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Boosting tourism's contribution to growth and development: Analysis of the evidence

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Abstract

The tourism sector's contribution to economic development depends upon complex and dynamic socioeconomic, environmental, and institutional factors. Policymakers require objective evidence to base decisions on which public policies or investments to pursue. In this paper we develop an economy-wide approach to assessing public investments in tourism. The approach is powerful in that it considers all intersectoral linkages that are critical for tourism-sector analysis. This framework is linked to a microsimulation module that enables estimation of household-level and destination-specific impacts and the distribution of benefits. To illustrate the framework and the insights it can generate, we apply it to a public investment in Belize's Cayo District. Our findings show that the overall level of economic activity increases while an appreciation of the real regional exchange rate results in slower growth in traditional nontourism exports. Greater availability of capital and labor to meet increased demand would reduce this effect. The investment results in a reduction in the poverty headcount on the order of 0.7 percentage points, though there is a small increase in inequality that is a function of the skill requirements of the new positions created as a result of the investment.

1 | INTRODUCTION

Belize boasts diverse natural resources as well as rich cultural heritage, which provide a range of attractions for tourists. Since 2000, tourism has grown to be an important sector of Belize's economy, with around 340,000 overnight visitors in 2015 and a further 960,000 cruise arrivals. The World Travel and Tourism Council (WTTC) estimates that the industry's direct contribution to GDP grew from 8.5 percent in 2000 to 13.9 percent in 2016 (WTTC, 2016). As expressed by the government of Belize, tourism has strong potential for further expansion, and is therefore a priority sector for Belize's economic development strategy (Government of Belize, 2012, 2015).

The tourism supply chain involves a wide range of sectors of society and the economy. The industry's contribution to growth, poverty reduction, and long-term development depends upon complex and dynamic economic, social, environmental, and institutional linkages, spillovers, and externalities. To maximize the positive effects and minimize the negative ones, policymakers need to understand what types of tourism, and kinds of policies, are associated with the most beneficial outcomes, and how they can stimulate the types of private sector innovation and investment (domestic and international, large and small) that foster these outcomes.

In this study we develop an evidence-based tool to guide public policy and investment choices, to maximize developmental returns from tourism. We develop tourism-extended social accounting matrices and dynamic computable general equilibrium (CGE) and microsimulation models for Belize, at both national and regional levels. This framework builds on Banerjee, Cicowiez, and Gacho (2015), and Banerjee, Cicowiez, and Cotta (2016), in four main ways: (i) the framework developed here is the first multiregional CGE model for Belize, a data scarce country, and one of the few multiregional models developed for the Latin American and Caribbean Region; (ii) the linked microsimulation model is one of the first applications of Belize's only household income and expenditure survey implemented in 2008/2009 and thus makes an important contribution by facilitating future research into household-level public policy and investment analysis; (iii) in another first for Belize, a destination-specific tourism expenditure survey was implemented to estimate baseline tourist arrivals, expenditure and expenditure composition at destination; and (iv) the linked CGE-microsimulation modeling framework developed here is extended and customized for tourism-sector analysis, though this framework could be applied to public policy and investment analysis related to most of Belize's other important economic sectors.

The dynamic CGE model of Belize's national economy and the multiregional model comprised of Belize's six regions can be used to quantify the direct and indirect, and short- and long-run impacts of public policy proposals and investments in tourism. The national model is powerful in its ability to evaluate the impacts of policies and investments across sectors, their impacts on government revenues, changes in unemployment, and distributional and welfare effects in terms of poverty and inequality metrics. The multiregional model is amenable to destination-specific analysis, where for instance, it could be used to estimate the impacts of building a port for cruise ships and/or improving the road to Caracol, a world renowned Mayan archeological site. To that end, the analyst implementing the model would need access to: (i) investment projections and (ii) an estimate of the expected impact on gross tourist arrivals and/or tourist spending.

This paper is structured as follows. Section 2 provides an overview of the literature on tourism as a driver of economic development, while Section 3 discusses previous CGE applications to tourism, and presents the model and core databases. Section 4 describes the baseline and a set of scenarios to identify the impact of investment policy decisions related to the development of Belize's tourism sector under different tourism demand assumptions. Our analysis focuses on

Belize's Cayo District as an illustrative case study. Section 5 presents the model results. Section 6 closes the paper with key findings.

2 | TOURISM AS A DRIVER OF ECONOMIC DEVELOPMENT AND POVERTY REDUCTION

Tourism is one of the fastest growing economic sectors, generating 10 percent of global GDP and 30 percent of global exports in the services sectors. Tourism employs one out of 11 workers across the globe, equivalent to 109 million jobs in 2016 (WTTC, 2017). Empirical evidence reviewed by Pablo-Romero and Molina (2013) has shown a strong causal relationship between tourism and economic growth. This relationship also bears out in the case of Latin America and the Caribbean (LAC) where Eugenio-Martin, Morales, and Scarpa (2004) confirmed this finding for 21 LAC countries between 1985 and 1998, particularly as this applies to low- and middle-income countries. Furthermore, a study by Fayissa, Nsiah, and Tadesse (2009) found that a 10 percent increase in tourism expenditure in the region can increase per capita GDP by 0.4 percent. Analysis of the overall relationship between tourism and economic growth in the region generally appears positive, though how benefits are distributed is more variable.

The distribution of benefits can vary depending on a variety of factors that may be destination or activity specific and conditioned by the country context, among other features. Mitchell and Ashley (2010), for example, find evidence that in a survey of destinations, 10 to 30 percent of tourism expenditure tends to accrue to the poor. Where the economy of a destination is characterized by lower skilled and labor intensive sectors, there is a great probability that tourism development will increase the income of the poor (Njoya & Seetaram, 2017). Njoya and Seetaram (2017) map the primary channels through which tourism can impact the poor, both positively and negatively. These include poor peoples' labor participation in the tourism value chain, tax collection that may be then transferred to the poor, price channels with currency appreciation as an example, and complex dynamic channels that can affect the socioeconomic environment of the destination and thus the setting in which the poor develop their livelihood activities.

In the LAC context, a number of country case studies have been undertaken to understand the dynamics between tourism development and poverty reduction. For example, In Nicaragua, evidence suggests that a 1 percent increase in foreign tourism expenditure reduces poverty by 0.51 percent. In Panama, Klytchnikova and Dorosh (2012) found that 20 percent of national income derived from tourism expenditure reached the poor; this impact increased to 43 percent in particularly poor though tourism-oriented destinations in the country. In Haiti, Banerjee et al. (2015) found that a U.S.$36 million public investment in tourism could reduce the number of poor by 1.6 percent. Analysis undertaken by Croes and Rivera (2015) find a strong potential for tourism to reduce poverty and inequality in Ecuador. Finally, where island states are concerned, Jiang, DeLacy, Mkiramweni, and Harrison (2011) found that for the 16 island states considered in their study, human development indicators and GDP per capita were positively correlated with tourism.

3 | METHODS AND DATA

While the previous section considered the overall impacts of tourism on the economy and poverty, public policy and investment in tourism has sector-specific impacts where there may be winners and losers as a result of a tourism intervention. The tourism sector is far from being an isolated sector:

indeed, it is an important component of many sectors, ranging from the hotels and restaurants sector where it is dominant, to food and beverages and transport, where its influence is also strong. Similarly, investments in diverse sectors contribute to the development of tourism, from infrastructure development, the provision of basic public services such as water and sanitation, and capacity building in the services sector, to institutional strengthening in terms of tourism-sector governance. Thus, in order to assess the impact of any of the many types of policy interventions, investments and external shocks that might affect the tourism sector, a framework that considers all economic sectors and their inter-linkages is essential (Dixon & Rimmer, 2002; Dwyer, Forsyth, Madden, & Spurr, 2000; Dwyer, 2015). A CGE modeling approach provides a systematic method for predicting both the direction and approximate magnitudes of impacts of policies and external shocks on different agents. As Nobel economist Kenneth J. Arrow stated, "… in all cases where the repercussions of proposed policies are widespread, there is no real alternative to CGE" (Arrow, 2005).

CGE models have a history of application to exploring the economic impacts of tourism, tourism policy, and tourism investments, including multilateral development loans (Banerjee et al., 2015, 2016; Banerjee, Cicowiez, & Moreda, 2017). The United Nations World Tourism Organization (WTO) provides a useful summary of many CGE applications to tourism (WTO, 2014), for example, CGE has been applied in the valuation of special events (Abelson, 2011; Blake, 2005; Bohlmann & Van Heerden, 2008; Dwyer, Forsyth, & Spurr, 2005; Li, Blake, & Cooper, 2011; Madden, 2006). Tourism's impacts on reducing poverty has been considered in a number of studies. An early example is that of Adams and Parmenter (1995), which evaluated the sectoral distribution of gains from tourism. Narayan (2004) also looked at this sectoral distribution of gains, finding some off-setting through losses in traditional export sectors arising from an appreciation of the real exchange rate. Alavalapati and Adamowicz (2000) examined how the tourism sector interacts with other economic sectors and the environment in resource extractive intense regions in Canada.

A microsimulation approach, which can be linked to a CGE model as in Banerjee et al. (2015), and Njoya and Seetaram (2017), has also been recommended to provide greater insights into tourism's impact on household-level dynamics (Blake, 2009; Blake, Arbache, Sinclair, & Teles, 2009). Mahadevan, Amir and Nugroho (2016) evaluate poverty reduction impacts of tourism in Indonesia, finding a positive impact though potentially negative implications for income equality. Blake et al. (2009) found that the earnings structure of traditional export sectors play an important role in determining the poverty impacts of tourism in Brazil while Wattanakuljarus and Coxhead (2008) found that factor ownership is an important determinant of how the benefits of tourism development are distributed in Thailand.

In this study, we develop a national and regional, tourism-extended recursive dynamic CGE model linked with a microsimulation for Belize. We apply the multiregional variant of the model for illustrative purposes to a case study of public tourism investment in the Cayo District. The approach was developed to be sufficiently flexible to be used in different contexts, such as other countries in the Central American region and beyond. While the model developed here is tourism-extended, it can readily be applied to public policy and investment analysis concerning other important economic sectors such as the agriculture and services sectors. In fact, our model was developed as a "standard" model, which implies structural flexibility. This structural flexibility is reflected in a complete separation between the model code and the underlying database.[1]

The modeling framework is not only designed to be applicable to different countries or regions, but also to be sufficiently flexible to allow customizable versions. Users can therefore select from a national or regional model version, a static or dynamic model version, flexible (dis)aggregation (e.g., sectors and/or factors) options, alternatives specified for selected assumptions, the application of a special treatment for the (domestic and foreign) tourism sector, macro closures,[2] rules for government receipts and spending, rules for nongovernment payments, presence/absence of (endogenous) unemployment, and various other features.

3.1 | The computable general equilibrium model

In essence, the CGE model combines a relatively standard recursive dynamic CGE model (see, e.g., Lofgren, Harris, & Robinson, 2002; Robinson, 1989), with additional equations and variables that, depending on data availability, can single out: (i) the domestic and foreign tourism demand, (ii) different modalities of tourism supply and demand, and (iii) the impact of public capital investment in infrastructure on sectoral productivity. Moreover, the regional or subnational variant of the model can handle: (i) trade between the modeled region and the rest of the country, and the rest of the world, and (ii) local and central government operations in the modeled region (i.e., tax collection, and current and capital spending). Thus, compared with other CGE models, the one developed here provides a combination of policy-relevant features for the study of tourism investment or policy-counterfactual scenarios in a national or regional economy.

The regional variant of the model is similar to the national variant, but with additional elements to capture transactions between the modeled regional economy and the rest of the country. Figure 1 depicts, for each simulation period, the circular flow of income within the regional (subnational) economy and between this regional economy and the rest of the country, and the rest of the world.

For the national economy as a whole, the major building blocks of our CGE model may be divided into: activities (producers of commodities), markets for commodities (goods and services);

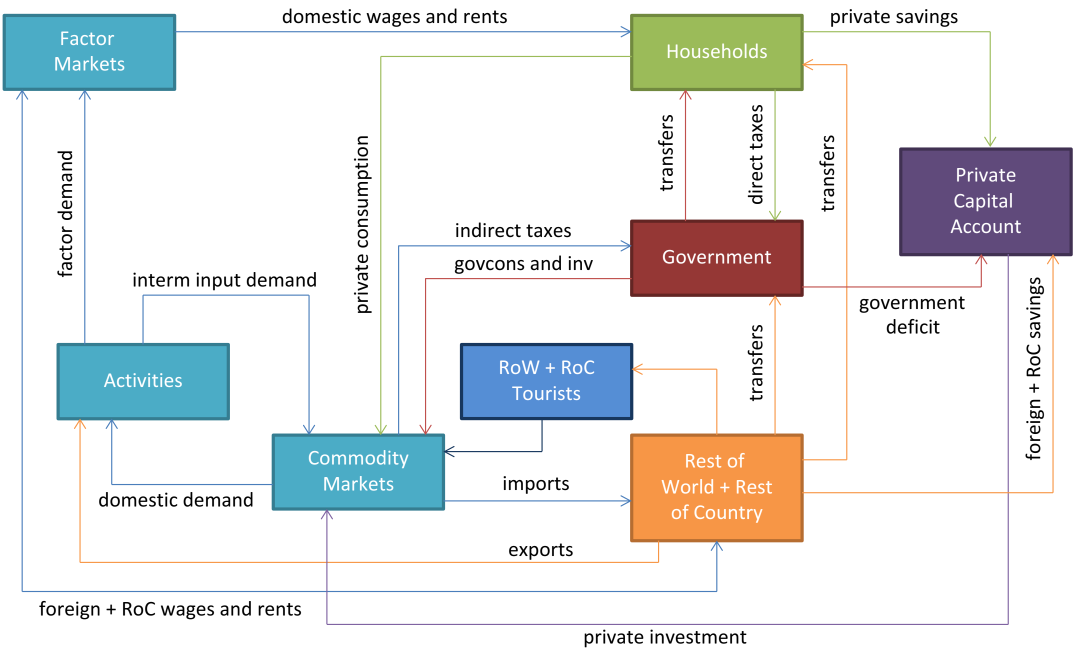

FIGURE 1 Circular income flow in the RCGE; within-period module

Source. Authors' own elaboration

markets for factors (labor, land, and capital stock) and private capital, and four institutions: households, government, the rest of the world, and tourists (both domestic and foreign). As shown, foreign and domestic tourism are sources of income for the modeled region. Specifically, foreign tourism is a source of foreign exchange. In any application (and database) of our CGE model, most blocks in Figure 1 are disaggregated—the disaggregation in the Belize Cayo District Regional CGE (RCGE) application is shown in Table 2 below.

The main features of the model building blocks are as follows:

(1) Activities produce, selling their output at home or abroad (i.e., the rest of Belize and/or the rest of the world), and use their revenues to cover their costs (of intermediate inputs, factor hiring, and taxes) and provide a return to investors. Their decisions to pursue particular activities with certain levels of factor use are driven by profit maximization. The shares of output that are exported and sold domestically depend on the relative prices of the output in world, national, and domestic markets. For any exported commodity, exporters face either: (i) export prices (here we refer to free on board prices) that are exogenously determined, in which case export demand is infinitely price-elastic, or (ii) price-sensitive export demands (defined by constant-elasticity functions) with the free on board export prices linked to domestic conditions (e.g., the costs of production) and the real exchange rate.
(2) Households earn incomes from factors and transfers. These are used for consumption, direct taxes, and savings. Their consumption decisions change in response to income and price changes. By design (and as required by the household budget constraints), the consumption value of the households equals their income net of direct taxes and savings.
(3) The government gets its receipts from taxes and transfers from abroad; it uses these for consumption, transfers to households, and investment, drawing on the loanable funds market for supplementary funding. To remain within its budget constraint, it either adjusts some part(s) of its spending on the basis of available receipts or mobilizes additional receipts in order to finance its spending plans.
(4) The rest of the world (income flows to and from which appear in the balance of payments) sends foreign currency to the modeled region (or country if using the national version of the model) in the form of transfers to its government and households. The region uses these inflows to finance its imports. It is assumed that the balance of payments clears (inflows and outflows are equalized) via adjustments in the (local) real exchange rate (the ratio between the international and domestic price levels), influencing export and import quantities and values in foreign currency.
(5) The private capital account provides investment financing from savings by households, government, the rest of the world, and the rest of Belize.

For the regional model, the relation between the modeled region of Belize (e.g., Cayo District) and the rest of Belize is also taken into account. Here, tourism demand from the rest of the world and the rest of Belize can be modeled as an exogenous volume or using constant elasticity of demand functions. In the latter case, the modeled region of Belize faces a downward-sloping demand curve for its tourism exports. In both cases, total tourism demand is disaggregated across locally produced commodities using fixed coefficients. For concreteness, Equations 1 and 2 show the demand functions used to model tourism export demand from the rest of the world and the rest of Belize, respectively. Naturally, in the national variant of the model, only tourism export demand from the rest of the world is considered.

The relationships in the model are described by the following equations:

$$QTROW_{c,i} = \overline{qtrow}_{c,i} \left(\frac{PQ_c / EXR}{PQ_c^0 / EXR^0} \right)^{\eta rowt,i} \tag{1}$$

$$QTROC_{c,i} = \overline{qtroc}_{c,i} \left(\frac{PQ_c / CPI}{PQ_c^0 / CPI^0} \right)^{\eta roct,i} \tag{2}$$

where c is tourism-related commodities such as hotels and restaurants; i is tourism demand modalities such as tourist and business visitors ; $QTROW_{c,i}$ is rest of the world (RoW) tourism type i demand quantity of commodity c; $QTROC_{c,i}$ is rest of country (RoC) tourism type i demand quantity of commodity c; PQ_c is composite commodity price for c; CPI is consumer price index; EXR is exchange rate; $\overline{qtroc}_{c,i}$ is baseline RoC tourism type i demand quantity of commodity $\overline{qtroc}_{c,i}$ is baseline RoW tourism type i demand quantity of commodity c; $\eta roct$, $i$is constant price elasticity of RoC tourism demand (< 0); and $\eta rocw$, i is constant price elasticity of RoW tourism demand (< 0).

As shown, we use constant elasticity of demand functions to model tourism export demand from RoW and RoC. In addition, note that, within domestic and foreign tourism demand, the model allows for the identification of one or more tourism demand modalities (i.e., see index i in Equations 1 and 2).[3] In Equation 1, foreign tourists' demand is a function of local (tourism-related) prices relative to the exchange rate EXR. In Equation 2, national tourists' demand is a function of local (tourism-related) prices relative to the consumer price index CPI. Note that although tourists from the rest of Belize do not need to change currencies, a real exchange rate exists between any specific region of Belize that is being modeled and the rest of the country, defined as the ratio between regionally tradable and nontradable commodities such as housing.

On the supply side, the modeling of alternative tourism modalities—for example, all-inclusive beach resorts, boutique hotels, eco-lodges—is straightforward. Provided data is available, the model can consider different cost structures for the different tourism modalities on the supply side.

In domestic commodity markets, flexible prices ensure balance between demand and supply. Import prices in most cases would be exogenous, but the assumptions of the model can be adjusted for cases where their prices are endogenous (for example, in the case of the regional model, where a large increase in imports from a specific region could push up the price). The share of imports in the national market is determined by their prices relative to domestic prices.

In factor markets, demand curves are downward-sloping reflecting the responses of production activities to changes in factor prices. In the case of labor, unemployment is endogenous. For each labor type, the model assumes an inverse relationship between the real wage and the unemployment rate[4] (Blanchflower & Oswald, 1994, 2005). The model allows for the input of assumptions for labor mobility in response to wage differentials between Belize and outside, and (in the regional version) between one region and another within Belize. For nonlabor factors, the supply curves are vertical in any single year: that is, their quantity is fixed, but price adjusts according to the level of demand.

In our CGE, national income growth over time is largely endogenous. The economy grows owing to the expansion of capacity determined by net fixed capital formation (investment minus depreciation) and the availability of labor (determined by exogenously imposed projections), as well as improvements in total factor productivity (TFP), which have both endogenous and exogenous components. Endogenous determinants of TFP include the levels of government capital stock (public goods) and economic openness. The accumulation of private and government capital is through investment financed by local and external savings. Increased private capital is allocated across sectors according to their relative profitability. Once installed, capital becomes sector specific and can only by adjusted through exogenously determined depreciation and the attraction of new investments.

3.2 | Social accounting matrix

The basic accounting structure and much of the underlying data required to implement our Belize RCGE model is derived from a Social Accounting Matrix (SAM) for Belize or one of its regions. A SAM is a comprehensive, economy-wide statistical representation of the economy at a specific point in time. It is a square matrix with identical row and column accounts, where each cell in the matrix shows a payment from its column account to its row account. It can be used for descriptive purposes and is the key data input for a CGE.

Major accounts in a standard SAM match the main building blocks of the CGE as described above: activities, commodities, factors used in production, and institutions such as households, government, and the rest of the world. Most features of the Belize SAM are familiar from SAMs used in other models,[5] but the Belize SAM has nonconventional features related to the explicit treatment of foreign tourism-related spending, together with the corresponding inflow of foreign exchange.[6] In turn, the regional SAMs built for the six districts of Belize single out trade with the rest of the country and domestic (i.e., from the rest Belize) tourism-related spending.

In most cases, a (national) SAM is built using supply and use tables as the starting point. However, in the case of Belize, where the necessary national accounts data are not available, we built the Belize national SAM using: (i) as much data as possible from the Statistical Institute of Belize (SIB) and other government agencies—specifically, the most recent (2013) national accounts on GDP by Activity and GDP by expenditure, balance of payments and fiscal data; (ii) input–output data for a similar country within the region, namely Ecuador. This is the approach used by the internationally recognized Global Trade Analysis Project (GTAP; Aguiar, Narayanan, & McDougall, 2016) team to build the "rest of Central America" input–output table used in the GTAP database. Banerjee et al. (2016) provide guidance on constructing a SAM in data scarce environments. To disaggregate households and regions in the SAM, we used the 2008 Household Income and Expenditure Survey (HES).

In what follows we first focus on the Belize national (Macro) SAM. Then, we describe the regional SAM built for the Cayo District of Belize. Cayo is a district in western Belize with several parks and ecological reserves that are important tourism attractions. In addition, the Cayo District is known especially for Caracol, the country's largest Mayan archaeological site. Using the 2008 HES, we also developed regional SAMs for the six departments of Belize. In Tables 6 and 7 below we show some of the regional data that was used to disaggregate the national SAM.

A stylized MacroSAM for Belize is provided in Table 1. In 2013, for example, Belize's GDP was BZ$3,252 million, the government current account surplus was around 3.1 percent of GDP and government current consumption (spending on wages, salaries, goods, and services) was 15.1 percent of GDP. Regarding international trade (goods and services), Belize exported 60.8 percent of GDP and imported 66.3 percent of GDP. Remittances (transfers) inflows were equivalent to 6.4 percent of GDP and capital income outflow to the rest of world was 7.2 percent of GDP.

For the application in this study, the Belize RCGE was calibrated twice: (i) to a 2013 SAM and other data for the whole of Belize, as shown above, and (ii) to a 2013 Regional Social Accounting Matrix (RSAM) and other data for the Cayo District of Belize. In what follows we focus on the latter.

TABLE 1 Macro-SAM for Belize 2013 (percent GDP)

	act	com	f-lab	f-cap	tax-act	tax-imp	tax-com	tax-dir	hhd	gov	row	sav-inv	dstk	Total
act		86.3												86.3
com									71.5	15.1	60.8	17.8	1.0	166.3
f-lab	46.2										0.1			46.4
f-cap	39.8										0.2			40.1
tax-act	0.2													0.2
tax-imp		6.0												6.0
tax-com		7.7												7.7
tax-dir									7.7					7.7
hhd			46.0	30.0						6.0	6.4			88.3
gov				2.9	0.2	6.0	7.7	7.7			0.0			24.5
row		66.3	0.4	7.2					1.6	0.3				75.8
sav-inv									7.5	3.1	8.2			18.8
dstk												1.0		1.0
Total	86.3	166.3	46.4	40.1	0.2	6.0	7.7	7.7	88.3	24.5	75.8	18.8	1.0	

Note: Rows show income flows received by the respective building blocks of the model; columns indicate the source of income. Abbreviations: act = activities; com = commodities; f-lab = labor; f-cap = capital; tax-act = activity taxes; tax-imp = import tariffs; tax-dir = direct taxes; hhd = households; gov = government; row = rest of the world; sav-inv = saving-investment; dstk = change in stocks.
Source. Authors' own elaboration.

Table 2 shows the accounts in the Cayo District RSAM that identify 18 activities and commodities. The factors of production include two types of labor, defined by level of education, those who have completed less than lower secondary, and those who have completed lower secondary or above. The growth in the labor force and changes in its composition are exogenous, allowing us to consider alternative counterfactual scenarios. The nonlabor factors of production include data for public capital stock, private capital stock, land, and natural resources used/extracted in forestry, fishing, and mining.[7] The RSAM also includes current transactions (inflows and outflows) for institutions (household, government, rest of the country, rest of world, and domestic and foreign tourists), investment flows (one entry per type of capital stock), and auxiliary accounts for taxes and trade and transport margins.

According to our estimates in the RSAM, the Cayo District's Gross Regional Product (GRP) reached BZ$696.7 million in 2013 (see Table 3), equivalent to 21.5 percent of the national GDP. In 2013, local and central government current consumption in Cayo District was 16.4 percent of gross regional product (GRP), and total fixed capital formation and remittances from abroad accounted for 19 and 6.9 percent of GRP, respectively.

On the basis of RSAM data, various indicators may be calculated to describe Cayo's economy. These include sectoral shares in value-added, production, employment, exports, and imports, as well as the split of domestic sectoral supplies between exports and domestic sales, and domestic sectoral demands between imports and domestic output. Transactions between Cayo and the rest of Belize may also be extracted and show the share of each sector in total exports and imports to/from the rest of the country, respectively. Numerous insights may be obtained from this analysis. For example, based on the RSAM, we found that while hotels and restaurants represent a significant share of employment (around 5.8 percent), its share of exports is much larger (around 26.4 percent). Factor shares in total sectoral value-added may also be extracted. In analyzing this data, one may discover for example that the crop and livestock are intensive in their use of unskilled

TABLE 2 Accounts in the Cayo District RSAM, 2013

Category (No.)	Item	Category (No.)	Item
Sectors (activities and commodities) (18)	Crops	Factors (7)	Labor, unskilled
	Livestock		Labor, skilled
	Forestry		Capital
	Fishing		Land
	Mining		Natural res in Forestry
	Food and beverages		Natural res in Fishing
	Textiles		Extractive res in Mining
	Other manufacturing	Institutions (5)	Households
	Electricity and water		Government
	Construction		Rest of the country
	Trade		Rest of the world
	Hotel and restaurants		Foreign Tourism
	Transport	Taxes (4)	Taxes on production
	Post and telecommunications		Taxes on sales
	Financial intermediation		Taxes on imports
	Real estate, renting and bus svc		Taxes on income
	Community, social and pers svc	Savings and Investment (4)	Savings
	General government services		Investment, nongovernment
Dist marg (3)	Trade and transp marg, dom		Investment, government
	Trade and transp marg, imp		Stock change
	Trade and transp marg, exp		

Abbreviations: bus svc = business services; per svc = personal services; transp marg, dom = domestic transport margins; transp marg, imp = transport import margins, and; transp marg, exp = transport export margins.
Source: Authors' own elaboration.

labor and land, while the general government services and financial intermediation sectors are relatively intensive in the use of skilled labor. Prior knowledge of these features of the economy being studied facilitates the interpretation of model simulation.

In Tables 4 and 5 we present regional data computed from the 2008 HES. As previously discussed, this data was used to estimate regional social accounting matrices for the six departments of Belize.

In addition to the RSAM, our Belize RCGE model requires: (i) base year estimates for capital stocks, and sectoral employment levels and unemployment estimates for the different labor types, (ii) a set of elasticities for production, consumption and trade, (iii) population projections by household group (i.e., rural and urban), and (iv) a baseline projection for growth in GDP at factor cost (see below). In order to estimate sectoral employment we combined population data from the United Nations with estimates for the unemployment rate computed from the 2013 labor force survey.

3.3 | Microsimulation model and data

As discussed, CGE models are effective in capturing macro and meso (i.e., for 30–35 sectors) responses to shocks such as an improvement in the terms of trade. However, the standard configuration of a CGE model is not well suited for analysis of questions related to poverty and income

TABLE 3 Gross regional product, Belize Cayo District 2013

Item	BZ$m	GRP%
Total demand		
Private consumption	531.9	76.3
Fixed investment	132.7	19.0
Stock change	−4.7	−0.7
Government consumption	114.4	16.4
Exports to RoW	263.7	37.9
Exports to RoC	162.2	23.3
Tourism demand RoC	0.0	0.0
Tourism demand RoW	154.6	22.2
Total	1,354.9	194.5
Total supply		
GRP at market prices	696.7	100.0
Imports from RoW	479.5	68.8
Imports from RoC	178.7	25.7
Total	1,354.9	194.5

Note: GRP = gross regional product. BZ$ = Belize dollar.
Source. Authors' own calculations based on 2013 Belize Cayo District SAM.

TABLE 4 Household per capita expenditures by district

Department	Mean	Median	*SD*
Corozal	3,654	2,694	3,907
Orange Walk	4,895	3,367	6,822
Belize	7,183	4,041	12,537
Cayo	5,258	2,764	10,607
Stann Creek	4,902	2,322	13,007
Toledo	2,274	1,413	3,566
Total	5,284	2,905	10,190

Source. Authors' own elaboration.

inequality. This is due to the fact that most CGE models use a representative household (RH) formulation where all households in an economy are aggregated into one or a few households to represent household and consumer behavior. The main limitation of the RH formulation is that intrahousehold income distribution does not respond to shocks introduced into the model.

Consequently, in order to provide greater resolution with regard to household-level impacts, we generate results in terms of poverty and inequality at the micro level by linking the CGE model with a microsimulation model. The two models interact in a sequential "top-down" fashion (i.e., without feedback): the CGE communicates with the microsimulation model by generating a vector of (real) wages,[8] aggregate employment variables such as labor demand by sector and the unemployment rate, and nonlabor income. The functioning of the labor market thus plays an important role, and the CGE model determines the changes in employment by factor type and sector, and changes in factor and product prices that are then used for the microsimulations.

TABLE 5 Poverty headcount ratio by district (value of poverty line (PPP, 2005) per day per person)

Department	U.S.$2.5	U.S.$4
Corozal	33.3	52.2
Orange Walk	26.5	44.7
Belize	23.3	34.5
Cayo	36.7	53.9
Stann Creek	47.0	62.5
Toledo	66.2	76.8
Total	34.7	49.6

Source. Authors' own elaboration.

To build the microsimulation model, the Belize HES for 2008, conducted by the Statistical Institute of Belize (SIB), was used. These data cover 11,438 individuals in 3,023 households in all of Belize. The 2008 HES is the only available household survey in Belize that covers both income and spending. No attempt was made to reconcile the household survey data with the national accounts. Instead, the results from the CGE model are transmitted to the microsimulation model as percentage deviations from base values.[9] To estimate poverty, we used the U.S.$4 and U.S.$2 dollars-a-day poverty lines for 2008; the U.S.$2 and U.S.$4 national poverty rates are calculated as 49.6% and 34.7%, respectively.

The microsimulation model follows the nonparametric method described in Vos and Sanchez (2010) but was extended to consider changes in nonlabor income.[10] First, the labor market structure is defined in terms of rates of unemployment U among different segments of the population of working age (in this case, defined according to skill), the structure of employment S (in this case, defined according to sector of activity S) and (relative) remuneration $W1$, as well as overall level of remuneration $W2$. The labor market structure can thus be written as:

$$\lambda = (U, S, W1, W2).$$

The effect of altering each of its four parameters on poverty and inequality can then be analyzed by simulating counterfactual individual earnings and family incomes. Briefly, the model selects at random (with multiple repetitions) from the corresponding labor groups the individuals who will change labor market status (i.e., employment/unemployment and sector) and assigns wages to new workers according to parameters for the average groups. Then, the new wage and employment levels for each individual result in new household per capita incomes that are then used to determine the new poverty and income distribution results. Analytically, we can write

$$yl_i = f(\lambda, X_i)$$

where yl_i is individual labor income and X_i represents individual characteristics, for example, skill level.

In each counterfactual scenario, labor market conditions might change and in turn affect the individual labor income, that is,

$$yl_i^* = f(\lambda^*, X_i)$$

where λ^* refers to the simulated labor market structure parameters.

The labor market variables and procedures that link the CGE model with the microsimulations are as follows. This "unemployment effect" is simulated by changing the labor status of the active population in the 2008 HES sample, based on the results from the CGE model. For instance, if according to the CGE simulations, unemployment decreases at the same time that employment increases for skilled workers in sector A, the microsimulation model "hires" randomly from the 2008 HES sample among the unemployed skilled workers. As explained above, individual incomes for the newly employed are assigned based on their characteristics (e.g., educational level) by looking at similar individuals that were originally employed. If the CGE simulations indicate a decrease in employment for a specific labor category and sector, the microsimulation program "fires" the equivalent percentage from the type of labor and sector, and the counterfactual income for those newly unemployed is zero.

The "sectoral structure effect" is simulated by changing the sectoral composition of employment. For those individuals that move from one sector to another, we simulate a counterfactual labor income based on their characteristics and on their new sector of employment, again by looking at individuals that were originally employed in the sector of destination.

To model the change in relative wages, the wage level for a given labor category (e.g., skilled workers in sector A) are adjusted according to the changes from the CGE simulations but keeping the aggregate average wage for the economy constant. The impact of the change in the aggregate average wage for the economy is simulated by changing all labor incomes in all sectors by the same proportion, based on the changes from the CGE simulations. Next, all the previous steps are repeated several times and averaged.

For nonlabor incomes, government transfers and remittances from abroad are proportionally scaled up or down using changes taken from the CGE model. The final step in the microsimulation model is to adjust the micro data such that the percentage change in the household per capita income matches the change in the level of household per capita income—for each representative household in the CGE simulations. Thus, this residual effect implicitly accounts for changes in all items not previously considered (i.e., nonlabor and nontransfer incomes) such as natural resource and capital rents.

Finally, we should note that our CGE model can only solve for the relative prices and the real variables of the economy. Thus, in order to anchor the absolute price level, a normalization rule has been applied. The CPI is chosen as the numéraire, so all changes in nominal prices and incomes in simulations are relative to the weighted unit price of households' initial consumption bundle (i.e., a fixed CPI). The model is also homogenous of degree zero in prices. In macro terminology, the model displays neutrality of money.

4 | SCENARIO DESIGN

To illustrate the use of the model and dataset we have developed, four scenarios were simulated. While the following scenarios were designed to be illustrative of the model mechanics, any tourism-related scenario would be likely to contain some of the elements present in this set of scenarios:

(1) **Base:** the baseline or reference scenario is the "business-as-usual" scenario. In the baseline, we impose an average growth of 2.5 percent, based on projections from the April 2016 International Monetary Fund World Economic Outlook (IMF, 2016).[11] In addition, because of the assumption of a balanced growth path, the following assumptions were also imposed: (i) macro aggregates are kept fixed as a share of the gross regional product at base year values, (ii) transfers to/from government/RoC/RoW to households are also kept fixed as a share of GRP, and (iii) tax rates are fixed over time.

(2) **Invest:** this investment scenario implements a 25 percent increase in government investment in tourism-related infrastructure between 2016 and 2020 (Figure 2). This investment is financed with transfers from the rest of the country and implicitly represents transfers from the central government.[12]
(3) **Dem:** this demand scenario implements a 3.5 percent yearly increase in foreign tourism demand and arrivals during 2016 to 2020 (Figure 2); afterwards 2020 (i.e., 2021–2030), foreign tourism demand is around 20 percent higher than in the baseline.
(4) **Combi:** the combination scenario implements the **invest** and **dem** scenarios combined.

At the macro level, our RCGE, as any other CGE model, requires the specification of the equilibrating mechanism for three macroeconomic balances. For the nonbase scenarios these are:

- The impact on the government fiscal balance is cleared via changes in income tax rates on households. This assumption ensures that the simulations are budget neutral; that is, there is no additional domestic and/or foreign financing beyond baseline values.
- Private investment in the Cayo District follows an exogenously imposed path. Given this path, adjustments in savings from the rest of Belize clear the savings–investment balance.
- The real exchange rate adjusts to equilibrate inflows and outflows of foreign exchange, by influencing export and import quantities. That is, the simulations are neutral in terms of changes in region net foreign assets. The nontrade-related payments of the (local) balance of payments (transfers and foreign investment) are nonclearing, following exogenously imposed paths.

In addition, given the regional character of the model, a mechanism is required to clear the current account of the balance of payments between the local economy and the rest of the country. It is assumed that the real exchange rate is flexible with respect to the RoC, with equilibrium achieved through changes in the price of local nontradable commodities. In other words, prices for nontradable commodities are region specific, while for tradable commodities the local price is a weighted average of the price of three different varieties: local, from the RoC, and from the RoW.

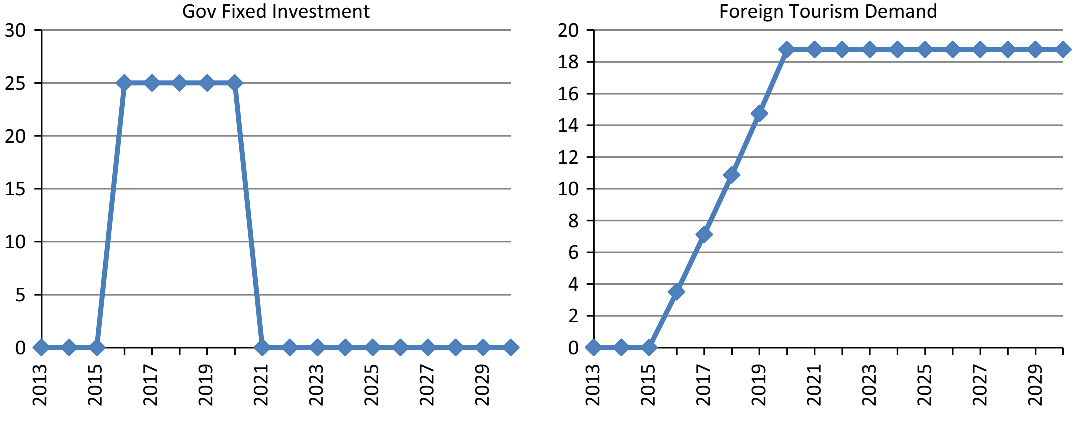

FIGURE 2 Definition of scenarios "invest" and "dem", percent deviation from base

Source. Authors' elaboration

5 | RESULTS

5.1 | Macro results

In Table 6 and Figure 3(a,b), we show key macroeconomic results for the baseline and other scenarios for the year 2020 (i.e., the year when the tourism-related infrastructure investment is completed) and 2030. In Table 6, all indicators are for the Cayo District alone. As the table shows, the increase in government tourism investment has, in the medium to long run, a positive impact on the activity level (simulation **invest**). At the same time, the inflow of foreign resources—both from RoC to finance investment and from RoW owing to increased tourist arrivals—gives rise to slower nontourism-related goods and service export growth and faster import growth, both of which were induced by an appreciation of the regional real exchange rate.[13] In turn, the expansion of tourism demand tends to expand domestic absorption more rapidly than it expands GRP, also causing deterioration in the nontourism trade balance (scenario **dem**). In other words, the increase in "tourism exports" also generates an appreciation of the real exchange rate that hurts the other tradable goods sectors. Slower export growth here is a function of increasing domestic demand and prices in Cayo District as a result of the investment. Where factor supply constraints exist (labor/capital/land/natural resources), increased domestic prices relative to world prices result in a reallocation of resources toward domestic production to meet more rapid growth in domestic demand.

5.2 | Sectoral results

Unsurprisingly at the sectoral level, service industries catering directly to tourists, including hotels and restaurants, are strongly stimulated by the expansion in tourism (simulation **dem**). At the same time, the upward pressure on prices and the real exchange rate leads to reduced competitiveness of traditional

TABLE 6 Change in real macro indicators (percent deviation from base)

	base (LCU)	invest		dem		combi	
Item	2013	2020	2030	2020	2030	2020	2030
Absorption	912	0.2	0.3	4.8	4.1	5.0	4.4
Private consumption	532	0.7	0.4	2.7	1.5	3.4	1.8
Government consumption	114	0.0	0.0	0.0	0.0	0.0	0.0
Exports to rest of world	264	1.1	0.8	−4.8	−6.6	−3.7	−5.7
Imports from rest of world	479	0.5	0.4	4.5	2.9	5.0	3.3
Exports to rest of Belize	162	−5.1	0.8	0.8	0.0	−4.3	0.8
Imports from rest of Belize	179	2.7	0.2	0.4	−0.3	3.2	−0.1
GRP at market prices	697	0.3	0.5	1.4	0.8	1.7	1.3
RER wrt rest of world	1	−0.1	0.1	−3.4	−1.8	−3.5	−1.7
RER wrt rest of Belize	1	−2.4	0.3	−0.2	−0.1	−2.5	0.2
Wage, average	1	0.7	0.1	1.8	1.2	2.6	1.3
Capital return, average	1	0.5	0.4	2.8	1.0	3.2	1.4
Unemployment rate	14.3	13.0	14.2	12.2	12.9	10.9	12.8

Note: Local currency units = BZ$m.
Source. Authors' own elaboration.

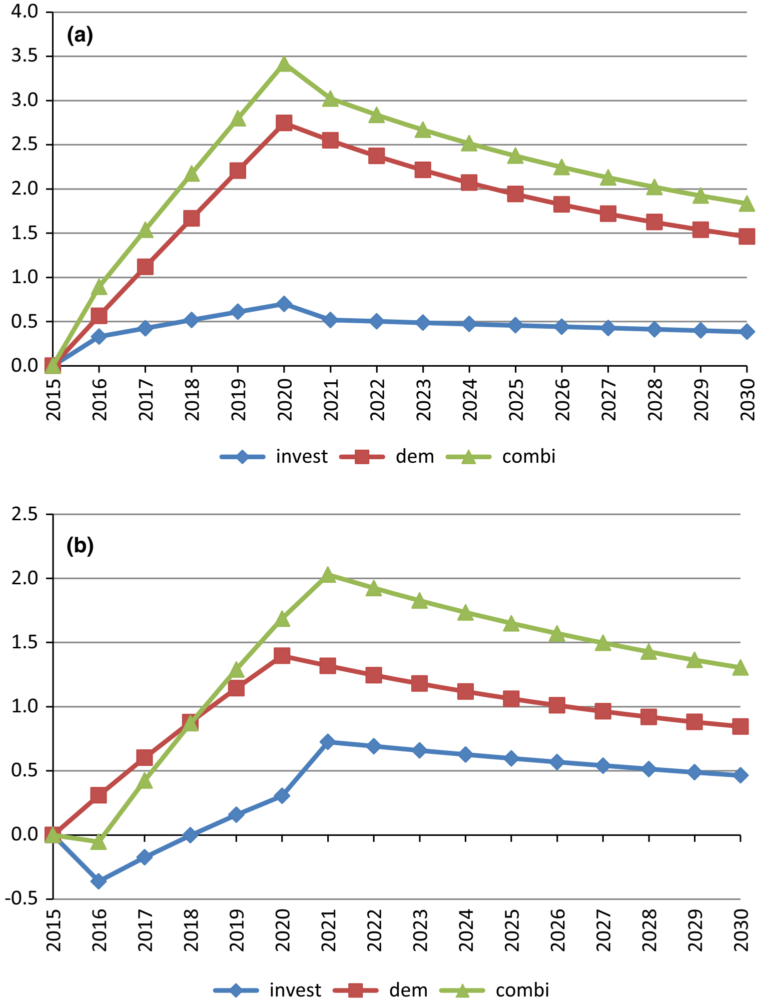

FIGURE 3 (a) Change in real private consumption 2015 to 2030, percent deviation from base; (b) Change in real gross regional product 2015 to 2030, percent deviation from base

Source. Authors' own elaboration

nontourism export sectors. Table 7 shows a decrease in value-added in food products and mining, two of the most export-oriented sectors. To some extent, this result changes when labor and capital are in greater supply. In other words, if there is surplus labor available that may be employed as a response to the demand stimulus, wage increases would be limited and these types of crowding out effects are weaker. In the case of Belize, where the level of underemployment is persistently high, and porous borders allow labor supply to grow in response to stronger demand, we would expect wage-cost pressures to be low. As expected, changes in sectoral employment follow those of sectoral value-added (not shown).

5.3 | Poverty results

At the national level, the economy's employment structure can be calculated for 17 sectors of the economy. Table 8 shows that the hotel and restaurant sector is responsible for 7.8% of total

TABLE 7 Change in sectoral real value added, exports, and imports (percent deviation from base)

	base (LCU)	invest		dem		combi	
Commodity	**2013**	**2020**	**2030**	**2020**	**2030**	**2020**	**2030**
Value Added							
Crops	44	−0.3	0.7	−2.8	−2.7	−3.3	−2.0
Livestock	12	−1.0	0.2	0.1	−0.5	−0.9	−0.3
Forestry	4	0.9	1.0	0.0	−0.4	0.8	0.6
Fishing	16	−0.8	0.4	−0.3	−1.0	−1.1	−0.6
Mining	5	2.6	1.2	−5.3	−9.3	−2.3	−8.0
Food and beverages	41	0.6	0.8	−4.5	−6.6	−4.0	−5.8
Textiles	0	−1.7	0.9	5.9	4.8	4.1	5.7
Other manufacturing	43	−1.8	0.2	1.4	1.1	−0.5	1.4
Electricity and water	26	−0.6	0.2	0.8	0.5	0.3	0.7
Construction	23	18.4	1.2	0.6	0.3	19.0	1.5
Trade	103	0.4	0.4	1.3	0.6	1.6	1.0
Hotel and restaurants	25	0.0	0.2	15.3	15.8	15.3	15.9
Transport	21	−0.1	0.5	0.5	0.0	0.4	0.5
Post and telecommunications	20	−1.3	0.2	0.5	0.3	−0.8	0.5
Financial intermediation	16	−1.5	0.5	0.2	−0.2	−1.2	0.3
Real estate, renting and bus svc	43	−0.7	0.6	−0.2	−0.5	−0.9	0.1
Community, social and pers svc	49	0.3	0.4	6.0	5.9	6.3	6.3
General government services	106	−2.1	0.4	−0.1	−0.4	−2.2	0.0
Exports							
Crops	41	−0.4	0.7	−3.9	−3.1	−4.4	−2.4
Livestock	0	−0.7	0.3	−2.8	−1.9	−3.6	−1.6
Forestry	0	0.1	1.0	−4.2	−2.6	−4.2	−1.6
Fishing	0	−0.1	0.4	−3.3	−2.1	−3.4	−1.6
Mining	74	2.6	1.2	−5.3	−9.3	−2.3	−8.0
Food and beverages	126	0.8	0.8	−4.9	−6.9	−4.2	−6.1
Textiles	0	−1.2	0.7	0.7	2.9	−0.4	3.6
Other manufacturing	3	−0.8	0.1	−1.9	−0.4	−2.7	−0.3
Transport	2	0.4	0.5	−3.2	−1.8	−2.9	−1.3
Post and telecommunications	1	0.1	0.0	−3.9	−2.1	−3.8	−2.0
Financial intermediation	1	−0.3	0.4	−4.0	−2.5	−4.3	−2.1
Real estate, renting and bus svc	14	0.5	0.3	−4.4	−2.8	−4.0	−2.5
Imports							
Crops	8	0.0	0.7	1.4	−1.1	1.3	−0.5
Livestock	1	−0.5	0.1	1.8	0.3	1.4	0.4
Forestry	0	6.7	0.7	4.4	2.1	11.4	2.7

(Continues)

TABLE 7 *(Continued)*

Commodity	base (LCU)	invest		dem		combi	
	2013	2020	2030	2020	2030	2020	2030
Fishing	0	−0.7	0.3	1.6	−0.5	0.9	−0.3
Mining	2	2.7	2.9	−7.5	−17.2	−3.6	−14.3
Food and beverages	56	0.2	0.6	11.6	9.5	11.7	10.0
Textiles	9	0.6	1.1	11.9	6.2	12.5	7.3
Other manufacturing	324	0.7	0.3	2.4	1.3	3.1	1.6
Hotel and restaurants	14	−0.1	0.1	20.8	18.0	20.7	18.2
Transport	33	0.2	0.5	3.6	1.5	3.8	1.9
Post and telecommunications	3	−0.9	0.2	4.4	2.6	3.5	2.8
Financial intermediation	11	−1.1	0.4	3.7	1.8	2.6	2.2
Real estate, renting and bus svc	14	0.1	1.3	7.8	4.3	8.0	5.7
Community, social and pers svc	6	0.2	0.2	10.3	8.1	10.6	8.4

Note: LCU = BZ$m.
Source. Authors' own elaboration.

employment in Belize. Individuals employed in this sector also exhibit generally lower rates of poverty than most other economic sectors.

At the Cayo District level, owing to a smaller number of observations per sector, we can evaluate employment and poverty for three aggregate sectors, namely the primary, manufacturing and services sectors. In this case, Table 9 shows that the services sector, which includes the hotel and restaurant sector, exhibits a lower poverty rate when compared with the regional average. On this basis, it can be concluded that the promotion of activities linked with the tourism sector would have a greater than average impact on poverty reduction.

In the **combi** scenario, the U.S.$2-a-day poverty headcount ratio in the Cayo District falls by 0.7 percentage points in the last year of the simulation period (Figure 4). The main drivers of this result are a decrease in unemployment, a higher average wage, and an increase in nonlabor income. In terms of inequality, we find a slight increase, driven by the decrease in the unemployment rate. This is due to two characteristics of the regional economy: (i) those with the very lowest incomes are under-represented among the newly employed, and (ii) the change in the sectoral structure of employment favors the services sector.

5.4 | Sensitivity analysis

Results from the RCGE model are a function of: (i) the model structure, which includes the functional forms used to model production and consumption decisions, and macroeconomic closure rules, among other elements, (ii) the base year RSAM used for model calibration, and (iii) the values assigned to the model elasticities or, more generally, to the model's free parameters.

Certainly, the elasticities used in this study implicitly carry an estimation error, as in any similar model. Consequently, we have performed a systematic sensitivity analysis of the results with respect to the value assigned to the model elasticities. Hence, if the conclusions of the analysis are

TABLE 8 National employment structure and poverty rates by sector (percent)

Industry	Share in employment	Poverty rate U.S.$2	Poverty rate U.S.$4
Growing of crops; horticulture	14.4	41.9	57.4
Forestry and logging	1.0	20.3	28.1
Fishing	2.2	27.1	34.1
Mining and quarrying	0.7	64.9	78.9
Manuf. of food products and beverages	4.1	14.7	32.0
Manuf. of textiles, clothing and food	0.7	35.8	46.6
Other manufacturing (incl. petroleum)	3.9	20.2	35.4
Electricity and water supply	1.2	13.1	18.9
Construction	8.3	22.5	37.4
Wholesale and retail trade, repairs	16.9	22.6	33.6
Hotels and restaurants	7.8	19.3	27.4
Transport and storage	5.7	14.7	22.4
Post and telecommunications	1.3	3.8	5.7
Financial intermediation	1.7	11.5	11.5
Real estate, renting and business serv	4.7	18.7	30.0
Community, social and personal serv	19.4	21.1	32.7
General government services	6.0	17.9	22.8
Total	100.0	23.5	34.7

Source. Authors' own elaboration.

TABLE 9 Regional employment structure and poverty rates by sector (percent)

Industry	Share in employment	Poverty rate U.S.$2	Poverty rate U.S.$4
Primary	13.8	45.1	55.0
Manufacturing	13.8	18.3	41.4
Services	72.4	24.3	37.2
Total	100.0	26.4	40.3

Source. Authors' own elaboration.

robust to changes in the set of elasticities used for model calibration, we will have greater confidence in the model results.

In order to perform the systematic sensitivity analysis, it is assumed that each of the model elasticities is uniformly distributed around the central value used to obtain the results. The range of variation allowed for each elasticity is ±85 percent. As such, a wide range of variation for each model elasticity is considered in this analysis. Then, a variant of the method originally proposed by Harrison and Vinod (1992) is implemented, which allows for performing a systematic sensitivity analysis. In short, the aim is to solve the model iteratively with different sets of elasticities. Thus, a distribution of results is obtained to build confidence intervals for each of the model results. The steps for implementing the systematic sensitivity analysis are as follows.

Step 1. In the first step, the distribution (i.e., lower and upper bound) for each of the model parameters that will be modified as part of the systematic sensitivity analysis is computed:

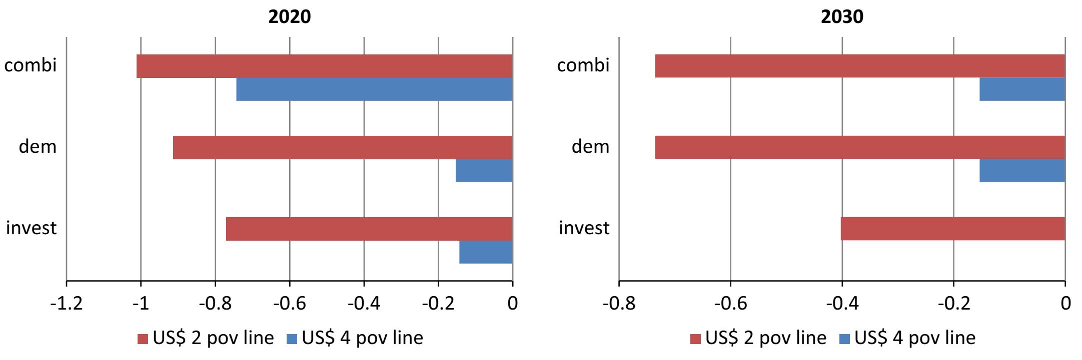

FIGURE 4 Change in poverty, percentage points from base

Source. Authors' own elaboration

elasticities of substitution between primary factor of production, trade-related elasticities, expenditure elasticities, and unemployment elasticities for the wage curves.

Step 2. In the second step, the model is solved repeatedly, each time employing a different set of elasticities; it is, therefore, a Monte Carlo type of simulation. First, the value for each model elasticity is randomly selected. Second, the model is calibrated using the selected elasticities. Third, the same counterfactual scenarios as previously described are conducted. Then, the preceding steps are repeated several times, 1,000 in this case, with sampling with replacement for the value assigned to the elasticities.

Table 10 shows the percentage change in private consumption estimated (i) under the central elasticities, and (ii) as the average of the 1,000 observations generated by the sensitivity analysis. For the second case, the upper and lower bounds under the normality assumption were also computed. Notice that all runs from the Monte Carlo experiment receive the same weight. As can be seen, the results reported above are significant, while estimates presented in Table 6 are within the confidence intervals reported in Table 10. For example, there is virtual certainty that the **combi** scenario has a positive effect on private consumption in the Cayo District of Belize.

Figure 5 shows nonparametric estimates of the density function for the percentage change in 2030 in private consumption in the **combi** scenario. Again, the sign of the results (i.e., positive) is not changed when model elasticities are allowed to differ by ±80 percent of their "central" value.

6 | CONCLUDING REMARKS

The tourism sector's contribution to growth, poverty reduction, and long-term development depends upon complex and dynamic economic, social, environmental, and institutional linkages,

TABLE 10 Sensitivity analysis; real private consumption percent deviation from base; year 2030 (95 percent confidence interval under normality assumption)

Scenario	Central Elast	Mean	*SD*	Lower bound	Upper bound
invest	0.3835	0.3800	0.0303	0.3206	0.4394
dem	1.4596	1.4391	0.0927	1.2575	1.6207
combi	1.8333	1.8100	0.0916	1.6305	1.9895

Source. Authors' own elaboration.

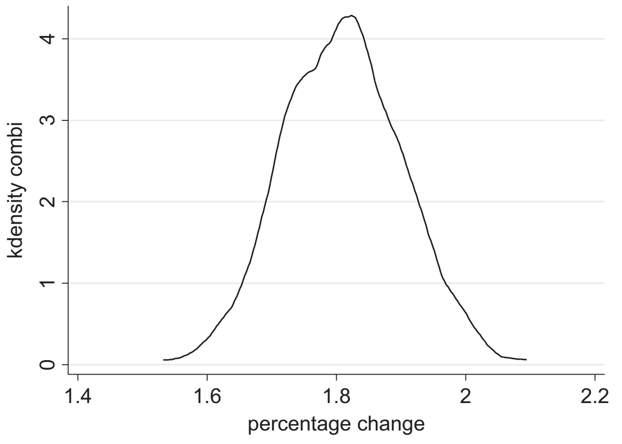

FIGURE 5 Sensitivity analysis, real private consumption deviation from base in 2030
Source. Authors' own elaboration

spillovers, and externalities. The evidence demonstrates that tourism and tourism investment have positive impacts on national and local economies, though the distribution of benefits is dependent on socioeconomic and institutional factors. The sectoral distribution of benefits is also conditioned by these factors and the structure of the economies at the destination. Invariably, there are some winners and some losers when a new public investment or policy is implemented. A laudable public policy goal would be to maximize the net benefits of public investments in tourism, while ensuring that benefits are equitably distributed and reach all segments of society, especially the poor and most marginalized.

Policymakers require objective evidence to base decisions on which public policies or investments to pursue. In this paper, we developed an economy-wide approach to assessing public investments in tourism. The approach is powerful in that it considers all inter-sectoral linkages that are known to be particularly important where the tourism industry is concerned. This framework is linked to a microsimulation module that enables estimation of household-level impacts of policies and destination-specific analysis of the distribution of benefits.

There are several innovative features of the approach developed, including the multiregional variant of the framework, one of the first and only implementations of Belize's household income and expenditure survey to calibrate a household microsimulation model, and estimation of baseline tourism demand based on a destination-specific expenditure survey implemented for this study. The framework developed draws on a significant amount of the data available to describe Belize's economy, and can serve as an important starting platform for others pursuing the analysis of public policy and investments in tourism, as well as a range of other public policy issues.

To illustrate the application of the framework and some of the indicators and insights it can generate for policymakers, we apply the approach to the evaluation of an investment in Belize's Cayo District. At the macro level, we find that the investment has a positive impact on the overall level of economic activity in the district. At the same time, the inflow of foreign resources to the district gives rise to slower export growth of traditional, nontourism export sectors and faster growth of imports. The increase in tourism exports generates an appreciation of the real exchange rate that hurts the other tradable goods sectors. In practical terms, the increase in domestic prices relative to world prices results in a reallocation of resources toward domestic production, at the expense of exports, to meet more rapid growth in domestic demand. In contexts where there is idle capital and labor that could be allocated to meet such increases in demand, this negative impact on the traditional export sector would be subdued. At the sectoral level, service industries catering to tourists are strongly stimulated by the investment.

In terms of poverty impacts, the poverty headcount in the district falls by 0.7 percentage points by 2030. Driving this reduction in poverty is the decrease in unemployment, a higher average wage, and an increase in nonlabor income. There is, however, a small increase in inequality that is due to the under-representation of lower income people among the newly employed, and the sectoral structural change of employment that favors the services sector, which generally uses more high skilled labor. In terms of inequality, we find a slight increase, driven by the decrease in the unemployment rate. Certainly, these insights would not have been evident without the linked economy-wide and microsimulation module framework developed here. Finally, the sensitivity analysis demonstrates that the results are robust to model assumptions, with virtual certainty, for example, that the public investment would have a positive impact on private consumption.

ACKNOWLEDGEMENTS

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ENDNOTES

[1] Specifically, the model comprises the following files: (i) a generic set of model files in GAMS (General Algebraic Modeling System), and (ii) application-specific files in Excel for data and simulations. Thus, anything that is not specific to an application dataset for the particular country or regional case appears in the model code. Finally, note that the model code is written and customized to capture whatever data is available in each case.

[2] In a CGE model, the macro closure refers to the rules on the basis of which a market (quantity demanded = quantity supplied) or a macro balance (income = expenditure) clears. In any application, the model macro closure comprises three elements: (i) government (adjustment of one or more receipt or spending items), (ii) balance of payments (adjustment of the real exchange rate—more common—or of a nontrade foreign exchange flow), and (iii) savings–investment balance (investment clears—investment is savings driven—or one or more savings flows adjust—savings is investment driven).

[3] For example, index i in Equation 1 can refer to tourists from different countries.

[4] In this case, the unemployment elasticity of the real wage is assumed to be –0.1, which is consistent with estimates derived from the literature. That is, a 1 percent increase in the unemployment rate is assumed to reduce wages by 0.1 percent.

[5] See Pyatt and Round (1985) or King (1981) for a more detailed introduction to SAM construction and interpretation.

[6] In addition, depending on data availability, a (multi) regional SAM can be used to implement the multiregional model developed, but not presented here.

[7] In fact, the model can handle more than one input for government capital stock (i.e., one for each government sector). However, the Belize 2013 SAMs do not provide the sectoral detail that would be needed to consider such disaggregation of the government sector.

[8] The real wage is defined in terms of the CPI.

[9] The 2008 HES was processed as part of the Socio-Economic Database for Latin America and the Caribbean (CEDLAS and The World Bank, 2012); see <http://sedlac.econo.unlp.edu.ar/eng/index.php>.

[10] In turn, this approach is an extension of the earnings inequality method developed by Almeida dos Reis and Paes de Barros (1991).

[11] The exogenous part of total factor productivity growth is adjusted to generate such a growth path. In nonbase scenarios, GRP growth is endogenous.

[12] It should be noted that in this application, no additional government spending on operations and maintenance of the new capital stock was included. The model does, however, allow for this additional spending to be included in the simulation.

[13] Notice that "exports" do not include tourism-related spending made by foreigners. Certainly, the latest correspond to tourism exports, but the two are treated differently in the model and Table 3.

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