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Abstract

Rwanda's Nyungwe National Park is a biodiversity hotspot with the most endemic species in the ecoregion as well as the highest number of threatened species internationally. In addition to great biological diversity, Nyungwe National Park supplies significant ecosystem services to the Rwandan population including water provisioning and tourism services. Tourism in the Park has strong potential for improving the sustainable management of the Park for continued provision of natural habitat and critical ecosystem services. This paper explores quantitatively the economic impacts of adjustment in Park visitation fees and tourism demand as a source of revenues to improve Park tourism opportunities and ongoing operations and maintenance where budgetary restrictions are particularly acute. The methods developed in this paper are novel in integrating the results of stated preference techniques with regional economy-wide modelling approaches to capture multi-sectoral, direct, indirect and induced impacts. Such methods have strong potential for assessing revenue generation alternatives in other contexts where Park Managers are faced with the need to generate additional revenue for sustainable park management while facing diminishing budget allocations.

1.0. Introduction

Nyungwe National Park forms part of the largest remnant of intact lower montane forest in Africa and is an important conservation area within the Albertine Rift Valley biodiversity hotspot. It is part of an eco-regional natural forest ecosystem known for the most diverse endemic vertebrae in the African continent, the most endemic species in the ecoregion, and the second highest number of threatened species internationally (Plumptre et al., 2007, Fischer and Killmann, 2008). The Park is home to threatened or near-threatened primates, including chimpanzees and owl-faced monkeys (Dowsett, 1990). Nyungwe National Park is also home to over 300 bird species, including 16 endemics, and 75 different species of mammals. As Rwanda's primary water catchment area and to protect it from the encroaching threat of logging, agricultural intensification and mining, Nyungwe was designated as a National Park in 2004 from its earlier status as a national reserve (Birnie et al., 2015).

Figure 1. Rwanda's National Parks.
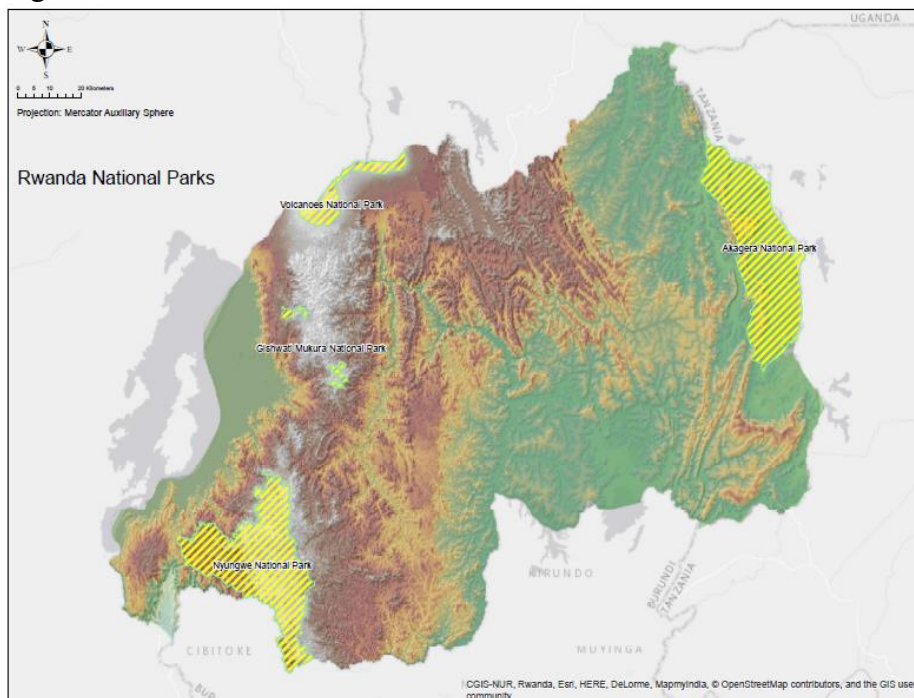
Source: Authors' own elaboration based on Rwanda Ministry of Agriculture and Animal Resources, Centre for Geographic Information Systems of National University of Rwanda data.

Nyungwe provides a range of critical ecosystem services to society and the economy. In terms of water provisioning ecosystem services, Nyungwe generates 70% of Rwanda's rainfall input in

the country's principal river systems, including the Nyabarongo and Akagera river systems of the southern Nile Basin to the east, and the Lake Kivu and Congo River systems to the west. The Park plays a vital role in erosion control on the lower cultivated slopes surrounding the Park. The densely-forested slopes in this area are responsible for regulating ecosystem services that reduce the potential for flooding and act as a reservoir of nutrients for the economically important agricultural areas downslope. The Park contributes to climate regulation both through its role in carbon sequestration and in regulating rainfall patterns. Finally, its abundant plant diversity supports pollination ecosystem services that drive agricultural productivity in the region (Masozera et al., 2006).

In terms of cultural and aesthetic ecosystem services, tourism in Nyungwe makes important contributions to the regional economy. Since becoming a National Park in 2004, visitation has increased steadily from 2,386 in 2005 to 13,644 in 2016, representing 15% of total Park visitation in Rwanda. Nyungwe has also experienced higher average annual growth in visitation than Rwanda's three other National Parks, Volcanoes, Akagera and Gishwati - Mukura National Parks. Overall visitation is still lower, relative to those of Volcanoes and Akagera National Parks which received over 32 thousand and 41 thousand visitors in 2016, respectively.

There are substantial opportunities for increasing the Park's contribution to Rwanda's economy, and to do so in a sustainable way. In 2015, Park revenue was US$317,992, accounting for only 2.1% of Rwanda's total tourism revenue. Projected tourism revenue, however, is expected to increase by 61% by 2025 (WTTC, 2016) and Nyungwe is well poised to capture a greater share of this growth. Certainly its natural features are like none other in the region with the oldest continuous rainforests in the world and the best preserved montane rainforest in East Africa. The recent introduction of two new lodges and the addition of a popular new attraction, the canopy walk, have strengthened demand and are indicative of the scope and positive impacts new tourism opportunities can have on visitation and tourism demand.

Despite the positive outlook for Park visitation, as a developing country, the resources the Rwandan Government can allocate toward sustainable management of Nyungwe National Park are limited given competing priorities for scarce public funds. To address this challenge, Rwanda's Development Board carried out a comprehensive strategic review of its protected area management functions which led to consideration of Public-Private Partnership arrangements

between the Development Board and the private sector. Such arrangements have proven to be successful in the management of Rwanda's Akagera National Park.

Following this strategic review, the Rwandan Development Board commissioned the development of a 10-year business plan, produced by Conservation Capital, which assessed the status of Nyungwe's conservation context and determined conservation priorities for the Park (Birnie et al., 2015). The plan identified conservation management actions, potential revenue generation models, as well as appropriate governance structures. The plan outlines the investments that would be required to finance the improvements in Park recreational opportunities, conservation and management, considering a first five-year development phase followed by a consolidation phase that would continue into the foreseeable future. The first phase would involve developing a management framework and implementing new management operations, completing the requisite capital expenditures to support these operations, and developing the structures for the commercial revenue flow system that would be expected to mature during the second consolidation phase. The total cost of the plan over the ten-year period is approximately US$16.1 million, with recurring annual operations and maintenance costs of US$776,124.

Nyungwe National Park fees serve the dual role of a marketing tool and a revenue generation tool to finance Park operations and management. The marketing function of the fees projects an image of quality and exclusivity, as international visitors have shown strong preferences for a quality experience related to Rwanda's Park visitation. The revenue generation function is critical for Park operations and maintenance; in the case of Volcanoes National Park, visitor fees generate 75% of total Park revenues. The shortfall between revenues and costs is greater in the case of Nyungwe National Park, and is usually supplemented with donor financing (Moore and Baca, 2012).

With the investments proposed under the business plan, securing additional revenues for Park management is a high priority issue on the Rwandan Development Board's Agenda. Demonstrating the potential economic contribution Nyungwe can make to regional development can stimulate private sector investment and substantiate a business case for investing in the Park. As in the case of Akagera National Park, there is significant scope for public-private partnerships and new revenue generation models through the development and leasing of concession spaces

and educational centers. Demonstrating the development impact of such investment can also help make a compelling case for development grant financing.

This paper contributes to the current debate by evaluating the regional economic impacts of investing in improving the tourism opportunities and management of Nyungwe National Park. We develop a regional computable general equilibrium model (RCGE) of Rwanda's South and West Provinces to evaluate the potential economic impacts from adjusting the current Park fee structure and from increased tourism demand for Nyungwe arising from an enhanced tourism experience. This paper is organized as follows. Section two reviews the importance of fee structures for the sustainable management of protected areas and provides a review of a recent study assessing consumer surplus for Nyungwe National Park. Section three presents the methodology and provides an overview of the RCGE model. Section four describes the scenarios implemented in the RCGE and presents the results. The paper closes with a discussion of how the evidence generated here can support investment in Nyungwe National Park as a means of stimulating regional development and the establishment of public-private partnerships for the Park.

2.0. Financing Protected Area Management through Park Access and Activity Fees

Sustainable management of a national Park for nature-based tourism requires a delicate balance between competing economic and environmental objectives. The value of the tourist visit depends to large measure on the quality of the visitor experience which is closely related to environmental quality. Analysis of visitor preferences at Nyungwe National Park in particular has revealed strong visitor preferences for quality. Policies to increase Park visitation necessarily must consider the carrying capacity of the ecosystems and how protected area visitation is distributed over time. The use of Park entrance and activity fees are market mechanisms that Park managers have to achieve this balance.

A well designed fee structure serves to regulate access, reduce congestion, and reduce disturbance of the wildlife and other natural features that are the key assets of protected areas (Cessford, 2000). At the same time, Park activity and entrance fees are important sources of revenue for Park operations and maintenance as public budget allocations to protected areas is commonly insufficient (Manning, 1999, Walpole et al., 2001, Whitelaw et al., 2014).

Furthermore, Park fees can help compensate for the opportunity cost of protected areas (Buckley, 2003).

The current fee structure at Nyungwe National Park has been shown to generate visitor dissatisfaction. Since the Park was formally established, the number of activities available in the Park has increased and the menu of options expanded. Currently, fees are a function of activity, activity duration and visitor residency status, among other variables. The fee structure also has caused issues for Park tour operators, particularly when there are unannounced changes in fees. This can affect client relations as well as generate unnecessary uncertainty in operator financial planning (Moore and Baca, 2012).

Determining the correct pricing structure for protected areas is a complex task requiring consideration of revenue requirements for management and equitable Park access to all segments of society. Understanding potential visitor responses to changing Park fee structures before implementing changes is critical (More and Stevens, 2000, Kim and Crompton, 2002, Fix and Vaske, 2007). Contingent valuation is a stated preference approach (Champ et al., 2003) that can be used to determine how visitors would respond to changes in fee structures. Estimates of tourist willingness to pay (WTP) can be used to estimate fee structures that ensure adequate revenues while maintaining visitation rates at a desirable level.

In this study, we use estimates generated by Lal et al (2017) through a contingent valuation exercise to estimate visitor WTP for improved Park features at Nyungwe National Park (Lal et al., 2017). Lal et al (2017) surveyed 304 international tourists between February and July 2015. This period includes part of the peak tourism season which facilitated access to potential respondents. In addition to eliciting respondent Park use habits and standard demographic information, respondents were asked which activities they participated in and the maximum amount they would be willing to pay to engage in these activities.

Next, respondents were advised that there was a proposal to improve the quality of the visit to Nyungwe National Park where the proposed improvements included improving Park protection to increase the population of birds and primate species thus improving the probability of spotting wildlife during a visit. Additional improvements would enhance the beauty of the waterfalls and the nature walks with more rest areas and better trails. Respondents were asked to select from a

list of options which indicated the entry and activity fee that they would be willing to pay to finance the Park improvements. For visitor residents of Rwanda, the mean WTP was US$6.15 for activities and US$4.66 for the entrance fee. For tourist non-residents, the mean WTP was estimated as a 29% increase over the current fee structure. For the entrance fee, the WTP was estimated at US$14.35. Table 1 shows the current and proposed fee structure based on Lal et al. (2017). The proposed fee structure along with the estimated WTP for a Park entrance fee represents potential new direct revenues that would result from adjusting the Park fee structure. These direct benefits can contribute to financing the sustainability of current and future Park operations and maintenance following an investment in Park improvements.

Table 1. Current and proposed activity fee in USD.

Activity	Current fee	New fee
Guided Nature Walk of Trails	$ 40	$ 52
Guided Birding Walk	$ 50	$ 65
Canopy Walkway Guided Hike	$ 60	$ 77
Tropical Waterfall Guided Hike	$ 50	$ 65
Congo Nile Trail Guided Hike	$ 100	$ 129
Chimpanzee Tracking with Guides	$ 90	$ 116
Other Primates Tracking with Guide	$ 60	$ 77
Camping/Tent/Night Stay	$ 30	$ 39

Source: Lal et al. (2017).

The Park improvements considered follow the valuation scenarios described in Lal et al (2017) and the investments considered in the business plan for the Park (Birnie et al., 2015). The business plan assessed Nyungwe's natural values and determined priority lines of action for conservation management. These lines of action included strengthening research, evaluation and monitoring functions, maintaining the wilderness character of Nyungwe, increasing the natural character of the buffer zones, restoring degraded habitats, and strengthening policy and advocacy for the Park.

Threats were also identified in the plan, most of which were directly related to the livelihood needs of inhabitants surrounding the Park. These threats included fire, invasive species, agricultural expansion, wood-gathering, mining, poaching, and infrastructure development. To combat these threats, priority lines of action included strengthening the community engagement program, improving law enforcement, and building stronger relationships with government

authorities. To capitalize on the opportunities presented by Nyungwe National Park and allay the perceived threats, the business plan proposed management actions that may be classified as Field Operations and Central Project Management actions. For each line of action, objectives, strategies and required resources were delineated. For Field Operations, major lines of action are: (i) law enforcement; (ii) habitat and wildlife management; (iii) community engagement; (iv) transport and logistics; (v) research, and; (vi) monitoring and evaluation.

Under Central Project Management, major lines of action are delineated as: (i) finance management; (ii) general administration, compliance and human resources management; (iii) commercial management; (iv) revenue collection; (v) risk management; (vi) stakeholder management; (vii) donor management, and; (viii) policy development. The investment costs used in this paper follow directly from the business plan and are estimated at US$16.1 million for the first ten-years, followed by recurring annual operations and maintenance costs of US$776,124 (Birnie et al., 2015).

3.0. Methods

The tourism industry is not an isolated sector. Indeed, it is comprised of and has important linkages with many sectors, ranging from the hotel and restaurant sector where it is dominant, to food and beverages and transport, where its influence is also strong. Similarly, investments in diverse sectors contribute to the development of tourism, from infrastructure development, the provision of basic public services such as water and sanitation, and capacity building in the services sector, to institutional strengthening in terms of tourism-sector governance.

Thus, to assess the economic impact of the many types of policy interventions, investments and external shocks that might affect the tourism sector, a framework that considers all economic sectors and their inter-linkages is essential (Dwyer, 2015, Banerjee et al., 2015). A computable general equilibrium (CGE) model provides a systematic method for predicting both the direction and approximate magnitudes of impacts of policies and external shocks on different economic agents and institutions. What follows is an overview of the regional, tourism-extended, dynamic RCGE model for Rwanda's South and West Provinces developed to evaluate the direct, indirect and induced impacts of investing in improving the visitor experience in Nyungwe, a restructuring

of the Park's fee system and increased tourism demand. The RCGE model was developed for the South and West Provinces since Nyungwe National Park straddles both of these provinces.

3.1. A Dynamic Computable General Equilibrium Model for Rwanda's South and West Provinces

The RCGE model developed here combines a relatively standard recursive dynamic CGE model (Lofgren et al., 2002, Robinson et al., 1999) with a tourism-specific extension. The tourism extension follows (Banerjee et al., 2016, Banerjee et al., 2015) and contains additional equations and variables where one can define: (i) the domestic and foreign tourism demand; (ii) different modalities of tourism supply and demand, and; (iii) the impact of public capital investment in infrastructure on sectoral productivity.

Given the regional character of the model developed here, it is customized to account for: (i) trade between the modeled region and the rest of the country and the rest of the world, and; (ii) local and central government operations in the modeled region (i.e., tax collection and current and capital spending). In summary, compared to other RCGE models, the one developed here provides a combination of policy-relevant features for the study of tourism investment or policy counterfactual scenarios in a regional economy. Figure 2 depicts, for each simulation period, the circular flow of income within the regional economy and between this regional economy and the rest of the country and the rest of the world.

The major building blocks of the RCGE model for Rwanda's South and West Provinces can be categorized as: activities (producers of commodities), markets for commodities (goods and services); markets for factors (labor, land and capital stock) and five institutions: households, government, the rest of the country, the rest of the world, and foreign tourists. As shown, foreign tourism is a source of income and foreign exchange earnings for the modeled region. In applications of the RCGE, the blocks depicted are disaggregated; the disaggregation used in the current application is shown in table 2.

Figure 2. Circular income flow in the RCGE; within-period module.
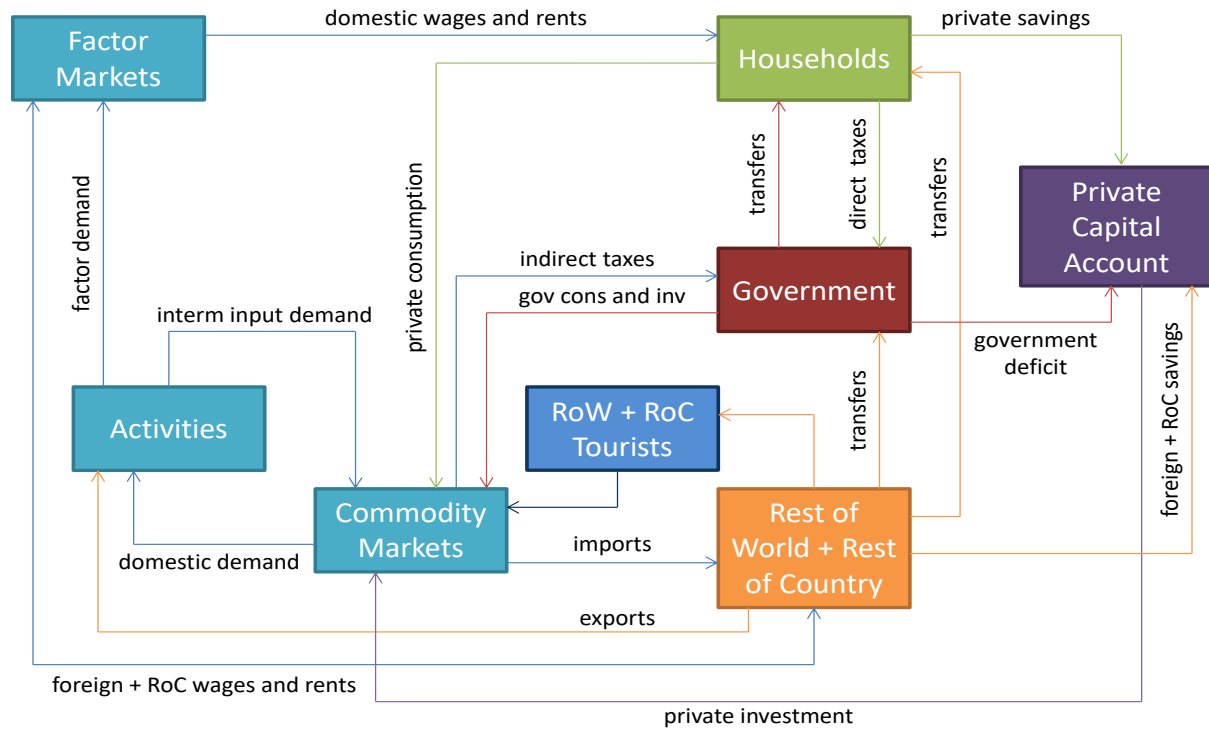
Source: Authors' own elaboration.

Activities represent economic sectors in the South and West Provinces that produce and sell their output at home (within the South and West Provinces) or outside of the South and West Provinces, to the rest of Rwanda and/or the rest of the world. Activity revenues are used to finance costs of production and provide returns to investors. Decisions to pursue specific activities with certain levels of factor use are driven by their profit maximization objective. The shares of output that are exported and sold domestically depend on the relative prices of the output in world, national, and domestic markets. For any exported commodity, exporters face either: (i) export prices (here referred to free on board prices) that are exogenously determined, in which case export demand is infinitely price-elastic, or; (ii) price-sensitive export demands defined by constant-elasticity functions with the free on board export prices linked to domestic conditions such as costs of production and the real exchange rate.

Households earn incomes from factors of production and transfers. This income is used for consumption and savings and to pay direct taxes. Household consumption decisions change in

response to income and price changes. By design and as a constraint imposed by the household budget, the value of household consumption is equal to its income net of direct taxes and savings.

The government receives revenue from taxes and transfers from abroad, and uses these for consumption, to transfer to households, and for investment, drawing on the loanable funds market for supplementary funding. To remain within its budget constraint, the government adjusts its spending according to available receipts or mobilizes additional receipts to finance its spending plans.

The rest of the country institution represents income flows from the South and West Provinces to and from the rest of the country to the South and West Provinces. **The rest of the world** account represents income flows to the Rwanda and from Rwanda and are those that appear in the balance of payments. This account sends foreign currency to the Provinces in the form of transfers to its government and households. The Provinces use these inflows to finance their imports. It is assumed that the balance of payments clears meaning that inflows and outflows are equalized through adjustments in the local real exchange rate (the ratio between the international and domestic price levels), influencing export and import quantities and values in foreign currency.

The private capital account for the South and West Provinces provides investment financing from savings by households, the government, the rest of the world and the rest of Rwanda.

Tourism demand from the rest of the world and the rest of Rwanda can be modeled as an exogenous volume or using constant elasticity of demand functions. In the latter case, the South and West Provinces face downward-sloping demand curves for their tourism exports. In both cases, total tourism demand is disaggregated across locally produced commodities using fixed coefficients. Equations 1 and 2 show the demand functions used to model tourism export demand from the rest of the world and the rest of Rwanda, respectively.

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

$$QTROW_{c,i} = \overline{qtrow}_{c,i} \left(\frac{PQ_c/EXR}{PQ_c^0/EXR^0} \right)^{\eta_{rowt,i}} \qquad \text{eqn' 1}$$

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

where

c = tourism-related *commodities* such as hotels and restaurants

i = tourism demand *modalities* such as tourist and business visitors

$QTROW_{c,i}$ = Rest of the *World* (RoW) tourism type i demand quantity of commodity c

$QTROC_{c,i}$ = Rest of *Country* (RoC) tourism type i demand quantity of commodity c

PQ_c = composite commodity price for c

CPI = consumer price index

EXR = exchange rate

$\overline{qtroc}_{c,i}$ = baseline RoC tourism type i demand quantity of commodity c

$\overline{qtroc}_{c,i}$ = baseline RoW tourism type i demand quantity of commodity c

$\eta_{roct,i}$ = constant price elasticity of RoC tourism demand (< 0)

$\eta_{row,i}$ = constant price elasticity of RoW tourism demand (< 0)

As shown, constant elasticity of demand functions are used to model tourism export demand from the rest of the world and the rest of the country. In addition, within domestic and foreign tourism demand, the model allows for the identification of one or more tourism demand modalities (i.e., see index i in equations (1) and (2)).[1] In equation (1), foreign tourist demand is a function of local tourism-related prices relative to the exchange rate. In equation (2), national tourist demand is a function of local tourism-related prices relative to the consumer price index. Note that although tourists from the rest of Rwanda do not need to change currencies, a real exchange rate exists between any specific region of Rwanda that is being modeled and the rest of the country. This regional exchange rate is defined as the ratio between regionally tradable and non-tradable commodities such as housing.

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[1] For example, index i in equation (1) can refer to tourists from different countries.

In domestic commodity markets, flexible prices ensure balance between demand and supply. Import prices in most cases would be exogenous, but the assumptions of the model can be adjusted for cases where their prices are endogenous; for example, where a large increase in imports from a specific region of the country could push up prices. The share of imports in the national market is determined by their international prices relative to domestic prices. In factor markets, demand curves are downward-sloping reflecting the responses of production activities to changes in factor prices.

In the case of labor, unemployment is endogenous. For each labor type, the model assumes an inverse relationship between the real wage and the unemployment rate (Blanchflower and Oswald, 2004, Blanchflower and Oswald, 1994). The model allows for different assumptions about labor mobility in response to wage differentials between Rwanda and outside the country and between one region and another within Rwanda. For non-labor factors, the supply curves are vertical in any single year: that is, their quantity is fixed, but price adjusts according to the level of demand.

In this RCGE, national income growth over time is largely endogenous and the economy grows as capacity expands which is determined by net fixed capital formation, labor force growth, and improvements in total factor productivity which have both endogenous and exogenous components. The endogenous determinants of total factor productivity include the levels of government capital stock and economic openness. The accumulation of private and government capital is through investment financed by local and external savings. Increased private capital is allocated across sectors according to their relative profitability. Once installed, capital becomes sector-specific and can only be adjusted through exogenously-determined depreciation and the attraction of new investments.

Table 2. Accounts in the South West Regional SAM

Category	Sector	Category	Sector
Primary	Food crops	Services continued	Realestate
*(6)	Export crops		Technological services
	Livestock		Support services
	Forestry		Government
	Fisheries		Education
	Mining		Health
Manufacturing	Processed food	Factors	Other services
*(8)	Beverages and tobacco prod	*(6)	Labor
	Textiles		Capital
	Wood products		Land
	Chemicals, rubber and plastic		Livestock
	Non-metallic mineral prod		Natural resources
	Machinery and equipment	Taxes	Commodity taxes
	Other manufactures	*(3)	Import taxes
Services	Electricity		Direct taxes
*(15)	Water	Institutions	Households
	Construction	*(4)	Government
	Repairs		Rest of Country
	Trade		Rest of World
	Transportation	Savings and investment	Tourism
	Hotel and restaurant	*(4)	Savings
	Telecommunications		Non-government investment
	Financial		Government investment

Source: Authors' own elaboration based on the Social Accounting Matrix for the South and West Provinces of Rwanda (2011).

The basic accounting structure and much of the underlying data required to implement the RCGE model is based on the Social Accounting Matrix (SAM) developed for Rwanda's South and West Provinces. A SAM is a comprehensive, economy-wide statistical representation of the economy at a specific point in time. It is a square matrix with identical row and column accounts, where each cell in the matrix shows a payment from its column account to its row account. It can be used for descriptive purposes and is the core database input for a CGE. Major accounts in a standard SAM match the main building blocks of the CGE as described above: activities, commodities, factors used in production, and institutions such as households, government, and the rest of the world/country. Table 2 shows the main accounts in the SAM while table 3 provides a snapshot of the economy of Rwanda's South and West Provinces.

Table 3. Macro indicators for South and West Provinces; millions of 2011 USD.

Item	USD
Demand	
Private consumption	1,806
Government consumption	419
Fixed investment	492
Exports	753
Tourism demand	115
Total demand	3,584
Supply	
Gross Regional Product	2,603
Imports	982
Total supply	3,584

Source: Authors' own calculations based on the SAM for the South and West Provinces of Rwanda (2011).

Gross regional product (GRP) for the South and West is equal to US$2.6 billion which is equivalent to approximately 41% of national Gross Domestic Product (GDP). Imports into the two provinces are slightly greater than exports at US$982 million and US$753 million, respectively. Total supply must balance with demand and is equal to US$3.58 billion. Regional tourism demand, much of which can be attributed to Nyungwe National Park, is US$115 million.

Figure 3 shows the sectoral structure of the South and West Provinces of Rwanda. In this region, the hotel and restaurant sectors most closely related to tourism are responsible for 2.4% of value added and 2.3% of employment. The strongest value added sectors are the agriculture sector (42% of value added), followed by other services (18.9%), commerce and trade (13.4%) and construction (6.9%); employment shares are similar to value added shares. Exports to the rest of the country are highest for manufacturing, hotel and restaurants and agriculture (24.6%, 22.1% and 19.6%, respectively). Imports from the rest of the country are outweighed by manufacturing exports with an 83.4% import share.

Figure 3. Value added, import, export and employment shares for the South and West Provinces; percent.
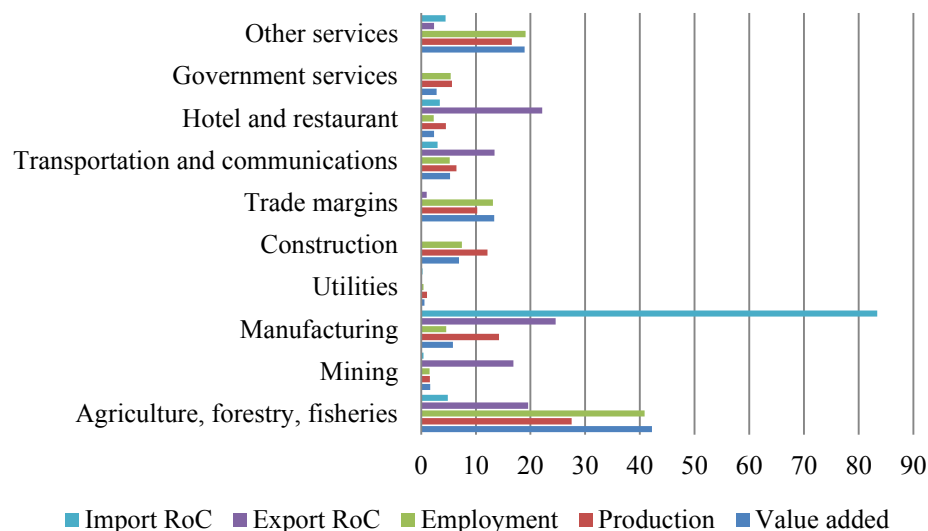
Source: Authors' own elaboration based on SAM for SW Rwanda (2011).

4. Results

4.1. Scenario design

BASELINE: the first scenario, 'BASELINE' is the baseline scenario which projects the economy of the South and West Provinces of Rwanda from 2011 to 2040. All other scenarios are compared to the baseline scenario. Here it is assumed that past trends will continue from 2011 to 2040. In fact, in the absence of better projections, it is assumed that the economy of Rwanda's South and West Provinces is on a balanced growth path, which means that real or volume variables, including tourism demand, grow at the same rate while relative prices do not change. In the baseline, the most recent estimate of Government revenues from the Park was US$317,992 in 2015.

Figure 4. Visitors to Nyungwe National Park and additional Park revenue with new fee structure; (2011 USD).
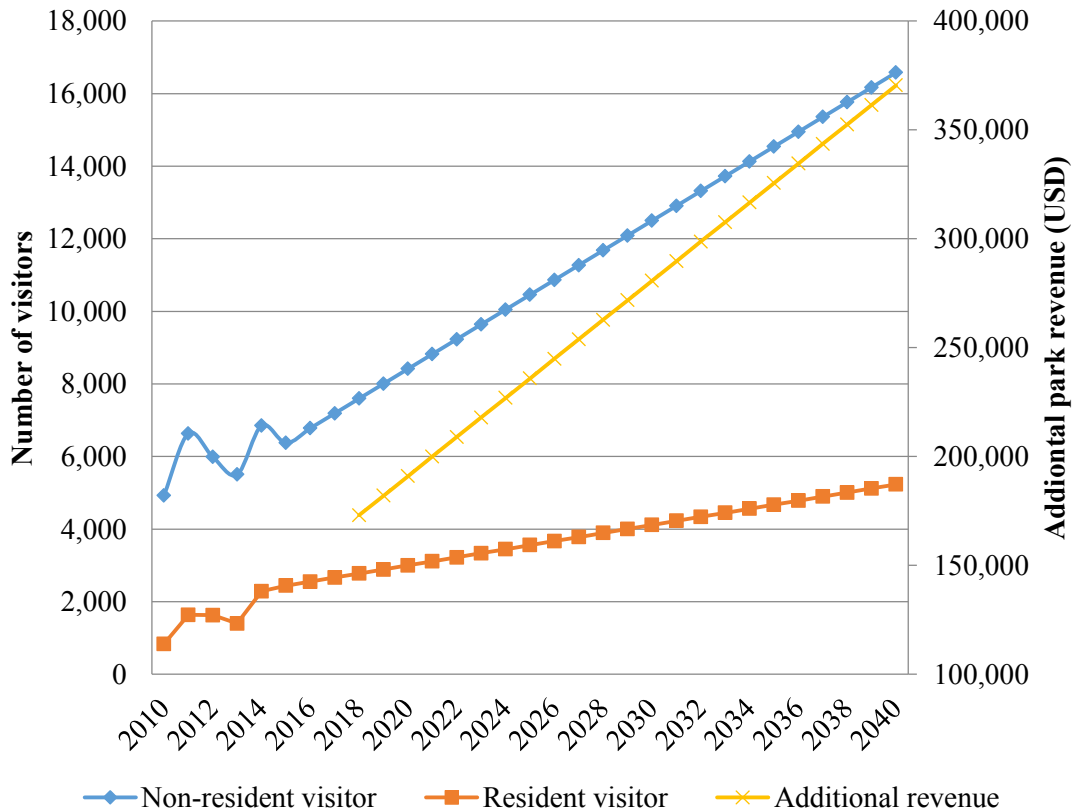
Source: Authors' own elaboration. Data source: Lal et al (2017) and RDB (2015).

The primary y-axis of figure 4 shows the number of visitors to Nyungwe National Park. In 2010, non-resident and resident visitors to the Park were 4,930 and 839 visitors, respectively. With the short time series of observations for visitor numbers, a conservative approach is taken to projecting growth in Park visitation by imposing a linear trend line on the data. In this scenario, no assumptions are made about an increase in the number of tourists as a result of any investments or improvements made in the Park. By 2040, the number of Park visitors is 16,581 and 5,231 for non-resident and resident visitors, respectively. The projection of the number of non-resident visitors and the product of the activity fee increase and the entrance fee represent the increase in government revenue derived from the change in fee structure (secondary y-axis).

INVEST: The second scenario, 'INVEST' simulates the Government investment in improving Park tourism opportunities and management. This scenario increases government expenditure

and investment by US$2,015,035 per year from 2018 to 2022, and by US$776,124 annually thereafter.

ACTFEE: The third scenario 'ACTFEE', simulates the increase in the activity fee for non-resident visitors to the Park. This is equivalent to US$90,281 in 2018 and, driven by the business-as-usual growth rate in visitors, it is equal to US$189,780 by 2040. Since the estimated willingness to pay for activities was linked to Park improvements, this scenario also includes the investment described in the INVEST scenario. The Rwandan Government, as the Park manager, is the recipient of the activity fee.

ENTFEE: The fourth scenario 'ENTFEE', simulates the establishment of an entrance fee to the Park for non-resident visitors. In 2018, this is equal to US$82,804 and, driven by the business-as-usual growth rate in visitors, reaches US$180,684 by 2040. Since the estimated willingness to pay for entrance to the Park was linked to Park improvements, this scenario also includes the investment described in the INVEST scenario. The Rwandan Government, as the Park manager, is the recipient of the entrance fee.

DEMAND: The fifth scenario 'DEMAND', simulates a 10% increase in tourism demand resulting from improvements in Park tourism opportunities. The increase begins gradually in 2018 and reaches 10% in 2022. This scenario also includes the INVEST scenario which is reasoned to be largely responsible for this increase in demand. This increase in demand, although above baseline demand, is still conservative given tourism demand projections made elsewhere (Lal et al., 2017, Moore and Baca, 2012).

COMBI: The sixth scenario is 'COMBI' which simulates the INVEST, ACTFEE, ENTFEE and DEMAND scenarios simultaneously. As depicted in figure 4, the new fee structure generates an additional US$173,085 in direct government revenues in 2018 and reaches US$370,464 by 2040.

At the macro level, the RCGE model requires the specification of the equilibrating mechanism for three macroeconomic balances. For the non-base scenarios these are:

(i)   The impact on the government fiscal balance is cleared through changes in income tax rates on households. This assumption ensures that the simulations are budget neutral; that is, there is no additional domestic and/or foreign financing beyond baseline values.

(ii)   Private investment in the South West region follows an exogenously imposed path; given this path, adjustments in savings from the rest of Rwanda clear the savings-investment balance; and

(iii)   The real exchange rate adjusts to equilibrate inflows and outflows of foreign exchange, by influencing export and import quantities. That is, the simulations are neutral in terms of changes in regional net foreign assets. The non-trade-related payments of the (local) balance of payments (transfers and foreign investment) are non-clearing, following exogenously imposed paths.

In addition, given the regional character of the model, a mechanism is required to clear the current account of the balance of payments between the South and West Provinces and the rest of Rwanda. Specifically, it is assumed that the real exchange rate is flexible with respect to the rest of Rwanda, with equilibrium achieved through changes in the price of local non-tradable commodities. In other words, prices for non-tradable commodities are region-specific, while for tradable commodities the local price is a weighted average of the price of three different varieties: local commodities, commodities from the rest of Rwanda, and commodities from the rest of the world.

4.2. Scenario Results

Figure 5 shows the way in which the activity fee and the imposition of an entrance fee are transmitted in the model and how they impact key economic indicators. The increased fees are transferred to the Government account which increases government savings. An increase in government savings enables greater levels of non-government investment. At the same time, the Park fee payments cause a small appreciation of the exchange rate which negatively impacts exports from the South and West Provinces while imports increase.

Figure 5. Activity and entrance fee transmission pathways in the RCGE model.
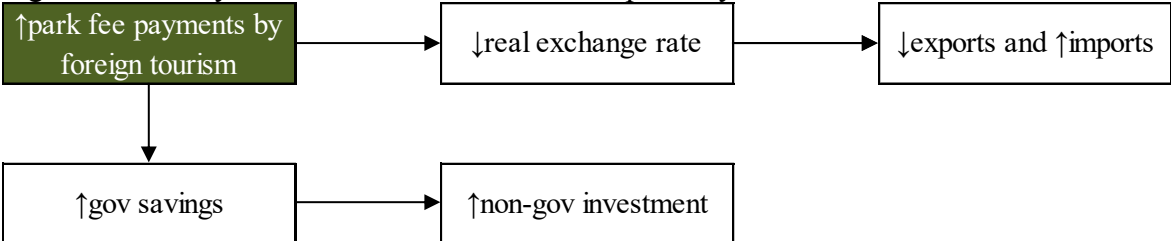
Source: Authors' own elaboration

Figure 6 shows how in the INVEST scenario, the new Government investment is transmitted through the economy. In this scenario, there are three main mechanisms at work. Panel A describes how the increase in tourism infrastructure that arises from the investment generates increased government demand for goods and services. This represents the purchase of goods and services that are required to improve the tourism opportunities within Nyungwe National Park. Construction services, for example, are a key economic sector stimulated as a result of the investment. This increased demand for goods and services produces increased demand for factors of production including labor which pushes wages up, unemployment down, and results in greater household income, consumption and well-being.

Figure 6. Panel A. Government investment transmission pathways in the RCGE model.

```
┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
│ ↑gov inv tourism     │──▶│ ↑final demand        │──▶│ ↑wages and           │──▶│ ↑hhd income          │
│ infra                │   │ (construction svc)   │   │ ↓unemployment        │   │                      │
└──────────────────────┘   └──────────────────────┘   └──────────────────────┘   └──────────────────────┘
                                                                                              │
                                                                                              ▼
                                                                                   ┌──────────────────────┐
                                                                                   │ ↑hhd cons and sav    │
                                                                                   └──────────────────────┘
```

Panel B.

```
┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
│ ↑gov inv tourism     │──▶│ ↑infra capital stock │──▶│ ↑sector-specific TFP │──▶│ ↑GRP                 │
│ infra                │   │                      │   │                      │   │                      │
└──────────────────────┘   └──────────────────────┘   └──────────────────────┘   └──────────────────────┘
```

Panel C.

```
┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
│ ↑gov inv tourism     │──▶│ ↑gov foreign         │──▶│ ↓real exchange rate  │──▶│ ↓exports and         │
│ infra                │   │ borrowing            │   │                      │   │ ↑imports             │
└──────────────────────┘   └──────────────────────┘   └──────────────────────┘   └──────────────────────┘
                                      │
                                      ▼
                           ┌──────────────────────┐
                           │ ↑foreign debt stock  │
                           └──────────────────────┘
```
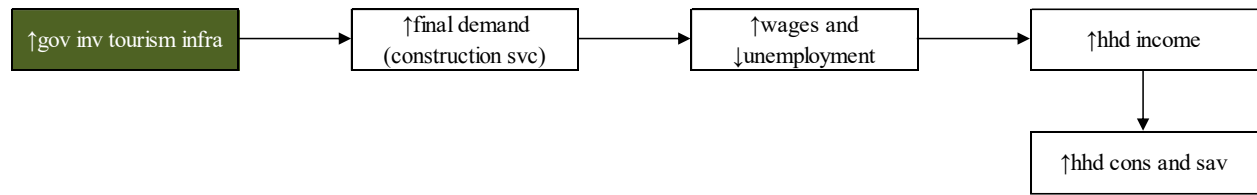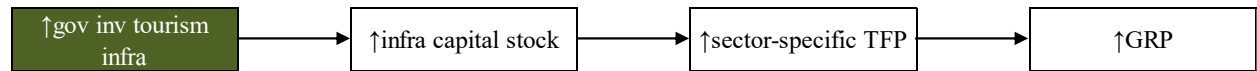
Source: Authors' own elaboration.

Panel B shows the impact of the Government investment in generating additional tourism infrastructure and capital stock. This increase in capital stock results in an increase in tourism factor productivity which directly produces faster economic growth and boosts gross regional product. Panel C describes the impact of increased foreign borrowing to finance the investment. New foreign borrowing to finance Park improvements increases the stock of foreign debt. The large influx of investment capital leads to exchange rate appreciation rendering exports less competitive and imports more appealing as was the case with the activity and entrance fee transmission mechanism.

Figure 7. Tourism demand transmission pathway in the RCGE model.

```
┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
│ ↑foreign tourism     │──▶│ ↓real exchange rate  │──▶│ ↓exports and         │
│                      │   │                      │   │ ↑imports             │
└──────────────────────┘   └──────────────────────┘   └──────────────────────┘
          │
          ▼
┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
│ ↑dem tourism-related │──▶│ ↑wages and           │──▶│ ↑hhd income          │──▶│ ↑hhd cons and sav    │
│ svc                  │   │ ↓unemployment        │   │                      │   │                      │
└──────────────────────┘   └──────────────────────┘   └──────────────────────┘   └──────────────────────┘
```
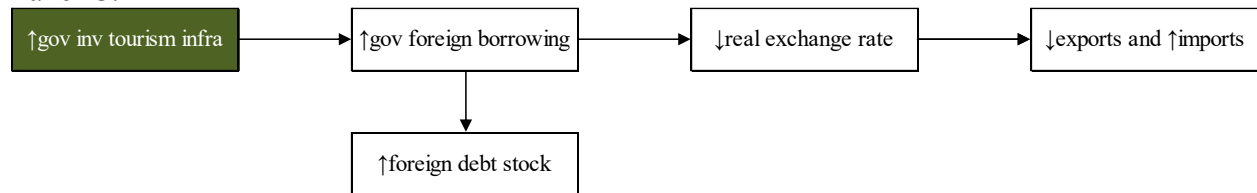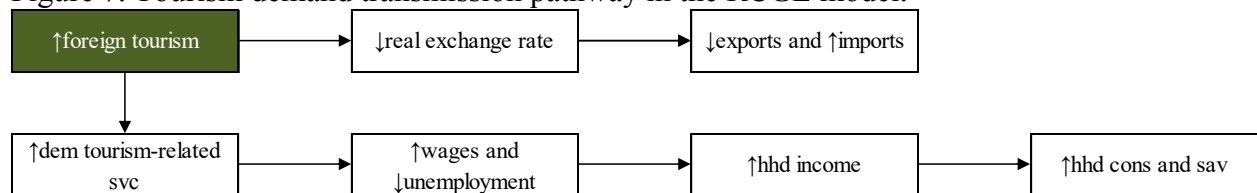
Source: Authors' own elaboration.

Figure 7 describes how the increase in foreign tourism demand is transmitted through the RCGE model. With increased tourist arrivals and/or expenditure, there is an increase in demand for tourism-related goods and services which includes hotels, restaurants and transportation among

other goods and services. This increased demand is transmitted through the economy by increasing the output from these and related sectors and at the same time, increasing demand for factors of production including labor. This increased demand results in higher wages, reduced unemployment and greater household consumption, savings and well-being. At the same time, the increase in tourism demand contributes to an appreciation of the exchange rate which renders exports less competitive and imports more appealing for the South and West Provinces.

Figure 8 shows the difference from baseline values in 2040 for key macroeconomic indicators. In the baseline by 2040, GRP would grow to US$10.7 billion. Clearly, it is the DEMAND scenario that would drive results with a GRP impact of US$9.5 million. The investment itself is second in terms of its impact, and would increase regional product by US$1.28 million (INVEST scenario). The activity fee and the entrance fee would increase GRP by US$1.30 million, though the investment makes the larger contribution in this scenario. The GRP impact of ENTFEE would be similar to that of ACTFEE (US$1.30 million).

Figure 8 shows that in the COMBI scenario, imports from both the rest of Rwanda and the rest of the world would increase by US$6.88 million and US$56.52 million, respectively. Exports in the COMBI scenario would also tend to fall from both the rest of Rwanda and the rest of the world, by US$9.69 million and US$28.51 million, respectively. It is the appreciation of the real regional exchange rate that would make exports less competitive and imports more appealing across scenarios. Absorption would increase by US$32.77 and GRP by US$9.57 million.

Figure 8. Macro-indicators, difference from baseline by 2040; millions of USD (2011).
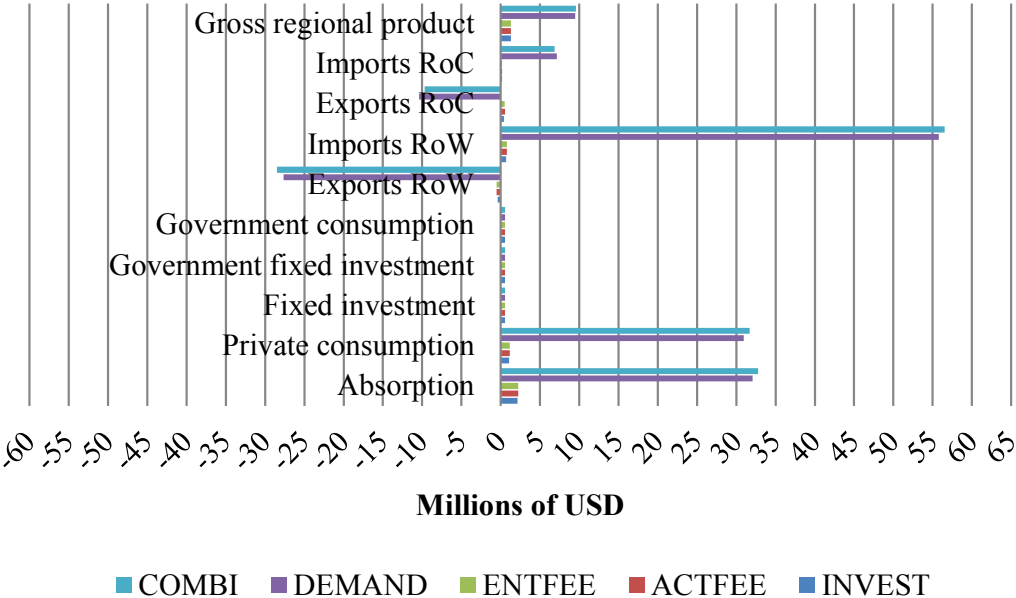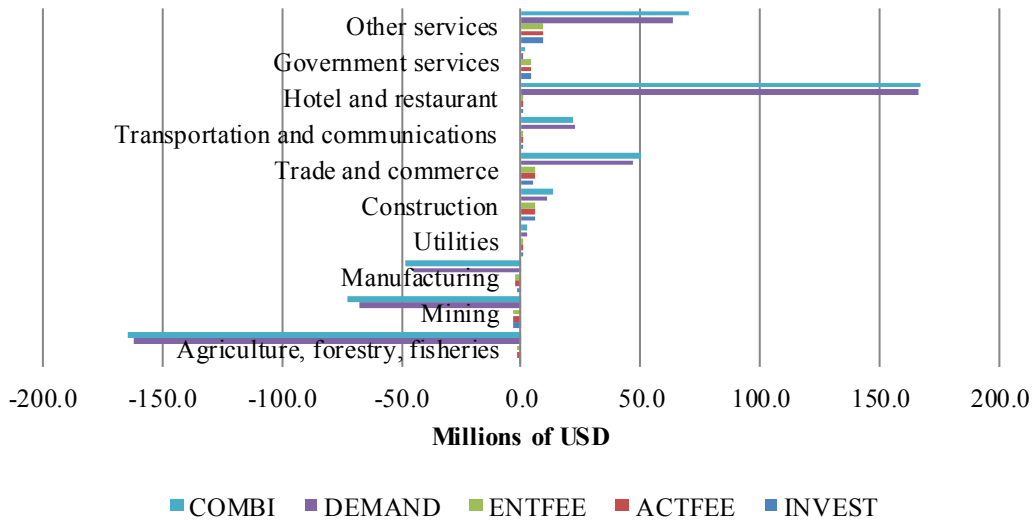

Source: Authors' own elaboration based on modelling results.

Figure 9 shows cumulative value added of sector output. Value added would increase across most sectors with the exceptions of the agriculture, forestry and fisheries, mining, and manufacturing sectors. These sectors are the most export-oriented and thus would be the most heavily impacted by the real exchange rate appreciation. The hotel and restaurant sector would grow the most, by US$167.4 million in the COMBI sector, followed by other services (US$70 million) and trade and commerce (US$50.1 million).

Singling out the investment impact on the regional economy, the other services sector, construction and trade and commerce would be those most stimulated by the Government investment (US$8.8 million, US$5.8 million and US$5.3 million, respectively). This is due to the fact that both the construction and trade/commerce sectors are the mainstays of the public sector's capital stock. Increased consumption of government services on the other hand are a function of increased Government purchasing.

Figure 9. Cumulative value added between 2040 and baseline; millions of USD (2011).

Source: Authors' own elaboration based on modelling results.

In this analysis, equivalent variation is used as the measure of changes in household welfare (Banerjee et al., in review.). Equivalent variation is the change in household income at current prices that a change in prices would have on household welfare if income were held constant. In other words, where an intervention does not occur, equivalent variation is the amount of income an individual would have to be given to make them as well off if the intervention did take place. Impacts on equivalent variation are shown in figure 10. It is the COMBI scenario, followed closely by the DEMAND scenario, that would result in the greatest positive welfare impact. By the end of the period, welfare would increase by US$31.7 million in COMBI and US$31 million, US$1.17 million, US$1.18 million and US$1.05 million in DEMAND, ENTFEE, ACTFEE and INVEST, respectively.

Figure 10. Welfare impacts expressed as equivalent variation; millions of USD (2011).
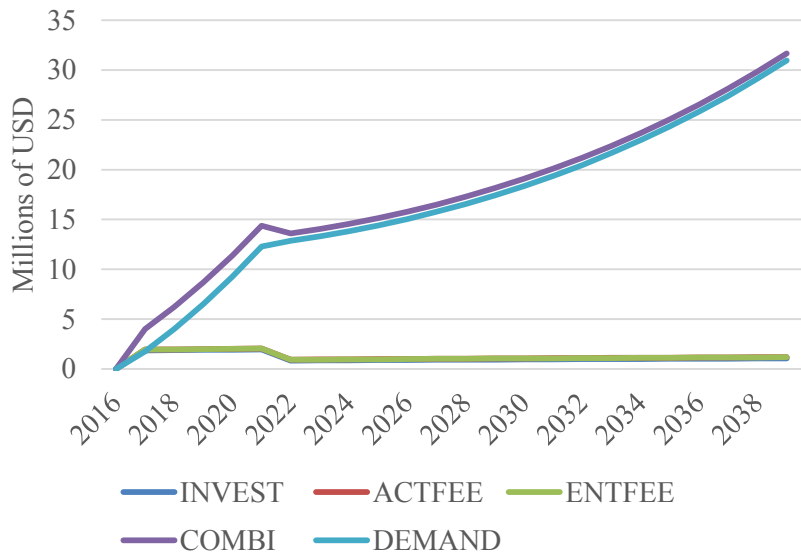
Source: Authors' own elaboration based on modelling results.

The net present value of each scenario was calculated using a discount rate of 12%. The net present value for the INVEST, ACTFEE, ENTFEE, DEMAND and COMBI scenarios would be equal to US$10.61 million, US$11.33 million, US$11.29 million, US$92.69 million and US$103.59 million respectively.

5.0. Conclusions and Discussion

In this paper, an RCGE for the South and West Provinces of Rwanda was developed to evaluate the regional economic impacts of an investment in improving the tourism opportunities in Nyungwe National Park, an adjustment to the Park fee structure, and the impact of increased tourism demand. The methods developed here can be applied to other contexts where Park Managers are faced with the need to generate additional revenue for sustainable park management while facing diminishing budget allocations. Results of this analysis show that overall, increases in Park activity fees and imposing an entrance fee have a small relative impact when compare to the regional economic impact of investment in the Park visitor experience and increased tourism demand.

The investment in Park improvements alone would generate an increase of US$1.28 million in gross regional product, while the increased fees, together with the investment impact, would increase regional product by US$1.30 million. It was the increase in tourism demand that would

drive the overall regional economic impact and would raise regional product by US$9.5 million. Fee adjustments, investment and increased tourism demand taken together would lift regional product by US$9.57 million while the overall increase in household well-being would be US$31.7 million.

Evaluating the transmission channels through which the scenarios impacted regional economic development, the reasons for the small impact arising from the fee adjustment are evident. Imposing an entrance fee and adjusting the current Park activity fee structure would result in an increase in the direct transfer of resources from foreign tourists to the Rwandan Government, as the manager of Nyungwe National Park. While these additional resources may be made available for Park operations and maintenance, they would not permeate the regional economy in any significant way, nor would they produce second-round economic impacts and spill-overs. Where the investment in Park tourism opportunities is concerned, there would be increased Government consumption of the goods and services required to improve the visitor experience in Nyungwe National Park. This increased consumption would stimulate greater output and demand for factors of production including labor which would push up regional wages, reduce employment and increase household income, consumption and well-being. These effects would be largely absent in the case of adjustments to the Park fee structure.

In the case of a conservative increase in tourism demand, the aforementioned effects would be amplified. The increase in tourism demand would generate an increase in the production of a broader set of goods and services consumed by tourists than those demanded by the Government in the investment scenario. More demand for goods and services from multiple sectors would increase economic activity which would be catalyzed by stimulating a greater number of backward and forward sector linkages characteristic of tourism-related sectors. With greater direct, indirect and induced benefits, household welfare would also improve markedly with heightened tourism demand.

What this analysis highlights is that if the Government of Rwanda is interested in generating higher revenues for investing in Nyungwe National Park and to offset Park operations and maintenance, an emphasis on Park fees may be misguided. Though the results presented in Lal et al (2017) show that there is a willingness to pay for improved Park services, in terms of overall economic impact and revenue generation, adjusting fees would have a small marginal effect.

On the other hand, this analysis demonstrated that efforts to increase tourism demand for Nyungwe National Park, potentially through communications and marketing of the new opportunities available in the Park, would be justified as a strategy for generating additional revenues for investments in the Park and its ongoing operations and management. The flow on regional economic impacts and spill-overs arising from greater tourism demand would have a significant impact on the regional economy, wages, employment and household well-being. This increase in regional economic output would generate additional tax revenues which could be used for investment in the Park and its operations and maintenance. While issues of Park ecological and managerial carrying capacity must be considered, current rates of visitation are low and there is significant scope to expand Park visitation before such limits are reached.

Of course for such a strategy to be successful, it would be necessary for the increased tax revenue arising from greater tourism demand be allocated to the Park. While this would require more complex political maneuvering and involve more institutions and stakeholders than would a simple adjustment to the Park fee structure, the overall economic impact of increased tourism demand would compensate for potential increased transaction costs, generating a win-win outcome for Nyungwe National Park management and the Government of Rwanda.

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