A quantification of the local net economic costs of the recent global crises in the Azores tourism cluster.

Mario Fortuna[1] and Hans Kremers[2]

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After slowly recovering from the financial crisis of 2009, the previous years have seen the world economy being shaken up by several major crises. It started with the spreading of COVID19 becoming a global pandemic, followed by the invasion of the Ukraine by Russia. The countries in focus during these crises are China which currently stands at the starting point of many global supply chains and Russia to which many western countries naively tied their economies to secure a cheap energy supply. One of the major results of these crises was hence a major disruption of these global supply chains, in particular with respect to energy security. The consequences were that globally many industry sectors and consumption sectors had to be rationed in their demand for energy and many other goods. The world economy suffered a major (energy) supply driven inflation.

The COVID19 pandemic urged many governments to implement severe travel restrictions on global travel in an attempt to prevent the pandemic to spread rapidly in their regions, causing severe disruptions to the local economies. One of the most obvious consequences was an overburdened health care system and an initial lack of supplies in the necessary vaccines and mouth caps. The costs to the local economies were significant. Not only to the health care systems. Also the local tourist industries have experienced a major reduction in spending due to strict travel regulations.

This paper can be seen as a first attempt to quantify the net economic costs of the aforementioned consequences of the global crises. We concentrate on the tourism cluster in the Azores using the AZCLUST regional computable general equilibrium model, described in Fortuna et al. (2021). A computable general equilibrium model is a theoretical economic model of an economy with an efficient competitive market equilibrium allocation among price-taking (microeconomic) consumers and producers, see Debreu (1959), Arrow and Debreu (1954) for general equilibrium models, and Varian (1992) for the underlying microeconomic theory.

Fortuna et al. (2021) calibrate a regional version of a computable general equilibrium model on a Social Accounting Matrix (SAM), i.e. they choose concrete actors for the abstract consumers and producers in the CGE model that are of relevance to their issue, they choose functional forms to describe the optimising behaviour of these microeconomic households, and compute a value for the parameters from the SAM, thus obtaining an efficient benchmark equilibrium. The Social Accounting Matrix applied in Fortuna et al. (2021) is obtained from data of the Portuguese Statistical Offices (INE) combined with data from so-called Tourism Satellite Accounts (TSA), see INE (2017).

Several international organisations such as the World Trade Organisation (WTO), the United Nations, as well as the OECD, have proposed a methodological framework and international recommendations for the construction of tourism statistics. An innovative aspect of this paper is the reformulation of the Social

[1] University of the Azores, School of Business and Economics and Centre of Applied Economics Studies of the Atlantic (CEEAplA), Rua da Mãe de Deus, s/n, 9501-801 Ponta Delgada, Portugal. E-mail: mario.ja.fortuna@uac.pt. Tel.: +351 917 285 882

[2] ModlEcon S.a.r.l.-S, Rue de l'Alzette 94, L-4010 Esch-sur-Alzette, Luxembourg. Email: hkremers@icloud.com, Tel.: +49 171 2273566.

Accounting Matrix according to the framework introduced in OMT, ONU, Eurostat, and OCDE (2010) and United Nations and World Trade Organization (2008). This reformulation of the Social Accounting Matrix is referred to as the ‘Tourism Social Accounting Matrix’ (TSAM). The TSAM explicitly includes consumptive expenditure by inbound, outbound, and domestic tourists in the local economy of the Azores.

In this paper, we take the Social Accounting Matrix (SAM) underlying the AZCLUST model, reformulate it to what we call a 'Tourism Social Accounting Matrix' (TSAM), and recalibrate the AZCLUST model on the latter ‘TSAM'. The recalibrated CGE model, we rename as the AzorCLUSTR model. Contrary to the AZCLUST model, which is a recursive dynamic model, the AzorCLUSTR model is a static computable general equilibrium model.

Fortuna et al. (2021) consider the economic consequences of a reduction in spending on local tourism activities in the Azores following the COVID19 pandemic in five different scenarios, applying their AZCLUST model. Allan et al. (2022) provide a similar analysis for the Scottish economy, applying a model based on the AMOS framework. Both studies externally limit consumption expenditure on tourism.

We apply the AzorCLUSTR computable general equilibrium model to compute three so-called counterfactual equilibria based on three scenarios formulated in Fortuna et al. (2021). A first counterfactual scenario is computed assuming a 50% reduction in the export demand for tourism related products, e.g. hotels, restaurants etc., a 10% reduction in the export demand for non tourism related products, a 50% reduction in capital stock use by tourism related production activities, and a 10% reduction in capital stock use by non-tourism related production activities, a 5% total factor productivity shock for tourism activities, and a 2% total factor productivity shock for non-tourism activities. Counterfactual 2 is a more severely impacted equilibrium computed assuming an 80% reduction in the export demand for tourism related products, e.g. hotels, restaurants etc., a 10% reduction in the export demand for non tourism related products, an 80% reduction in capital stock use by tourism related production activities, and a 10% reduction in capital stock use by non-tourism related production activities, a 10% total factor productivity shock for tourism activities, and a 5% total factor productivity shock for non-tourism activities. Counterfactual 3 resembles the second counterfactual plus Fortuna et al. (2021) assume a 10% reduction in the labour supply by the active population.

A comparison of the AzorCLUSTR benchmark equilibrium with aforementioned policy induced counterfactual equilibria according to the Hicksian Equivalent Variation (HEV) then provides an initial quantification of the net economic costs of the global crisis to the Azores economy. The Hicksian Equivalent Variations quantifies the amount of income a consumer has to receive as a compensation for net losses of welfare due to the implementation of a policy. Notice that policy makers mainly apply changes in Gross Domestic Product (GDP) to quantify the net economic costs of a policy, in spite of GDP experiencing large scrutiny as a measure of welfare in the past decade.

We obtain similar results as Fortuna et al. (2021) when comparing the three different counterfactual equilibria to the common benchmark equilibrium, with respect to welfare measures such as the change in GDP, and value added in the the various production activities. On top of these results, we include results on the expenditure of inbound, outbound, and domestic tourists obtained from the counterfactual TSAMs.

The actual conclusions of this paper are initial suggestions for further research to improve the application of computable general equilibrium modelling to study the impact of tourism policies. The replacement of the usual SAM with a TSAM in order to satisfy the methodological framework and recommendations introduced in OMT, ONU, Eurostat, and OCDE (2010) and United Nations and World Trade Organization (2008) is one of them. Another one is the inclusion of rationing in tourism export demand as an alternative way to model the counterfactual shocks on export demand, thus formulating the equilibrium problem as a Mixed

Complementarity Problem, i.e. a complementarity problem with lower and upper bounds. Notice that demand is seen as a given parameter in input-output modelling which can easily be shocked. In CGE models, we include a demand function of prices and income, which results in a demand variable that cannot be shocked.

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