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Environment, Rural Development and Disaster Risk Management Division

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Tourism Investment Insights from the Integrated Economic-Environmental Modeling (IEEM) Platform for Costa Rica

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Abstract

This paper applies the Integrated Economic-Environmental Modeling (IEEM) Platform to the analysis of public investment in tourism in Costa Rica. We show how our IEEM Platform can generate insights into the differential impacts of investments in different tourism modalities which can be useful for designing public investment strategies in tourism. We highlight additional features of IEEM which show some of the environmental impacts of investments as well as how they may affect government revenues. Finally, as a whole-of-economy analytical framework, we demonstrate how this holistic view of the economy captures and quantifies economic benefits and costs that would have been obscured in a traditional partial equilibrium-based cost-benefit analysis.

JEL Codes: D58 Computable and Other Applied General Equilibrium Models; Q56 Environment and Development • Environment and Trade • Sustainability • Environmental Accounts and Accounting • Environmental Equity • Population Growth; Q57 Ecological Economics: Ecosystem Services; Biodiversity Conservation; Bioeconomics; Industrial Ecology; Z3 Tourism Economics.

Keywords: ex-ante economic impact evaluation; computable general equilibrium; cost-benefit analysis; public investment in tourism development; Costa Rica.

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1.0 Introduction

With declining transportation costs and rising disposable income, tourism is one of the fastest growing economic sectors accounting for over 10% of global GDP and, 319 million jobs (10% total employment) and 30% of total services exports (WTTC, 2019). In 2012, tourism contributed 4.4% to GDP, growing to 6.3% in 2016 (BCCR, 2019). Tourism supports over 200 thousand jobs or 8.8% of total employment in Costa Rica. The Costa Rican Institute for Tourism's mission is to define public policy and programs to promote a competitive and sustainable tourism industry to improve the well-being of Costa Rican citizens.

There is a pressing need for tools to inform the design of public policy and investment in tourism to capitalize on tourism growth to enhance economic and social benefits locally, while sustainably managing the natural capital that underpins some of the most coveted destinations in Costa Rica. In this paper we present the Integrated Economic-Environmental Modeling (IEEM) Platform for Costa Rica and demonstrate the value-added of the framework for the ex-ante economic analysis of public policy and investment in tourism. Specifically, we illustrate how IEEM: (i) captures and quantifies the differentiated impacts of investments in different tourism modalities in term of economic output and well-being; (ii) captures the direct, indirect and induced impacts of tourism investment that otherwise have been missed, and; (iii) captures natural capital and ecosystem service impacts of public investment in tourism.

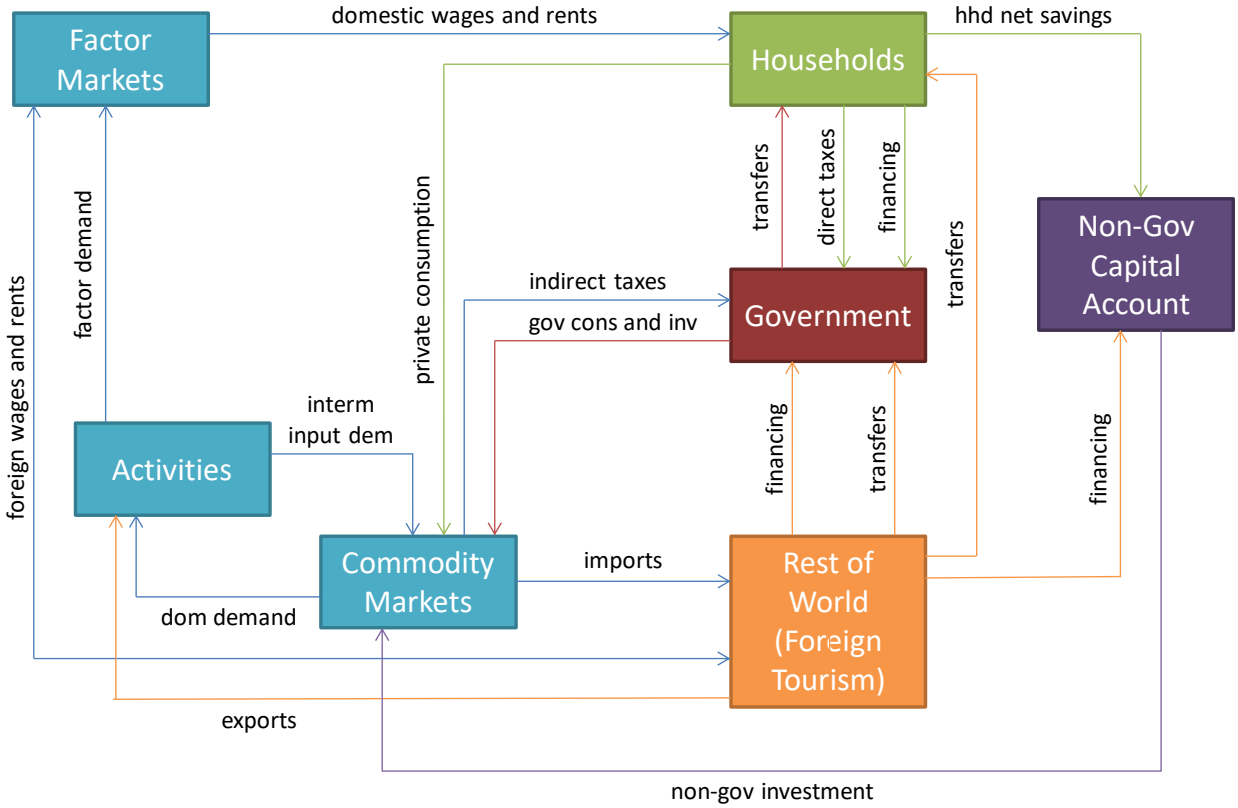
This paper is structured as follows. Following this introduction, we present the IEEM Platform approach including the modeling framework and the data from which we draw some preliminary insights. Section three begins with assessing how increased demand from different tourism modalities affect the economy and the environment differently. Concluding section three, we evaluate public investment scenarios in tourism from a partial and general equilibrium perspective and consider alternative means of investment financing. The final section concludes the paper with a summary of the key findings.

2.0 Methods

2.1. The Model: The Integrated Economic-Environmental Modeling Platform

The IEEM Platform for Costa Rica (IEEM-CRI) takes as its starting point the framework developed in (Banerjee et al., 2019b) and is extended for tourism applications. The baseline year of the model is 2016 and singles out five types of tourism: health, education, business, leisure, and cruise tourism. This disaggregation of tourism modalities is drawn directly from Costa Rica's System of National Accounts. Figure 1 shows the main economic flows captured by IEEM. The arrows represent the flow of income. In general, as with other Computable General Equilibrium (CGE) models, IEEM is concerned with the real side of the economy and excludes monetary aspects. Thus, the framework is most suitable for analyzing changes in how resources are allocated throughout the economy as a result of a change in public policy or investment.

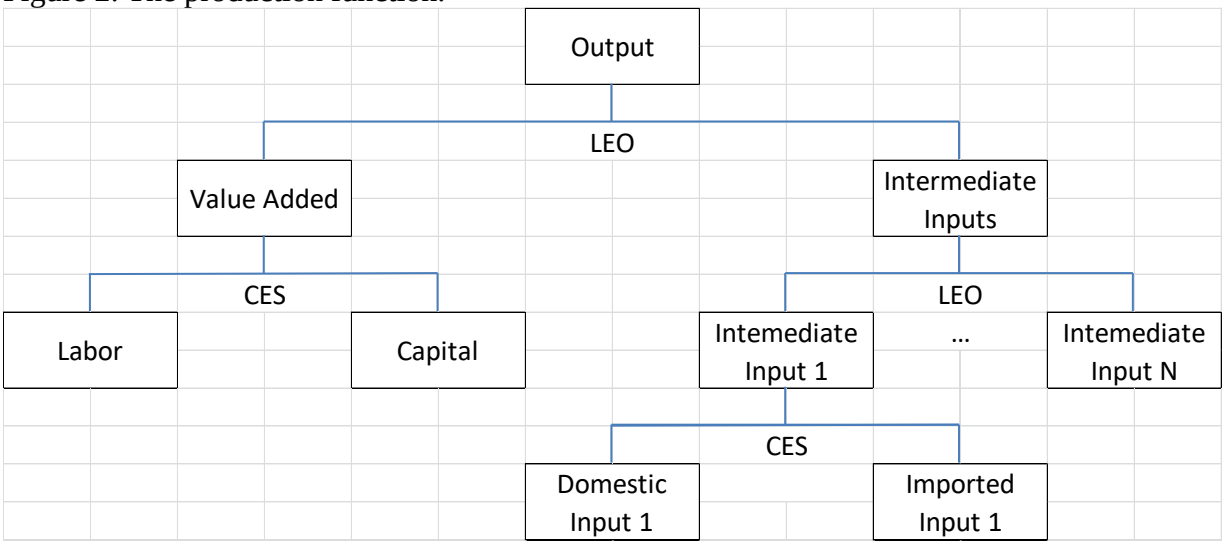
Figure 1. The circular flow of income in IEEM.



Source: authors' own elaboration.

The productive sectors of the economy are represented by activities that maximize their benefits in competitive markets. The production technology captured in the model, in its simplest form, is shown in figure 2. First, value-added and intermediate inputs are combined in fixed proportions. Value added, in turn, is generated by combining primary production factors (labor, capital and potentially natural resources). On the other hand, intermediate inputs may come from national supply or from the rest of the world as imports. Activities can produce one or more products in fixed proportions. In turn, each product can be produced by more than one activity. The total production of each good or service can be destined to the domestic market or exported to the rest of the world.

Figure 2. The production function.



Note: CES is constant elasticity of substitution and LEO is Leontief fixed proportions. Source: authors' own elaboration.

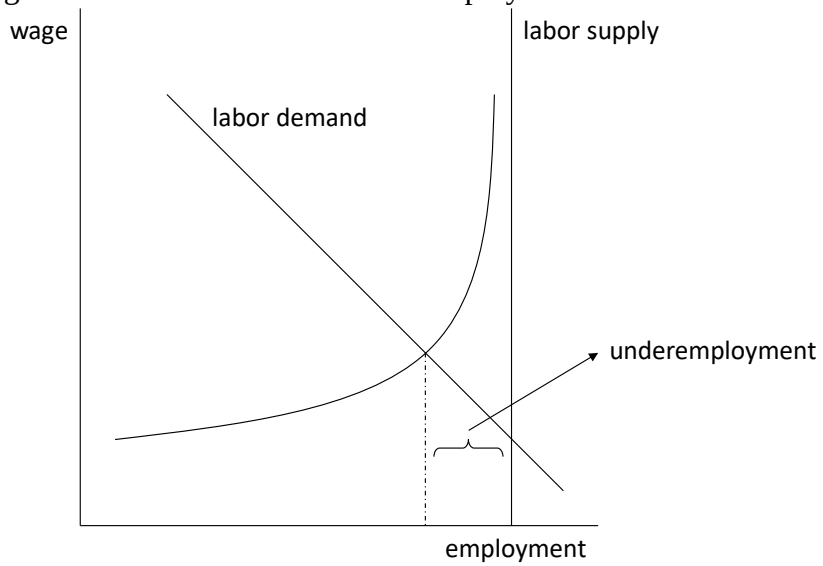
Institutions in IEEM-CRI are identified as households, enterprises, government, and the rest of the world. Foreign tourists are disaggregated from the rest of the world. Households obtain their income from the productive factors they own, as well as from the transfers they receive from the other institutions included in the model. Households allocate their income to buy the goods and services they consume, save, pay direct taxes and make transfers to other institutions. The government receives tax revenues while consuming goods and services, providing transfers to households and saving (or borrowing). The rest of the world demands exports and supplies imports.

IEEM-CRI identifies eight types of taxes, namely: household and enterprise incomes, activity, consumption, value added, export, import, and factor income taxes as well as taxes on the use of factors of production by economic activities. On the other hand, marketing and transportation margins are explicitly modeled, assuming that the corresponding services are demanded in fixed proportions to move a good from the producer to the consumer. Foreign tourists split their spending among specific goods and services such as hotels and restaurants. Naturally, foreign tourism spending is recorded as an inflow of foreign exchange in the balance of payment.

In terms of foreign trade, goods and services are assumed to differ according to the country of origin (Armington, 1969). This also implies that a good can be imported and exported simultaneously. The combination of national and imported products is carried out at the border. That is, the domestic/imported composition of consumption is the same regardless of the destination of the products (for example, intermediate consumption versus final consumption). The assumption of imperfect substitution between imports and domestic purchases is implemented with a Constant Elasticity of Substitution type function. On the production side, a symmetric assumption is made where exports are an imperfect substitute for sales to the domestic market. Imperfect transformation is implemented through a Constant Elasticity of Transformation function. In addition, Costa Rica is modeled as a small country, so it takes as a given the international prices of the products it trades with the rest of the world.

In the labor market, it is assumed that there is unemployment generated by a wage curve (Figure 3), which establishes a negative relationship between the wage level and unemployment rate (Blanchflower and Oswald, 1994). In all cases, labor is perfectly mobile between sectors. With respect to capital, once installed, it is considered immobile between sectors.

Figure 3. The labor market with unemployment.



Source: authors' own elaboration.

IEEM is a recursive dynamic model, though a static variant may also be implemented. Recursive dynamics implies that economic agents are nearsighted in that their expectations do not change. Consequently, economic agents expect future prices to be identical to the prices of the current period. There are four sources of dynamics in IEEM: capital accumulation, labor force growth, natural resource supply, and changes to factor productivity. At the beginning of each period, sectoral capital stocks are modified based on levels of investment of the previous period. Endowments of other productive factors grow exogenously. The investment and capital stocks in each period differ between public and private sector. As a recursive dynamic model, the model solution involves solving a succession of static models connected through time by changes in factor endowments.

Conventional CGE analysis does not produce results that show the distribution of costs and benefits with a meaningful level of detail and disaggregation. To overcome this short-coming, built into IEEM is a microsimulation model which is used to estimate public policy and investment impacts on poverty and inequality. Specifically, the results for per capita income by representative households generated by IEEM are used in a microsimulation model to modify the per capita income of each of the households registered in the 2018 National Household Survey (ENAHO), which is the most recent household survey available for Costa Rica.

2.2. The Data

Table 1 shows the basic structure of the Social Accounting Matrix (SAM) that underpins IEEM and the transactions that it captures. Table 2 defines each of the accounts presented in the aggregate

SAM. To simplify, we identify two economic activities, one private sector and the other the government sector. A SAM is a square matrix that records all transactions of an economy in a given year. The rows and columns of a SAM are called accounts. The accounts contained in a SAM can be grouped into activities, products (i.e. goods and services), institutions, and savings and investment. Our SAM considers both private and public sector capital investment accounts which can be useful for specific applications. The macro and micro-economic consistency with supply being equal to demand, income equal to expenses, is ensured provided that the sums of corresponding rows and columns are equal.

Table 1. Structure of the Social Accounting Matrix for Costa Rica.

	act	com	marg	f-lab	f-cap	hhd	ent	gov	row	trst	taxes	cap-insdng	cap-gov	cap-row	inv-prv	inv-gov	dstk	total
act		output																income
com	interm		trd-trns			cons			exp	cons					inv	inv	dstk	demand
marg		marg																
f-lab	va								yrow									factor
f-cap	va								yrow									income
hhd				ylab	ycap		trnfr	trnfr	trnfr									current income
ent					ycap	trnfr		trnfr	trnfr									
gov					ycap	trnfr	trnfr		trnfr		taxes							
row		imp		ylab	ycap	trnfr	trnfr	trnfr										
trst									ytrst									
taxes	taxes	taxes		cssec		taxes												
cap-insdng						sav	sav							borr				capital income
cap-gov								sav				borr		borr				
cap-row									sav			drf						
inv-prv												inv		inv				
inv-gov													inv					
dstk												dstk						
total	cost	supply		trnsfr	fac	current spending						capital spending						

Source: Authors' elaboration.

The description of cells in table 1 is as follows. Economic sectors use intermediate inputs [com, act] and factors of production [f-lab, act], [f-cap, act] and [f-lab, act] to generate output. In addition, they face indirect taxes on production [taxes, act]. The supply of domestic products at basic prices is recorded in cells [act, com]. Then, imports [row, com], marketing and transportation margins required to take goods and services from producer to consumer [marg, com], and taxes are charged on goods and services [taxes, com] to obtain the total supply at purchaser prices. On the demand side, we have intermediate consumption, marketing and transportation margins [com, marg], household consumption [com, hhd], government consumption [com, gov], exports [com, row], foreign tourist consumption [com, trst], private gross fixed capital formation [com, inv-prv] and public gross fixed capital formation [com, inv-gov], and changes in stocks [com, dstk].

Table 2. Aggregate accounts in the Costa Rican SAM for 2016.

Account	Description	Account	Description
act	activities	borr	net borrowing
com	commodities	cons	consumption
marg	distribution margins	cssec	social security contributions
f-lab	labor	drf	change in foreign reserves
f-cap	capital	dstk	change in inventories
hhd	households	exp	exports
ent	enterprises	imp	imports
gov	government	interm	intermediate inputs
row	rest of the world	inv	investment (GFCF)
trst	foreign tourists	output	production
taxes	indirect and direct taxes	sav	savings
cap-insdng	capital account - households and enterprises	taxes	indirect and direct taxes
cap-gov	capital account - government	trd+trns	trade and transport margins
cap-row	capital account - rest of the world	trnsfr	transfers
inv-prv	investment - GFCF private	va	value added
inv-gov	investment - GFCF government	ycap	capital income
dstk	investment - change in inventories	ylab	labor income
		yrow	factor income from rest of the world
		ytrst	tourism income

Source: Authors' own elaboration.

Institutions in the SAM show how factor income is distributed among four of the institutions identified in the SAM. For example, cell [row, f-cap] shows the remittance of capital income to the rest of the world. Cell [cssec, f -lab] records the payment of social security contributions by employees.

Transactions between institutions show inter-institutional transfers. For example, cell [hhd, row] records the remittances that households receive from the rest of the world which could be from family members who migrated in the past. Cells [cap-insdng, hhd], [cap-insdng, ent], [cap-gov, gov] and [cap-row, row] record savings by institutions. The value of savings is calculated as the difference between income and current expenditures. In the case of the rest of the world, it is equivalent to the negative balance of the current account of the balance of payments.

Finally, capital transactions between institutions record: (i) government domestic borrowing/lending [cap-gov, cap-capinsdng]; (ii) the government external debt/surplus [cap-gov, cap-row], and; (iii) the external indebtedness/surplus of households and businesses [cap-capinsdng, cap-row]. Payments from institutional capital accounts to the investment accounts inv-prv, inv-gov and dstk represent private investments [inv-prv, cap-hhd], government investments [inv-gov, cap-gov] and foreign direct investment [inv-prv, cap-row]. These transactions are not typically part of a conventional SAM which usually contains only one capital account for the entire economy.

Our SAM for Costa Rica has a base year of 2016 and was developed in two stages as described in detail in (Banerjee et al., In preparation). In the first stage, a top-down approach was implemented

following the conventions identified in Round 2003 and Reinert and Roland-Holst 1997, among others (Round, 2003, Reinart and Roland-Holst, 1997). First, an aggregate SAM was developed showing the aggregate information captured by Costa Rica's National Accounts, specifically, the 2016 supply and use tables and integrated economic accounts. Second, National Accounts data was used to disaggregate economic activities, goods and services and factors of production. In turn, households were disaggregated using the latest available (2013) Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH). Costa Rica's National Accounts data presents tourism disaggregated by tourism modality, namely health, education, business, leisure and cruise tourism. Finally, additional model parameters are required for the calibration of IEEM-CRI, many of which are model elasticities. SAM data sources may be found in Banerjee et al. (in preparation).

2.3. Insights from the Social Accounting Matrix for Costa Rica

Table 3 shows the structure of consumption by tourism modality. For purposes of presentation, the 43 activities in the SAM were aggregated to the 12 shown in Table 2. Seventy-eight percent of health tourism consumption is of Health goods and services, and 10.1% from the Hotel and restaurant sector. Education tourism expenditure is more evenly distributed among goods and services as this tourism modality often involves temporary residence in the country. In this case, 27.5% is spent on Education goods and services, 16.9% on Hotels and Restaurants, 14.1% on Food, 15.1% on Transport and so on.

Table 3. Consumption structure by tourism modality; percent.

Commodity	Health	Education	Business	Leisure	Cruises
Agriculture	0.0	1.9	0.0	0.0	0.0
Food	0.9	12.2	1.9	4.1	4.1
Textiles and leather	0.1	0.4	0.1	0.2	26.9
Other manufacturing	1.2	7.5	2.5	3.8	3.0
Electricity, gas and water	0.0	1.8	0.0	0.0	0.0
Trade	0.1	0.0	0.1	0.3	0.0
Taxis	2.6	1.1	7.5	5.1	0.6
Other transport	0.9	14.0	2.0	5.1	1.4
Hotels and restaurants	10.1	16.9	77.6	61.6	3.4
Education	0.0	27.5	0.8	0.2	0.0
Health	78.1	0.2	1.4	1.0	0.5
Other services	6.0	16.5	6.1	18.7	60.1
Total	100.0	100.0	100.0	100.0	100.0

Source: IEEM-CRI database.

Business tourism spends a large share on Hotel and restaurant goods and services (77.6%) and 7.5% on Taxis. Leisure tourism expenditure is 61.6% on Hotel and restaurant goods and services and 18.7% on Other services, which include tours and other tourism goods and services. Cruise tourism expenditure is concentrated on Other services (60.1%) and 26.9% on Textiles and leather goods which included souvenirs and related goods and services.

Table 4 and table 5 show sectoral factor intensities and sectoral wages, respectively. It is worthwhile to note that table 4 is based on payments to factors (i.e., wages and rents), thus, it does not show factor intensities in physical units. In the case of Education and Health, the capital shares are relatively small since services are provided for free through the public education and health system and thus according to the SNA, no gross operating surplus (i.e., capital rents) is recorded.

Directly related to the tourism modalities under consideration are the Hotel and restaurant sector, the Education sector and the Health sector. The Hotel and restaurant sector use a greater proportion of semi-skilled labor (30%) compared with 9.2% of unskilled and 4.7% of skilled labor. It is relatively capital intense, with 56% factor intensity. The education sector uses a greater share of skilled labor (73.3%) and is not capital intensive (17.2%). The Health sector again is highly concentrated in its employment of skilled labor (72.2%) and not intense in terms of the use of capital (17.7%).

Table 4. Sectoral factor intensities; percent.

Activity	Low-skilled labor	Semi-skilled labor	Skilled labor	Capital	Natural resources	Total
Agriculture	22.2	19.6	6.0	32.2	20.0	100.0
Mining	2.1	8.4	6.0	61.9	21.6	100.0
Food	5.3	17.8	14.6	62.2	0.0	100.0
Textiles and leather	5.4	44.2	1.5	48.9	0.0	100.0
Other manufacturing	4.6	26.2	10.4	58.7	0.0	100.0
Electricity, gas and wate	1.8	11.0	22.1	65.1	0.0	100.0
Construction	21.7	19.1	14.2	45.1	0.0	100.0
Trade	5.0	36.5	19.4	39.2	0.0	100.0
Taxis	21.1	51.3	11.6	16.0	0.0	100.0
Other transport	6.6	27.5	9.9	55.9	0.0	100.0
Hotels and restaurants	9.2	30.0	4.7	56.0	0.0	100.0
Education	4.0	5.4	73.3	17.2	0.0	100.0
Health	3.1	7.0	72.2	17.7	0.0	100.0
Other services	5.2	15.1	28.4	51.3	0.0	100.0
Total	7.0	18.5	28.4	44.8	1.2	100.0

Source: IEEM-CRI database. Unskilled is less than secondary education; semi-skilled is secondary education; and skilled is higher education.

This information is of interest for public policy and investment in terms of the insights it provides especially for labor force development, for tourism as well as other economic sectors. Public policy oriented toward creating jobs for poorer segments of society could do well by promoting basic skills in the tourism sector, with a view to eventually increasing the share of skilled labor used by the tourism sector. Greater access to more advanced skills in health and education could generate additional opportunities for expanding Health and Education tourism modalities.

Table 5 shows sectoral wages per year per worker. The table reveals that average wages are rather low in the tourism sector, higher for the education sector and highest for the health sector, where

our tourism modalities are concerned. It also shows the differentiation in wages between low, medium and highly skilled labor. Clearly, the agricultural sector generates the lowest returns for its workers, though this activity may be performed in conjunction with other work.

Table 5. Sectoral wages; in thousands of colones per year per worker.

Activity	Low-skilled labor	Semi-skilled labor	Skilled labor
Agriculture	1,996	2,901	10,656
Mining	2,899	3,854	3,051
Food	3,582	4,404	10,225
Textiles and leather	4,913	2,870	5,399
Other manufacturing	4,200	5,909	10,146
Electricity, gas and water	5,137	5,917	32,609
Construction	3,390	4,975	10,193
Trade	781	3,313	11,189
Taxis	5,674	9,021	10,376
Other transport	3,798	6,151	11,305
Hotels and restaurants	2,824	3,179	7,911
Education	5,024	5,647	12,444
Health	6,289	8,319	16,904
Other services	3,093	5,694	12,396

Source: IEEM-CRI database.

3.0. Scenarios

3.1. Expansion of Demand of Alternative Tourism Modalities

IEEM-CRI contains five tourism modalities, namely, Health, Education, Business, Leisure and Cruises. We implement five scenarios to investigate the impacts of a permanent increase in tourism expenditure in each tourism modality equivalent to 0.15% of GDP during the period 2020-2030. In 2016, this amount was equivalent to US$80.6 million in additional tourism expenditure. For each of the five scenarios, the consumption structure for tourism demand follows that show in table 1. This analysis identifies tourism modalities that could generate the greatest returns in terms of economic growth, employment and well-being from investments aimed at enhancing tourism opportunities to increase tourism demand.

At the macro level, IEEM-CRI requires the specification of the equilibrating mechanisms or closures for three macroeconomic balances: government, savings-investment and the balance of payments. In all simulations, unless specified otherwise, the following macroeconomic closure rules are applied: (i) government changes in income tax rates on households and enterprises clear the government budget (i.e., compared to base values, no other changes in taxes or other revenue sources, domestic or foreign, are permitted); (ii) savings-investment: domestic private investment adjusts to the available (domestic and foreign) financing; and (iii) balance of payments: the real

exchange rate equilibrates this balance by influencing export and import quantities and values; the non-trade-related payments of the balance of payments (transfers and non-government net foreign financing) are non-clearing. In turn, with regard to factors, labor is perfectly mobile across sectors while non-labor factors are sector-specific and thus there is no sector mobility permitted.

We implement the following scenarios:

- trst-health = 0.15% of GDP increase in Health tourism demand.
- trst-edu = 0.15% of GDP increase in Education tourism demand.
- trst-bus = 0.15% of GDP increase in Business tourism demand.
- trst-leisure: 0.15% of GDP increase in Leisure tourism demand.
- trst-cruises: 0.15% of GDP increase in Cruise tourism demand.

Table 6 shows, for each scenario, the percentage change in tourism spending. These results illustrate baseline expenditure for each tourism modality. Leisure tourism is the most important of the five modalities considered; the increase of 0.15% of GDP in tourism demand resulted in an overall expenditure increase of 3.8%. On the other hand, Cruise tourism has the least tourism expenditure, with a 0.15% of GDP increase increasing overall Cruise tourism expenditure by over 1,103%.

Table 6. Tourism expenditure; percentage change.

Health	Education	Business	Leisure	Cruises
17.5	32.3	19.6	3.8	1,103.3

Source: IEEM-CRI results.

Table 7 shows impacts on macroeconomic indicators as the percentage deviation from the base in 2030. Changes in private consumption translate closely to impacts on household welfare. Here we find that Health tourism would boost private consumption the most (0.07%) and GDP by 0.05%. Cruise tourism on the other hand has the smallest impact, increasing private consumption by 0.01% and GDP by 0.01%. Interestingly, it is Business tourism that reduces unemployment the most (0.10%) with leisure tourism a close second (0.08%). Wages would be positively impacted across scenarios, particularly in the case of Health tourism as demand for skilled labor would increase thus positively affecting wages.

Table 7. Macro results; percent deviation with respect to the baseline in 2030; base year in millions of colones.

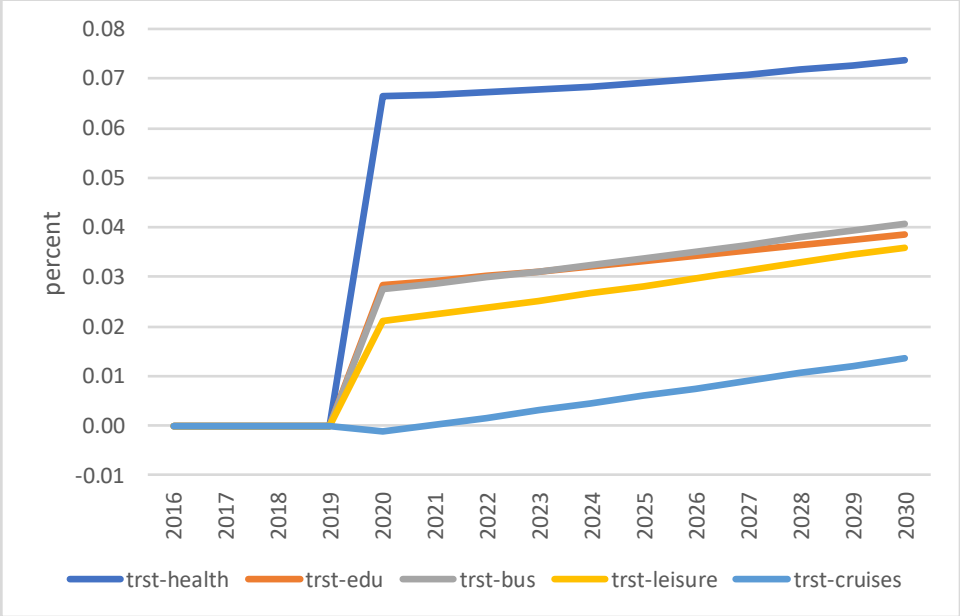
Item	2016	trst-health	trst-edu	trst-bus	trst-leisure	trst-cruises
Absorption	31,054	0.06	0.04	0.04	0.04	0.02
Private consumption	19,975	0.07	0.04	0.04	0.04	0.01
Exports	9,832	0.11	0.14	0.13	0.13	0.14
Imports	9,750	0.14	0.17	0.18	0.18	0.17
GDP market prices	31136.21	0.06	0.03	0.03	0.03	0.01
Real exchange rate	1	-0.28	-0.27	-0.27	-0.28	-0.28
Wage, average	1	0.18	0.08	0.04	0.03	0.02
Capital return, average	1	-0.03	-0.01	0.00	0.00	0.03
Unemployment rate	9.5	-0.05	-0.04	-0.10	-0.08	-0.03

Source: IEEM-CRI results.

Table 7 shows an increase in total exports, including tourism-related goods and services. However, at the sectoral level, non-tourism exports decrease and imports increase due to the real exchange rate appreciation. It is important to note that tourism demand includes imported goods and services, though the more important driver of increased imports is the real exchange rate appreciation.

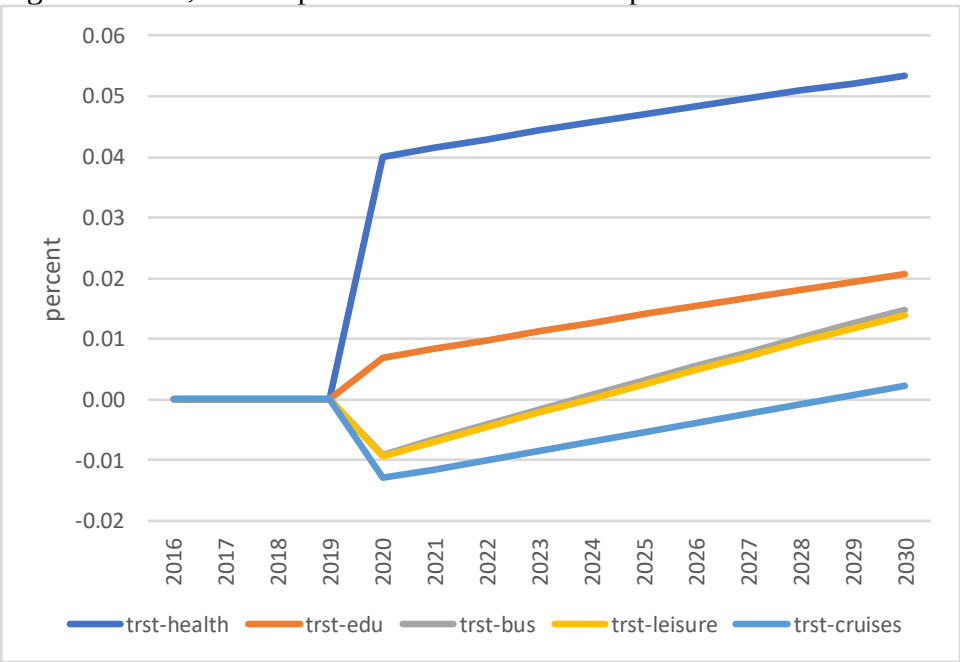
Figures 4 and 5 show the time path for deviations from the baseline for private consumption and GDP, respectively, noting that changes in private consumption follow closely household welfare impacts. Figure 5 shows that the increase in tourism demand has a short-lived negative impact on GDP in the case of Business, Leisure and Cruise tourism, as Costa Rica's economy adjusts to the demand stimulus generated by these tourism modalities.

Figure 4. Private consumption; annual percent deviation with respect to baseline.



Source: IEEM-CRI results.

Figure 5. GDP; annual percent deviation with respect to the baseline.



Source: IEEM-CRI results.

Table 8 shows the sectoral impacts of the increase in tourism demand and identifies the winners and losers of the expenditure shock. Health tourism stimulates the Health sector, as well as Hotel and restaurants. Other unrelated sectors experience some decline in activity. Education tourism stimulates the education sector, as well as transport sector. Business tourism is heavy in demand for Taxi services and strongly stimulates the Hotel and restaurant sector. Leisure tourism also strongly stimulates the Hotel and restaurant sector. Cruise tourism results are the most disperse in terms of sectoral impacts though the Textile and leather sector is the mostly strongly stimulated.

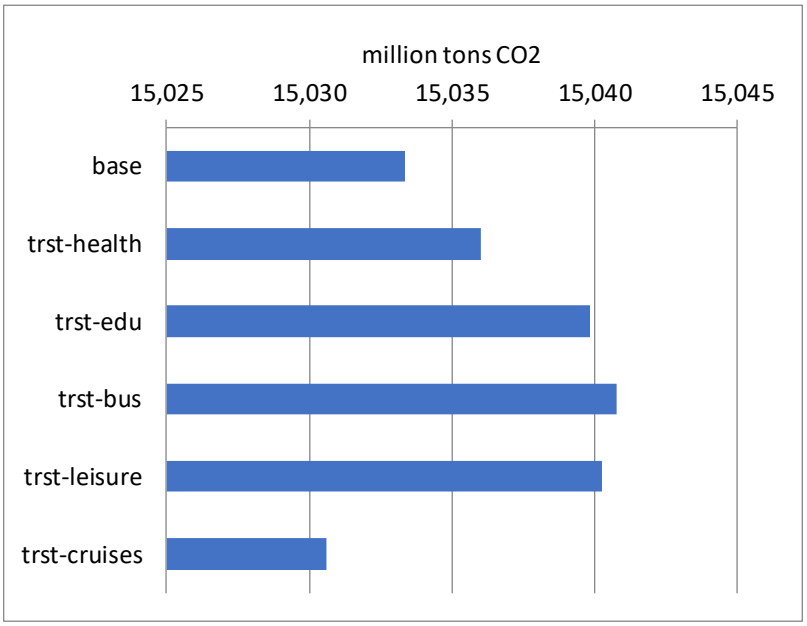
Table 8. Sector impacts, percent deviation with respect to the baseline in 2030; base year (baseyr) expressed as millions of colones.

Commodity	baseyr	trst-health	trst-edu	trst-bus	trst-leisure	trst-cruises
Agriculture	1,556	-0.18	-0.16	-0.19	-0.19	-0.19
Mining	93	-0.01	-0.02	0.00	0.00	-0.03
Food	1,347	-0.12	-0.03	-0.05	-0.05	-0.13
Textiles and leather	115	-0.12	-0.17	-0.24	-0.23	0.86
Other manufacturing	1,748	-0.31	-0.31	-0.37	-0.36	-0.36
Electricity, gas and wate	761	0.01	0.07	0.07	0.05	-0.02
Construction	1,398	0.07	0.06	0.09	0.09	0.06
Trade	2,770	0.00	0.01	-0.01	0.00	0.04
Taxis	266	0.27	0.12	0.63	0.43	0.06
Other transport	946	-0.03	0.17	-0.03	0.04	-0.03
Hotels and restaurants	1,039	0.18	0.26	1.09	0.87	0.05
Education	2,361	0.01	0.40	0.03	0.02	0.00
Health	2,008	1.24	0.00	0.04	0.03	0.01
Other services	11,270	-0.04	-0.02	-0.02	0.00	0.07
Total	27,679	0.05	0.02	0.01	0.01	0.00

Source: IEEM-CRI results.

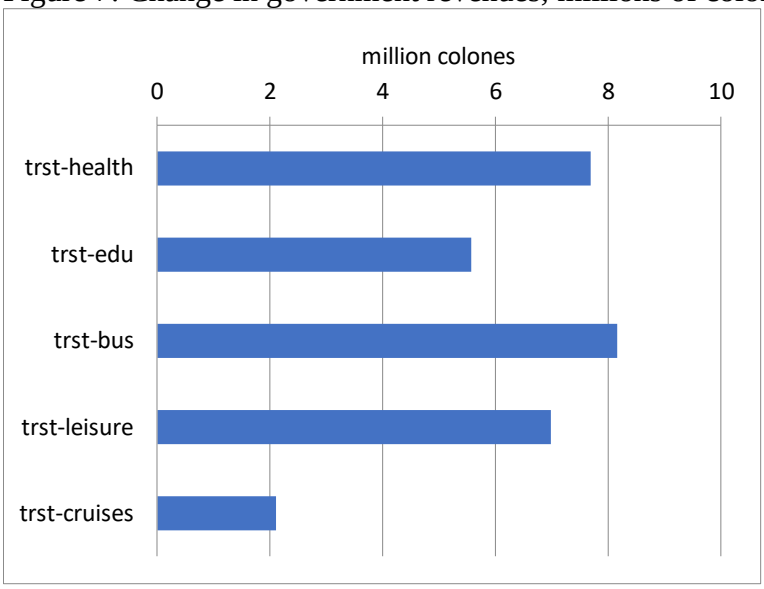
Figure 6 shows changes in greenhouse gas emissions resulting from increased tourism demand. Business tourism generates the greatest increase in greenhouse gas emissions. Table 1 shows the commodity composition of tourism demand by tourism modality and sheds light on this should be the case. With Business tourism's large demand for Taxi services, increasing Business demand bring with it an increase in demand for these services which are emissions intense. Educational tourism is a close second for its demand for Transportation services.

Figure 6: Greenhouse gas emissions; millions of tons of CO_2, deviation with respect to the baseline base in 2030.



Source: IEEM-CRI results.

Figure 7: Change in government revenues; millions of colones.



Source: IEEM-CRI results.

Figure 7 shows the scenario impacts on total government tax revenues. The increase in Business tourism demand generates the greatest increase in tax revenues, followed by Health, Leisure, Education and finally Cruise tourism[1].

[1] Note that to generate these results, the closure rule was changed. For these results, the government budget is financed through internal debt. For all other scenarios, the government budget is financed through direct taxes. This change is necessary to capture the government tax revenue impacts of the tourism demand scenarios.

3.2. Partial Versus General Equilibrium Analysis of Public Investments in Tourism

The IEEM Platform is an economy-wide general equilibrium model. This type of general equilibrium model distinguishes itself from partial equilibrium models in that it accounts for all sectors of an economy and their interlinkages, thus capturing direct, indirect and induced impacts of public policy and investment. Where a general equilibrium approach is implemented, one key consideration is how the investment cost is factored into the analysis. The purpose of this section is two-fold. First, we evaluate a new public investment in tourism from a partial and general equilibrium analytical perspective. Second, we consider alternative formulations of how costs are accounted for in the analysis.

We implement the following scenarios:

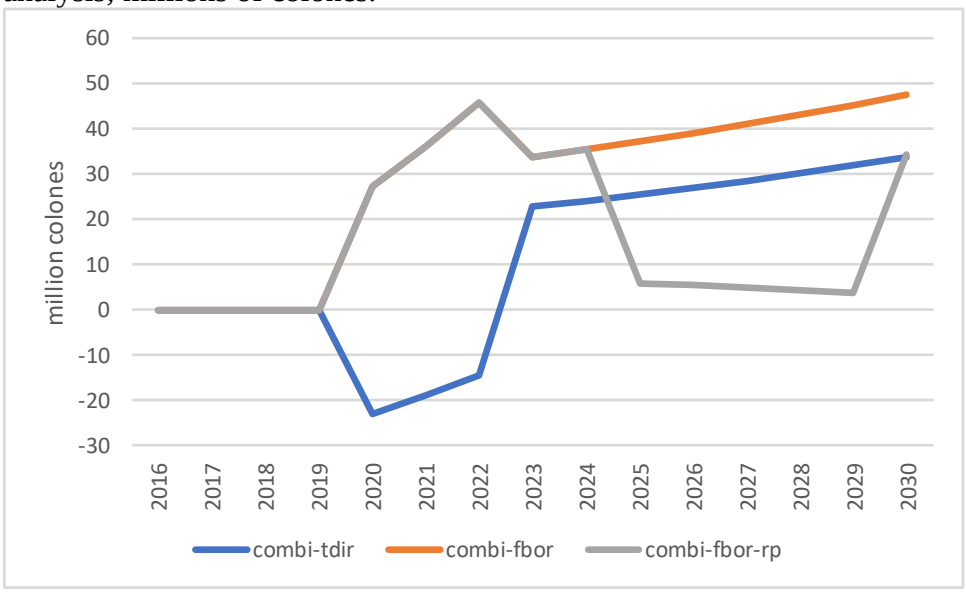
- invest-tdir: public investment in tourism distributed evenly between 2020 and 2022 amounting to 0.25% of GDP in the base year. This investment is financed through direct taxation.
- spnd: increase in foreign tourism expenditure equivalent to 0.15% of GDP during 2020-2030 (i.e., same increase as in the previous set of scenarios). In this scenario, the distribution of expenditure across tourism modalities is the same as in the baseline.
- combi-tdir: this scenario is the joint implementation of spnd and invest-tdir scenarios. This scenario captures the expectation that the public investment in tourism will result in an increase in foreign tourism demand.
- invest-fbor: this scenario is the same as invest-tdir, but the investment in tourism is financed with a foreign loan.
- combi-fbor: this scenario is the joint implementation of spnd and invest-fbor.
- combi-fbor-rp: this scenario is the combi-fbor scenario with the difference that it includes the repayment of the foreign loan.

In the partial equilibrium analysis, the increased tourism expenditure is compared alongside the investment cost as in figure 8, to estimate net benefits which are then discounted, at 12% in this case. In this case, tourism expenditure is taken as the equivalent of welfare benefit which can be argued to be not an entirely appropriate measure of welfare.

Figure 8. Scenario definition and inputs for calculation of partial equilibrium NPV; millions of colones.

Source: IEEM-CRI results.

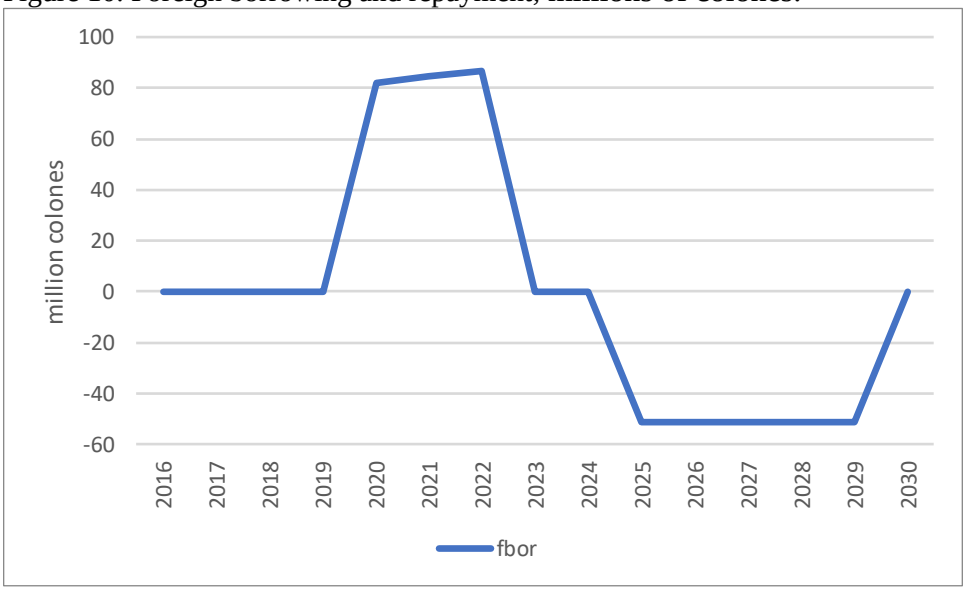
Figure 9. Equivalent variation by scenario, used for calculation of NPV from general equilibrium analysis; millions of colones.



Source: IEEM-CRI results.

Figure 9 shows the inputs used in the calculation of NPV from a general equilibrium perspective, considering investment financing through direct taxation (combi-tdir), through a non-reimbursable foreign grant (combi-fbor) and through a foreign loan that is repaid (combi-fbor-rp). To calculate NPV from a general equilibrium perspective, equivalent variation is an appropriate welfare measure to use as discussed in (Banerjee et al., 2019a). Figure 10 presents the time path of the foreign borrowing and the repayment of the loan.

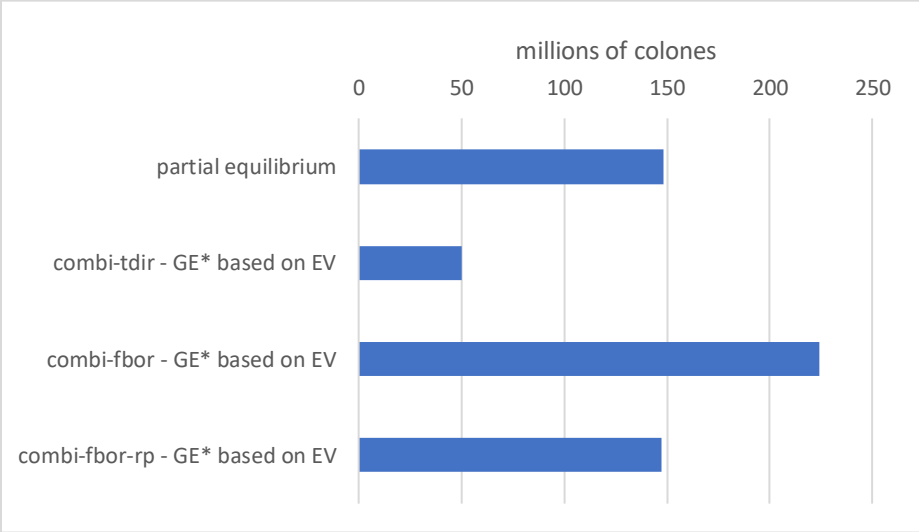
Figure 10. Foreign borrowing and repayment; millions of colones.



Source: IEEM-CRI results.

Figure 11 shows the results of the general equilibrium versus partial equilibrium results. The partial equilibrium approach yields an NPV of 148 million colones. While not a necessary consideration in the partial equilibrium analysis, consideration of investment financing is a necessary consideration in general equilibrium analysis where any expenditure must be met by equivalent income to respect model closure. Where household income taxes are used to finance the investment, NPV reaches almost 50 million colones. This relatively low NPV compared with the partial equilibrium result is derived from the fact that increased household taxation implies reduced consumption which exerts downward pressure on equivalent variation.

Figure 11. General equilibrium versus partial equilibrium cost benefit analysis; millions of colones.



*GE is general equilibrium.
Source: IEEM-CRI results.

Where non-reimbursable foreign financing is used to fund the investment, NPV is greater than the partial equilibrium case at 224 million colones. Finally, where foreign financing funds the investment and must be repaid, NPV is slightly lower than in the partial equilibrium case at 147 million colones. Thus, since general equilibrium analysis includes direct, indirect and induced effects in terms of both costs and benefits, the general equilibrium impacts of investments costs and loan repayment can result in a lower NPV than in the partial equilibrium case. We find that for public investment analysis, the general equilibrium approach is more realistic in capturing how an investment is implemented in an economy and how in effect it must eventually be repaid through future government revenues.

4.0. Conclusions

This paper applied the IEEM Platform to public tourism investment analysis in Costa Rica. Analysis with IEEM-CRI generated at least 5 important insights that are only possible with such an integrated framework. First, IEEM-CRI identified the tourism modalities that generated the highest returns for a given an increase in tourism expenditure. This information is particularly powerful for the design and targeting of public investment to enhance welfare. For example, Health tourism generates the greatest impact on GDP, while Business tourism followed by Leisure tourism are most effective in reducing unemployment. If, on the other hand, export earnings for generating foreign exchange earnings are the priority, Educational tourism would be the modality to target.

Second, it is important to consider the labor skill profile of the tourism sector vis a vis other economic sectors. If the tourism sector does not increase its share of skilled labor, expansion of the tourism sector could generate less returns than otherwise possible. A greater rate of expansion of one sector usually means that one or more other sectors could expand more slowly due to factor

scarcity and relative prices. If the other sectors that grow more slowly use a higher proportion of higher skilled and higher wage labor, overall welfare impacts would be less than optimal.

Third, IEEM-CRI shows changes in greenhouse gas emissions resulting from increased tourism demand. The *commodity composition of tourism demand by tourism modality* drives changes in emissions. In this application, we found that expansion of Business tourism demand generates the largest increase in emissions given this modality's demand for Taxi services. As Costa Rica moves toward electrification of its vehicle fleet, this impact will be less pronounced. Nonetheless, explicit consideration of climate change impacts of public investments and multilateral development assistance in particular can help generate a business case for mitigation measures that may facilitate access to additional sources of funding for the implementation of these measures. The Inter-American Development Bank's NDC Invest Accelerator is one such example of potential funding.

Fourth, IEEM-CRI sheds light on the government revenue implications of increased tourism demand. These results are largely driven by the tax rates faced by economic sectors that generate the goods and services consumed by each tourism modality. In our application, we found Cruise tourism to contribute the least to government revenues, with Health and Leisure tourism generating the greatest impact on government coffers.

Fifth and finally, IEEM-CRI's general equilibrium approach to cost benefit analysis is more robust and defensible than that possible with a partial equilibrium approach. The reason for this is three-fold. Partial equilibrium analysis of tourism investments seldom measures changes in societal welfare, rather it is typically based on expected changes in tourism expenditure. Our general equilibrium approach with IEEM-CRI directly measures changes in welfare represented by equivalent variation. Second, cost benefit analysis with IEEM-CRI captures direct, indirect and induced effects while a partial equilibrium approach is limited to direct effects. Third and most importantly, our approach captures the general equilibrium impacts of not only the benefits of enhanced tourism demand, but also the impacts of the costs incurred by governments through the financing of the investment. How the investment is financed affects societal welfare and these effects are non-trivial, and until now, have largely been omitted in cost benefit analysis of public investments in tourism.

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