10 Case study: Urban rejuvenation of a tourist destination

Juan L. Eugenio-Martin
Federico Inchausti-Sintes
Jose M. Cazorla-Artiles
Ubay Pérez-Granja

10.1 Introduction

This paper corresponds to a case study that seeks further understanding of the differences between Cost-Benefit Analysis (CBA) and Computable General Equilibrium (CGE) methodologies, in terms of project appraisal. The case study consists in the evaluation of the rejuvenation of a tourism destination. The purpose is to measure with CBA and CGE the social welfare obtained from the implementation of the project. CBA is approached with surpluses, whereas CGE employs the equivalent variation after project implementation. Specifically, it addresses the following key issues:

i) The valuation of non-market goods or services in a spatial context.
ii) The spatial spillover effects on nearby areas.
iii) Undesirable crowding-out effects on residents.
iv) The relevance of the induced effects in an economy with involuntary unemployment.

Rejuvenation may be required to restore the attractiveness of the urban environment and the competitiveness of a tourism destination. However, the quality of the urban environment is subjective and, more importantly, it belongs to the family of non-market goods. If the urban environment of a tourist destination improves, then tourists enjoy a better experience, and they are more willing to pay more at the destination. At the same time, businesses can grow, and may improve their sales. Hedonic price models are useful to deduce the role that the characteristics of certain products play in price setting. At tourism destinations, some key urban environments are far from hotels, or the relationship between them may be blurred. In contrast, this application employs this method in a novel way, by working with the prices of drinks served in the establishments. This has two advantages: the number of establishments is large and are more similar than hotels. Additionally, because the drinks chosen had to be homogeneous, the prices of coffee, water, beer, and coke are employed. Spatial econometric models are developed to estimate the willingness to pay for this qualitative improvement.

This application works on the spatial spillover effects of a project. It operates with two competing areas, meaning that a quality improvement in one also affects demand in the other. This spatial relationship is considered in the application of both CBA and CGE models. Additionally, if a tourist destination improves its quality and the tourists are willing to pay more for a better service, then it may crowd out local visitors who face higher prices. However, they may spend a similar amount somewhere else in the region. This is an issue explored in this application with both models.

Finally, this application also deals with induced effects. These effects are the result of an increase in production and income which are also partially consumed in local products and imports. They imply a second-round production effect, which is relevant for the project's impact, and must be taken into account to compare with the counterfactual for the net welfare effect under involuntary unemployment.

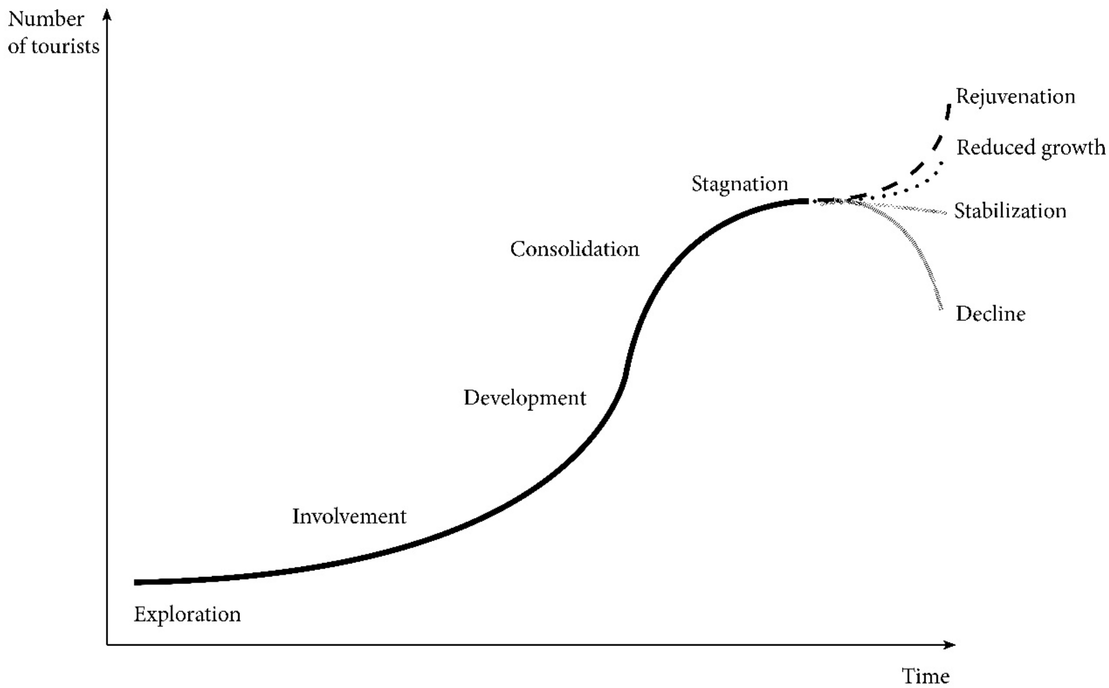
The tourism sector is of particular importance for many European regions. According to UNWTO (2018), in the European Union (EU), in 2014, the direct contribution of the industry contributed to value added at a factor cost of 2,734,494 million euros and required the employment of more than 57 million people. The tourism sector represents a significant share of the Gross Domestic Product (GDP) of many regional European economies. The most relevant countries are located in or around the Mediterranean Sea, i.e. Spain (10.9%), Portugal (9.2%), France (7.0%) and Italy (6.0%). The Covid-19 crisis aside, in recent decades tourist arrivals have shown a solid yearly growth of about 4% (UNWTO, 2018).

GDP partly depends on aggregate tourism expenditure at destinations. Such expenditure is the result of multiplying the number of arrivals, length of stay and daily expenditure per tourist. Tourism policies usually pursue the increase or sustainability of these three variables. Tourist arrivals depend on the relationship between each origin and destination in terms of distance and relative prices, but also on destination competitiveness, which in turn depends on destination accessibility, infrastructure, safety, attractiveness, climate conditions, or education, among many other factors.

Butler (1980) developed the Tourist Area Life Cycle (TALC) concept, which describes the stages that destinations usually experience over time (see Figure 1). Tourists starts visiting a destination as explorers, while later, the destination may be developed, and eventually may be consolidated. Eventually, the locations enter a stagnation period, which is usually followed by a decline, unless a rejuvenation process is applied.

In terms of the relevant literature, this paper is novel for three reasons. As far as we know, this is the first time that a rejuvenation project is assessed, the first time that a hedonic price model is applied to assess a local impact with the willingness to pay for drinking or eating and the first time that a tourism project appraisal (not economic impact) is assessed with CGE, and furtherly compared with CBA.

Figure 1. Butler's (1980) Tourist Area Life Cycle



10.2 Literature review

There is a lack of research related to economic valuation in tourism in comparison with other fields in the economy. Moreover, among the few works on economic evaluation, the literature has focused on the economic impact approach. According to Burgan and Mules (2001), in most sectors of the economy, public expenditure should be justified by measuring welfare changes through Cost-Benefit Analysis (CBA). However, government expenditure in tourism is usually justified in terms of economic impacts measured through a growth-based paradigm. As stated by Dwyer, Jago and Forsyth (2016) the traditional approach of impact analysis through Input-Output analysis (I-O) and Computable General Equilibrium (CGE) is not able to isolate the net effects on the economy. CGE models were not originally built for project appraisal, and further adaptation is required.

CBA has practically been inexistent in the tourism literature, and most of its applications are related to other sectors. For example, Raybould and Mules (1999) evaluated the protection of the northern beaches of Australia's Gold Coast with a CBA approach. The authors concluded that the loss in tourism receipts due to the beach erosion far exceeded the cost of protecting the beaches. Another economic evaluation of environmental impacts on tourism can be found in Tervo-Kankare, Kaján and Saarinen (2017), who analyzed changes in welfare resulting from shifting environmental conditions in Arctic Finland. Additionally, Hefner, Crotts and Flowers (2001) employed CBA to evaluate a 'fee-in-lieu of property tax' in South Carolina (United States), which consisted in tax incentives to attract the tourism industry. The cost and benefits were measured according to the Board of Economic Advisors (BEA) model, with some adaptations to include the particularities of the tourism sector such as the direct and indirect effects of tourism expenditure and taxes from the hospitality sector.

However, as aforementioned, most of the research related to economic evaluations has focused on the economic impacts of the events. Among those works, the use of CGE and I-O (Wood and Weng, 2020) are the most common. For instance, the literature has analyzed the effects of hosting a mega-event such as the Olympics. Specifically, Li, Blake and Cooper (2011) and Li, Blake and Thomas (2013) addressed the impact of the 2008 Beijing Olympics though a CGE model and concluded that the impact was not significant in comparison with the size of the economy and the ex-ante analysis. It shows how difficult it is to assess a local event with national accounts. However, Allan, Lecca and Swales (2017) successfully employed a CGE model to investigate the impact of the Glasgow 2014 Commonwealth Games on the local economy.

Events are not the only tourism activities evaluated in the literature, as policies have also been studied. Inchausti-Sintes and Voltes-Dorta (2020), for example, analyzed the impact of the 'tourism moratoria' in Spain's Canary Islands. This policy consisted in prohibiting the building of any kind of tourist accommodation, except 5-star hotels. Further, some authors have also applied economic evaluation to public investment on tourism infrastructure. Banerjee, Cicowicz and Moreda (2019) combined CGE and CBA methods to evaluate, from the perspective of a multilateral bank, an investment project in tourism infrastructure in Uruguay.

The combined vision of CGE and CBA can be of particular interest to tourism researchers. On the one hand, it provides information about the economic impacts, such as changes in tourism expenditure, number of visitors, employment, or GDP, which governments and other stakeholders are interested in. On the other, assessments in terms of net welfare (event, policy, or infrastructure) provides a measurement of the project's social desirability. To date, the two methods have been applied separately and CGE has not been employed as a tool for welfare appraisal in the tourism literature (see Table 1). In contrast, our work considers CGE as a method for policy appraisal and compares its assumptions and results with CBA.

Table 1. Summary of main economic evaluation studies in tourism related projects

Authors	Year	Country	Methodology	Topic
Raybould and Mules	1999	Australia	CBA	Beach protection and its effect on tourism receipts
Hefner *et al*.	2001	USA	CBA	Tax incentives to the tourism industry
Li *et al*.	2011	China	CGE	2008 Beijing Olympics
Li *et al*.	2013	China	CGE	2008 Beijing Olympics
Tervo-Kankare *et al*.	2017	Finland	CBA	Response of tourism industry to environmental changes
Allan *et al*.	2017	UK	CGE	Glasgow 2014 Commonwealth Games
Banerjee *et al*.	2019	Uruguay	CGE+CBA	Evaluation of public investment in tourism
Wood and Meng	2020	Korea	I-O	2018 Pyeongchang Winter Olympics
Inchausti-Sintes and Voltes-Dorta	2020	Spain	CGE	Restrictions to building new accommodation

10.3 Methodology

10.3.1 Non-market valuation with hedonic price models

This paper relies on the hedonic price model to estimate the willingness to pay (WTP) of tourists to improve the urban environment of a destination. These kinds of models have a long tradition in the environmental valuation literature, especially to estimate the value of air quality within the real estate market (Smith and Huang, 1993). In tourism, they have been employed to identify what underpins accommodation choice. For instance, Latinopoulos (2018) estimates valued added for sea views on hotel rates, and Rui and Soora (2022) estimate the value of streetscape features for P2P accommodation. In sum, it is a well-known and established method in the literature (Papatheodorou, Lei and Apostolakis, 2012).

Urban rejuvenation has an impact on WTP for the whole tourist experience, especially for leisure walking, but also when eating and drinking outside. However, this type of regeneration may have a local impact, which sometimes may not extend further. Hence, in order to deal with this, we have decided to specifically consider price impact on eating and drinking establishments. This approach has two advantages: on the one hand the spatial impact can be identified and, on the other, the products served can be perfectly compared. We employ the prices of a small black coffee, coke, water, and beer, because they are standard products that can easily be compared among establishments. Moreover, control variables such as size, container, brand, kind of establishment and location are taken into account. The equilibrium hedonic price function takes the following form:

$$p = h(z, \alpha), \tag{1}$$

where p is the price of a standard drink, z is the vector of attributes and α is a vector of parameters describing the shape of the hedonic price function; while α is usually unknown and its uncertainty is part of the random error. Since the hedonic equation is an outcome of a market equilibrium, several implications can be taken from that. Haab and McConnell (2002) state that the welfare change after a variation in the vector of attributes takes place is the following:

$$WTP = h(z^*) - h(z), \tag{2}$$

where $h(.)$ represents the hedonic price function and z^* denotes the new vector of attributes. More precisely, the amount that tourists will gain is given by the following implicit WTP:

$$u(y - h(z) - WTP, z^*; \beta) = u(y - h(z), z; \beta). \tag{3}$$

where u denotes the utility function, β denotes the parameter of the preference function and y denotes the household income. Thus, WTP is the maximum amount of income that the tourists will give up to obtain the new vector, provided the hedonic function remains the same and βs are known. However, the βs are subjected to an identification problem because they cannot be identified from the equilibrium conditions. According to Haab and McConnell (2002), a feasible procedure is to employ a 'bid function' instead, which is the solution to the following expression:

$$u(y - B(y, z; \beta), z; \beta) = u^0, \tag{4}$$

where $B(y, z; \beta)$ represents the 'bid function', i.e. the amount that the household with preferences β will pay for the bundle z when their alternative choices allow them utility level u^0. Moreover, they conclude that:

$$\frac{\frac{\partial u(x, z; \beta)}{\partial z_c}}{\lambda} \equiv B_c(x, z; \beta) = \frac{\partial h(z)}{\partial z_c}, \tag{5}$$

where λ denotes the marginal utility of income and z_c denotes the marginal cost of z. Hence, in practice, the estimated WTP can be approximated as the marginal change of the hedonic price function, i.e.:

$$\widehat{WTP} = \Delta z_c \frac{\partial h(z)}{\partial z_c}. \tag{6}$$

Two conditions need to be met in order to obtain reliable WTP values. On the one hand the $h(z)$ function needs to be properly specified, and on the other, the marginal change should not imply the need for a new hedonic function (Bartik, 1988).

Hedonic price models of tourism establishments

The model specification is critical to obtain unbiased estimates of the WTP. We believe that the experience of drinking a coffee, or a beer, goes beyond swallowing the products. We assume that three sets of variables matter: i) the environment; ii) location; and iii) product characteristics.

10.3.1.1 The environment

The whole environment makes a difference to the enjoyment experienced. The environment comprises:

- The natural environment, such as the beauty of the natural surroundings or sightseeing.
- The urban environment, in terms of cleanliness, safety or tidiness, as well as its beauty and integration with the natural environment.
- The local environment, where the quality of the establishment in architectural terms, furniture, and/or service is important.

In particular, the relevance of the urban environment is the key determinant to be estimated. However, this parameter may be subject to an identification problem, especially if the different kinds of environment are related. When multicollinearity is present, the parameter estimates cannot show reliable values to be treated independently of the other parameters. A solution to this problem is the application of instrumental variables.

10.3.1.2 Location

If the establishment is close to a tourist destination, then it has got a spatial advantage with respect to other establishments. The result of this particular equilibrium raises prices, meaning that this proximity factor needs to be considered in controlling prices. Moreover, nearby establishments may belong to a spatial cluster that may share a common characteristic that is not easily measured, but that exists. To control for such latent spatial effects, the error component is spatially lagged according to a spatial weight matrix that employs an inverse-distance weight.

10.3.1.3 Product characteristics

The volume size of the product, the brand, and the bottling quality matters for the price, so that they are considered to control for the product characteristics.

Hence, the hedonic price function is the following:

$$h(z_e) = f(l_e, u_e(n_e, b), x, W\varepsilon), \tag{7}$$

where l denotes the local environment of establishment e, u_e denotes the urban environment of establishment e, which is instrumented with the natural environment n and whether it is located at the seafront or not (b), x denotes the product characteristics, W denotes the spatial weight matrix and ε denotes the error term, so that $W\varepsilon$ denotes the spatially weighted error term. This hedonic price function may be estimated with an instrumental variables spatial model regression with spatially lagged error term. From this model, the WTP can be estimated and employed as an input for the CBA analysis and for the CGE model, as shown below.

10.3.2 Cost-Benefit Analysis

Let us consider a representative consumption good of a tourism market. It is expected that the initial demand shifts upward, which is caused by generated demand and the increase in WTP thanks to the project. Three effects will take place simultaneously:

- New tourists and residents will be attracted to the destination.
- Some of the current tourists and residents will remain and consume at the destination, at higher prices.
- Some of the current tourists and residents will leave to go to other destinations. Thus, other destinations will face a similar but smaller shift in demand. This effect occurs depending on the degree of substitutability between both destinations (which is relevant only if there is distortion).

10.3.2.1 Producer surplus in the main market

The demand shift implies an increase of the prices charged to all current tourists and residents. Moreover, this effect is distributed to both producers and taxpayers. The change in the producer surplus (*PS*) can be measured as:

$$\Delta PS = \int_{p_0}^{p_1} q_s(p)\, dp, \tag{8}$$

where $q_s(.)$ denotes the supply function of a consumption good of the tourism market, while p denotes prices, using a subscript 1(0) to denote the final (initial) level of prices.

Assuming a lineal approximation and the introduction of an *ad-valorem* tax (t), we can apply the following expression:

$$\Delta PS = \left(\frac{1}{1+t}\right)\frac{1}{2}(p_1 - p_0)(q_0 + q_1). \tag{9}$$

where q_0 and q_1 denotes quantity demanded at prices p_1 and p_0, respectively.

10.3.2.2 Consumer surplus in the main market

The new tourists and residents will be willing to pay higher prices to enjoy a better quality experience. The same happens with some of the current tourists and residents who remain paying higher prices as well. This demand shift implies an increase in the consumer surplus. It should be noted that if the tourists belong to a population that is out of the scope of interest for the welfare function, they should not be considered. For instance, if the tourists are foreigners they may be excluded (Johansson and de Rus, 2019). However, in tourist destinations, since part of the consumption corresponds to residents, the effects on the residents' consumer surplus cannot be ignored. Let's denote the share of residents' consumption with respect to tourists by α. Thus, after the rejuvenation, the consumer surplus of the residents can be approximated as follows:

$$\Delta CS = \alpha\left(\int_{p_1}^{\overline{p_1}} q_{d_1}(p)\,dp - \int_{p_0}^{\overline{p_0}} q_{d_0}(p)\,dp\right), \tag{10}$$

where $q_{d1}(.)$ and $q_{d0}(.)$ denotes the demand function of a consumption good of the tourism market with the project (with reservation price $\overline{p_1}$) and without the project (with reservation price $\overline{p_0}$) respectively.

If the demand function is linear:

$$\Delta CS = \alpha\left[\frac{1}{2}(\overline{p_1} - p_1)q_1 - \frac{1}{2}(\overline{p_0} - p_0)q_0\right]. \tag{11}$$

10.3.2.3 Taxpayers' surplus

From a local perspective, the taxes accrued from the tourists represent a cash inflow for the economy. The change in the taxpayers' surplus can be measured as follows:

$$\Delta TS = (1-\alpha)\left[\frac{t}{1+t}(p_1 - p_0)(q_1 - q_0)\right]. \tag{12}$$

10.3.2.4 The crowding out effect over other goods consumed by the local population

The tourists consume local products. This means that an increase in the number of tourists also shifts demand on these products, increasing the price of these goods and reducing local consumption, while the quantities supplied go up, i.e., tourism demand is supplied with new production and with the crowding out of some local consumption. According to Johansson and de Rus (2019), the net welfare effect on this local market is positive.

10.3.2.5 Mature destinations versus developing destinations, the relevance of shadow pricing

Since the tourism destinations are assumed to have unemployment, this means that wages do not reflect the social opportunity costs of labour. In these cases, the net benefits exceed the aforementioned positive welfare effect because we should correct the supply function to count only the opportunity cost of workers employed after the expansion of production.

10.3.2.6 Non-resident owned businesses

Most international guidelines omit foreign business from the welfare analysis. In the case of tourism, the share of business owned by non-residents could be significant, especially in the accommodation sector in developing destinations. This idea is fully discussed in Johansson and de Rus (2019).

10.3.3 Computable General Equilibrium approach

The model has been calibrated according to Canary Islands economy Input-Output tables for 2005, programmed in MPSGE (Rutherford, 1999) and adapted from Inchausti-Sintes and Voltes-Dorta (2020). Briefly, it is composed of 21 sectors providing the following goods/services: “Agriculture and fishing”, “Energy and mining”, “Processed food, beverages and tobacco”, “Textiles”, “Industry”, "Construction", "Trade", "Accommodation", "Catering services", "Road transport", "Maritime transport", "Air transport", "Other transport services", "Travel agencies", "Real estate", "Rent a car", "Entertainment", "Other services", "Public services", "Education" and "I+D". In terms of economic agents, the model assumes a central government, a representative household and tourists. Government demand is assumed to behave according to a Leontief function, predominantly because it faces rigid demand. However, for the household and tourists, demand is assumed to be a Cobb-Douglas function because it allows for a more flexible substitution among alternative goods and services.

Both domestic and import goods are assumed to behave as imperfect substitutes. Hence, the intermediate and final demands of this economy are satisfied with Armington goods (Armington, 1969). Labour (L) and capital (K) are perfectly mobile among sectors, while all markets operate under competitive market postulates. Regarding *model closure,* it is assumed that the government deficit and the current account deficit are fixed (small-open economy assumption), the labour market operates with involuntary unemployment and the model follows a savings-driven investment decision. The elasticities of imports and domestic goods, and the elasticities of capital and labour in the production function are sourced from Hertel (1997). The main equations of the model are summarized in the following subsections:[1]

10.3.3.1 Armington goods

Armington goods are defined according to the following expression:

$$A_i = \gamma \left(\chi_i D_i^{1-\frac{1}{\sigma_{dm}}} + (1-\chi_i) M_i^{1-\frac{1}{\sigma_{dm}}} \right)^{\frac{1}{\sigma_{dm}-1}}, \tag{13}$$

where A_i represents a vector of Armington goods (Armington, 1969), which allows for imperfect substitution between domestic and import goods. Subscript i refers to commodities, which are generated by combining both imports (M_i) and domestic goods (D_i) for each good i into a composite Armington good. This good can be either demanded as intermediate (*inputs*) or final demand (consumed or devoted to investment by the representative household and government). Thus, all the goods in the economy

[1] Taxes have been omitted from the equations for the sake of clarity.

are demanded to generate Armington goods. Such aggregation is carried out according to a constant elasticity of substitution (CES) function (equation 13), where γ, χ_i and σ_{dm} denote the scale parameter, the value share of domestic goods, and the elasticity of substitution of domestic and imported products, respectively.

10.3.3.2 Sectoral production

When Armington goods are demanded as intermediate goods, they are transformed according to a nested production function (see equations 14 and 15). In the first nest, each activity (a) demands capital (K_a) and labour (L_a) according to a CES function to form a composite good (va_a). η, ϕ and ρ denote the scale parameter, the value share of capital and the elasticity of substitution by activities, respectively. In the second one, intermediate goods ($id_{i,a}$) are demanded together with va_a according to a Leontief function to determine the total production by activities ($actv_a$).

$$actv_a = min\left\{\min \frac{id_{i,a}}{\beta_{i,a}}, \frac{va_a}{\alpha_a}\right\}, \tag{14}$$

$$va_a = \eta_a(\phi_a K_a{}^{\rho} + (1-\phi_a)L_a{}^{\rho})^{\frac{1}{\rho}} \text{ being } \rho = \frac{\sigma_{va}-1}{\sigma_{va}}. \tag{15}$$

For each activity, production is disentangled into domestic (D_i) and export goods (X_i) by using a Constant Elasticity of Transformation function (CET) (Gilbert and Tower, 2013) (see equation 16). However, a previous step should be taken by aggregating the commodities production of each activity according to the following equation: $Y_{i,} = \sum_a \psi_{i,a} actv_a$, where $\psi_{i,a}$ represents the value share by goods and activities. The parameters ε_i, δ_i and T of equation 16 denote the scale parameter, the value share of domestic goods and the elasticity of transformation between domestic and export goods, respectively.

$$Y_{i,t} = \varepsilon_i\left(\delta_i D_{i,t}{}^{(1+T)} + (1-\delta_i)X_{i,t}{}^{(1+T)}\right)^{\frac{1}{T}}, \tag{16}$$

10.3.3.3 Households and government

As already noted, Armington goods (A_i) can also be demanded by the representative household (H) and the government (G) as final goods (final consumption and investment). Both are assumed to be rational agents that take the optimal decision within their respective income constraints. In the case of households, they are constrained by the fixed endowment of capital ($\overline{K_H}$) and labour ($\bar{L}$), and the current account deficit ($\overline{CC}_H$), so that $H = r\bar{K}_H + w\bar{L} + rer\overline{CC}_H$, where r, w and rer denote the cost of capital, wage and real exchange rate, respectively.

In the case of the government, its income constraint comes from its fixed endowment of capital ($\bar{K}_G$), current account deficit - that is assumed to be fixed ($\overline{CC}_G$) - and the collection of taxes (net of subsidies): $G = r\bar{K}_G + rer\overline{CC}_G + taxes$. Thus, the total capital endowment is $\bar{K} = \bar{K}_H + \bar{K}_G$. The total endowment of labour and capital are demanded by the economic activities, such that $\bar{L} = \sum_a L_a$ and $\bar{K} = \sum_a K_a$, which generate incomes for both agents. The sectoral demand of both factors is defined as follows, where $Pactv_a$ denotes the price by sectors:

$$K_a = {\eta_a}^{\sigma_{va}-1} \left(\frac{(1-\phi_a)Pactv_a}{r}\right)^{\sigma_{va}} actv_a \ , \tag{17}$$

$$L_a = {\eta_a}^{\sigma_{va}-1} \left(\frac{\phi_a Pactv_a}{w}\right)^{\sigma_{va}} actv_a \ . \tag{18}$$

Given the rents obtained from the endowment, the representative household demands investment (INV^H) and consumes goods (C^H), fulfilling its income constraint such that: $Inv^H + C^H = H$. The total demand of goods follows a Cobb-Douglas demand function: $C^H = \frac{\lambda^H}{P_H} H$, where λ^G denotes the share of total consumption in the total budget and P_H represents the final price of the household's total consumption. At the same time, the total consumption is composed by the i goods and services demanded by the representative household (c_i^H), which follow a Cobb-Douglas demand function ($c_i^H = \frac{\alpha_i}{Pa_i} C^H$), where α_i is the share of good i in the basket of goods, whereas Pa_i denotes the Armington price of good i. P_H is obtained using a Cobb-Douglas cost function ($P_H = \prod_{i=1}^{19} \left(\frac{Pa_i}{\alpha_i}\right)^{\alpha_i} C^H$) and represents the consumer price index.

Following with the representative household, its total investment demand is: $INV^H = \frac{(1-\lambda^H)}{P_{inv}} H$, where $(1-\lambda^H)$ denotes the share of the total investment in the income constraint and P_{inv} is the price of the investment. As in the case of the total consumption, the total investment is composed of i goods, demanded as investment. In this case, these investment goods follow a Leontief demand function: $inv_i^H = \mu_i INV^H$, where μ_i denotes the share of investment good i in the total investment demand (INV^H). Similarly, the price of the investment is obtained algebraically as P_{inv}=$\sum_{i=1}^{19} \mu_i \, Pa_i INV$, with $INV = INV^H + INV^G$, where INV^G denotes the total investment demand of the government.

In terms of the government, its income constraint is devoted to demanding investment (INV^G) and consumption (C^G), such that ($INV^G + C^G = G$). However, in this case, its behaviour follows a Leontief demand function (fixed proportions). As a result, the total demand of goods and investment is: $C^G = \lambda^G G$ and $INV^G = (1 - \lambda^G)G$, where λ^G and $(1 - \lambda^G)$ denote the share of total consumption and total investment in the budget of the government, respectively. Hence, the consumption and investment by goods are: $c_i^G = \vartheta_i C^G$ and $inv_i^G = \tau_i INV^G$, where ϑ_i and τ_i denotes the share of good i in the total basket of goods and the share of the investment good i in the total investment, respectively. The price of government goods is obtained as P_{gov}=$\sum_{i=1}^{19} \vartheta_i \, Pa_i C^G$. The cost of investment (P_{inv}) is similar to the case of the representative household, as previously shown.

10.3.3.4 Tourists

In line with the objectives of this research, we consider an additional agent in this economy, which are the tourists. This agent demands goods and services (c_i^{Tour}) according to the following Cobb-Douglas demand function:

$$c_i^{Tour} = \frac{\theta_i}{Pa_i} C^{tour} \,, \tag{19}$$

where θ_i denotes the share of good i in the total basket of tourists' goods. The income balance constraint is their expenditure level multiplied by the real exchange rate such as $C^{tour} = rer \cdot exp$. Information about tourist expenditure is collected from the Canarian Statistical Institute (ISTAC), which draws on information from the Tourism Satellite Account (TSA).

10.3.3.5 Unemployment

Finally, the model also assumes the existence of unemployment, which is modelled according to the following condition: $w \geq P_H$ or, similarly $\frac{w}{P_H} \geq 1$. This introduces a minimum wage constraint (real wage curve): an unemployed person is willing to work if the real wage (w) compensates, at least, the consumer price (P_H), already defined above as $P_H = \prod_{i=1}^{19}\left(\frac{Pa_i}{\alpha_i}\right)^{\alpha_i} C^H$. As noted by Rutherford and Light (2001) when modelling unemployment in the Colombian economy, this real wage curve is obtained from $\frac{w}{P_H} = U^{-1/\theta}$. When θ approaches ∞, the real wage curve shows a downward-rigid real wage, as stated in the neoclassical approach. Mathematically, unemployment is introduced into the model as follows: $H = r\overline{K}_H + rer\overline{CC}_H + w\left(\frac{\bar{L}}{(1-\overline{U_0})}\right) - w\left(\frac{\bar{L}}{(1-\overline{U_0})}\right)U$, where U is a variable denoting the unemployment rate, whereas $\overline{U_0}$ is a parameter denoting the initial unemployment level, which is equal to 0.189.

10.3.4 Comparing CBA and CGE

It should be noted that CBA and CGE are both rooted in the same economic theory[2] (Arrow-Debreu). However, in practice, there are empirical concerns that may cause divergence between both methodologies. More specifically, they use different “starting points”. In the case of our example, the rejuvenation policy occurs at local level where CBA operates efficiently. However, the CGE model is calibrated with the regional Inputs-Outputs Tables of the Canary Islands’ economy. Hence, we must reconcile and combine both methodologies because CBA works at local level, whereas CGE represents the whole regional economy. For this case study, the following issues are discussed: a) induced effects; b) linearization; c) re-scaling; and d) elasticities.

10.3.4.1 Induced effects and involuntary unemployment

Most economies experience some degree of involuntary unemployment. When assessing the social welfare impact of an investment project this situation may matter for the analysis. According to Johansson and Kriström (2022), the reservation wage overestimates the social cost of unemployment, such that careful analysis is required. In order to understand the role of unemployment on the social welfare variation, the

[2] See de Rus (2023) and Inchausti *et al.* (2023) for details.

authors show that, under certain assumptions, the effects are located among: i) the unemployed; ii) the firm; and iii) the government.

i) Net new employees

The social welfare variation considering net new employees depends on three issues: net wage, unemployment benefits (m^B) and the opportunity cost of working ($CV^L > 0$). Thus, their social welfare variation is summarized by the following expression: $[(1-t)wL - m^B - CV^L]$, where *t* denotes income tax, *w* denotes hourly wage and L denotes the number of working hours. In other words, the current unemployed will be willing to work if the net wage is higher than unemployment benefits and the opportunity cost of working.

ii) The firm

The firm is expected to increase production (*x*), which increases income depending on the price level (*p*). Thus, their social welfare grows according to the following expression: $[p\Delta x - wL]$.

iii) The government

Once an unemployed person is employed, the government stops paying unemployment benefits and starts accruing income taxes, so that its social welfare varies according to the following expression: $[twL + m^B]$.

Hence, by totalling all changes in social welfare for all agents, we obtain that:

$$\Delta S = [(1-t)wL - m^B - CV^L] + [p\Delta x - wL] + [twL + m^B] = p\Delta x - CV^L \quad (20)$$

It can be easily proved that $p\Delta x - CV^L > 0$ by considering the role of wL. It should be noted that $p\Delta x > wL$ is a condition that needs to be met by firms to increase production. Moreover, $CV^L < wL$ is a condition that needs to be met by the unemployed to be willing to work. Hence, $p\Delta x > wL > CV^L$ and $p\Delta x - CV^L > 0$, which means that by decreasing unemployment, social welfare increases. This matters for the induced effects triggered by any project.

The induced effects are a second-round income effect that occur in the economy after any shock in consumption. In this case study, following rejuvenation, income rises because unemployment is reduced, and firms earn higher profits. This higher income leads to higher consumption and increases production and income, which is known as the induced effect. This effect happens across the whole economy and not necessarily only in the project's markets of interest. However, this induced effect does not have to be measured in CBA when the counterfactual is expected to have similar effects. In CGE, the induced effects are computationally always part of the results, so that, for a net welfare effect estimation using CGE, and an adequate comparison between CGE and CBA, they have to be ignored.

10.3.4.2 Linearization

In this paper, CBA analysis is performed by calculating the changes in net surpluses of all involved agents. For simplicity, the demand and supply functions are assumed to be linear. However, CGE models assume non-linear functions for the demand and supply (e.g. Cobb-Douglas demand function). For some specifications, the asymptotic behaviour of the non-linear functions may imply a large difference with respect to the linearized version.

10.3.4.3 Re-scaling

CGE models are built to represent the national or regional economy. They can accommodate and evaluate shocks to an initial equilibrium, given certain parameters and elasticities that govern the whole economy. However, when the impact is local, CGE models may not be applied straightaway and certain adjustments may need to be considered. For instance, in this paper, demand and supply at the location of interest are close to full capacity, so that the market responds by increasing prices and redistributing any rise in demand among close local competitors. However, this 'expected reaction' is not obtained from CGE straightaway. In some cases, the aggregate result may be the same, but not necessarily. For local impacts, it is recommended that satellite modelling and accounting provides feedback to the CGE model instead. The models need to be properly calibrated and integrated with the CGE model and this process may cause an additional source of divergence with respect to CBA.

For instance, in this application, the project is expected to attract more tourists, which increases the demand and price of domestic and imported goods in these areas. However, these economic changes are marginal at the regional level exerting, in this instance, no impact on the regional economy's 'foreign position' (imports and exports) or inflation level. Hence, the CGE model must be accommodated to capture the economic circumstances that take place at micro level.

10.3.4.4 Elasticities and model closure

The choice of elasticities and model closure in the CGE modelling condition the results obtained. In this application we assume the following key elasticities. For instance, the elasticity of transformation between domestic production and exports is assumed to be equal to zero (Leontief function) to control for the adjustment made by the change in imports and exports. Moreover, for the household and tourists, the demand is assumed to be a Cobb-Douglas function because it allows for a more flexible substitution among alternative goods and services.

10.4 Case study: Rejuvenation of Playa del Inglés beach

10.4.1 The investment project

The project under study is a simulation in which a micro-destination is rejuvenated. The rejuvenation investment project is applied at a sun and beach mature tourism destination in the Canary Islands known as Playa del Inglés. The total simulated investment is 676 million euros, which is equivalent to the *"Plan de Infraestructuras Turísticas de Canarias (PITCAN) 2021"*. For simplicity, we assume that the project will be finished within one year. The distribution of investment costs will be 70% for capital and 30% for labour. Capital is taxed at the general VAT rate of 7% in the Canary Islands while income tax is levied at 20%. This simulation assumes that the public sector will not incur additional costs to maintain the refurbished infrastructures, so maintenance costs are omitted from the analysis. Finally, it should be mentioned that the residual value after the project is finished is assumed to be null.

10.4.2 Survey

The tourism destination chosen comprises several micro-destinations with different degrees of rejuvenation. These differences are key to estimating WTP for the quality of the urban development. The method allows us to assess WTP for the highest available quality at present. A full sample of all establishments in the area was undertaken, which included a price survey of black coffee, water, beer and coke. The survey comprised 418 establishments in the areas of Meloneras, Maspalomas, Sonneland, Playa del Inglés, Las Burras, San Agustín and Bahía Feliz. Nine establishments refused to provide the prices requested. A team of three tourist experts assessed the natural, urban and local quality of all the establishments on a 5-point Likert scale, which had a predetermined uniform distribution. The spatial distribution of this quality assessment is shown in the figures below. Figure 2 illustrates the spatial distribution of the quality of the natural environment and shows that the coastal establishments have the most valued natural features. The darker dots represent higher quality.

Figure 2. Spatial distribution of the quality of the natural environment of all establishments surveyed

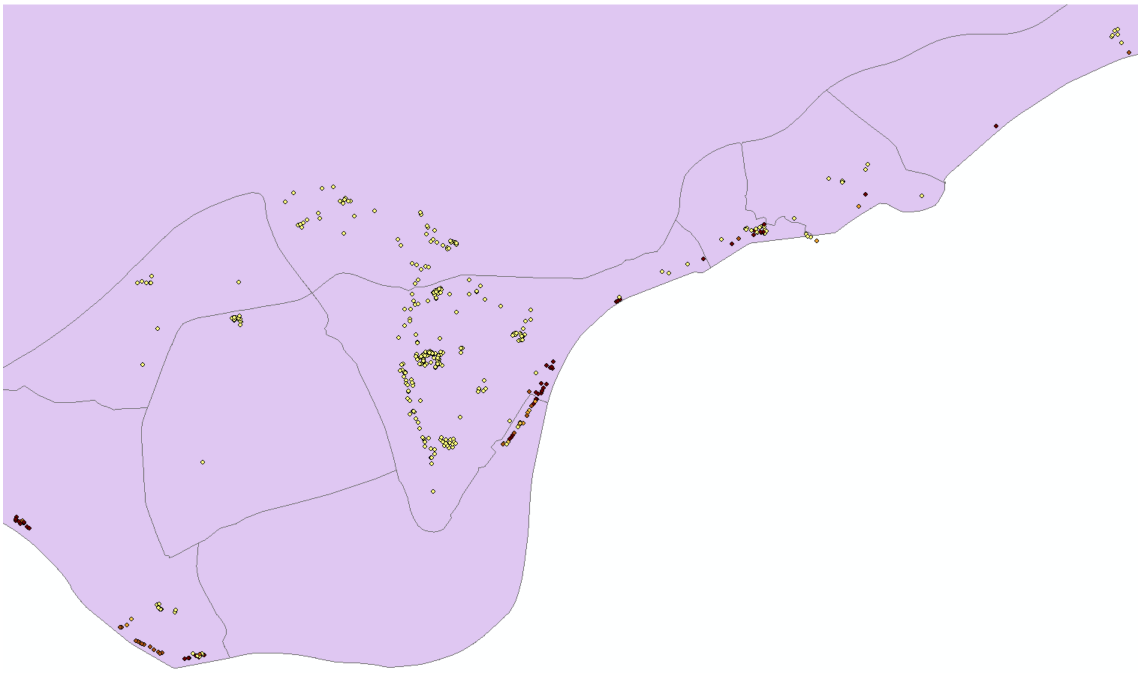


Figure 3 illustrates the heterogeneous spatial distribution of the quality of the local environment. The darker dots represent establishments with high quality in terms of local environment. Similarly, Figure 4 shows that the spatial distribution of the quality of the urban environment presents spatial clusters, depending on the current development or rejuvenation stage. This responds to different phases of the urban development in the past. Figure 5 shows the Kernel distributions of the prices of coffee, water, beer and coke. It shows that coffee is the lowest (at an average of 1.54 euros), followed by water (1.87 euros); whereas the highest prices correspond to coke (2.39 euros) and beer (2.43 euros). Concerning the width of distribution, it seems to have tails that double the mean, like a Gaussian distribution. Such differences are due to the location, kind of establishment, volume size and container, which are found to be relevant in the regression.

Figure 3. Spatial distribution of the quality of the local environment of all establishments surveyed

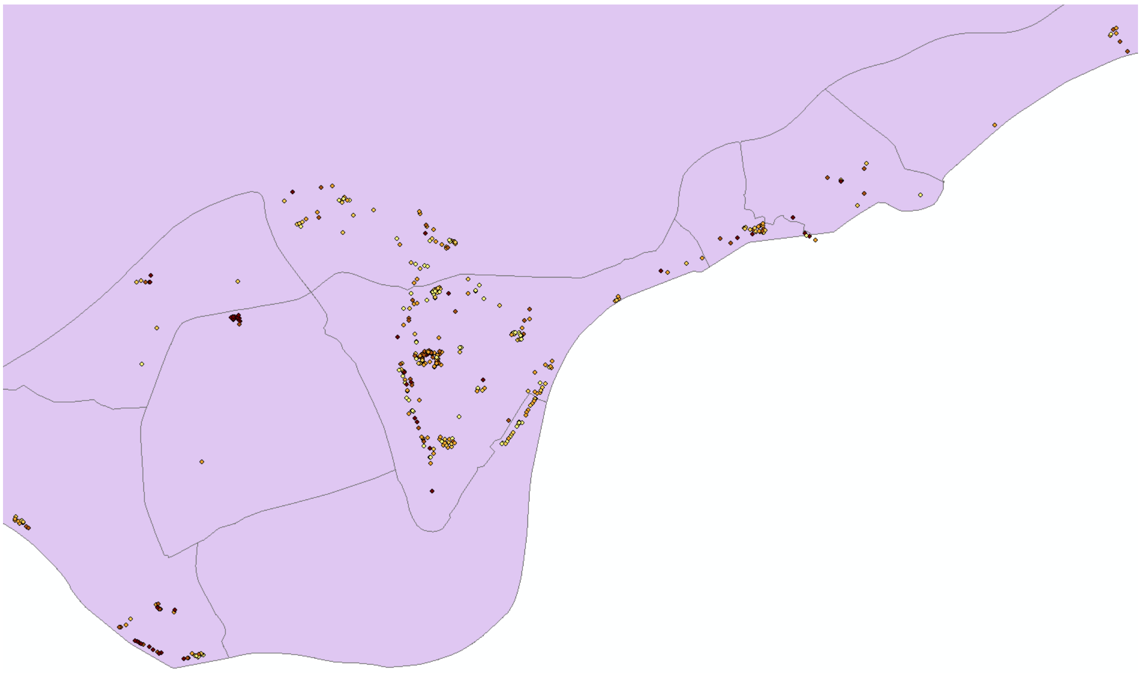


Figure 4. Spatial distribution of the quality of the urban environment of all establishments surveyed

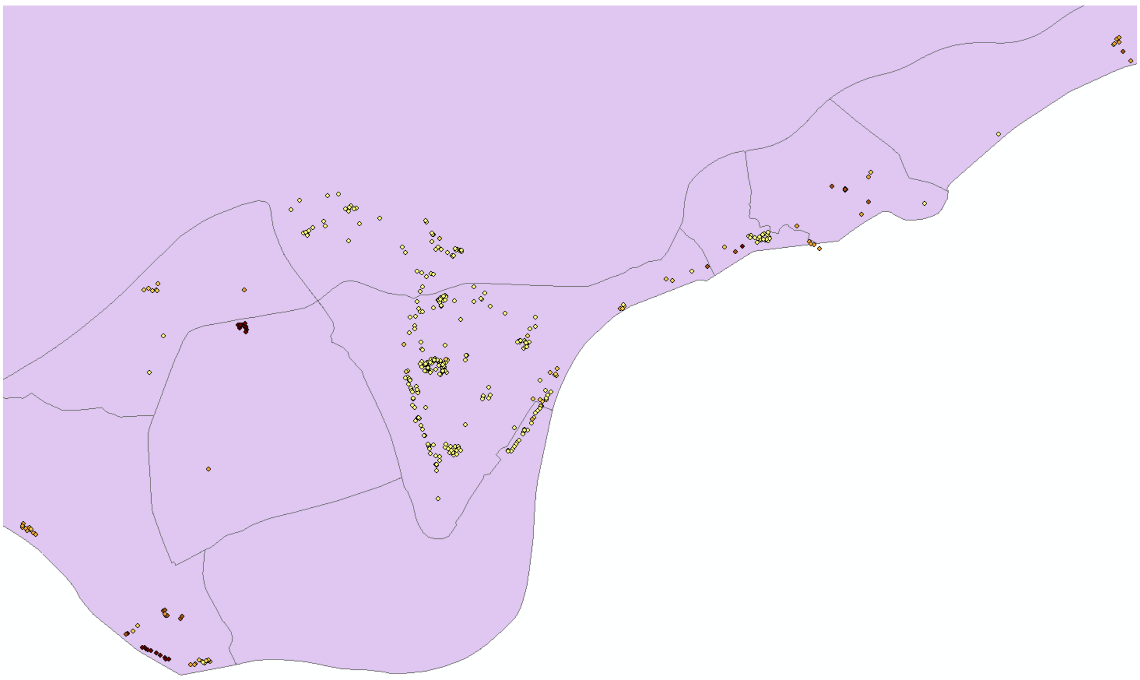
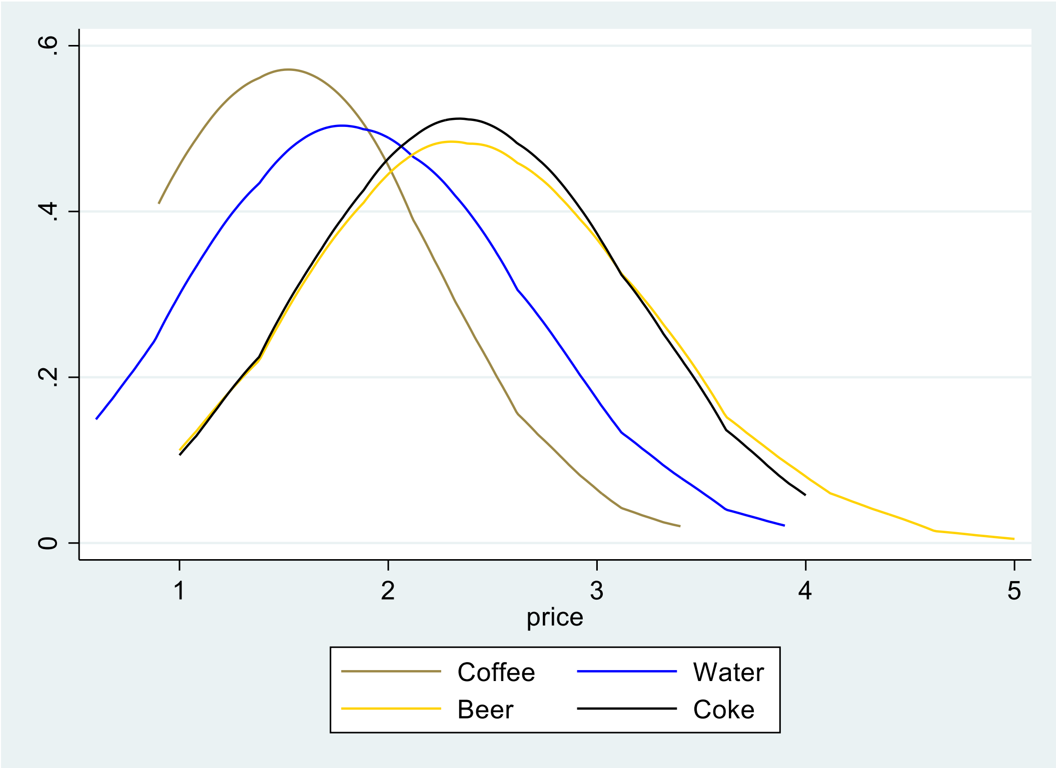


Figure 5. Coffee, water, beer and coke price Kernel distributions



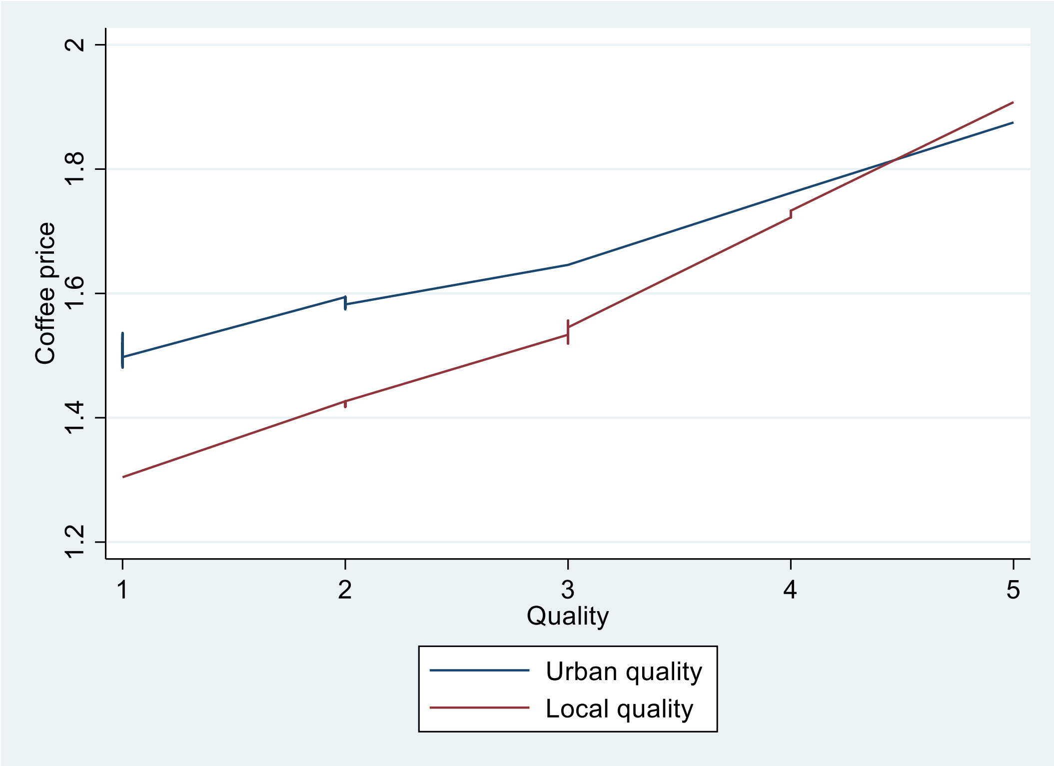
The project consists of improving the urban quality of the surrounding of all establishments that have not achieved the maximum score (5 points), at present, at destination. This maximum score was achieved by 6.46% of the establishments, whereas most (71.05%) got the lowest score (1 point).

10.5 Non-market valuation results

10.5.1 Endogeneity and the identification problem

A locally-weighted regression between two key variables provides the non-linear relationship between them. Figure 6 illustrates the semi-parametric moving window regression between the coffee price and urban and local quality and shows that the price grows with both. At the same time, a similar relationship may cause identification problems when estimating regression parameters, due to multicollinearity.

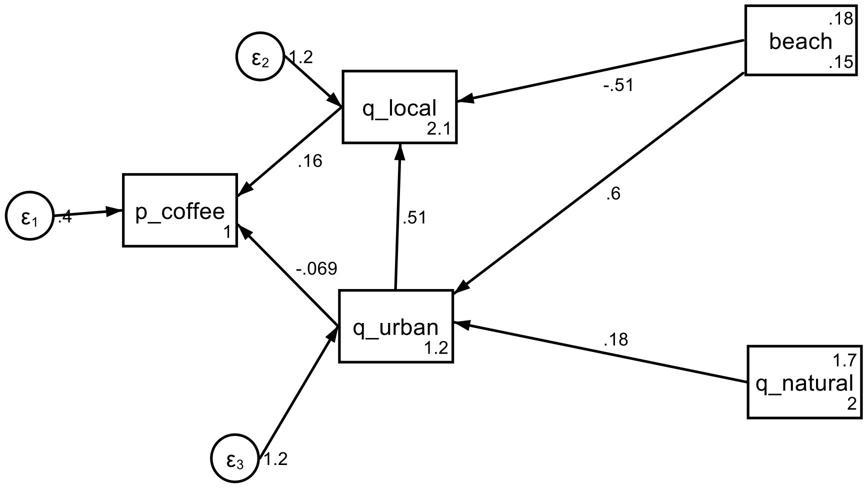
Figure 6. A semi-parametric analysis of the relationship between coffee price with urban and local quality



The Wu-Hausman F test and the Durbin-Wu-Hausman Chi squared tests of endogeneity show that the urban quality is endogenous in a coffee hedonic price model at 5%. This implies that the model requires instrumental variables to estimate the unbiased parameters of interest.

A preliminary structural equation model is performed to anticipate the endogenous relationship among the variables. The estimated parameters suggest the relationship shown in Figure 7. Thus, when the natural environment is good and/or has sea views, the public institution has invested in a better urban environment. This good urban environment has pushed entrepreneurs to improve the quality of their establishments. Both the presence of high establishment (local) quality and high urban quality increases the coffee price.

Figure 7. Structural Equation Model of the coffee price



This Structural Equation Modeling (SEM) does not consider the spatial relationship among all establishments. A better model is obtained with spatial regressions, but this endogenous relationship needs to be controlled by instrumental variables.

10.5.2 Instrumental Variables Spatial Hedonic Price Regression

Urban quality is instrumented with the natural quality and sea views. These variables prove to be useful instruments because they are significantly related to urban quality and are not significantly related to price. This way the relationship between urban and local quality is better controlled, and the multicollinearity effect is reduced.

Drinks other than coffee show a marked effect in nightlife pubs, so this needs to be controlled. However, it is also endogenous with local quality, so it is instrumented with a variable that takes into account the concentration of supply. This variable counts the number of establishments within 1,000 meters. Nightlife is usually concentrated in specific spaces with large numbers of close establishments. Moreover, beer and coke price are conditioned by size, container, and brand.

Table 2. IV Spatial hedonic price models of drinks

	Coffee	Beer	Coke	Water
Urban quality	0.1619**	0.2628***	0.2651***	0.1499***
	[0.034]	[0.000]	[0.000]	[0.007]
Local quality	0.0702*	0.0371	0.0364	0.0840**
	[0.074]	[0.251]	[0.305]	[0.011]
Nightlife pub		1.1069***	1.1806***	1.3566***
		[0.000]	[0.002]	[0.000]
Bar	-0.1868*	-0.1219	-0.1150	0.0064
	[0.097]	[0.328]	[0.399]	[0.962]
Restaurant	-0.0479	0.1265	0.2383***	0.2939***
	[0.645]	[0.162]	[0.008]	[0.001]
Can		-1.0779*		
		[0.069]		
25 cl.		2.4189***	1.0603***	
		[0.001]	[0.002]	
33 cl.		2.8789***	1.4109***	
		[0.000]	[0.000]	
Tropical brand		-0.2026**		
		[0.048]		
Bottle			0.5702*	
			[0.064]	
Constant	0.9447***	-0.4242	1.6215***	0.6759
	[0.000]	[0.291]	[0.000]	[0.115]
Spatial effect	1.8946***	1.3251**	0.7810	1.0010*
	[0.000]	[0.031]	[0.139]	[0.059]
Pseudo R^2	0.0132	0.3306	0.3049	0.1590

Urban quality parameters are key to understanding increases in WTP. In relative terms, they reveal that for each improvement level, coffee price increases by 11.88%. It is obtained by dividing the marginal price increase suggested by the parameter associated with the urban quality level for the coffee equation with respect to the average coffee price. Similarly, it can be obtained that, beer prices increase by 10.84%, coke by 7.34% and water by 8.03%. On average, one level urban quality improvement increases the price of drinks by 9.53%.

Some establishments can benefit from different levels of improvement, from one to four levels, depending on their present development. For instance, 71.05% of the establishments are located at urban quality level 1 and could benefit from improvements up to level 5. However, 6.46% of establishments already have level 5 development, so cannot benefit from any rejuvenation policy. Thus, an improvement in urban quality up to level 5 in all areas studied implies an average increase of 28% in prices. We assume that this can be extended to other food or drinks. The welfare considerations of such an impact are shown below by CBA and CGE approaches.

10.6 Welfare results

This section highlights the economic and welfare impact of the rejuvenation tourism policy with CBA and CGE. Specifically, the analysis focuses on the project's first year to stress the potential welfare divergences when applying both methodologies. Given the different approaches, the rejuvenation policy simulation requires different adjustments, as now explained. The welfare analysis focuses on the Food and Beverages (F&B) market in the tourist locations affected by the project.

10.6.1 Data

10.6.1.1 Local satellite modeling

In this case study, it is very important to work with data and parameters that are the same for both approaches. The main market under analysis is that of food and beverage at Playa del Inglés beach, which is classified as a tourism micro-destination. Thus, this is a project that affects a local area rather than a whole region. This difference matters for the CGE analysis, which is based on regional data. The structure of the economy and the parameters employed for a region are weighted averaged of the different localities that comprise the region. It should be noted that the regional parameters may or may not be suitable for the analysis of a local area. This depends on how different the local area is with respect to such average values. In this case, we think that the local area differs sufficiently, so that the strategy is to tackle the differences with a local satellite model that will feed the CGE model.

A satellite model offers both advantages and disadvantages. The main advantage is that the parameters, such as elasticities of demand and supply functions, are defined for the local area rather than those of the region. This permits a more precise analysis of market impacts. Another advantage is its flexibility to consider particular cross-elasticities with respect to other local areas that are competitors. The way it works is that the shock is initially modelled with the satellite model, which provides information on the new market equilibrium. Once the new market equilibrium is estimated, it enters the CGE model as an expenditure shock. The main disadvantage is that the satellite model works exogenously with respect to the rest of the CGE model, but this disassociation simultaneously permits greater accuracy (see Dwyer, Forsyth and Spurr, 2007). However, since the satellite model results enter the CGE model endogenously, all tourism sectoral linkages remain active anyway.

10.6.1.2 Scale and market definition

It is important to distinguish data applicable to the local area and that of the region. Thus, proper scale parameters need to be considered to feed each other. The main variable of interest is total expenditure, which comprises arrivals, length of stay and daily expenditure. The number of arrivals times the length of stay provides the total number of night stays, which is defined as the ‘quantity’ variable in this case study. Daily expenditure comprises various kinds of expenses, but this study focuses on daily food and beverages expenses, which is defined as the ‘price’ variable. Thus, the multiplication of price and quantity provides the tourism expenditure on food and beverages.

Two different markets are considered. On the one hand, Playa del Inglés destination (D1), which is where the rejuvenation takes place and on the other, the other destinations (D2) on Gran Canaria island that are competing with D1. According to ISTAC (the Canary Islands Statistics Institute), D1 represents 17.87% of the whole region’s night stays, so that D2 represents the remaining 82.13%. The year 2019 is employed for the analysis because that is the most recent year before Covid-19. Covid-19 caused considerable distress to tourism markets and the analysis of such equilibria should be avoided.

10.6.1.3 Data concerning the initial market equilibrium

According to ISTAC, the initial price of D1 is 13.97 euros, which corresponds to average daily expenditure on food and beverages in Playa del Inglés. The initial price of D2 is 12.39 euros. According to ISTAC, the initial quantity of D1 is 17,086,835 night stays, which corresponds to the whole year 2019, and will be referred to as 17.086

million night stays, for simplicity. The initial quantity of D2 is 78,530 million night stays.

10.6.1.4 Data concerning the new equilibria in the main market

Once D1 improves its urban quality, it is expected that tourists and residents will be willing to pay more. An improvement would shift demand, resulting in a price increase of about 28%, as estimated by the hedonic price model. Thus, this implies a price increase in D1 to 17.88 euros.

Moreover, as demand grows, it needs to be estimated. In order to capture such growth, we compared two different micro-destinations in the south of Gran Canaria island. On the one hand, Puerto Rico beach, one of the island's oldest but unrejuvenated (since 2000) micro-destinations, is taken as the control. On the other, Meloneras beach, which is the island's most recent and modern micro-destination, is employed as the treatment. We calculated the average growth rate in demand between 2009 (the first year available) and 2019, and found that Meloneras grew annually by about 0.4 percentage points more than Puerto Rico (2.2% vs 1.8%). This suggests that the rejuvenated destinations keep growing at a higher rate than mature destinations. This percentage is employed to estimate the expected growth of D1 after rejuvenation.

10.6.1.5 Data concerning the new equilibria in the other markets

At regional level, such 0.4% local yearly growth represents 0.071%. Adding this figure to the price increase provides the final tourism expenditure growth percentage, that reaches 0.581% for the whole region. This figure represents the expenditure shock that enters the CGE model. After the shock is simulated in the model, it provides information concerning the ex-post values of prices and quantities for the whole region.

Specifically, the CGE model works with a Cobb-Douglas demand function that is represented by the following expression:

$$q_d = \alpha \frac{m}{p}, \tag{21}$$

where α is a scale parameter calibrated by the CGE model, *m* denotes the income level, and p denotes prices. The CGE model shows that ex-post prices in the region grow by

0.329%. Application of the market rate adjustment leaves the D2 price at 12.40 euros and the number of night stays at about 78.669 million.

10.6.1.6 Linearization of the supply and demand functions

In order to quantify consumer surplus, we need to measure the area above the new equilibrium price (p_1) and below the demand function. Before the calculation of this area, it is necessary to calculate the reservation price with the project ($\overline{p_1}$). For this purpose, the derivative of the demand function is calculated, so that:

$$\frac{dq_d}{dp} = -\alpha \frac{m}{p^2}. \tag{22}$$

Once the slope of the demand function is calculated, it is straightforward to obtain $\overline{p_1}$ which takes the value of 45.12 euros for D1 (ex-post) and 39.58 for D2. Applying the same slope reveals the values of $\overline{p_0}$ in a similar fashion. In this way, it is also straightforward to calculate the consumer surplus (see section 10.6.3 below).

10.6.2 CGE results

At the macro-economic level, a 0.518% increase in tourism expenditure triggers three classical economic impacts (see, for instance, Copeland, 1991; Adams and Parmenter, 1995; Zhou, Yanagida and Chakravorty, 1997; Narayan, 2004; Chao, Hazari, Laffargue, Sgro and Yu, 2006; Blake, Durbarry, Eugenio-Martin, Gooroochurn, Hay, Lennon and Yeoman, 2006; Capó, Font and Nadal, 2007; Parilla, Font and Nadal, 2007; Pham, Jago, Spurr, and Marshall, 2015; or Inchausti-Sintes, 2015 and 2020).

First, it produces an increase in the demand of non-tradable/tourism sectors (Accommodation, Catering services, Travel agencies, Real estate, or Entertainment) (see, Table 3). However, in this case, the rest of the sectors also benefit from the tourism shock; stressing this economy's tourism dependency. This positive impact reduces the unemployment rate from 18.9% to 18.6%, whereas imports rise to 0.37%. Finally, the real exchange rate appreciates to 0.5%.

Table 3. Sectoral economic impacts for the first year (%)

Agriculture and fishing	0.174
Energy and mining	0.298
Processed food, beverages and tobacco	0.498
Textiles	0.795
Industry	0.436
Construction	0.265
Trade	0.267
Accommodation	0.167
Catering services	0.15
Road transport	0.267
Maritime transport	0.345
Air transport	0.344
Other transport services	0.340
Travel agencies	0.175
Real estate	0.022
Rent a car	0.019
Entertainment	0.152
Other services	0.277
Public services	0.130
Education	0.115
I+D	0.027

10.6.3 CBA results

The Cost-benefit Analysis focuses on the food and beverages (F&B) sector in the tourist locations in the south of Gran Canaria (primary markets). Table 4 summarizes the main data employed for the CBA.

Table 4. Main data used for the analysis

	Without project	With Project
Investment (€)	-	676,000,000
Overnights Stays	17,086,835	+0.4% yearly
Tourism F&B daily expenditure (€)	13.97	17.88

In order to proceed with the surplus calculations, we need to estimate the demand functions, and specifically, the slope of the demand function. For instance, as an illustration, the slope of the Playa del Inglés demand function takes the following value:

$$\frac{dq_d(PI)}{dp} = -\alpha\frac{m}{p^2} = -0.11\frac{0.1787 \cdot 10{,}238{,}940{,}000}{319.69} = 629{,}568.779$$

It can be easily verified that:

$$\overline{p_1} = \frac{q_1}{\frac{dq_d(PI)}{dp}} + p_1 = \frac{17{,}155{,}182.7}{629{,}568.779} + 17.88 = 45.12$$

A similar procedure is carried out for $\overline{p_0}$ and for both markets. For the calculation of the consumer surplus, recall that since most clients are foreigners, they may be ruled out of the consumer surplus calculation. In fact, the consumer surplus is adjusted by the share of the residents in the demand function, which takes the value of 22.9%. This figure is obtained from the tourism satellite account. The calculations of the producer and taxpayers' surpluses are straightforward.

Table 5 displays the results of the CBA calculations. It shows that most benefits are in the micro-destination of interest (Playa del Inglés), whereas some spillover effects also occur, but at a lower rate. It also illustrates that the agents that obtain most benefits are the producers, followed by the taxpayers. The increase in the consumer surplus of residents is very low.

Table 5. Economic welfare of the project in Year 1 disentangled by changes in surpluses (million euros)

Playa del Inglés	
Consumer Surplus	0.206
Producer surplus (existing demand)	62.464
Producer surplus (generated demand)	0.097
Taxpayers' surplus (existing demand)	4.373
Taxpayers' surplus (generated demand)	0.062
Remaining micro-destinations on the Canary Islands	
Consumer Surplus	0.412
Producer surplus (existing demand)	0.838
Producer surplus (generated demand)	0.000
Taxpayers' surplus (existing demand)	0.059
Taxpayers' surplus (generated demand)	0.087
Agricultural sector	
Consumer Surplus	-4.094
Producer surplus (existing demand)	3.832
Producer surplus (generated demand)	0.003
Taxpayers' surplus (existing demand)	0.268
Taxpayers' surplus (generated demand)	0.107
Total Welfare	68.743

Additionally, so as to illustrate the effect over non-tourism goods consumed by residents, we introduced the effect of the project on the agricultural sector. In order to ensure comparability with CGE, the change in prices and quantities in the agricultural sectors obtained from the CGE model are also used in the CBA analysis. For the calculations it was assumed that residents are already consuming agricultural products. Thus, the new demand derived from the project is considered to increase due to foreigners, meaning that the surplus of these consumers is omitted.

10.6.4 Comparing CGE and CBA results

The welfare obtained from the project reaches 68.743 million euros when measured with CBA, and arrives at 72.038 million euros when measured with CGE. However, the latter figure is obtained when we deduct the induced effects, which reaches about 20.319 million euros. Most of this difference is triggered out due to the presence of unemployment. If the induced effects are equivalent to those obtained in similar alternative projects, then they should be deducted. The effects were obtained from Schallenberg-Rodriguez and Inchausti-Sintes (2021), who found that the induced effects represented about 22% of the total impact shock to the Canary Islands' economy.

The remaining difference between the two approaches is explained because in CGE welfare is measured through equivalent variation and non-linear supply and demand functions, whereas in this CBA exercise it has been calculated through variations in surpluses of linearized demand and supply functions. Finally, it should be remembered that the choice of model closure in CGE, as well as the elasticities provided, also condition the results obtained.

10.7 Conclusions

Despite both CGE and CBA being rooted in the same economic theory, implementation of the methodologies may diverge in practice. This paper has shown some of the key differences between both approaches when applied to a tourism investment project.

This case study implies a local impact, as is the case of many investment projects. CGE is challenged here because the model is calibrated according to national or regional accounts that employ standard functions based on national or regional elasticities. When simulating a local shock in CGE, the national or regional functions and elasticities may not respond with sufficient accuracy to the implications. For this reason, we had to employ a satellite model that could measure the local shock properly and then input this shock into the CGE model.

CGE models consider all sectors of the economy simultaneously, which is helpful in measuring its induced effects. For an economic appraisal, it is particularly relevant when there exists involuntary unemployment because, if the project reduces the unemployment, then social welfare increases. This welfare increase relates to changes in prices and production, as well as the opportunity cost of labour. CGE models consider the induced effects in their results. However, such effects may also be triggered out under any other counterfactual scenario. Provided those effects are similar, then it is necessary to deduct them to obtain a net welfare measure from CGE models.

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