Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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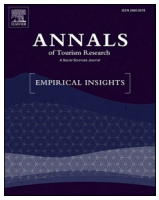

Tourism-induced poverty impacts of COVID-19 in Indonesia

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ABSTRACT

International tourism is an important sector in developing countries for its ability to alleviate poverty. Impacts of COVID-19 are detrimental to all tourism destinations. This paper examines the pandemic effects on poverty of regional economies based on a multi-household CGE model using Indonesia as a case study. Results are critically important for policymakers, as the pandemic retracts achievement of poverty reduction significantly, more than a decade of effort for Bali in this case study. Adverse impacts are transferred to other non-tourism destinations through inter-regional trade flows. The paper provides empirical evidence to call for government's targeted support to combat the economic impacts of the pandemic improve poverty more effectively.

1. Introduction

Tourism plays an important role across many countries. In 2019, the sector accounted for 6.8% of total world exports and 4% of direct contribution to the world GDP. The outbreak of the coronavirus began in late 2019 (COVID-19 hereafter) and spread across the world and resulted in border closures of more than 130 countries by April 2020. This effectively shut down the tourism industry worldwide, reducing the sector's world export share to 2.8% and its direct GDP contribution to 1.8% (UNWTO, 2021), a significant downturn of the world economy, and put millions of jobs at risk.

The sector has an essential role in alleviating poverty in many developing countries (Cárdenas-García, Sánchez-Rivero, & Pulido-Fernández, 2013; Croes & Rivera, 2015; Mahadevan, Amir, & Nugroho, 2016; Telfer & Sharpley, 2007; Zhao & Xia, 2019). For Indonesia, among the top industries, tourism contributes around 5.8% to the national GDP (WTTC, 2018). Being a labour-intensive sector, it is one of the main sources of employment, the economic downturn of COVID-19 would push many households into poverty.

Pandemic studies generally assess the impacts very broadly across all factors from supply to demand sides in the economy (del Rio-Chanona, Mealy, Pichler, Lafond, & Farmer, 2020; Fernandes, 2020; Maliszewska, Mattoo, & Mensbrgghe, 2020; McKibbin & Fernando, 2020). Fernandes (2020) points out that the consequences of the pandemic are not equally distributed in an economy. Ataguba (2020) alludes to the fact that poor and vulnerable people may bear a greater burden of the COVID-19 pandemic. So, to what extent would this pandemic affect poverty in a *tourism destination* of a developing country such as Bali of Indonesia? Who would be affected the most among all local workers? More importantly, would the impacts be on the tourism destinations only or spill over to other non-tourism-dependent regions in the country as well? These are important factors for policy development that policymakers need to know. The tourism-driven aspect of poverty across regions in a country from crises such as the phenomenon COVID-19 pandemic has not been addressed in the literature. Without this knowledge, government policies are at risk, as there is no basis for the government to base their policy development on. These questions are the motivation that constitutes the contribution of our study to the literature.

This study adds to the current literature on the impacts of COVID-19 the regional dimension, with a strong focus on the tourism-induced poverty impacts by region and by household group. In addition, as the standard Computable General Equilibrium (CGE) with a single representative household sector is unable to capture the poverty and distributional impacts, the standard household sector in the Indonesian CGE model is augmented to 100 household groups to capture the impacts on poverty and income distribution across all destinations. It is a new and comprehensive approach compared to most current studies. These contributions are essential, to provide insights for accurate response policies across time.

This study will focus on the international tourism effects, as the loss of international tourism demand is clearer than that of the domestic

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market when lockdowns were imposed intermittently. Moreover, the international segment is the main market for foreign income, its role and effects warrant a careful attention from government and policymakers for policies that can build a resilient tourism sector. As such, the paper focuses on the short-run impacts in 2020 where findings are more relevant for the objectives.

2. The economic tourism impacts of infectious diseases

Tourism has been affected by infectious diseases previously, including the swine flu (Haque & Haque, 2018; Page, Song, & Wu, 2011), the severe acute respiratory syndrome or SARS (Dwyer, Forsyth, & Spurr, 2006; Kuo, Chen, Tseng, Ju, & Huang, 2008; Liu, Moss, & Zhang, 2011), foot and mouth disease (Blake, Sinclair, & Sugiyarto, 2003), Ebola in 2013–14 (Sifolo & Sifolo, 2015), and the Middle East respiratory syndrome (MERS) in 2012. By and large, previous studies tend to adopt mainly traditional modelling methods (Liu, Kim, & Song, 2022) and they highlight that those infectious diseases have significant negative impacts on inbound tourism demand and on the wider economy. The main reason for a downturn of tourism during an outbreak is due to border closures and lockdowns (McKercher & Chon, 2004), limiting movements of visitors, consequently causing losses to tourism revenue and simultaneously driving down the aviation industry significantly (Chen, Demir, García-Gómez, & Zaremba, 2020; Liu, Kim, & O'Connell, 2021) during restriction time.

The scale and scope of COVID-19 are unprecedented and far more destructive than the previous ones, including social impacts (Qiu, Park, Li, & Song, 2020), that the pandemic ignites a large volume of very diverse academic discourse (Yang, Zhang, & Rickly, 2021). Indeed, it is the most serious public health threat since the 1918 Spanish flu pandemic (Ferguson et al., 2020), as the world economy is much more integrated in the supply chain and containing a higher share of the service sector, particularly in developed countries (Boissay & Rungcharoenkitkul, 2020). The World Bank (2021) reports a 3.5% contraction in the global economy for 2020. Sharp declines in individual economies around the world are also noted in Australia (Pham, Dwyer, Su, & Ngo, 2021); African countries (Ataguba, 2020), Tanzania (Henseler, Maisonnave, & Maskaeva, 2022); the United States of America (del Rio-Chanona et al., 2020; Muellbauer, 2020), and a wide range of developed and developing countries (Fernandes, 2020; Maliszewska et al., 2020; McKibbin & Fernando, 2020).

The approaches to modelling infectious diseases are quite diverse. These include the use of econometrics approaches (Haque & Haque, 2018; Kuo et al., 2008; Liu et al., 2011; Page et al., 2011), artificial neural networks (Jaipuria, Parida, & Ray, 2021), Input-Output multiplier model (Hai, Zhao, Wang, & Hou, 2004), the computable general equilibrium (CGE) models (Blake et al., 2003; Dwyer et al., 2006; Maliszewska et al., 2020; McKibbin & Fernando, 2020; Pham et al., 2021), the dynamic stochastic general equilibrium modelling technique (Yang, Zhang, & Chen, 2020), and the Tourism Satellite Accounts (TSA) approach (Pham et al., 2021; Wu, Cao, Liu, & Chen, 2022). The modelling choice will determine the outcomes of the analysis, as each approach has distinct characteristics. Partial equilibrium approaches such as econometric and artificial neural networks mainly focus on observed variables while assuming everything else is constant, thus constraining the feedback effects between supply and demand, and between industries. The use of I—O framework captures the inter-industry linkages very well. However, the technique relies on a fixed linear relationship assumption; price effects and resource constraints are not taken into consideration thus leading to overestimated results (Blake, Arbache, Sinclair, & Teles, 2008). Using the same I—O database, the CGE modelling technique adds the economic optimisation theory to deal explicitly with price effects and resource constraints. Thus, it offers a more robust capability for economy-wide analyses, as prescribed in Arrow (2005) that "*…in all cases where the repercussions of proposed policies are widespread, there is no real alternative to CGE*". For these reasons, the CGE modelling technique is adopted in this study.

From the tourism perspective, the System of National Accounts does not recognise tourism as a sector explicitly in the economy, thus it is not possible to understand the size and the importance of the sector among many other sectors in the economy. The TSA framework was developed by UNWTO (2010) so as to '*allow an expansion of the national accounts for selected areas of interest while maintaining the concepts and structures of the core accounts*' (ABS, 2019).

TSA plays an important role in tourism analysis and is the main tool to estimate the direct contribution of tourism to the economy (Pham & Dwyer, 2013). Using TSA alone cannot capture tourism impacts on the rest of the economy though. This gives rise to the approach that integrates the TSA framework and the CGE modelling technique to create a powerful modelling tool that can capture the economy-wide flow-on effects (Pham et al., 2021). On the one hand, the approach explicitly represents tourism as a sector in the economy; and, on the other hand, tourism consumption is decoupled from household consumption (domestic tourism) and exports (inbound tourism), the crowding-out effects on the same commodities by tourism demand versus household consumption (or exports) can be clearly delineated.

It is also important to note that all COVID-19 economic impact studies of tourism focus on the national level of the impacts. At the regional (sub-national) level, the pandemic has immensely diverse effects on tourism destinations. Although essential, the regional poverty impacts of tourism demand are ignored. Our research is set out to elaborate the modelling tasks further to unveil the regional impacts on poverty explicitly. From this angle, this paper has an important contribution in terms of policy implication for many other countries, as the task to alleviate poverty is increasingly an important objective. If the consequences on poverty of this pandemic are not addressed, the potential poverty effects could result in long lasting poor outcomes for many individuals.

3. Poverty and tourism

Poverty has always been an issue for many developing countries as it is a long-term multidimensional social-economic problem. It is the main cause of malnutrition, lack of education, poor health, lack of basic needs of living standard (Barnett, 1998; Brooks-Gunn & Duncan, 1997; Larson, 2007). Poverty hinders productivity, constraints economic growth and socially stimulates crimes (Breunig & Majeed, 2020; Holzer, Whitmore Schanzenbach, Duncan, & Ludwig, 2008).

Tourism has been identified as one of the effective tools that can be adopted to alleviate poverty in countries that are not rich in natural resources. Tourism creates job opportunities, generates foreign exchange earnings, improves the terms of trade, and increases investment that, in turn, will increase household income and help reduce poverty (Blake et al., 2008; Croes & Vanegas, 2008; Mahadevan et al., 2016; Njoya & Seetaram, 2018). Nevertheless, a drawback is that tourism boom can hurt non-tourism exporting activities due to the Dutch disease effects of the real exchange rate appreciation that tourism can crowd out non-tourism exporting industries (Blake, 2008; Pham, Jago, Spurr, & Marshall, 2015).

Although the tourism-poverty nexus has been studied in the tourism literature, the analysis is too aggregate, mostly at the national level. The regional dimension of poverty where tourism impacts actually occur has not been examined adequately. As such, analysis can overlook the actual conditions where appropriate policies are needed for improvements. As evidenced from Indonesia, the regional poverty incidence in 2019 ranges from 26.5% in the poorest region to only 3.4% in the wealthiest region (Statistics Indonesia, 2021). Therefore, without the regional analysis, it is hard to translate national perspective into accurate policy responses at the root level where tourism activities take place and are intended to improve poverty conditions.

The nature of tourism in Indonesia is not homogenous across all regions due to its geographical landscape. Bali and Yogyakarta are the

most popular tourist destinations in the country (Table 1). However, both regions offer different experiences for visitors. Bali is more appealing to international visitors while Yogyakarta is more attractive to the domestic tourism market. Among all regions, Bali alone contributes more than 40% of total international tourism revenue to the country (Table 1). Within Bali, the international market dominates with more than 83% of revenue share on a 10-year average (2010–2019) although international markets account for less than 40% of total visitor number over the period. In contrast, although the number of domestic visitors on the 10-year average accounts for more than 90% of total visitors to Yogyakarta, the international market is still a major source of income (more than 50% on the 10-year average) for the region (Table 1). The role of international tourism market is certainly very important to destinations in Indonesia.

Table 2 provides the combined shares in gross regional product (GRP) and gross domestic product (GDP) of two dominant tourism expenditure items, hotels and restaurants, to highlight the role of tourism at the regional and national levels. For Bali, the share had dwindled from 21.6% down to 18.9% over the period 1998–2005 (Table 2) due to adverse external shocks, including terrorist attacks (2002), the suicide bombings (2005), as well as the bird flu outbreak in 2004. The suicide bombings seemed to divert visitors away from Bali to Yogyakarta, thus the share of hotel and restaurant in GRP for Yogyakarta increased slightly (9.2% to 11.7%).

The tourism industry improved slowly over the period 2007 to 2015 for both Bali and Yogyakarta, through the global financial crisis. The post-2015 period experienced a boom in international tourism, induced by the visa-free policy for 169 countries the Indonesian Government introduced in 2016. The number of foreign visitors increased by almost 54.8% from 10.4 million visitors (2015) to 16.1 million (2019). The visa-free policy seems to have benefited Bali the most, with a strongest increase of 0.7 percentage points (from 19.6% to 20.3%) in the share of hotels and restaurants in the region's GRP. Over the 15-year period from 2005 to 2019, tourism had steadily adjusted back to the pre-crisis levels in both Bali and Yogyakarta. Overall, the share at the national level declined slightly after the Bali bombings and seems to have stabilised at the level of 3.0% ever since. Similar data of Tables 2 for other regions are provided in Appendix A.

Alongside improvements in tourism before COVID-19, the portion of the population living below the poverty line had decreased from 24.2% to 9.2% between 1998 and 2019 nationally (Table 2), a significant improvement for Indonesia, mainly due to a sustained robust economic growth over the past decades with an average annual rate of 5.3% since 2000 (Statistics Indonesia, 2021), the main driver of the long-term poverty reduction (Asra, 2000; Balisacan, Pernia, & Asra, 2003).

As seen in Table 2, Bali is among the provinces with the lowest poverty incidence, second to the capital city Jakarta (Appendix A). Such achievement can be attributable to the foreign income from the international tourism market (Table 1), the main industry of Bali. The persistent growth in per capita income improves the poverty consistently over time.

However, the success in poverty reduction has not been translated into equal improvement in income distribution among all regions, as reflected by the Gini index (Table 2). A large value for the Gini index indicates higher inequality among income earners. Table 2 shows that the inequality did not improve significantly overall between 2010 and 2019 and income distribution for Bali and Yogyakarta fluctuated over the period 2010–2019, more so for Bali.

The impact of the pandemic on poverty has posed serious questions that policymakers in Indonesia, and other developing countries, would like to understand, and need to understand well, for their effective response policies. This compelling reason is the motivation for this paper to undertake the combined topic of pandemic-tourism and regional poverty in Indonesia as a case study that can be useful for many other countries. Our paper contributes to this debate with invaluable information.

4. Methodology

4.1. The CGE core

As visitor expenditure covers a wide range of goods and services, the economic impacts of the COVID-19 pandemic will widely permeate through industries and regions in the Indonesian economy. This warrants a regional CGE for the analysis. The model in this study is augmented from an existing regional CGE model INDOTERM, that is widely used for Indonesia (Horridge, Madden, & Wittwer, 2005; Wittwer & Horridge, 2010; Yusuf, 2021; Yusuf, Roos, & Horridge, 2018). The original database was in 2010, containing 34 regions, 185 industries.

Regions are linked with each other through the inter-regional trade flows and with the rest of the world through the international trade flows. For each industry, intermediate inputs and the composite primary input are combined in a linear relationship, referred to as the Leontief technique. Although the model structure is flexible to alter this linear relationship when required, this linear relationship is usually kept constant throughout simulations. Intermediate inputs can be sourced from either domestic regions or overseas, depending on the relative prices of the supplies. An industry will purchase inputs from the cheapest source utilising the constant elasticity of substitution (CES) prescribed in the Armington imperfect substitution function (Armington, 1969) so as to minimise the production cost. Similarly, capital, labour and land are combined in the composite primary input bundle using the CES function. Each industry produces a single output.

Demands by the households are modelled using a Linear Expenditure System at the top level, governed by household income, commodity prices and population size. Commodity demands by the households are broken down into domestic and imports sources, then among domestic regions, all using the cost-minimising CES function. The CES function is also applied to demands for investment and government consumption. Foreign demands for domestic products are modelled as downward sloping demand curves.

Table 1
National and regional tourism indicators by selected tourism region.

Year	Number of Foreign Visitors (million)			Foreign tourism revenue (US$ billion)			Number of domestic visits (million)			Domestic tourism revenue (US$ billion)		
	Bali	Yogyakarta	Indonesia	Bali	Yogyakarta	Indonesia	Bali	Yogyakarta	Indonesia	Bali	Yogyakarta	Indonesia
2000	1.4	n.a	5.1	1.2	n.a	5.7	n.a	n.a	191.7	n.a	n.a	0.0
2005	1.4	0.1	5.0	1.5	0.1	4.5	n.a	0.9	198.4	n.a	0.0	7.7
2010	2.5	0.2	7.0	3.5	0.2	7.6	4.6	1.3	234.4	1.1	0.1	16.6
2015	4.0	0.3	10.4	5.7	0.4	12.6	7.1	3.8	256.4	1.1	0.2	16.7
2016	4.9	0.4	12.0	7.1	0.4	14.4	8.6	4.2	264.3	1.4	0.3	18.1
2017	5.7	0.4	14.0	7.1	0.5	15.9	8.7	4.8	270.0	1.3	0.3	18.4
2018	6.1	0.4	15.8	8.3	0.5	19.3	9.8	5.3	303.4	1.6	0.4	20.4
2019	6.3	0.4	16.1	7.5	0.5	18.5	7.2*	12.4*	282.9*	1.2*	0.8*	19.1*

Source: (Statistics Indonesia, 2021).
* Using Mobile Positioning Data technology.

Table 2
Tourism contribution and broad poverty assessment by selected tourism region.

Year	Share of hotel & restaurant sector in total GDP/GRP (%)			GDP/GRP per capita (US$ thousand)			Poverty incidence (%)			Gini index		
	Bali	Yogyakarta	Indonesia	Bali	Yogyakarta	Indonesia	Bali	Yogyakarta	Indonesia	Bali	Yogyakarta	Indonesia
1995	19.8	8.7	3.3	1.1	0.9	1.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1998	21.6	9.2	3.3	0.6	0.5	0.7	n.a.	n.a.	24.2	n.a.	n.a.	0.29
2005	18.9	11.7	3.0	1.0	0.8	1.3	6.7	19.0	16.0	n.a.	n.a.	0.33
2010	19.1	8.9	2.9	2.7	2.1	3.2	5.7	15.6	13.3	0.37	0.41	0.38
2011	19.2	8.9	2.9	3.0	2.3	3.7	4.6	16.1	12.4	0.41	0.40	0.41
2012	19.3	9.0	3.0	3.1	2.3	3.7	4.0	15.9	11.7	0.43	0.43	0.41
2013	19.5	9.2	3.0	3.1	2.2	3.6	4.5	15.0	11.5	0.40	0.44	0.41
2014	19.5	9.3	3.0	3.2	2.1	3.5	4.8	14.6	11.0	0.41	0.42	0.41
2015	19.6	9.4	3.0	3.2	2.1	3.4	4.7	14.9	11.1	0.38	0.43	0.41
2016	19.7	9.4	3.0	3.5	2.2	3.6	4.3	13.3	10.7	0.37	0.42	0.40
2017	20.3	9.5	3.0	3.8	2.4	3.9	4.3	13.0	10.1	0.38	0.43	0.39
2018	20.4	9.6	3.0	3.8	2.4	3.9	4.0	12.1	9.7	0.36	0.42	0.38
2019	20.3	9.8	3.0	4.1	2.6	4.2	3.8	11.7	9.2	0.37	0.42	0.38

Source: (Statistics Indonesia, 2021).

4.2. Poverty calculation

While the CGE core equations are inherited from the base model, an additional poverty module was developed to capture changes in income groups and poverty explicitly. Each region now has 100 groups of households corresponding to the percentiles of their per capita consumption level. Equations for income distribution reflect the individual sums of the 100 income groups (percentiles) across all industries. The income distribution provides the basis for the calculation of changes in poverty incidence (*before and after the pandemic*) for all regions (Appendix B). Poverty incidence refers to the proportions of the Indonesian population living under the poverty line with the income just enough to cover the *daily* food requirement for 2100 cal and *monthly* non-food basic items (e.g. rent and energy). The Indonesian Government estimates the poverty line for each province separately (Statistics Indonesia, 2021).

4.3. Data development

Fig. 1 illustrates the database development. First, the original IO database was updated from 2010 to 2019 but parameters remain unchanged as their update is beyond the scope of this paper. The single household sector was then expanded to 100 household groups corresponding to their per capita expenditure percentiles using shares obtained from the SUSENAS household survey data, while the labour income of the regional industries was disaggregated using the SAKERNAS labour force survey data. The development maintains the original dimensions of 185 single-output industries and 34 regions. However, for simplicity, the data are aggregated down to 20 industries and reported for 5 regions (Appendix C) in this study. The updated database has a strong focus on the regional aspects of income distribution and poverty.

4.4. Shock calculation

It is important to note that there are various ways the pandemic can affect the economy, such as health effects, supply-chain changes, demand-side shock, and direct labour supply disruption due to people staying away from work (Baldwin & Tomiura, 2020). This study only focuses on the effect of losing inbound tourists due to the closure of the Indonesian international borders, similar to the approach in Pham et al.

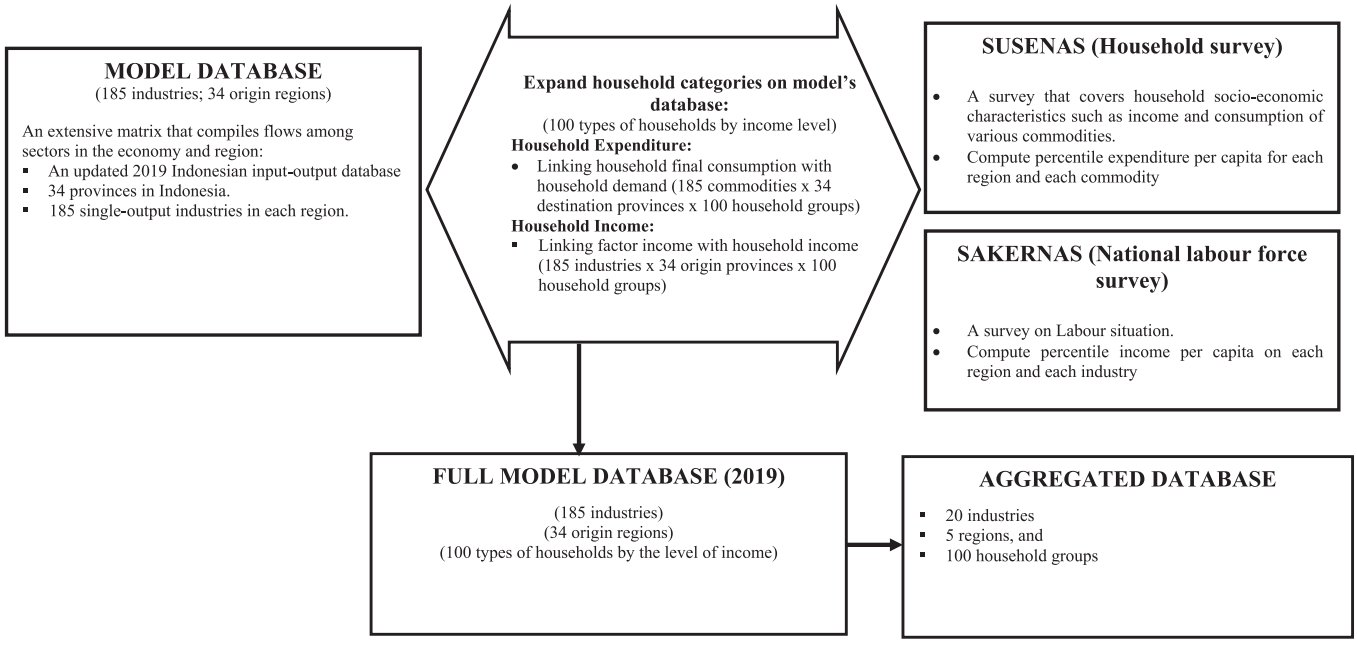

Fig. 1. Construction of the 2019 model database.
(Source: Authors)

(2021). The actual data of visitor arrivals during 2020 and inbound tourism expenditure from the latest Tourism Satellite Account (TSA) are used to calculate the shocks.

Fig. 2 presents monthly arrival data for all airports of Indonesia. The numbers of visitors started declining sharply at the end of January 2020. Comparing March-2020 with March-2019, arrivals dropped to 64.7% for the Ngurah Rai Airport of Bali, 68.4% for the Adi Sucipto Airport of Yogyakarta. By April 2020, arrivals to all airports had effectively stopped, as seen in the figure (CEIC, 2021).

The exact timeframe of the international border closure was difficult to estimate. However, the immediate effect was that the international tourism market for Indonesia was closed right through 2020. Compared to 2019, the reduction in the number of arrivals at Bali airport in 2020 was 83.3%, 83.6% for Yogyakarta, 82.7% for Jakarta and Banten, and 63.6% for Papua. Nationally, the reduction was approximately 83% (CEIC, 2021).

These changes in visitor numbers are translated into shocks by commodity and by region through a three-stage process: (i) distribute total tourism inbound expenditure to regions (Statistics Indonesia, 2019), (ii) disaggregate total regional tourism expenditure into specific goods and services (Statistics Indonesia, 2019), and (iii) calculate tourism shocks as proportions in the export values of the corresponding commodities from the region (CEIC, 2020). For example, "textile products" are typical shopping items that inbound visitors buy as presents to take home from Bali. The −24.6% decline in export demand for textile products in Bali is based on −83.3% reduction of international arrivals, then (a) 48.6% of the international visitor's expenditure is allocated to Bali, (b) 1.9% of the total regional tourism expenditure in Bali is allocated to textile using the latest expenditure pattern (c) shocks are derived by dividing tourism consumption of textile by total exports of textile from Bali, as presented in Table 3. The reduction in inbound tourism consumption is done via losses of export demands, introduced to specific export commodities of the supplying industries which are loosely defined as tourism-related industries as identified in Table 3.

Table 3
Regional shocks by product (per cent).

Commodities	Regions				
	Bali*	Yogyakarta*	Jakarta	Banten	Papua
Agriculture**	−7.3	−5.1	−11.5	−24.1	−0.1
Oil & gas mining	0.0	0.0	0.0	0.0	0.0
Other mining	0.0	0.0	0.0	0.0	0.0
Petroleum	0.0	0.0	0.0	0.0	0.0
Food products**	−54.0	−54.2	−26.5	−30.0	−0.4
Textile products**	−24.6	−35.3	−1.2	−20.0	0.0
Chemical, rubber, & plastic products	0.0	0.0	0.0	0.0	0.0
Metal products	0.0	0.0	0.0	0.0	0.0
Vehicles & equipment	0.0	0.0	0.0	0.0	0.0
Other manufacturing products**	−19.1	−54.2	−6.0	−4.6	−0.4
Utility	0.0	0.0	0.0	0.0	0.0
Construction	0.0	0.0	0.0	0.0	0.0
Trade	0.0	0.0	0.0	0.0	0.0
Transportation**	−95.0	−94.8	−95.0	−94.0	−2.6
Government services	0.0	0.0	0.0	0.0	0.0
Health	0.0	0.0	0.0	0.0	0.0
Hotels**	−54.0	−54.2	−94.9	−90.0	−29.9
Restaurants**	−53.9	−46.9	−95.0	−90.3	−7.0
Arts & entertainments**	−53.8	−54.2	−95.0	−95.0	−5.7
Other services**	−53.9	−4.2	−36.7	−64.5	−3.5

Source: Authors' calculation.
* Tourism-dependent region
** Tourism-related industries.

5. Results

5.1. Simulation setting

In this study, a short-run closure was applied on the model in a comparative static mode. Short-run results reflect impacts in the immediate period, ie. 2020 in this case. Given the fact that the demand for inbound tourism further declined in 2021, results in this paper will not be in the typical year manner that can represent impacts for 2021. They may, however, be used as a proxy for 2021, as the difference in the losses in inbound tourism demands was only marginal between the two years. It is important to note that results in the study are derived from the inbound tourism aspect of the COVID-19 on the Indonesian economy. Therefore, results should not be compared directly with published statistics, as during the pandemic, the Indonesian Government provided financial supports to the economy, thus softening the impacts.

In this short-run closure setting, capital stocks and land are held constant. Rates of return are flexible to reflect changes in demand for capital and land. In contrast, nominal wages are assumed to be constant while total employment adjusts to reflect changes in labour demand nationally. Regional real wage differentials become a driver to reallocate labour between regions. Regional household consumption is driven

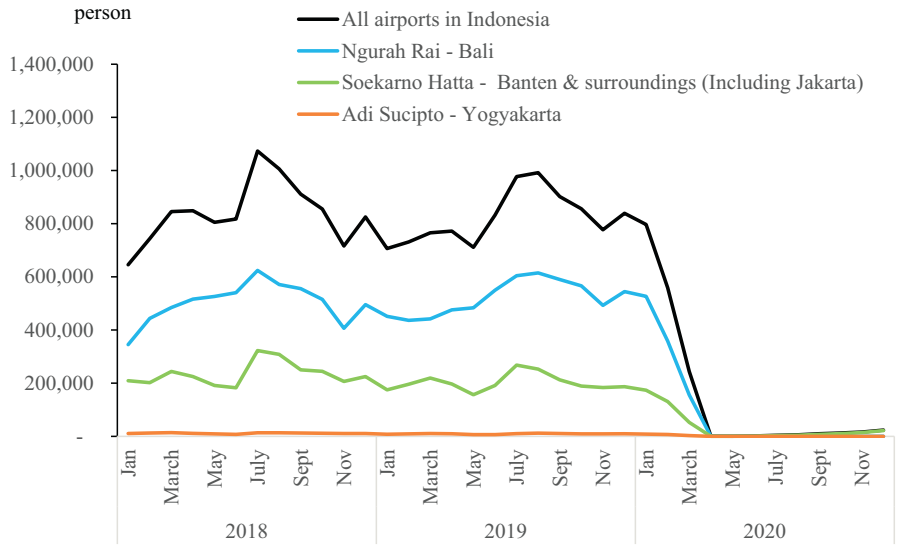

Fig. 2. Air gate arrivals by airport.
(Source: (CEIC, 2021).)

by regional income. Investment responds to the prevailing rates of return generated in the model. Although the Indonesian Government did increase government support to prop the economy, government demand is held constant in this study order to estimate strictly the impacts from the losses of international visitors. Lastly, nominal exchange rate is used as numeraire in the model.

Primarily, the analysis in this study examines the impacts on the regional economies of Indonesia due to the losses of international visitors to the regions. The standard closure would generate adverse impacts on tourism-related industries, which then release resources to the rest of the economy. In a non-pandemic condition, where strict social distancing is not imposed, country border is not shut down, other industries can make use of the released resources at cheaper costs to expand their output and exports. However, in the infectious conditions with a large-scale social distancing in all regions, labour mobility becomes rather restrictive for other industries to fully absorb the released resources. The paper will examine both scenarios in order to give a full range of possible outcome of the pandemic through the effects of the international tourism market.

Scenario 1: A decline in the number of inbound tourists, no exports response from other industries.

Scenario 2: A decline in the number of inbound tourists, with exports response from other industries.

The export response is an important factor that affects the overall economic impact. This scenario illustrates a possibility for the domestic industries to soften the adverse impacts of the pandemic without any burden on the government budget through fiscal policies.

5.2. Macro results

We first begin the analysis with an explanation of the scenario without the export response of the non-tourism industry (Scenario 1). At the macro level (the left panel, Table 4), the decline in the number of inbound visitors will reduce output of tourism-related industries. Given the short-run closure setting, output contraction mainly results in losses in demand for labour, as capital stock is assumed constant in the short term. Thus, under Scenario 1, the decline of −2.7% in GDP is mainly due to a − 6.2% contraction in employment.

The decline in foreign tourism demand brings immediate effect on reduced income to the economy, hence driving down household consumption by −3.4%. On the other hand, real investment is also estimated to decrease by −3.9% due to the decline in the rate of return to investment as average payment to capital dropped by −7.8%. The decreases in the final demand for household consumption and investment are strong, this makes the real exchange rate devalue by −5.2%. Such depreciation will generally make imported goods relatively more expensive, domestic users tend to substitute domestically produced goods for imports. Real import is estimated to decline by −4.1% and helps improve the trade balance by 1.4%. On top the depreciation effect, the decline in imports is also partly due to lowered income thus subsequently weaker consumption.

In contrast, the devaluation can make exports from Indonesia cheaper for foreign buyers, reflected by a decrease of −5.9% in the terms of trade. As exports of other non-tourism industries are assumed not to respond, the decrease in the terms of trade somewhat reflects a welfare loss, as the domestic economy cannot import as much as before for any existing units of exported commodities.

At the regional level, not a single region could be immune to the adverse impacts of the pandemic regardless of whether they are tourism-dependent regions such as Bali and Yogyakarta, or mining-based (Papua), manufacturing-based (Banten), and service-based (Jakarta) regions. Drivers of the economic downturn for each region are slightly different though. Both Bali and Yogyakarta are estimated to lose their exports significantly (−48.7% and − 30.4%, respectively) through tourism, well above the national total exports (just −3.3%), as seen in Table 4 (row 6).

Bali, with the largest market share of inbound tourists (38.5% of total international visitors, Table 1), experienced the most profound economic impacts. The GRP of the region is estimated to contract by −12%, more than four times of the decline by −2.7% in GDP at the national level. In contrast, GRP of Yogyakarta is estimated to decline by only −2.9%, much lower than that of Bali, even though both are tourism-dependent regions. This is because Yogyakarta relies more on

Table 4
Macroeconomic effects (percentage change).

		Scenario 1						Scenario 2					
		Inbound tourists decline, no exports response						Inbound tourists decline, with exports response					
		Bali*	Yogyakarta*	Jakarta	Banten	Papua	Indonesia	Bali*	Yogyakarta*	Jakarta	Banten	Papua	Indonesia
1	Real GDP	−12.0	−2.9	−2.8	−3.9	−1.3	−2.7	−11.3	−2.2	−1.4	−2.3	−0.5	−1.6
2	Real household consumption	−17.7	−3.0	−3.5	−5.7	−1.1	−3.4	−16.5	−1.9	−1.0	−2.7	0.6	−1.5
3	Real investment	−15.3	−3.8	−3.2	−4.8	−2.8	−3.9	−14.6	−3.3	−2.0	−3.2	−0.9	−2.6
4	Real government consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	Aggregate import	−13.4	−3.9	−4.1	−4.9	−2.9	−4.1	−12.1	−2.3	−1.7	−2.2	−0.7	−2.0
6	Aggregate export	−48.7	−30.4	−4.2	−7.5	−0.2	−3.3	−50.7	−33.2	−2.7	−4.2	0.5	−2.9
7	Trade balance (billion US $)	–	–	–	–	–	1.4	–	–	–	–	–	−1.6
8	Aggregate employment	−23.3	−5.8	−6.2	−8.8	−3.4	−6.2	−22.0	−4.4	−3.3	−5.2	−1.4	−3.9
9	Capital stock usage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	Real wage rate	8.9	4.5	4.5	5.0	3.9	4.5	7.2	2.8	2.5	2.9	2.1	2.7
11	Nominal wage rate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	Rental to capital	−27.6	−7.6	−7.0	−7.8	−7.4	−7.8	−26.1	−5.6	−3.6	−4.1	−1.7	−4.0
13	Consumer Price Index (CPI)	−8.2	−4.3	−4.3	−4.7	−3.7	−4.3	−6.7	−2.8	−2.5	−2.9	−2.0	−2.6
14	Real devaluation	–	–	–	–	–	5.2	–	–	–	–	–	2.5
15	Term of trade	–	–	–	–	–	−5.9	–	–	–	–	–	−1.5
16	Lowest 20% real consumption	−13.48	−2.34	−3.08	−4.61	−0.81	−2.90	−12.41	−1.23	−0.56	−1.66	0.64	−1.06
17	Highest 20% real consumption	−17.99	−3.17	−3.57	−5.92	−1.17	−3.53	−16.73	−1.96	−1.09	−2.88	0.54	−1.54

Source: Authors' results.
* Tourism-dependent region.

domestic visitors, the export share of inbound tourism in its GRP is relatively small (6.7%) compared to that of Bali (50.5%).

The pandemic affects not only tourism revenue but also suppresses investment across all regions in the country, essentially due to the negative rate of return. Among regions, investment in Bali is affected the most, mainly the construction industry in the region (Table 4). This may have a long-term effect on the supply side of the tourism industry if the pandemic prolongs. Although not popular as a tourism destination, Banten has also experienced *relatively* a strong contraction in its GRP (−3.9%), slightly higher than the loss to Yogyakarta (−2.9%). This is due to a decline in the export of air transport services, contributing to a total loss of −7.5% in the region's export, as Banten is home for the largest airport and occupies the largest share of air transport services in Indonesia (Soekarno Hatta international airport). The contraction in Banten's economy is a result of lower demand for transport services by inbound visitors travelling in the country, Bali and Yogyakarta. Given the fact that airfare expenditure is one of the largest expenditure items of visitors, the decline in Banten's GRP is inevitable.

In Scenario 2 (the right panel in Table 4), where the assumption of fixed exports of other non-tourism industries is relaxed, the impact *pattern* is the same, except results are not as strong. Industries other than tourism may be able to utilize some slack labour released from the tourism-related industries to increase their competitiveness and boost their exports. The total of exports at the national level is estimated to reduce by only −2.9%, less than that in scenario 1 (−3.4%). National GDP is estimated to contract by −1.6%, which is softer by more than 1.1 percentage points compared to the GDP result in scenario 1.

The impact on employment losses in the second scenario (−3.9%, row 8) is significantly lower than that in scenario 1 (−6.2%), due to resource reallocation. As the slack labour is now partially absorbed among other non-tourism related industries to produce more output, which also tends to add marginal demand for capital; thus, although rental to capital is still falling (−4.0%), it is not as low as the result in scenario 1 (−7.8%). Subsequently, investment is estimated to reduce modestly by only −1.5%. The combined effects of less losses of employment and rental income result in a less severe adverse outcome for household income, therefore the reduction in household consumption is estimated to be just −1.5% (row 2), a significant improvement from scenario 1 (−3.4%). Trade balance in this scenario declines by −1.6%, not improving as in scenario 1, mainly because import is not declining as much in scenario 1.

It is important to note that scenario 2 could not avoid the losses of employment completely. This is due to the assumption of the fixed nominal exchange rate that is intentionally applied to reflect the pandemic nature, which limits mobility of resources hence the ability to absorb the released resources to increase production capacity of non-tourism-related industries.

The increased exports of non-tourism related industries offset the total losses of the international tourism revenue more in non-tourism dependent regions than in tourism dependent regions. This is because the initial losses of the inbound sector in the tourism dependent regions (Bali and Yogyakarta) are so large that the increased production and exports of non-tourism-related industries could not improve the overall adverse impacts very effectively when the infrastructure of the non-tourism related industries in these tourism regions is not very strong. However, for non-tourism dependent regions (Jakarta, Banten, and Papua), the non-tourism-related industries are already there and play an important role (larger shares) in these regions; the cheaper costs of resources can help enhance the production of their traditional exporting industries. Importantly, the enhanced exports for the non-tourism-related industries could improve the returns to capital therefore softening the reduction in investment significantly. All in all, the enhanced exports can improve the GRP losses more effectively in the non-tourism dependent regions in comparison with Bali and Yogyakarta.

Among all industries, the tourism-related industries are estimated to decline more significantly than the others. At the national level, Arts and entertainments, hotels, restaurants and transportation, are the estimated to contract by 30.2%, 20.9%, 6.3% and 5.6% respectively in scenario 1 (Table 5). And the output losses of these industries concentrate more in Bail and Yogyakarta than in other regions, except Banten with the very large output decline in transport services (−12.8%). Given the inter-linkages among industries and regional economies, output of tourism supplying industries such as utility, food products, and other manufacturing industries is also curtailed. Simultaneously, lowering household income (consumption) leads to further output contraction in non-tourism-related industries. As a result, all industries contract across all regions. Between the two scenarios, as expected, output of industries is estimated not to decline as much in scenario 2, as non-tourism-related industries could take advantage of the cheaper costs to improve their competitiveness and increase exports to offset the adverse impacts.

5.3. Poverty effects

As the economy contracts, unemployment surges, poverty incidence is estimated to increase. In scenario 1, the 83% loss of inbound tourists could raise the national poverty incidence by 0.9% of the population (Fig. 3) or equivalent to more than 2.4 million people out of the total 268 million people in Indonesia. This pushes the national poverty incidence from 9.2% in 2019 (Table 2) to 10.1% in 2020. The decline in the number of inbound tourists effectively sets back poverty abatement at the national level by three years. Residents will face a lower living standard.

At the regional level, poverty changes are not uniform. The variation moves in line with results for GRP presented in Table 4. Bali is the most affected destination. The decline of 12% in GRP of Bali raises the poverty incidence in the region by 2.2% in scenario 1 (Fig. 3), the most severe among all regions. The increase in poverty is estimated to push the existing poverty level in Bali from 3.8% in 2019 up to 6.0%, the same level of poverty twelve years earlier in the period between 2007 and 2008 (Table 2). This is a severe set-back for the Balinese, by more than a decade of what had been achieved for poverty reduction in the region.

Banten, Yogyakarta and Jakarta also suffer from increases in the poverty incidence, although not as severe. Banten is the second region that suffers from income losses, just as the order of GRP losses (Table 4). This highlights the important contribution of a regional CGE model in this paper, that can detail the differences impacts across regions from the pandemic.

With the assumption of non-tourism industries being responsive to the resources released by the tourism related industries (Scenario 2), impacts on poverty incidence are significantly softened in non-tourism-dependent regions. In these regions, the regional economies can take up slack labour so that employment and wage levels do not drop significantly. Among all regions, Papua is estimated to experience a slight improvement in poverty incidence since the real income effect is somewhat stronger than the negative employment effect. In contrast, in the tourism-dependent regions, relaxing the assumption on exports for non-tourism-related commodities does not help much since production of these commodities are not readily available to take up such opportunity. In other words, *too much specialisation can put a region at a higher risk due to the lack of flexibility to respond to a crisis*. This underlines the importance of diversification in the industry structure to minimise risks for regions during crises.

For distributional impact, Figs. 4 and 5 present the percentage changes in real household consumption of each household group in 2020 compared to their base level in 2019 due to the international border closure. Each line encompasses all 100 household groups, corresponding to the 100 percentile income groups (horizonal axis), from poorest (household number 1) to wealthiest (household number 100).

The most prominent evidence is that all household groups in Bali suffer significant losses compared to all other regions, in both scenarios, but more so in scenario 1 (Fig. 4), ranging from 12% to nearly 19%. For other regions, the changes in real consumption tend to be equally

Table 5
Effects on outputs of selected industries (percentage change).

		Simulation 1						Simulation 2					
		Inbound tourists decline, no exports response						Inbound tourists decline, with exports response					
	Industries	Bali*	Yogyakarta*	Jakarta	Banten	Papua	Indonesia	Bali*	Yogyakarta*	Jakarta	Banten	Papua	Indonesia
1	Agriculture**	−6.3	−3.1	−2.2	−3.5	−1.8	−2.8	−5.5	−2.2	−1.4	−2.2	−1.2	−2.0
2	Oil & gas mining	−0.4	−0.4	−0.3	−0.3	−0.5	−0.3	0.0	0.0	0.0	0.0	0.0	0.0
3	Other mining	−2.0	−1.5	−1.6	−1.4	−0.6	−0.6	−0.5	−0.2	0.0	0.0	0.0	0.0
4	Petroleum	−4.4	−3.1	−2.6	−2.1	−1.8	−1.9	−1.5	−0.9	−0.9	−0.8	−0.5	−0.7
5	Food products**	−5.5	−3.0	−3.5	−3.9	−0.7	−2.8	−5.1	−2.5	−2.8	−3.1	−0.7	−2.4
6	Textile products**	−7.2	−3.6	−3.0	−3.6	−3.2	−3.3	−7.3	−3.5	−3.5	−4.4	−2.6	−3.7
7	Chemical, rubber, & plastic products	−2.2	−2.6	−2.1	−2.7	−0.9	−2.1	0.2	−0.4	0.5	0.2	2.2	0.5
8	Metal products	−2.9	−2.5	−0.7	−1.2	−1.9	−1.5	−0.5	−0.3	0.2	0.4	−0.1	0.2
9	Vehicles & equipment	−6.1	−4.8	−2.5	−4.2	−3.0	−3.2	−2.7	−1.8	−0.3	−0.8	−0.6	−0.6
10	Other manufacturing products**	−3.7	−3.1	−3.1	−3.1	−1.8	−2.6	−3.7	−3.0	−3.2	−3.1	−1.5	−2.9
11	Utility	−10.2	−2.2	−2.2	−2.8	−0.9	−2.2	−10.1	−2.1	−1.4	−1.7	−0.6	−1.6
12	Construction	−7.5	−1.5	−1.6	−3.2	−1.2	−2.2	−7.2	−1.3	−1.0	−2.0	−0.4	−1.4
13	Trade	−5.4	−3.1	−3.0	−3.5	−2.7	−3.1	−4.3	−2.0	−1.6	−2.0	−1.5	−1.8
14	Transportation**	−16.0	−6.1	−4.6	−12.8	−2.5	−5.6	−14.1	−4.8	−2.5	−10.2	−1.0	−3.8
15	Government services	−0.9	−0.2	−0.3	−0.9	−0.1	−0.4	−0.5	−0.1	−0.1	−0.4	0.0	−0.2
16	Health	−15.0	−3.0	−3.4	−6.3	−1.5	−3.9	−13.4	−1.8	−1.3	−3.2	0.0	−1.9
17	Hotels**	−29.4	−20.8	−17.1	−12.4	−8.5	−20.9	−29.2	−20.6	−15.6	−10.8	−7.6	−20.1
18	Restaurants**	−34.2	−6.0	−5.7	−10.4	−1.7	−6.3	−33.9	−4.7	−3.1	−7.3	0.0	−4.1
19	Arts & entertainments**	−51.8	−31.0	−34.8	−44.6	−4.6	−30.2	−52.1	−30.9	−32.9	−42.6	−4.4	−29.8
20	Other services**	−9.7	−3.0	−3.4	−4.0	−1.9	−3.1	−8.7	−2.0	−1.8	−2.3	−0.7	−1.8

Source: Authors' results.
* Tourism-dependent region.
** Tourism related industries.

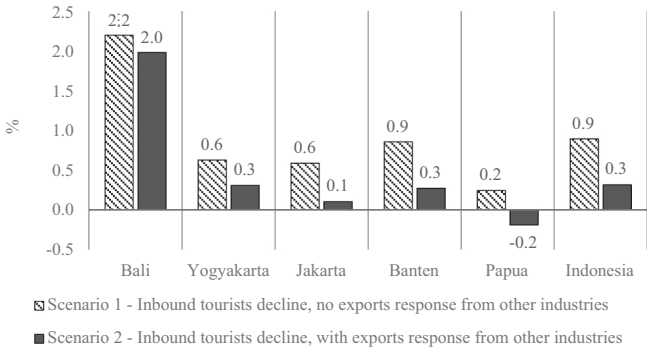

Fig. 3. Impacts on poverty incidence (percentage incidence).

distributed across household groups within individual regions.

For Bali alone, in relative terms, the impacts on income and consumption losses tend to skew toward the middle-income to high-income groups (30th to 100th percentiles), and more so on the middle groups between 40th to 70th percentiles. The adverse impact on the poorest groups (from the 1st to the 30th percentiles) are less severe. This is because the middle- to upper-income household groups experience a stronger negative income effect. The drop in the international tourist revenue results in lower output level across a whole range of industries, including those providing inputs into the tourism services, as well as tourism-related industries, such as hotel, art and entertainments, restaurants, utility, and transportation (Table 5) in which technicians, managers, professionals in the middle- to upper-income groups take up large income shares. With relatively small shares of the low-income groups in the tourism-related industries, changes to the tourism sector do have an impact on these households but would not be as much. This finding is consistent with the previous case studies for Australia (Pham et al., 2021) and Brazil (Blake et al., 2008), as the low-income groups only take up a small proportion of employment in the sector.

However, the absolute level of changes in the low-income groups are the results of changes in the poverty incidence, as these groups are already close to the poverty line, small changes can push them over the threshold easily. The households that have the monthly average expenditure per capita in the range between IDR380,000 and IDR460,000 or US$29.6 to US$35.8 are the most vulnerable ones.

In scenario 2, changes in the real household consumption across regions are in similar patterns but marginally less severe (Fig. 5). However, the gap between Bali and all other regions is widened up as other regions have larger foundation of non-tourism-related industries than Bali, they can expand their exports, thus reducing the adverse impacts.

6. Conclusions

This study provides empirical evidence on the adverse impacts of the decline in inbound tourists from COVID-19 on the economy and poverty. Using a regional multi-household CGE model, this study unveils the dynamic relationship between economic impacts, income distribution and poverty effects among all household groups across provinces of Indonesia, an important contribution to the current literature.

Results of this study show that the impacts of the unprecedented decline in inbound tourists from COVID-19 are devastating for a developing country like Indonesia, as it reduces growth and increases poverty significantly. All regions in the country are affected, regardless if they are tourism-dependent or not. Patterns of impacts are different across regions though, depending on the economic structure of each region. Destinations or regions with international tourism attraction like Bali are strongly affected, with the most severe economic downturn compared to all other regions in the country. Non-tourism-dependent regions are not immune to the pandemic either. The trade flows among regions are the channel that the adverse impacts are transferable across regions. Non-tourism-dependent regions are affected either because of the losses of demand from tourism-dependent regions; or, indirectly via reduction of investment driven by the declining rates of return and the deterioration in the terms of trade.

Nationally, the poverty is estimated to deteriorate and revert back to the level of 2017–2018. But at the regional level, poverty in tourism-dependent region such as Bali is estimated to escalate significantly,

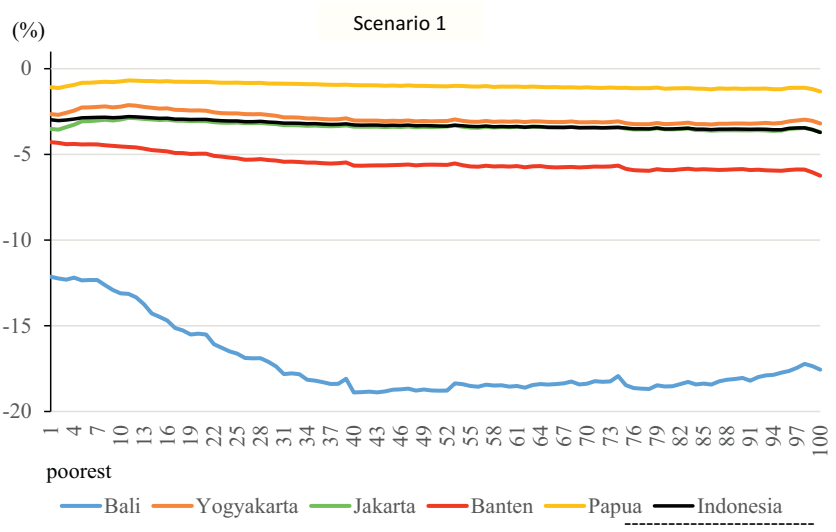

Fig. 4. Impacts on real consumption of all household groups compared to base year (percentage change).

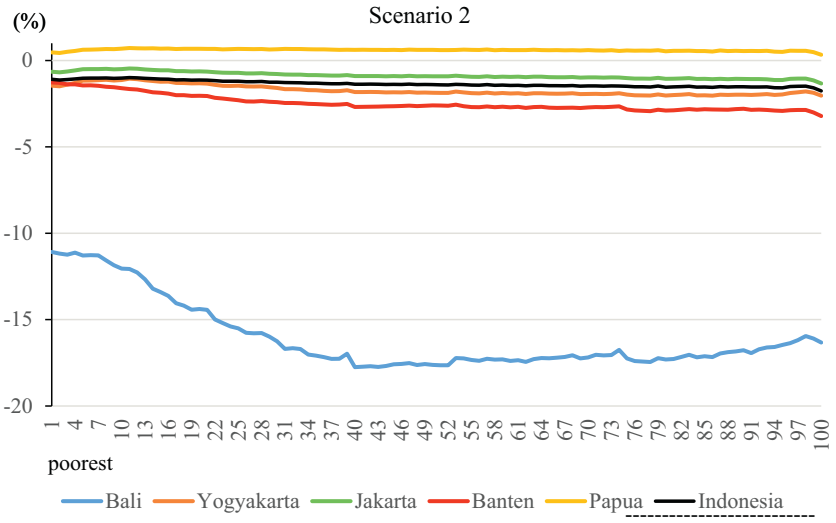

Fig. 5. Impacts on real consumption of all household groups compared to the base year (percentage change).

setting back the achievement of poverty reduction in the region for more than a decade.

Changes in income distribution within Bali show that the real consumption declines relatively larger for the middle- and upper-income groups. This is due to the fact that these groups are employed across all types of occupations in both non-tourism-related and tourism-related businesses, thus taking up larger shares than the low-income groups.

Due to economic interconnection between regions, the decline in the number of inbound visitors causes not only a contraction in the popular tourism destinations, but also in regions that supply inputs into tourism activities. Banten, the main air transportation service provider, experiences relatively a strong economic contraction due to a decline in demand for its aviation services.

This study offers important policy implications. The findings of this study can assist the efforts to mitigate the poverty impact of losing international tourists to the country. In 2020, the Indonesian Government launched a fiscal stimulus of IDR695.3 trillion (US$ 47.6 billion), equivalent to 4.3% of the country's GDP (Indonesian Ministry of Finance, 2020), the stimulus covered general support for all workers across industries. While such response was much needed and might help at the early stage of the pandemic, it may require more detailed policies during the recovery to ensure rapid growth. Importantly, specific income groups of specific regions would warrant more financial support than the others when poverty alleviation is an objective, as the COVID-19 effects are not equally distributed across industries, across regions and income groups. Support can be through options such as business assistance, household assistance, and employment assistance to address poverty impact along the tourism production chains and tourism-based region. This way, the poverty impact can be minimized more effectively, as poverty can cause many poor long-lasting outcomes (Brooks-Gunn & Duncan, 1997; Larson, 2007).

Assistance is required to help the tourism sector survive during the COVID-19 years and provides a stepping-stone to enable business owners to quickly resume their activities when international tourism returns for a long-term sustainable development. The strategic recovery plan based on the impact pattern identified from this paper will help policymakers minimise the adverse impacts and ensure a rapid remedy for poverty. Findings from this analysis are important and applicable for other countries, in particular developing nations which face similar challenges on losing inbound tourists and rising poverty and, also to

prepare for similar crises in the future.

Some limitations of this study need to be noted. First, tourism is not considered as an independent economic sector; rather it is a set of tourism-related economic activities. The introduction of tourism as a specific industry such as in (Pham et al., 2015) could capture the impacts more accurately. Second, as the impact from the domestic visitor is not observable due to data unavailability, this study only focuses on demand impacts from the inbound sector. The analysis of the domestic sector could be carried out when the data becomes available. Future research could also utilize a dynamic model (Dixon & Rimmer, 2002; Mahadevan et al., 2016; Ponjan & Thirawat, 2016) to capture the changes in magnitude and trends over time, particularly when comprehensive international tourism forecasts (Song & Li, 2021) are now readily available alongside the opening up of the international borders.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Tourism contribution and broad poverty assessment by tourism region (continued)

Year	Share of hotel & restaurant sector in total GDP/GRP (%)			GDP/GRP per capita (US$ thousand)			Poverty incidence (%)			Gini index		
	Jakarta	Banten	Papua	Jakarta	Banten	Papua	Jakarta	Banten	Papua	Jakarta	Banten	Papua
1995	4.7	n.a.	0.5	3.4	n.a.	1.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1998	5.0	n.a.	0.4	1.7	n.a.	1.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2005	4.9	3.0	0.5	5.0	0.9	2.0	3.6	8.9	40.8	n.a.	n.a.	n.a.
2010	5.0	2.3	0.5	12.3	2.8	4.3	4.0	7.0	34.1	0.36	0.42	0.41
2011	5.0	2.3	0.6	14.3	3.2	4.2	3.6	6.3	31.3	0.44	0.40	0.42
2012	5.0	2.3	0.6	14.7	3.2	4.0	3.7	5.7	30.7	0.42	0.39	0.44
2013	5.0	2.3	0.6	14.7	3.1	3.8	3.7	5.9	31.5	0.43	0.40	0.44
2014	5.0	2.3	0.7	14.7	3.1	3.6	4.1	5.5	27.8	0.43	0.39	0.41
2015	5.0	2.3	0.7	14.5	3.0	3.5	3.9	5.9	28.2	0.43	0.40	0.42
2016	5.0	2.4	0.7	15.8	3.2	4.1	3.8	5.4	28.5	0.41	0.39	0.39
2017	5.0	2.4	0.7	17.0	3.4	4.3	3.8	5.5	27.6	0.41	0.38	0.40
2018	4.9	2.4	0.7	17.4	3.4	4.4	3.6	5.2	27.7	0.39	0.37	0.40
2019	4.9	2.4	0.8	18.9	3.6	4.0	3.4	4.9	26.5	0.39	0.36	0.39

Source: Statistics Indonesia, 2021

Appendix B. : Formula for poverty incidence

Following (Warr & Yusuf, 2014), a Foster–Greer–Thorbecke (FGT) class of the headcount poverty (P_r), is performed for each of them.

$$P_r(\{y_{c,r}\}, y_{p,r}) = max\{c|y_{c,r} \le y_{p,r}\} + \frac{y_{p,r} - max\{y_{c,r}|y_{c,r} \le y_{p,r}\}}{min\{y_{c,r}|y_{c,r} \ge y_{p,r}\} - max\{y_{c,r}|y_{c,r} \ge y_{p,r}\}} \quad (1)$$

where c = 1, …, 100 percentiles of expenditure per capita (y_1 is the poorest centile group, y_{100} is the richest) and r = regions in the model database;$y_{c,r}$ = real consumption of the c^{th} percentile household in region r;$\{y_{c,r}\}$ = a set containing all $y_{c,r}$; and$y_{p,r}$= poverty line in region r.

Eq. (1) consists of two terms. The first term, $max\{c|y_{c,r} \le y_{p,r}\}$ calculates the highest centile for which real consumption per capita is less than or equal to the poverty line, while the second term, $\frac{y_{p,r} - max\{y_{c,r}|y_{c,r} \le y_{p,r}\}}{min\{y_{c,r}|y_{c,r} \ge y_{p,r}\} - max\{y_{c,r}|y_{c,r} \ge y_{p,r}\}}$ does a linear approximation to where poverty incidence lies between centiles c and c + 1.

Next, the change in the poverty incidence (ΔP_r) is calculated as:

$$\Delta P_r = P\left(\left\{y'_{c,r}\right\}, y_{p,r}\right) - P(\{y_{c,r}\}, y_{p,r}) \quad (2)$$

where $y_{c,r}'$ is the *initial* real consumption per capita calculated as $y'_{c,r} = (1 + \frac{\widehat{y}_{c,r}}{100})y_{c,r}$. The percentage change in per capita the real consumption, $\widehat{y}_{c,r}$ is produced from the simulation in the model.

Appendix C. Indonesia and the five selected regions

Source: created by authors using the SAS template.

References

ABS. (2019). Quality declaration – Summary. In *Australian National Accounts: Tourism satellite accounts 2017–18*. Canberra: ABS.

Armington, P. S. (1969). A theory of demand for products distinguished by place of production. *IMF Staff Papers, 16*, 159–178.

Arrow, K. J. (2005). Personal reflections on applied general equilibrium models. In *Honor of Herbert scarf*. New York: Cambridge University Press.

Asra, A. (2000). Poverty and inequality in Indonesia. *Journal of the Asia Pacific Economy, 5*(1–2), 91–111.

Ataguba, J. E. (2020). COVID-19 pandemic, a war to be won: Understanding its economic implications for Africa. *Applied Health Economics and Health Policy, 18*(3), 325–328.

Baldwin, R., & Tomiura, E. (2020). Economics in the time of COVID-19. In *Economics in the time of COVID-19*. London: Centre for Economic Policy Research Press.

Balisacan, A. M., Pernia, E. M., & Asra, A. (2003). Revisiting growth and poverty reduction in Indonesia: What do subnational data show? *Bulletin of Indonesian Economic Studies, 39*(3), 329–351.

Barnett, W. S. (1998). Long-term cognitive and academic effects of early childhood education on children in poverty. *Preventive Medicine, 27*(2), 204–207.

Blake, A. (2008). Tourism and income distribution in East Africa. *International Journal of Tourism Research, 10*(6), 511–524.

Blake, A., Arbache, J. S., Sinclair, M. T., & Teles, V. (2008). Tourism and poverty relief. *Annals of Tourism Research, 35*(1), 107–126.

Blake, A., Sinclair, M. T., & Sugiyarto, G. (2003). Quantifying the impact of foot and mouth disease on tourism and the UK economy. *Tourism Economics, 9*(4), 449–465.

Boissay, F., & Rungcharoenkitkul, P. (2020). Macroeconomic effects of Covid-19: An early review. *BIS Bulletin, No. 7*. https://www.bis.org/publ/bisbull07.pdf.

Breunig, R., & Majeed, O. (2020). Inequality, poverty and economic growth. *International Economics, 161*, 83–99.

Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children. *The Future of Children, 7*(2), 55–71.

Cárdenas-García, P. J., Sánchez-Rivero, M., & Pulido-Fernández, J. I. (2013). Does tourism growth influence economic development? *Journal of Travel Research, 54*(2), 206–221.

CEIC Data Provider. (2020). Regional exports. Retrieved from https://insights.ceicdata.com/ (accessed: 18 December 2020).

CEIC Data Provider. (2021). Indonesia's Air gate arrivals by airport. Retrieved from https://insights.ceicdata.com/.

Chen, M.-H., Demir, E., García-Gómez, C. D., & Zaremba, A. (2020). The impact of policy responses to COVID-19 on U.S. travel and leisure companies. *Annals of Tourism Research Empirical Insights, 1*(1).

Croes, R., & Rivera, M. (2015). *Poverty alleviation through tourism: A comprehensive and integrated approach*. New York: CRC Press.

Croes, R., & Vanegas, M. (2008). Cointegration and causality between tourism and poverty reduction. *Journal of Travel Research, 47*(1), 94–103.

Dixon, P. B., & Rimmer, M. T. (2002). *Dynamic, general equilibrium modelling for forecasting and policy: A practical guide and documentation of MONASH. North-Holland*.

Dwyer, L., Forsyth, P., & Spurr, R. (2006). Effects of the SARS crisis on the economic contribution of tourism to Australia. *Tourism Review International, 10*(1), 47–55.

Ferguson, N. M., Laydon, D., Nedjati-Gilani, G., Imai, N., Ainslie, K., Baguelin, M., … Dighe, A. (2020). *Report 9 - impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand*. London: Imperial College London.

Fernandes, N. (2020). Economic effects of coronavirus outbreak (COVID-19) on the world economy. *IESE Business School Working Paper, No. WP-1240-E*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3557504.

Hai, W., Zhao, Z., Wang, J., & Hou, Z.-G. (2004). The short-term impact of SARS on the Chinese economy. *Asian Economic Papers, 3*(1), 57–61.

Haque, T. H., & Haque, M. O. (2018). The swine flu and its impacts on tourism in Brunei. *Journal of Hospitality and Tourism Management, 36*, 92–101.

Henseler, M., Maisonnave, H., & Maskaeva, A. (2022). Economic impacts of COVID-19 on the tourism sector in Tanzania. *Annals of Tourism Research Empirical Insights, 3*(1), Article 100042.

Holzer, H. J., Whitmore Schanzenbach, D., Duncan, G. J., & Ludwig, J. (2008). The economic costs of childhood poverty in the United States. *Journal of Children and Poverty, 14*(1), 41–61.

Horridge, M., Madden, J., & Wittwer, G. (2005). The impact of the 2002–2003 drought on Australia. *Journal of Policy Modeling, 27*(3), 285–308.

Indonesian Ministry of Finance. (2020). *Realisasi PEN dan Penanganan Covid-19* (accessed: 26/06/2021) https://www.kemenkeu.go.id/publikasi/berita/realisasi-pen-dan-penanganan-covid-19-hingga-pertengahan-oktober-capai-rp344-11-triliun/.

Jaipuria, S., Parida, R., & Ray, P. (2021). The impact of COVID-19 on tourism sector in India. *Tourism Recreation Research, 46*(2), 245–260.

Kuo, H. I., Chen, C. C., Tseng, W. C., Ju, L. F., & Huang, B. W. (2008). Assessing impacts of SARS and Avian Flu on international tourism demand to Asia. *Tourism Management, 29*(5), 917–928.

Larson, C. P. (2007). Poverty during pregnancy: Its effects on child health outcomes. *Paediatrics & Child Health, 12*(8), 673–677.

Liu, A., Kim, Y. R., & O'Connell, J. F. (2021). COVID-19 and the aviation industry: The interrelationship between the spread of the COVID-19 pandemic and the frequency of flights on the EU market. *Annals of Tourism Research, 91*, Article 103298.

Liu, A., Kim, Y. R., & Song, H. (2022). Toward an accurate assessment of tourism economic impact: A systematic literature review. *Annals of Tourism Research Empirical Insights, 3*(2), Article 100054.

Liu, J., Moss, S. E., & Zhang, J. (2011). The life cycle of a pandemic crisis: SARS impact on air travel. *Journal of International Business Research, 10*(2), 63.

Mahadevan, R., Amir, H., & Nugroho, A. (2016). Regional impacts of tourism-led growth on poverty and income inequality. *Tourism Economics, 23*(3), 614–631.

Maliszewska, M., Mattoo, A., & Mensbrgghe, D. (2020). The potential impact of COVID-19 on GDP and trade a preliminary assessment. In *World bank policy research working paper, 9211*.

McKercher, B., & Chon, K. (2004). The over-reaction to SARS and the collapse of Asian tourism. *Annals of Tourism Research, 31*(3), 716–719.

McKibbin, W. J., & Fernando, R. (2020). *The global macroeconomic impacts of COVID-19: Seven scenarios*. CAMA Working Paper No. 19/2020.

Muellbauer, J. (2020). The coronavirus pandemic and US consumption. Retrieved from https://voxeu.org/article/coronavirus-pandemic-and-us-consumption.

Njoya, E. T., & Seetaram, N. (2018). Tourism contribution to poverty alleviation in Kenya: A dynamic computable general equilibrium analysis. *Journal of Travel Research, 57*(4), 513–524.

Page, S., Song, H., & Wu, D. C. (2011). Assessing the impacts of the global economic crisis and swine flu on inbound tourism demand in the United Kingdom. *Journal of Travel Research, 51*(2), 142–153.

Pham, T. D., & Dwyer, L. (2013). Tourism satellite accounts and their applications in CGE modelling. In *Handbook of tourism economics: Analysis*. New Applications and Case Studies.

Pham, T. D., Dwyer, L., Su, J.-J., & Ngo, T. (2021). COVID-19 impacts of inbound tourism on Australian economy. *Annals of Tourism Research, 88*.

Pham, T. D., Jago, L., Spurr, R., & Marshall, J. (2015). The Dutch disease effects on tourism – The case of Australia. *Tourism Management, 46*, 610–622.

Ponjan, P., & Thirawat, N. (2016). Impacts of Thailand's tourism tax cut: A CGE analysis. *Annals of Tourism Research, 61*, 45–62.

Qiu, R. T. R., Park, J., Li, S., & Song, H. (2020). Social costs of tourism during the COVID-19 pandemic. *Annals of Tourism Research, 84*, Article 102994.
del Rio-Chanona, R. M., Mealy, P., Pichler, A., Lafond, F., & Farmer, J. D. (2020). Supply and demand shocks in the COVID-19 pandemic: An industry and occupation perspective. *Oxford Review of Economic Policy, 36*(Supplement_1), S94–S137. https://doi.org/10.1093/oxrep/graa033
Sifolo, P. P., & Sifolo, S. (2015). The tourism inconvenience of the Ebola epidemic : Lessons for the south African tourism sector. *African Journal of Hospitality, Tourism and Leisure, 4*(1), 1–11.
Song, H., & Li, G. (2021). Editorial: Tourism forecasting competition in the time of COVID-19. *Annals of Tourism Research, 88*.
Statistics Indonesia. (2019). *Neraca satelite pariwisata nasional (NESPARNAS) 2017*. Jakarta: Statistics Indonesia.
Statistics Indonesia. (2021). Tabel dinamis. Retrieved from https://www.bps.go.id/ (accessed: 19 January 2022).
Telfer, D. J., & Sharpley, R. (2007). *Tourism and development in the developing world*.
The World Bank. (2021). *Global economic prospects - June 2021*. Washington DC: The World Bank.
UNWTO. (2010). *International recommendations for tourism statistics 2008*. New York: UNWTO.
UNWTO. (2021). *The economic contribution of tourism and the impact of COVID-19*. Madrid: UNWTO.
Warr, P., & Yusuf, A. A. (2014). World food prices and poverty in Indonesia. *Australian Journal of Agricultural and Resource Economics, 58*(1), 1–21.
Wittwer, G., & Horridge, M. (2010). Bringing regional detail to a CGE model using census data. *Spatial Economic Analysis, 5*(2), 229–255.
WTTC. (2018). *Travel and tourism economic impact 2018, Indonesia*.
Wu, D. C., Cao, C., Liu, W., & Chen, J. L. (2022). Impact of domestic tourism on economy under COVID-19: The perspective of tourism satellite accounts. *Annals of Tourism Research Empirical Insights, 3*(2), Article 100055.
Yang, Y., Zhang, C. X., & Rickly, J. M. (2021). A review of early COVID-19 research in tourism: Launching the annals of tourism Research's curated collection on coronavirus and tourism. *Annals of Tourism Research, 91*, Article 103313.
Yang, Y., Zhang, H., & Chen, X. (2020). Coronavirus pandemic and tourism: Dynamic stochastic general equilibrium modeling of infectious disease outbreak. *Annals of Tourism Research, 83*, Article 102913.
Yusuf, A. A. (2021). The impact of industry 4.0 on the Indonesian economy: A general equilibrium assessment. *Regional Science Policy & Practice, 13*(6), 1805–1824.
Yusuf, A. A., Roos, E. L., & Horridge, J. M. (2018). Indonesia's moratorium on palm oil expansion from natural forests: Economy-wide impacts and the role of international transfers. *Asian Development Review, 35*(2), 85–112.
Zhao, L., & Xia, X. (2019). Tourism and poverty reduction: Empirical evidence from China. *Tourism Economics, 26*(2), 233–256.

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