays⁴⁹. The US and Canada (although not within archetype 1) did not implement similar wage subsidy schemes, and in both countries working hours fell by over 10% during the early months of the pandemic⁵³.

The demographic structure of a country plays a significant role in the infection profile and impact of the pandemic on the labour force. Factors such as gender, age, and economic and social vulnerability alter the transmission of the virus and its overall impact on the workforce. Depending on the country, the covid-19 pandemic has affected different age cohorts in differing ways. In several high-income countries—Italy and Japan, for example—covid-19 mortality among older-age cohorts is higher than in younger cohorts. The economic impact on older groups is likely to be predominantly due to direct healthcare costs, as those affected are more likely to have left the workforce. In contrast, younger working-age populations are at greater risk of long covid and the associated loss of productivity, despite lower rates of initial symptomatic infection⁵⁶. Even though younger children are not economically active in the workforce, work foregone due to caregiving responsibilities for children contracting covid-19 contributes to the indirect costs⁵⁷.

Key insight: The initial introduction of job retention schemes mitigated dramatic reductions in job and productivity losses. By reducing labour costs and preserving jobs, well-designed job retention schemes can be an effective policy tool to maintain employment rates and sustain the labour force during difficult times. However, given that such schemes can be expensive and contribute to the worsening of national financial liabilities, governments may consider targeting longer-term job retention schemes to vulnerable industries and demographic groups to mitigate the potential shortfalls of this strategy.

Archetype 2: High productivity, low infection

Archetype 2 consists of countries such as Canada, Spain, Sweden and the US, which are high-productivity countries that experienced low infection rates. This research finds that for the representative country within this archetype, 0.32% of GDP would be lost in 2025 owing to covid-19. This equates to a potential loss of 27m hours of work and US\$ 2.2bn. GDP loss would be greater in the pessimistic infection rate scenario and lower in the optimistic infection rate scenario.

Alongside differences in the enforcement of measures to limit the spread of covid-19, variations in the impact of the virus on the labour force can also occur due to historic trends in employment. For example, Spain has suffered from a youth unemployment problem since the 2008-09 global financial crisis; having peaked at 55.5% in 2013, the proportion of the workforce aged 15-24 who were unemployed had been consistently falling, declining to a still-high 32.7% in 2019⁵⁸. This figure increased to 38.5% in 2020 before falling to 36.9% in 2021⁵⁹. An IMF study reported that youth workers, alongside low-skilled workers and women, were disproportionately affected by the pandemic because they were more likely to be employed within sectors that were strongly impacted⁶⁰. The recovery of youth employment in 2021, and employment more broadly, could be partly attributed to the opening up of the economy^{58,59}. The pandemic is said to have exacerbated structural labour market inequalities in Spain, having impacted women, younger cohorts, those with lower levels of education and low-skilled workers the hardest⁵⁹. Variation across countries in unemployment trends between 2019 and 2021 may also indicate how labour markets react to economic changes. While Canada and Spain saw an increase in the level of overall unemployment between 2019 and 2020 and then a fall in 2021, Sweden's level of unemployment increased annually between 2019 and 2021⁶¹.

The size and contribution of various sectors within a country also play a role in how the economic burden of the pandemic manifests itself. For countries that have large tourism and hospitality industries, significant disruptions to travel activity have a large impact on GDP. For example, a study by the IMF found that in Spain and some states within the US, where tourism makes up a large segment of the local or national economy, populations faced disruption to the job market and large falls in GDP⁵⁸.

As with archetype 1, the differing approaches to implementing pandemic mitigation measures in archetype 2 countries, such as enforcing lockdowns versus advising populations to social distance, also feed into differences in the economic impact between countries. For example, Sweden was one of few countries determined to keep its economy going during the pandemic. In contrast to rapid lockdowns and school closures seen in other countries, Sweden's government advised citizens to work from home, kept schools open for children under 16, and did not close restaurants and bars, all of which allowed economic activity within these sectors to continue^{61,62}. In contrast, Canada, Spain and the US implemented lockdowns that mandated the closure of retail shops, restaurants and bars, which negatively impacted businesses⁴⁸. According to a study evaluating Sweden's covid-19 response, while the country saw high excess death rates during the first wave of the virus, excess mortality between 2020 and 2021 was lower than in other European countries⁶⁴.

Key insight: Long-term absenteeism and unemployment are core drivers of economic losses and can arise from a variety of covid-related causes, such as long covid and major shifts in demand and supply within specific industries. Evidence suggests a natural recovery of employment rates took place following initial shocks in the early phase of the pandemic, although the extent of recovery varied by country^{61,65}. Mechanisms to support industries that are heavily impacted should be prioritised alongside retention strategies.



Archetypes 3 & 4: Low productivity

Archetypes 3 and 4 are defined by low productivity and contain a mix of high-, middle- and low-income countries. Archetype 3 models countries which experienced high infection rates, including Slovakia, South Korea and the Czech Republic. Archetype 4 contains countries, such as India, Indonesia, Pakistan, Peru, Poland, Russia and South Africa, that experienced low infection rates. This research finds that 0.71% of GDP would be lost in 2025 in the representative archetype 3 country if covid-19 infection rates continued at 2022 levels; this equates to a potential loss of US\$ 2.1bn and 58m hours of work. Under the same scenario, the representative country for archetype 4 would lose 0.021% of GDP in 2025, equating to a potential loss of US\$ 310m and 60m hours of work.

Countries reliant on international trade were heavily impacted by business closure, pivots in production processes and supply-chain challenges during the height of the pandemic. For example, early pandemic uncertainty affected the automotive sectors in the Czech Republic, Poland and Slovakia: data show that average sales of automobiles were 19% lower in the Czech Republic and 23% lower in Poland and 25% lower in Slovakia in 2020 than in 2019⁶⁶. This rise was fuelled by pent-up demand and lagging export recovery from other emerging economies in Africa and the Middle East⁶⁷.

Health system structures and capabilities can also play a role in outcomes. Health systems across the world were, and continue to be, harshly tested in the face of the covid-19 pandemic⁶⁸. The infrastructure and readiness of country health systems to manage and cope with the waves of covid-19 affect health outcomes and the covid-related economic consequences in each country⁶⁹. Similarly, the nature of different countries' responses to the pandemic, and how the health burden of covid-19 has been managed through vaccination efforts, healthcare infrastructure and policies created to respond to covid-19,

vary widely⁶⁸⁻⁷⁰. Healthcare staff shortages and burnout are both a cause and consequence of the struggles plaguing health systems globally as they continue to mitigate, plan for and respond to new waves of covid-19 cases^{71,72}. WHO estimates a shortfall of 10m health workers globally by 2030, mostly in low- and lower-middle-income countries, although all countries across the socioeconomic spectrum are affected⁷³.

Many developing countries have high levels of informal workers, which complicates the economic picture; according to a study by the International Labour Organization, 93% of global informal employment is in developing and emerging economies⁷⁴. The structure of a country's labour market and proportion of informal workers shapes the way that individuals and organisations are impacted by the economic fallout of covid-19⁷⁵. Within archetypes 3 and 4, many countries, including India, Indonesia, Pakistan, Peru and South Africa, have highly informal workforces. Although government support packages may have been available, evidence shows that the interventions used to protect citizens were unlikely to fully reach the informal economy⁷⁶. According to Dr Dicky Budiman, researcher in Global Health Security at Griffith University Australia and former CEO of Indonesia's National Health Insurance programme,, in countries such as Indonesia the majority of workers are informal and are not included in formal labour statistics⁷⁷. This not only inhibits the ability to generate estimates of the true impact of the pandemic on aspects such as absenteeism and unemployment, but also impacts their inclusion in economic support programmes.

In the midst of the many preparedness and response plans that have come into effect since March 2020, attention is now turning towards national health policies and priorities in terms of universal health coverage, global health security and disease surveillance^{68,69}. In recognition of the staggering economic damage that the world has seen since the onset of the covid-19 pandemic, these tenets of health system resilience will be

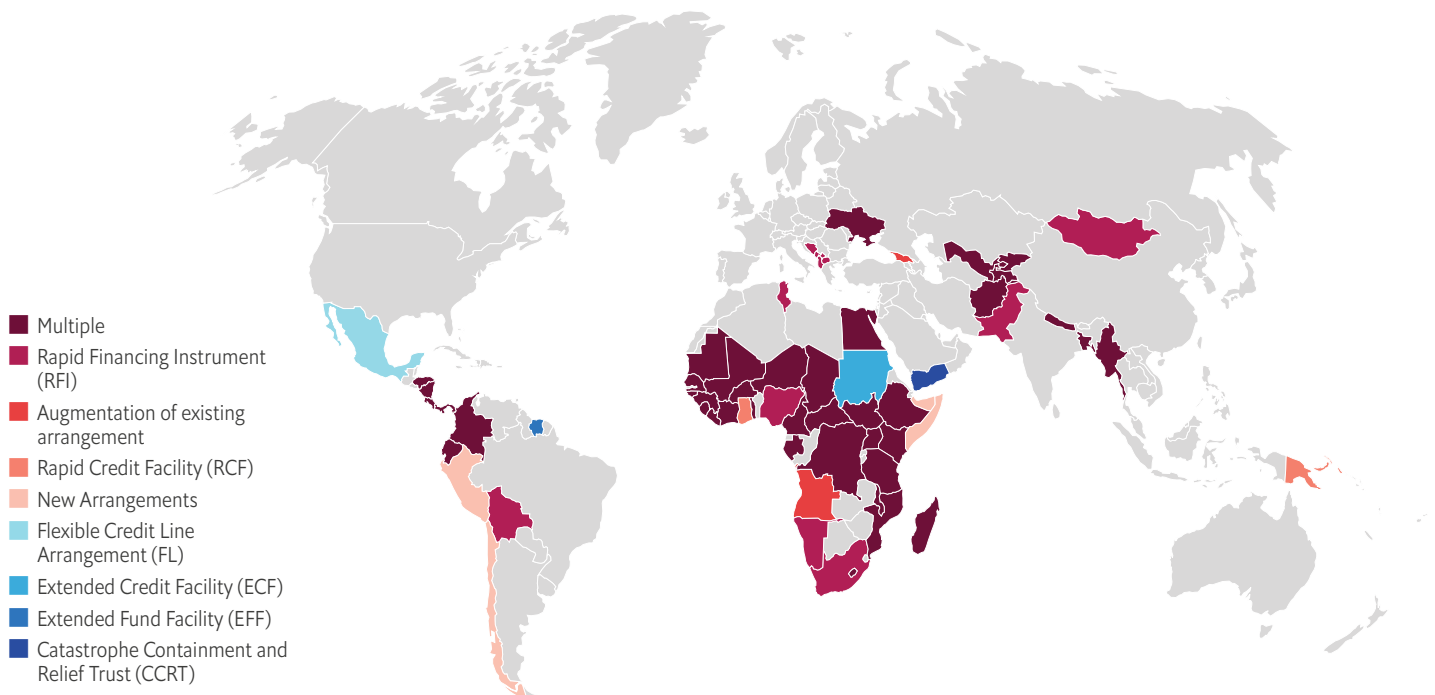
crucial for preparing for imminent epidemics and pandemics in the future, and to mitigate the possible economic shocks and repercussions that may ensue.

Key insight: For countries that experience low productivity or have large informal labour forces, regardless of infection rates, it is imperative that strong health infrastructure be prioritised. This includes public health measures that raise and protect the health stock of the population, particularly among the vulnerable, and maintaining appropriate supplies to manage different types of strain on the health system (as seen with covid-19). This includes prioritising efficient scale-up of different types of health workers and leveraging communities to access hard-to-reach populations. A strong health system should be viewed as an economic protective factor for countries marked by lower productivity in particular.

Economic stability and financial reserves have been paramount in determining a country's response to and recovery from the pandemic⁷⁸. High-income countries have been able to draw on financial reserves and crisis funds, but they also experienced greater economic losses due to business closures and workforce disruptions in real terms^{78,79}. In comparison, low-income and low-productivity countries are more likely to have faced severe shortages in resources and had little to no reserves to draw on in response to the pandemic^{78,79}. In response, bilateral, multilateral and private development assistance mechanisms were activated for countries and regions across all income levels^{78,79}.

As part of the global efforts to mitigate the impacts of the covid-19 pandemic, many non-governmental organisations, international coalitions and multilateral corporations made significant investment in response and recovery efforts. International financial institutions such as the IMF offered financial support to

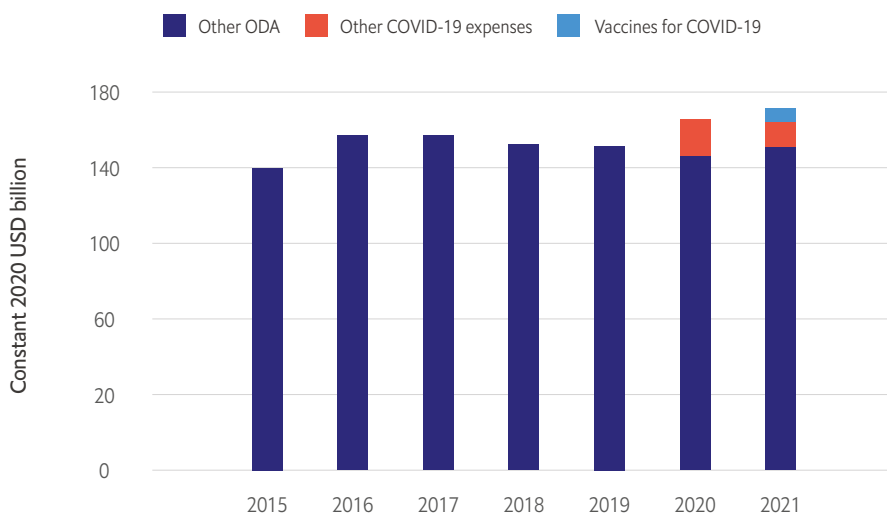
Figure 11: Countries receiving assistance and debt service relief from the IMF⁷⁹



Source: <https://www.imf.org/en/Topics/imf-and-covid19/COVID-Lending-Tracker>

Figure 12: Covid-19 assistance to developing countries lifts foreign aid in 2021⁷⁸

COVID-19 assistance to developing countries lifts foreign aid in 2021



DAC Statistics (2022)

countries struggling to combat the covid-19 pandemic with domestic funds alone. This included emergency support financing, grants for debt relief and policy guidance, among other actions^{78,79}. Countries receiving such assistance were more likely to be low-productivity countries (see Figure 11), represented in this study by archetypes 3 and 4.

Intergovernmental organisations such as the OECD mobilised member nations to increase existing aid to developing countries. In 2021, members of the OECD’s Development Assistance Committee (DAC) provided a total of US\$ 21.9bn for activities related to covid-19, equating to about 12% of the total combined net official development assistance (ODA) for that year⁸⁰. At the same time, DAC member countries also increased their individual contributions to foreign aid for 2020 and 2021, increasing their own expenditures in support of global health at a time of great economic stress. Overall, developing nations received increased foreign aid in 2020 and 2021 as a result of covid-specific ODA (see Figure 12). Similarly, the EU set out Next Generation EU, a comprehensive recovery plan to address the socioeconomic consequences of the covid-19 pandemic, with funds totalling more than €2trn

(US\$ 2.2trn). To date, more than 25 countries across all four archetypes have received EU funds to initiate recovery plans; they include France, Italy and the Czech Republic in 2021, and Sweden, Poland and the Netherlands in 2022. Italy is the largest single beneficiary of the Next Generation EU fund, given the rapid spread of the virus in the early stages of the pandemic and the resulting widespread economic consequences⁸¹.

Key insight: Understanding the unique circumstances within individual countries and how they contribute to or prevent economic losses is key to implementing far-reaching recovery plans. Countries across the four archetypes used funds from intergovernmental organisations, such as the OECD’s DAC and Next Generation EU, to bolster domestic efforts to combat the covid-19 pandemic and reduce its economic consequences. Recovery plans should be designed with socioeconomic context in mind, aiming to reduce inequalities and support vulnerable groups, as recommended by numerous intergovernmental organisations. Novel funding mechanisms can also be leveraged to mobilise resources that bolster health and economic mitigation tactics.

The way ahead

This report details potential economic impacts of the ongoing covid-19 pandemic, as modelled across three scenarios (optimistic, baseline and pessimistic) and four different country archetypes. The archetypes represent distinct country groups, based on two measures: productivity (as measured by GDP per hour worked) and the covid-19 infection rate.

The outputs of this study provide a point-in-time valuation of the potential impact that the pandemic may pose on economies and societies across the globe over the next three years. Although variation exists and real-term loss will be dependent on the specific economy of each country, the model forecasts that countries could experience GDP losses of between 0.019% and 0.84% in 2025. For a country the size of Italy, this could imply a loss of up to US\$ 19bn in 2025 alone.

The societal impact of such economic losses will be felt by generations to come, spanning increased unemployment, loss of income and increased vulnerability. However, the outcomes of the optimistic scenario would suggest that a significant reduction in the economic impact of the pandemic is achievable, highlighting the importance of striving to reduce the spread of covid-19 over the next few years.

The socioeconomic consequences of covid-19 are far reaching, impacting all aspects of society and economy. Countries across archetypes have

experienced and continue to battle with the direct and indirect costs of the pandemic; the potential future costs and uncertain outcomes associated with a pathogen with a high potential to mutate into more virulent strains are extensive. These impacts extend beyond national economies and into everyday life. During times of financial hardship and economic strain, coping strategies are adopted even at the household level, particularly in vulnerable or low-income populations. Adaptations to household expenditure can negatively influence educational, health and nutritional outcomes, all important components of social progress and factors that perpetuate inequalities and intergenerational transmission of poverty. There is a need to act to safeguard the health and wellbeing of future generations, in addition to ensuring that inequalities are not exacerbated.

Long-term declines in GDP can be reduced by prioritising resilience against covid-19 and other threats. Across all archetypes, countries experienced observable (and expected) GDP losses as a result of lost productivity due to acute illness, absenteeism, and premature death associated with covid-19. However this was heightened by uncertainty, inconsistency and poor implementation of pandemic suppression and control measures like lockdowns, mandatory mask wearing and travel restrictions. Existing evidence and the outcomes of the model suggest that lower infection rates result in



lower GDP losses. Successful policy responses consider not only the economic consequences of covid-19 and how to mitigate them, but also the socioeconomic and contextual factors that may provide insight on the effectiveness of specific control measures and guidance regarding the extent to which compliance will exist. Therefore, to reduce infection rates and minimise economic fallout, policymakers and other stakeholders must adopt strong mitigation strategies and ensure that they are adequately enforced and responsive to sociocultural influences.

Leaders should not only prioritise efforts focused on the control of covid-19, but also those that work towards eradication and elimination. Although the optimistic scenario used in this report provides some hope in terms of alleviating the largest impacts of the pandemic, sustained spread of covid-19 is associated with economic loss. To date, global

efforts have focused on minimising mortality and morbidity, whilst very few countries have adopted elimination strategies. It is important that efforts extend beyond infection control and recognise that the economic impact of covid-19 is likely to vary substantially at a country level depending on each country's socioeconomic profile and infection rates.

Ultimately, this research offers data-driven evidence that leaders should continue to channel resources and policies that reduce the spread of covid-19. Ongoing transmission not only impacts population health, it also impacts the labour force and economy more generally, as shown by the model. Increasing the resilience of people against threats such as covid-19 is one of the most powerful tools that leaders can use to manage risk and pursue progress and growth globally.

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Appendix A:

Methods and limitations

The targeted literature review followed a pragmatic methodology and focused primarily on identifying economic and forecasting studies, including existing modelling studies. The review was designed to identify key papers and indicators to inform the development of the economic model framework; the findings form the foundation of this study.

Covid-19 infection rates persist, resulting in ongoing direct and indirect costs and uncertainty around the future of the global economy. The findings from the literature review outline a subset of the different avenues through which covid-19 has affected the economy of different countries, but questions remain on the potential future impacts over the coming years.

Following the literature review, the research team created a model framework to capture the economic impact of covid-19 under different scenarios across four country archetypes. Through a series of expert interviews, the modelling methodology and assumptions were validated and feedback used to refine the model and adjust its parameters. A total of six interviews were conducted, with experts in a variety of disciplines related to this subject. The experts provided insight relevant to the covid-19 profile of specific countries from across the four archetypes, which contributed to the body of factors explored in the discussion.

The economic impact of covid-19 is likely to vary substantially at a country level depending on a country's unique socio-economic profile and the infection rate within the nation. Therefore, to better understand these differential impacts, this study developed and analysed four distinct archetype profiles, based on the magnitude of disease activity and economic structure. The analysis is undertaken for a country that is representative of each archetype (representative country). These countries were selected using a purposeful sampling approach to ensure representation across a mix of small and large economies with different infection rates. Further detail on the country archetypes, as defined by this research, is provided in the sub-section below. The archetypes are defined as follows:

- Archetype 1: high productivity and high infection rate
- Archetype 2: high productivity and low Infection rate
- Archetype 3: low productivity and high infection rate
- Archetype 4: low productivity and low infection rate

This approach allows for a theoretical mapping of all countries to one of the four archetypes, and therefore an extension of the findings to the countries within each group. The model to a pre-selected representative economy within each group. The representative is a country that was chosen from the group of countries that fall within the archetype as a representative for the entire group. However, country-specific economic impact will vary depending on the specific infection rate and productivity level of the respective country.

For each archetype, the underlying model assesses economic impacts (measured based on GDP) across three alternative hypothetical scenarios for covid-19 infection rates:

- **Baseline:** assumes that infection rates in 2023-25 remain the same each year as those observed in 2022
- **Pessimistic:** assumes a 10% increase in the baseline infection rate in 2023, maintained through 2025
- **Optimistic:** assumes a 10% decrease in the baseline rate in 2023, maintained through 2025

Country archetypes

Archetypes are defined by two key drivers of economic impact due to sustained covid-19 infection in the population. These are productivity (measured by GDP per hour worked) and covid-19 infection rates (measured by annual infections as a percentage of the total population).

The four archetypes modelled and their defining attributes are summarised below.

- **Productivity** is calculated by dividing a country's 2022 real GDP (obtained from the Economist Intelligence Unit - EIU) by the cumulative hours worked within the country (2022 employed population * average annual working hours per worker).^{82,83}
- **Infection rate** is calculated by dividing the total number of reported covid-19 cases in 2022 by the country's population in the same year.²

Cut-offs for each archetype were decided based on average productivity levels and infection rates among countries^f. The average productivity level in 2022 was US\$ 38/hour and the average infection rate was 19%; the archetype characteristics are defined below:

Archetype 1: High infection and high productivity—countries with a productivity level above US\$ 38/hour and an infection rate of 19% or above.

Archetype 2: Low Infection and high productivity—countries with a productivity level above US\$ 38/hour and an infection rate below 19%.

Archetype 3: High infection and low productivity—countries with a productivity level below US\$ 38/hour and an infection rate of 19% or above.

Archetype 4: Low infection and low productivity—countries with a productivity level below US\$ 38/hour and an infection rate below 19%.

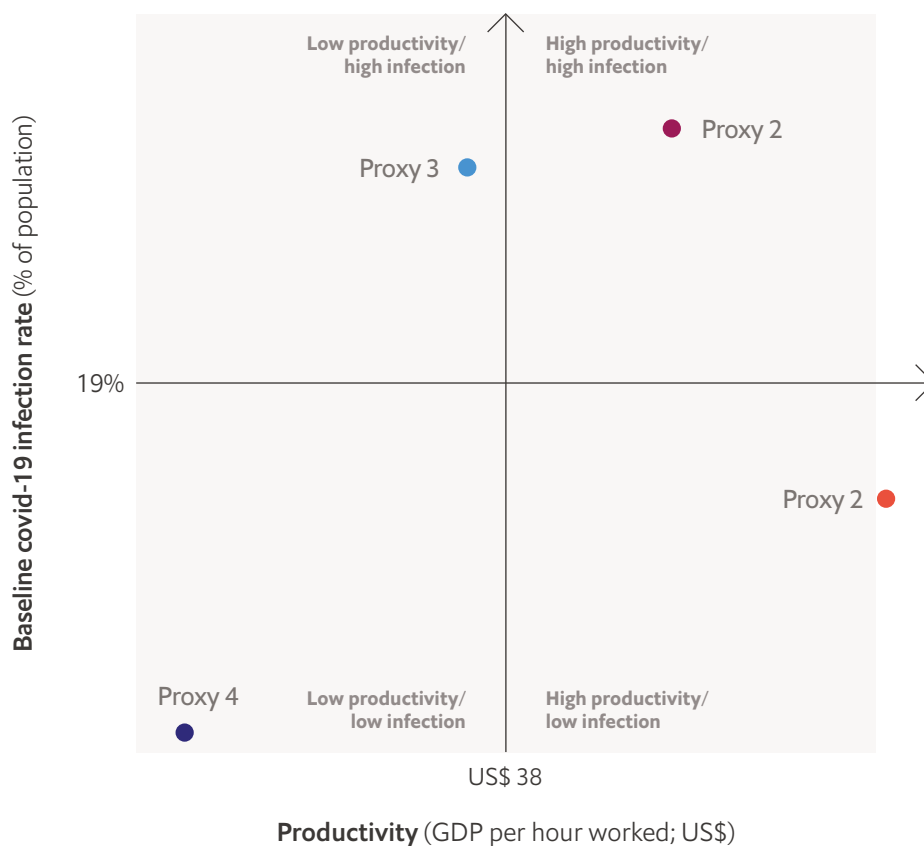
Table A1 and Figure A1 outline the specific productivity and infection levels used for the four representative countries. Infection rates range between 1% and 35%, and productivity levels vary between US\$ 5 and US\$ 77, highlighting the differences in characteristics between the representative countries analysed in this study.

^f Subject to availability of relevant data series including real GDP, statistics related to the total and employed population, average annual working hours per worker, and covid-19 infection rate.

Table A1: Infection rates and productivity levels (GDP per hour worked) for the modelled representative country across each archetype

	Archetype 1	Archetype 2	Archetype 3	Archetype 4
Baseline infection rate (% of population)	32%	13%	30%	1%
Average GDP per hour worked (USD), 2022-25	US\$ 55	US\$ 77	US\$ 34	US\$ 5

Figure A1: Mapping chosen representative countries within the spectrum of criteria that define the four archetypes.



Data and methods

For each archetype discussed above, the potential future impacts of covid-19 have been modelled across alternative infection rate scenarios using a representative country. The modelling approach is described below.

Step 0: Baseline GDP forecasts

The model uses GDP forecasts for each representative country obtained from EIU between 2023 and 2025 as a starting point. These baseline forecasts for GDP are used to estimate the relative GDP loss under alternative hypothetical scenarios for future covid-19 infection rate.

Step 1: Work hours lost

The first stage of the analysis estimates the labour market impacts of three covid-19 infection scenarios (baseline, optimistic and pessimistic) for each archetype.

Labour market impacts are calculated as lost hours of work resulting from covid-19 infections—that is, absenteeism, which can be driven by a number of factors including: temporary time off work due to acute covid-19 symptoms; extended time off work due to long covid; covid-19-induced exit from the labour force; or death due to the virus.

The model disaggregates the employed population into different groups:

- those that are not infected by covid-19
- those that are infected, but recover
- those that die of acute covid-19
- those that develop long covid

For each representative country, the percentage of working-age individuals falling into the first group (those not infected by covid-19) is defined by country-specific covid-19 infection rates under each scenario. For example, in a hypothetical country with an infection rate of 10%, 90% of the working-age (15-64 years) population are assumed to fall into this category and are not infected.

The remaining (infected) working-age population is then split into those that recover, those that die from acute infection and those that suffer long covid. The relative proportion of individuals falling into each of these categories using a combination of in-depth literature analysis^{84,85} and expert interviews^{45,77,86-89}. For the purpose of the modelling, these parameters are assumed to be consistent across country archetypes (see Table A2).

Table A2: Morbidity and mortality parameters

Parameter	% of infected population
Recovery from covid-19 ^{45,77,84-91}	93%
Long covid ^{45,77,84-91}	7%
Death caused by covid-19 ^{45,77,84-91}	<0.01%

Having estimated the number of people that fall into each category based on these parameters, the model calculates the total working hours lost across the population based on the assumptions below in Table A3:

Table A3: Loss of work hours parameters

Parameter	Value (hours lost)
No covid-19 infection	No loss of work hours
Covid-19 infection with recovery	One week of work lost (estimated based on country-specific annual working hours) ^{45,77,86-89}
Long covid (including exit from labour force)	One week of work lost, and an additional shift to part-time working for 1.9% of population within this category (estimated based on country-specific annual working hours) ⁸⁵
Covid-19-related death	Loss of total annual working hours (estimated based on country-specific annual working hours) ^{45,77,86-89}

Quantifying work hours lost due to covid-19 deaths, began with a review of the mortality rate for covid-19 in 2022 globally (roughly 1%) and across income groups and regions². However, information from desk research and expert interviews suggest that the 1% mortality rate seen globally is not necessarily representative of the population considered by this model. The value included in this report was calculated after applying the following considerations and validating the modified values using expert interviews.

1. Evidence from the in-depth literature review indicates that the majority of deaths due to covid-19 occur in older cohorts (those age over 65)⁹⁰. For example, analysis from the Kaiser Family Foundation of data from the CDC estimates that the proportion of covid-19 deaths that occur in people aged over 65 years ranges anywhere from 58-88% of total deaths⁹⁰. The model considers only the working population (15-64 years), which accounts for a smaller percentage of overall deaths due to covid-19.
2. In 2022, WHO considered the Omicron variant of covid-19 to be the dominant variant of the virus globally⁸⁸. The Omicron variant, while more transmissible than Delta and other earlier variants of the virus, has a relative risk roughly 66% lower, according to some studies⁹¹. The lower mortality risk associated with the Omicron variant is not necessarily due to the inherent properties of the virus⁹². Rather, research suggests that the lower mortality risk of the Omicron variant may be due to immunity built up in the population⁹². In any case, the experts indicated that over the next few years (that is, in 2023-25), the spread of covid-19 is likely to be characterised by similar variants and, thus, a lower mortality risk than seen in 2020-21^{45,77,86-89}.

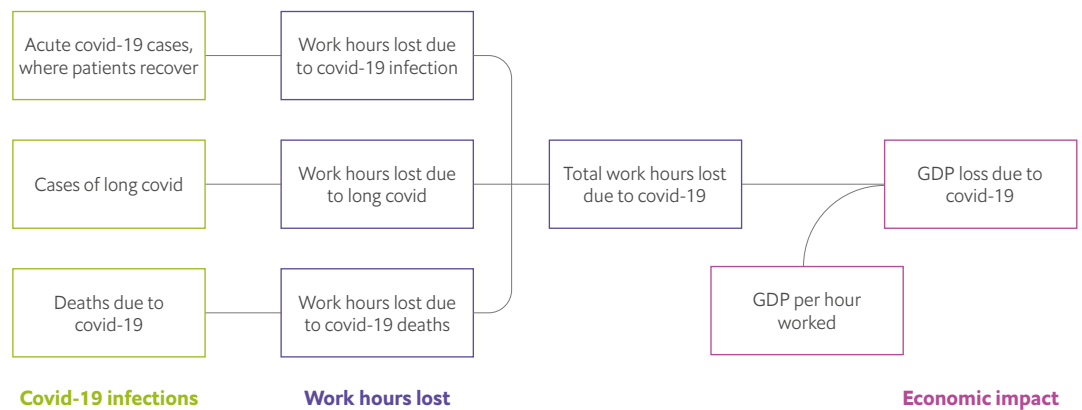
After considering these findings and modifying the suggested percentage for deaths due to covid-19, the final value was validated through a series of expert interviews. The experts considered this value to be a conservative estimate for most countries^{45,77,86-89}.

Using population estimates for the above groups along with annual working hours per worker, the model arrives at a) number of lost effective work hours due to acute covid-19 infection, b) number of lost effective work hours due to long-covid symptoms and c) the number of work hours lost due to covid-19 deaths. These three figures are aggregated into total work hours lost due to covid-19.

Step 2: GDP loss

In the final stage, the model estimates the GDP cost of the lost work hours estimated in Step 1 above, as illustrated in figure A2 below. The loss to GDP is estimated by multiplying the estimated hours lost by country-specific labour productivity estimates, defined as GDP per hour worked.

Figure A2: Logic map: economic consequences of covid-19



Limitations of the model

This model illustrates the direct effect that covid-19 has on labour markets and provides a lower bound for the true effect of this phenomenon. The results are likely to be an underestimate of the true effect, because the model does not consider reinfections and pandemic policies (lockdowns, vaccinations, welfare packages). It also does not consider how the pandemic affects the demand for labour, GDP forecasts or other macroeconomic variables (inflation, investment levels, growth), or the impact of smaller, direct effects (supply-chain disruptions, trade restrictions, disruptions to travel and migration).

The parameters and scenarios used in this model are constant over time, which is a simplification of the reality: the SARS-CoV-2 virus is constantly changing, with a variety of predictions for the future evolution of the virus. For this reason, responses to eventual new waves are not included in the model, as transmission, morbidity and case fatality rates may differ. The outcomes reported are expected consequences.

This model also does not consider the medical costs of covid-19, such as hospitalisations, nor the externalities, such as workers that are affected by covid-19-related disruptions (such as insufficient hospital beds). The impact on non-labour-market participants, such as students or unpaid workers, is also not accounted for in this model.

Lastly, uncertainty about the true prevalence of covid-19 and long covid affects the results of this study. Overall, the limitations imposed by the simplification of the complex dynamics of a pandemic contribute to the uncertainty and likely underestimation of the true impact of covid-19.

Appendix B:

Expert feedback on the model

Experts from different countries, representative of the four archetypes, were asked to assess the model and provide feedback and critique on the measures and methodology used. Overall, they found the model to be a novel and exciting conceptual approach for quantifying the impact of covid-19 on the workforce and economy, albeit within the limitations of the data available.

The scenarios are based on advice from experts in this area. For example, one expert proposed a few alternative options after voicing some concerns that the intended scenarios (changing the infection rate by X%) may be too subjective and not meaningful to readers. One option was to account for the baseline scenario continuing, with Omicron-like variants appearing every few months but the impact on mortality being lower than it has been the past few years due to immunity from previous infections and high vaccination rates. A second suggestion was to account for new, Delta-like variants emerging that are more virile than previous variants, with higher infection rates and increased severity of infection. The consideration of a third scenario with improved immunity and vaccination rates was also important, where immunity to covid-19 built up or a “holy grail” vaccine was developed against all variants, and covid-19 eventually stops being a major problem globally.

Discussions with experts revealed that the anticipated mortality rate for 2023-25 in the working-age population is likely much lower, as described in the Methods section above. After modifying the parameter value in response to initial feedback, all of the experts felt comfortable with the value included in this report (<0.01%). The research team initially discussed including the mortality rate for covid-19 as reported by Johns Hopkins University CSSE COVID-19 data via Our World in Data².

Experts agreed that long covid was difficult to quantify and model, but that an estimate of 7-10% of all covid-19 cases within the working-age population progressing to long covid was reasonable for the model. Data is lacking for aspects of long covid, such as brain fog and fatigue, that could impact sickness-related absences from work. One expert commented that the prevalence of long covid as observed by he and his colleagues in countries like Indonesia is much lower than in Western nations, which could skew results from the model assumptions. One expert recommended that the nature of covid-19 mutations should also be considered, and that with milder variants severe illness and long covid are less likely, which also has implications for the model's parameters.

Feedback on model limitations

Some experts had suggestions for additional factors that could be useful in exploring the relationship between covid-19 and economic outcomes, including disaggregating the data, where possible, by age, gender, immunisation rates, type of work and disease severity. One expert explained that, as age structures are very different across different economies, measures such as the “proportion of the population that is working age” could be a more interesting addition. Immunisation rates in locations where there are age-specific coverage differences (for example, younger people being less likely to get vaccines in some countries) could also provide additional insights from the data. Relationships between age and type of work may prove interesting, as younger individuals are more likely to work part time, whereas older individuals work full time more frequently. The gendered impact of covid-19, particularly on women, as well as the gender ratio of the working-age population, are also potentially interesting parameters. One expert raised a concern around the nature of the workforce in countries where the majority of workers are considered to be informal and not necessarily included in general workforce statistics, therefore impacting the model and its assumptions.



Appendix C:

Countries by archetype

The following includes a list of countries included in each archetype with their infection and productivity rates, calculated as described in the methods section (Appendix A). The countries included below are subject to data availability.

Archetype 1: High infection and high productivity

Countries with a productivity level above US\$ 38/hour and an infection rate at or above 19%.

Country	Infection rate	Productivity rate
Australia	41%	US\$ 71.64
Austria	49%	US\$ 73.86
Belgium	23%	US\$ 69.37
Denmark	48%	US\$ 97.19
Finland	22%	US\$ 65.32
France	45%	US\$ 68.01
Germany	36%	US\$ 70.39
Ireland	21%	US\$ 117.46
Israel	36%	US\$ 47.74
Italy	33%	US\$ 55.07
Japan	20%	US\$ 52.48
Netherlands	32%	US\$ 76.30
New Zealand	39%	US\$ 41.40
Norway	21%	US\$ 132.77
Singapore	34%	US\$ 44.68
Switzerland	37%	US\$ 96.62
United Kingdom	20%	US\$ 54.50

Archetype 2: Low Infection and high productivity

Countries with a productivity level above US\$ 38/hour and an infection rate below 19%.

Country	Infection rate	Productivity rate
Canada	7%	US\$ 60.56
Spain	18%	US\$ 44.23
Sweden	13%	US\$ 76.76
United States	15%	US\$ 69.49

Archetype 3: High infection and low productivity

Countries with a productivity level below US\$ 38/hour and an infection rate at or above 19%.

Country	Infection rate	Productivity rate
Czechia	21%	US\$ 28.39
Greece	43%	US\$ 31.18
Hong Kong	30%	US\$ 34.32
Portugal	42%	US\$ 28.99
Slovakia	24%	US\$ 24.04
South Korea	53%	US\$ 27.33

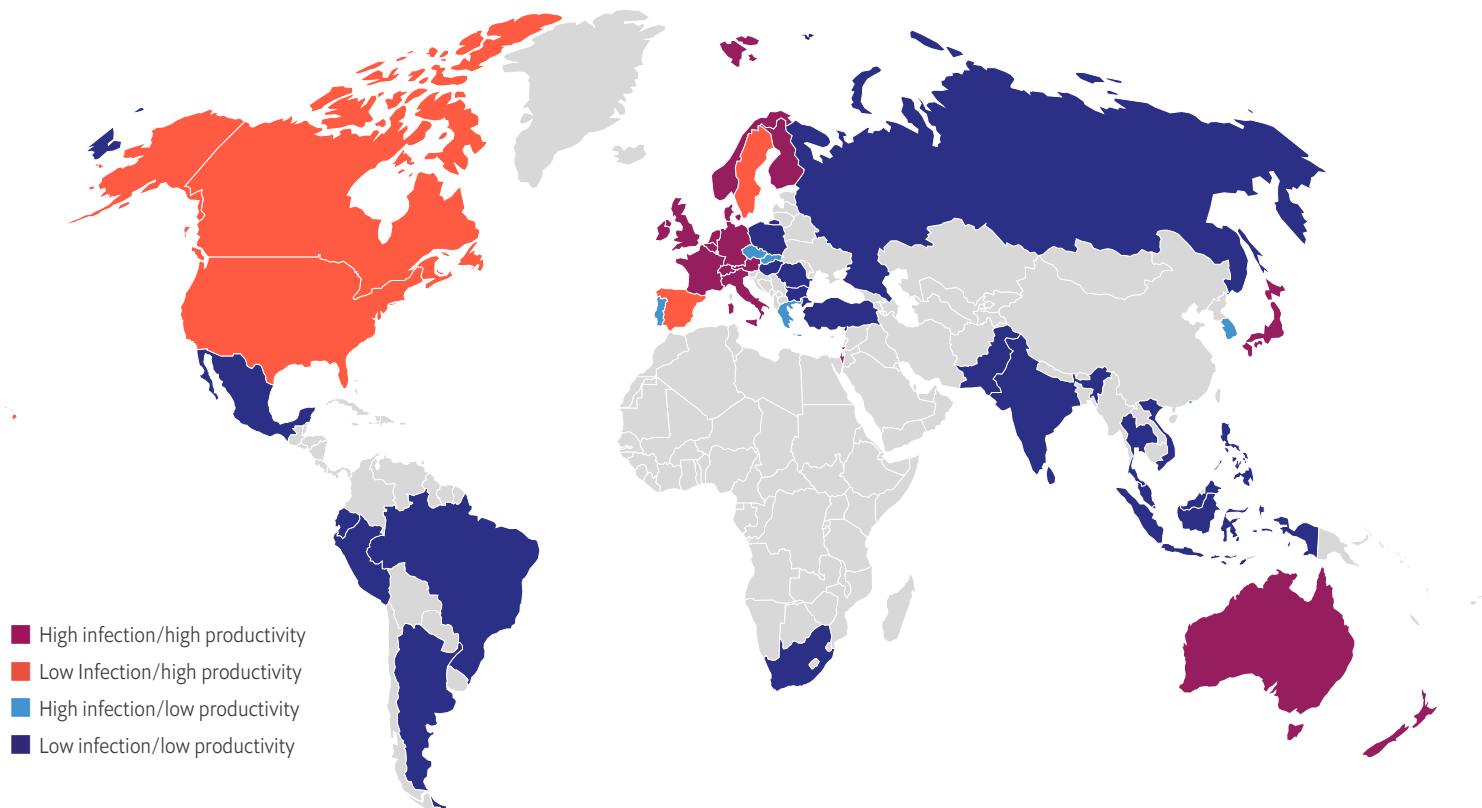
Archetype 4: Low infection and low productivity

Countries with a productivity level below US\$ 38/hour and an infection rate below 19%.

Country	Infection rate	Productivity rate
Argentina	10%	US\$ 20.90
Brazil	6%	US\$ 13.70
Bulgaria	8%	US\$ 12.97
Ecuador	3%	US\$ 6.11
Hungary	10%	US\$ 20.31
India	1%	US\$ 3.20
Indonesia	1%	US\$ 4.76
Malaysia	7%	US\$ 12.08
Mexico	3%	US\$ 9.96
Pakistan	0%	US\$ 2.39
Peru	6%	US\$ 6.56

Philippines	1%	US\$ 3.83
Poland	6%	US\$ 21.19
Romania	8%	US\$ 17.20
Russia	8%	US\$ 13.03
South Africa	1%	US\$ 14.60
Sri Lanka	0%	US\$ 5.17
Thailand	4%	US\$ 5.36
Turkey	9%	US\$ 27.57
Vietnam	10%	US\$ 2.47

Figure C1: Countries by archetype



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