

THE INTEGRATED ECONOMIC-ENVIRONMENTAL MODELING (IEEM) PLATFORM APPROACH TO TOURISM INVESTMENT ANALYSIS: AN APPLICATION TO COSTA RICA

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IEEM

TOURISM IN COSTA RICA

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 Costa Rica **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.

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 Policy Brief we apply our Integrated Economic-Environmental Modeling (IEEM) approach to Costa Rica to investigate:

- the differentiated impacts on the economy and environment of investments in different tourism modalities, namely Health, Education, Business, Leisure, and Cruise tourism and;
- the insights a whole of economy approach such as IEEM generates when compared to a sector-specific or partial analysis.

THE IEEM APPROACH

The IEEM Platform for Costa Rica (IEEM-CRI) is based on the IEEM framework described in previous Policy Briefs of this series. The value-added of the IEEM approach over a conventional economy-wide approach is:

- (i) IEEM's integration of environmental information organized under the United Nations' System of Environmental-Economic Accounting, the SEEA;
- (ii) specific environmental modeling modules that capture the dynamics of natural capital-intensive sectors;
- (iii) the indicators that IEEM generates speak to Ministries of Finance and include Gross Domestic Product (GDP), employment and income, but also capture policy impacts on wealth, well-being, natural capital and environmental quality, and;
- (iv) IEEM's extension for tourism sector analysis enables it to be applied to complex questions of public policy and investment in the various sectors that comprise the tourism industry.

IEEM-CRI takes as its starting point the framework developed in (Banerjee et al., 2019b) and is extended for tourism applications as described in (Banerjee et al., 2016). The baseline year of IEEM-CRI 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. IEEM-CRI has been linked to a microsimulation module to estimate policy impacts on poverty and inequality. The database for this model is built on Costa Rica most recent (2019) National Household Income and Expenditure Survey.

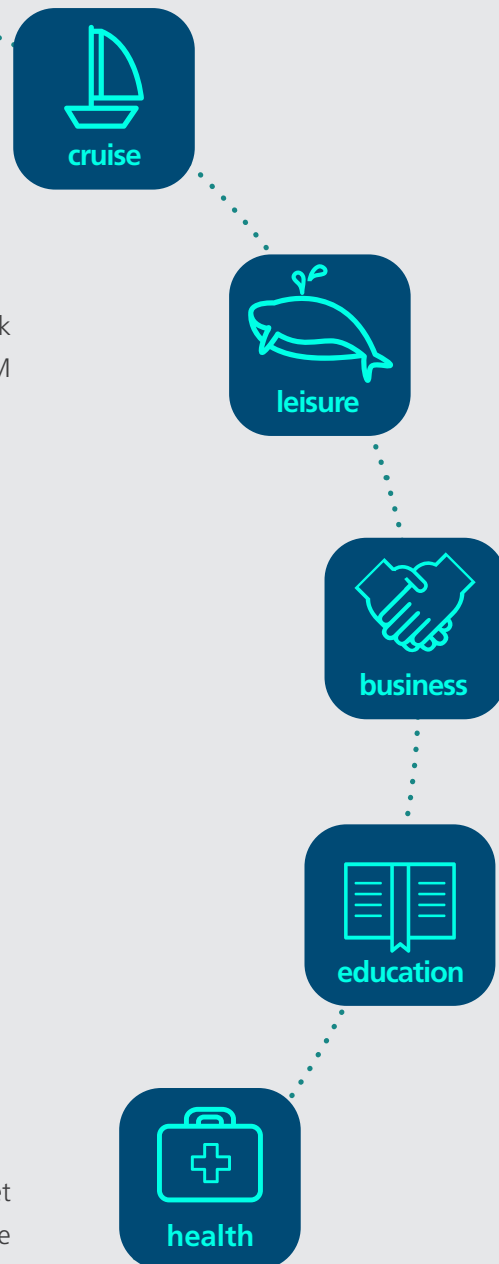


TABLE 1.

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	1.2	7.5	2.5	3.8	3.0
MANUFACTURING					
ELECTRICITY, GAS AND WATHER	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.

TABLE 1 shows the structure of consumption by tourism modality. For purposes of presentation, the 43 activities in IEEM-CRI were aggregated to the 12 shown in Table 1. 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.

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.

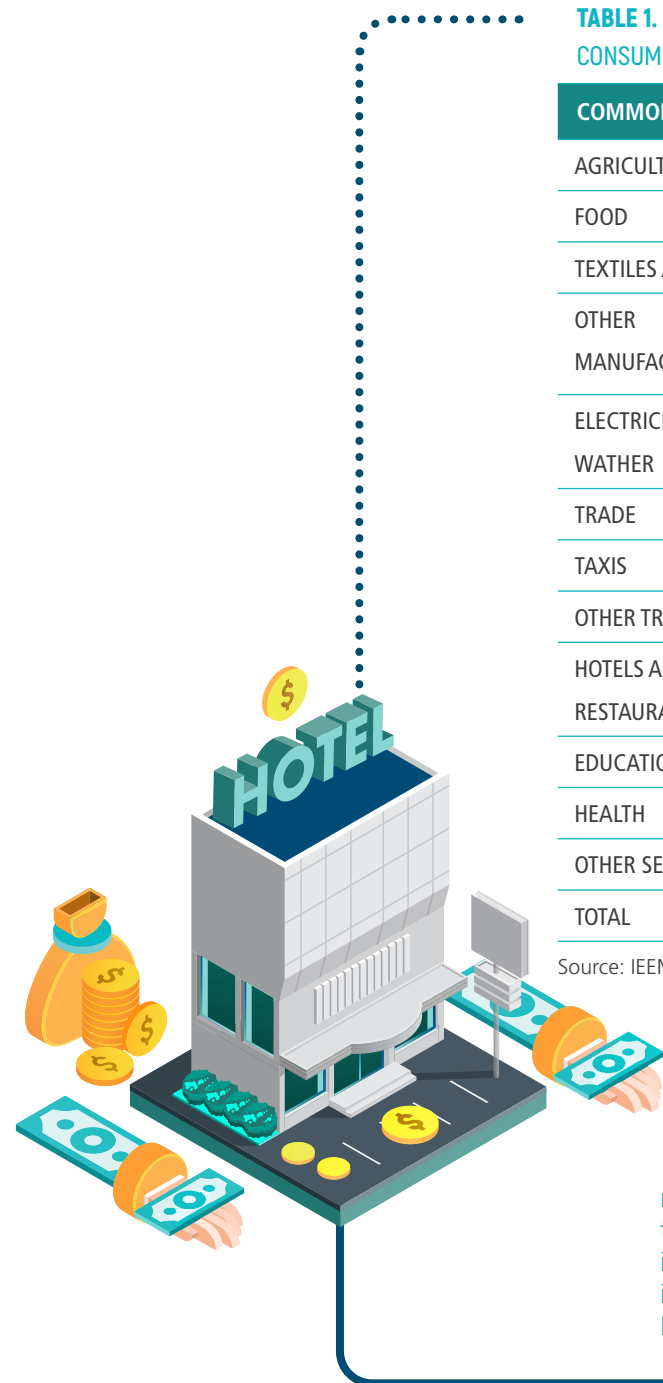
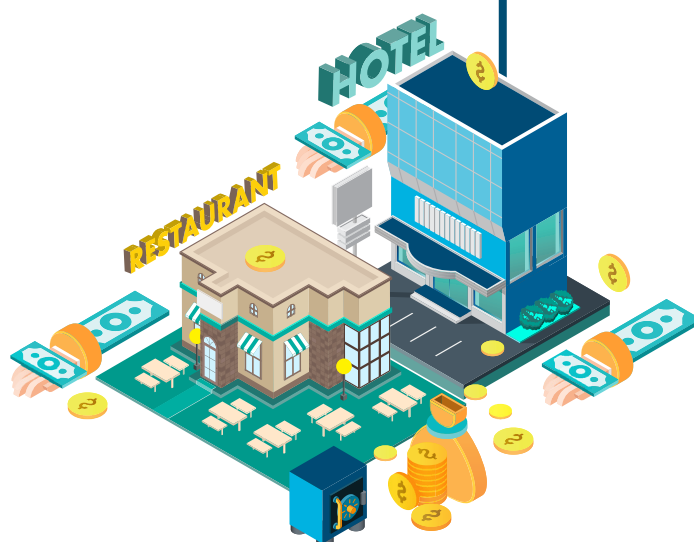


TABLE 2.
SECTORAL FACTOR INTENSITIES; PERCENT.

ACTIVITY	LOW- SKILLED LABOR	SEMI- SKILLED LABOR	SKILLED LABOR	CAPITAL	NATURAL RESOURCE	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 WATHER	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.

TABLE 2 factor intensities. 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%).



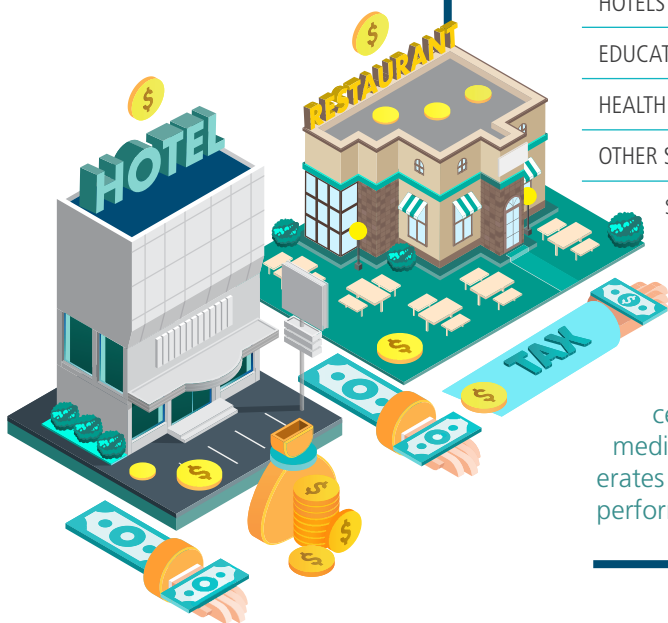
This information is of interest for public policy and investment in terms of the insights it provides especially for labor force development, for tourism as well as other economic sectors. Public policy oriented toward creating jobs for poorer segments of society could do well by promoting basic skills 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 3.
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 WATHER	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.

TABLE 3 shows sectoral wages per year per worker which shows 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.



SCENARIO ANALYSIS WITH **IEEM**: INCREASING TOURISM DEMAND

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 (US\$80.6 million in 2016 USD) during the period 2020-2030. 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.

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.

With the US\$80.6 million increase in tourism demand, Leisure tourism is the most important of the five modalities considered with an overall tourism expenditure increase of 3.8%. On the other hand, Cruise tourism has the least tourism expenditure, with the US\$80.6 million increase in tourism demand increasing overall Cruise tourism expenditure by over 1,103%.

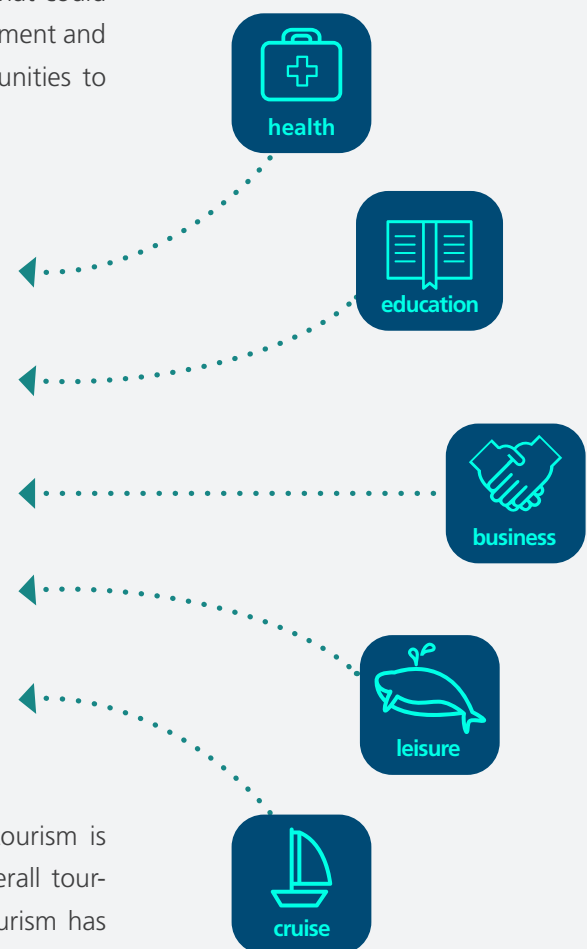


TABLE 4.

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 4 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.



FIGURE 1.

PRIVATE CONSUMPTION; ANNUAL PERCENT DEVIATION WITH RESPECT TO BASELINE.

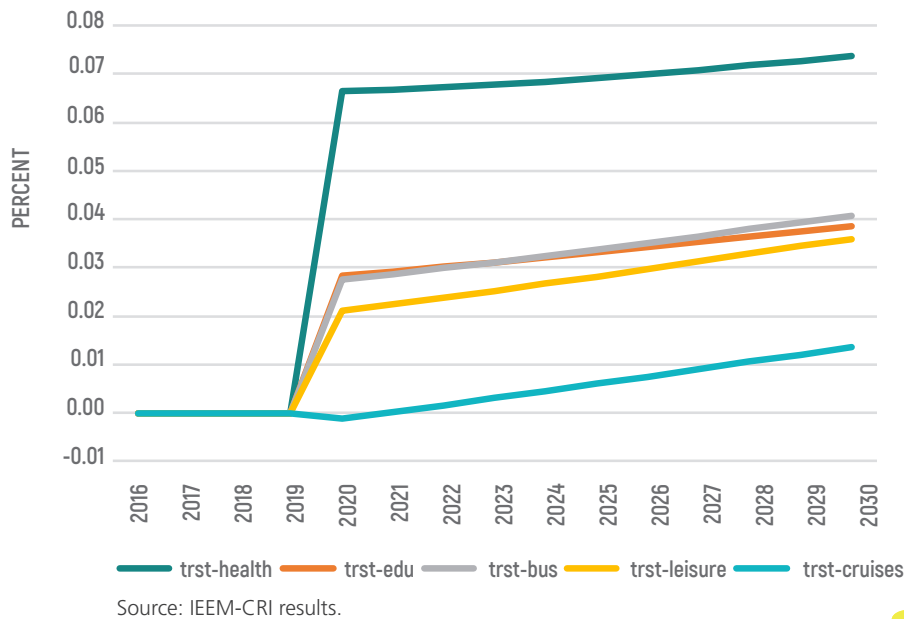
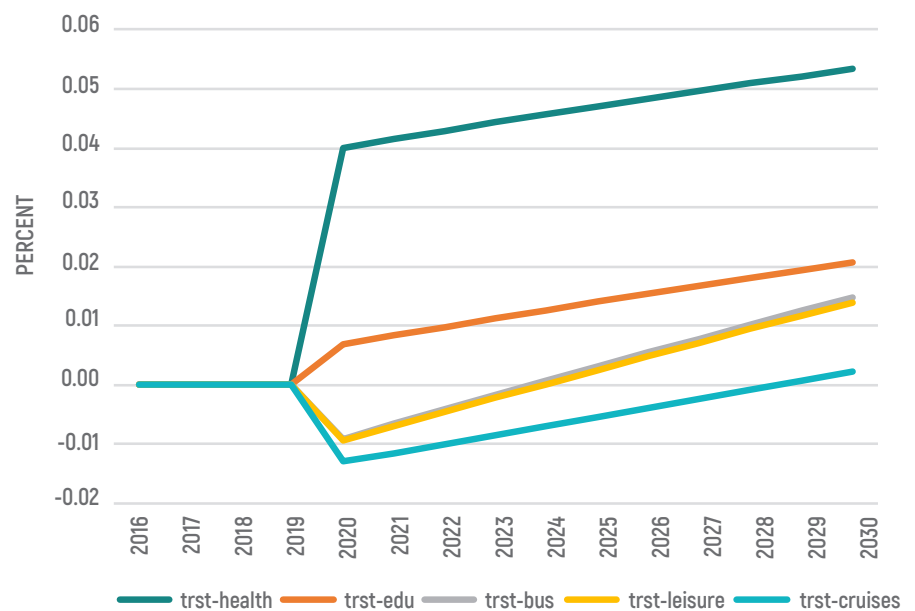


FIGURE 2.

GDP; ANNUAL PERCENT DEVIATION WITH RESPECT TO THE BASELINE.

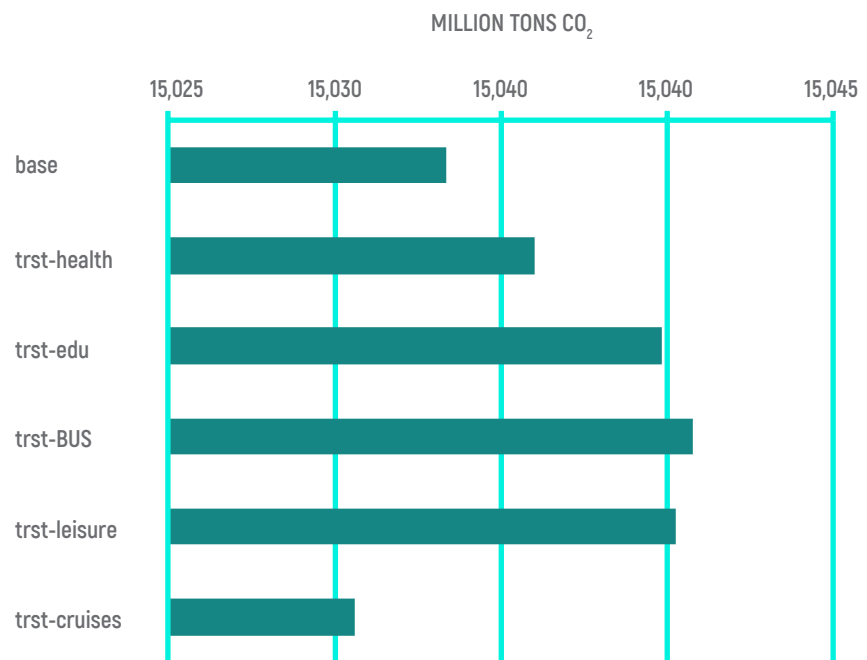


FIGURES 1 AND 2 show the time path for deviations from the baseline for private consumption and GDP, respectively, noting that changes in private consumption follow closely household welfare impacts. Figure 2 shows that the increase in tourism demand has a short-lived negative impact on GDP in the case of Business, Leisure and Cruise tourism, as Costa Rica's economy adjusts to the demand stimulus generated by these tourism modalities.

Analysis of the impacts at the sectoral level identifies winners and losers of the tourism 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.

FIGURE 3.

GREENHOUSE GAS EMISSIONS; MILLIONS OF TONS OF CO₂, DEVIATION WITH RESPECT TO THE BASELINE BASE IN 2030.



Source: IEEM-CRI results.

FIGURE 3 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 4.
CHANGE IN GOVERNMENT REVENUES; MILLIONS OF COLONES.

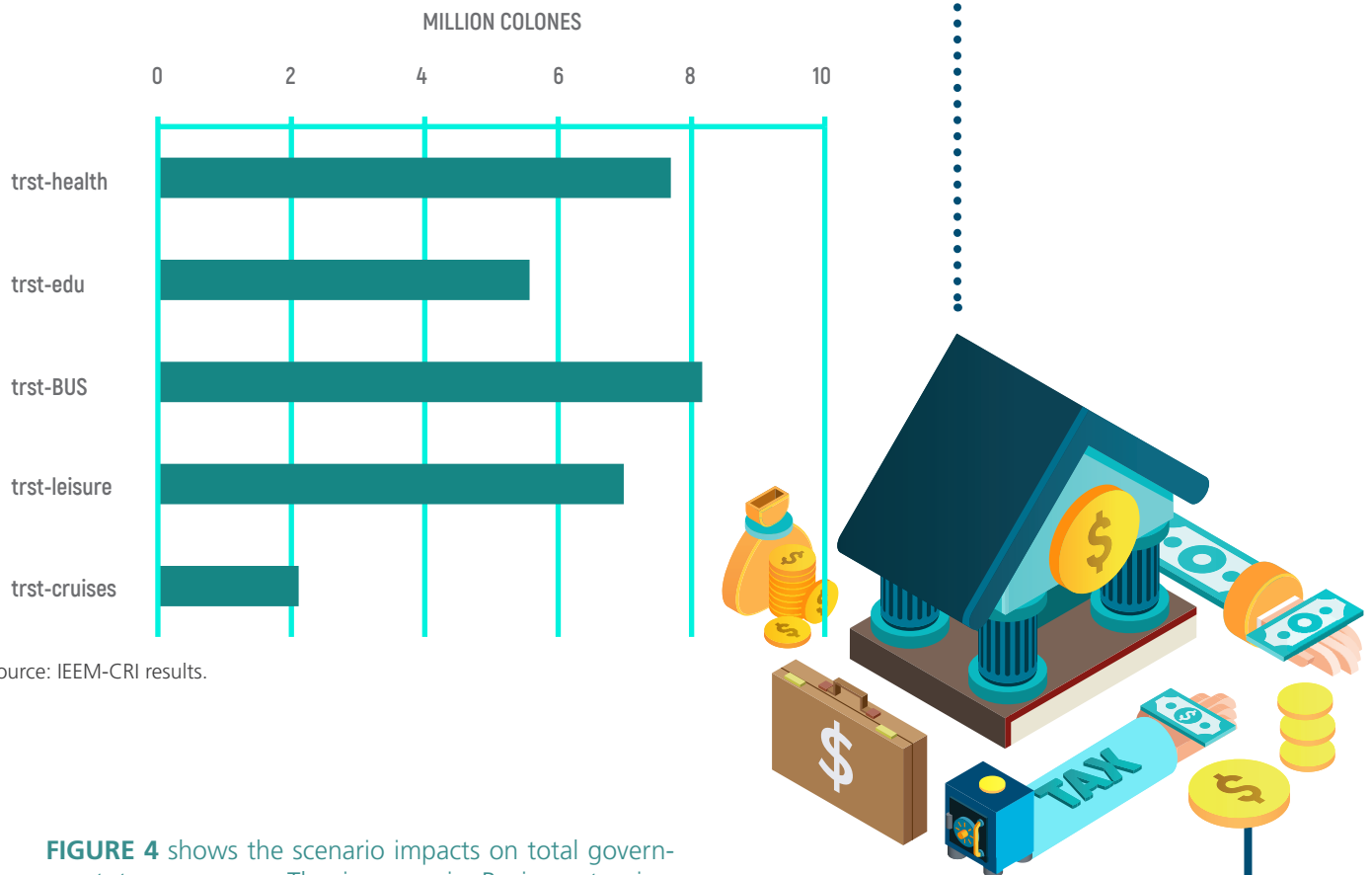


FIGURE 4 shows the scenario impacts on total government tax revenues. The increase in Business tourism demand generates the greatest increase in tax revenues, followed by Health, Leisure, Education and finally Cruise tourism.

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.

THE **IEEM** WHOLE OF ECONOMY APPROACH VERSUS PARTIAL SECTORAL ANALYSIS

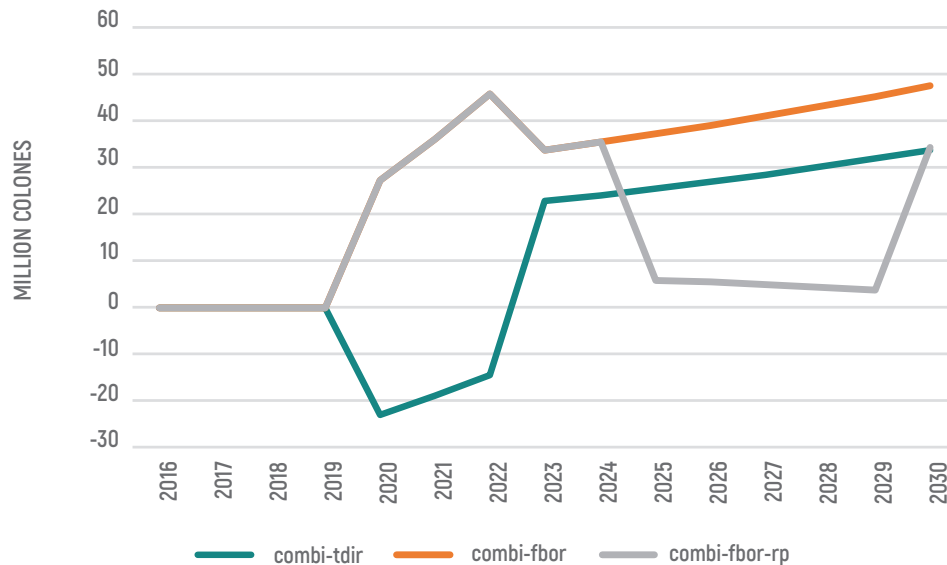
The IEEM Platform is based on a whole of economy, general equilibrium model. This type of general equilibrium model distinguishes itself from partial equilibrium models in that it accounts for all sectors of an economy and their interlinkages, thus capturing direct, indirect and induced impacts of public 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.

FIGURE 5.

EQUIVALENT VARIATION BY SCENARIO, USED FOR CALCULATION OF NPV FROM GENERAL EQUILIBRIUM ANALYSIS; MILLIONS OF COLONES.



Source: IEEM-CRI results.

FIGURE 5 shows the inputs used in the calculation of Net Present Value (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). The discount rate of 12% used is the standard rate used by some multi-lateral development banks.



FIGURE 6.

GENERAL EQUILIBRIUM VERSUS PARTIAL EQUILIBRIUM COST BENEFIT ANALYSIS; MILLIONS OF COLONES.

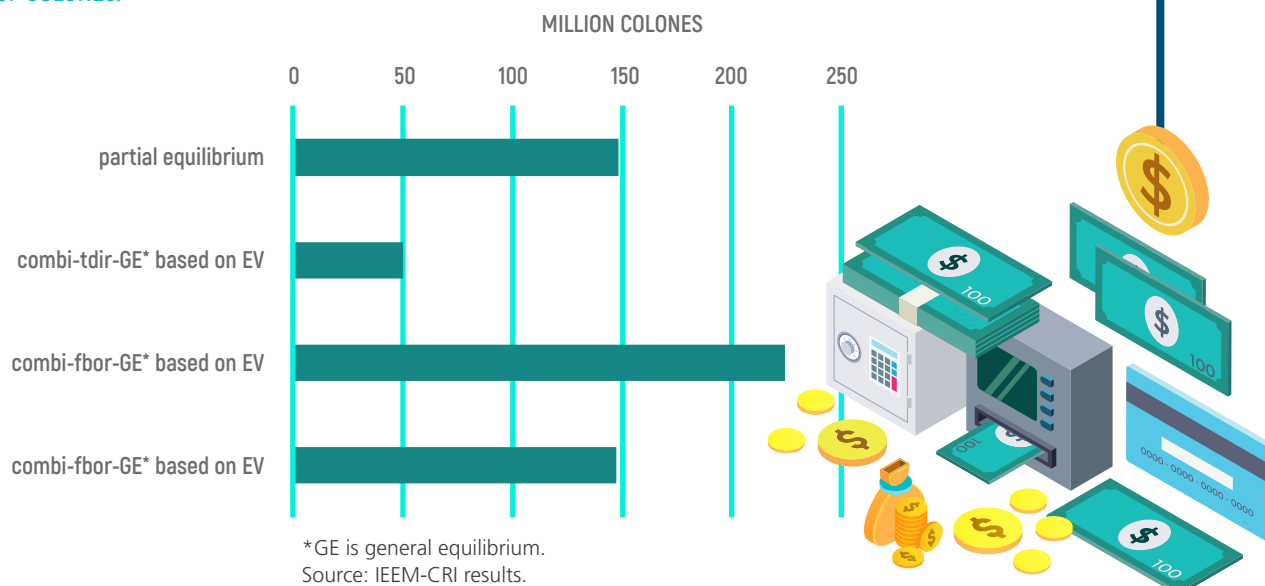


FIGURE 6 shows the results of the general equilibrium versus partial equilibrium approaches. The partial equilibrium approach yields an NPV of 148 million colones. While not a necessary consideration in the partial equilibrium analysis, consideration of investment financing is a necessary consideration in general equilibrium analysis where any expenditure must be met by equivalent income in this modeling framework. 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.

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.**

INSIGHTS FROM THE IEEM PLATFORM APPLICATION TO TOURISM INVESTMENT

This Policy Brief applied the IEEM approach to tourism investment analysis in Costa Rica. Five important insights arose from this application:

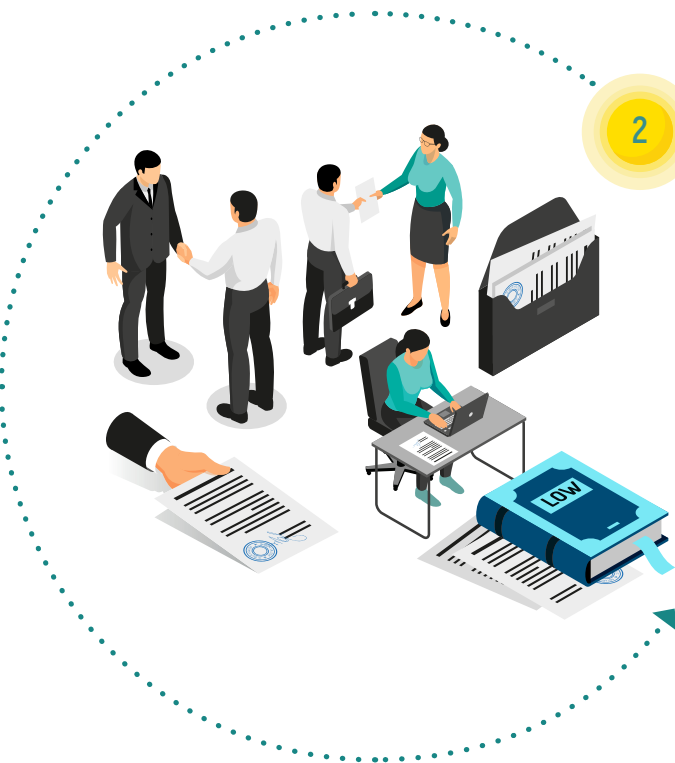
IEEM-CRI identified the tourism modalities that generated the highest returns for a given increase in tourism expenditure.

1 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.



It is important to consider the labor skill profile of the tourism sector vis a vis other economic sector.

2 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.



3

The IEEM approach 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.**

4

The IEEM approach 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.

5

IEEM's whole of economy approach to cost benefit analysis is more robust and defensible than that possible with a partial equilibrium or sector-specific 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 whole of economy approach with IEEM-CRI directly measures changes in welfare. 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.

MAIN FINDINGS:

Public investment in different types of tourism, from business to leisure tourism, has differentiated impacts on local economies, environment, people and government revenues. A fully integrated analytical approach such as the IEEM Platform is required to capture these multi-dimensional impacts.

- 1 Investing in a higher skilled labor force particularly in traditional tourism-related activities will improve household welfare.



- 2 Similar increases in demand across all types of tourism show that Health tourism generates the greatest impact on household welfare, while Business tourism has the best prospects for reducing unemployment.

- 3 Business tourism generates the largest increase in government revenues, but also has the largest greenhouse gas emission footprint



- 4 The whole of economy perspective of IEEM that captures direct, indirect and induced impacts results in a higher Net Present Value estimation of the investment..

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