

Assimilation of tourism satellite accounts and applied general equilibrium models to inform tourism policy analysis

RIAAN ROSSOUW

School of Economics, North-West University, Potchefstroom Campus, South Africa and Eon Consulting, Midrand, South Africa. E-mail: riaan.rossouw@eon.co.za. (Corresponding author.)

MELVILLE SAAYMAN

Institute for Tourism, Wildlife Economics and Leisure Studies, North-West University, Potchefstroom Campus, Private Bag X6001, Potchefstroom 2520, South Africa. E-mail: Melville.Saayman@nwu.ac.za.

Historically, tourism policy analysis in South Africa has posed challenges to accurate measurement. The primary reason for this is that tourism is not designated as an ‘industry’ in standard economic accounts. This paper therefore demonstrates the relevance and need for applied general equilibrium (AGE) models to be completed and extended through an integration with tourism satellite accounts (TSAs) as a tool for policy makers (especially tourism policy makers) in South Africa. The paper sets out the reasons behind the need for economic models for policy analysis and other purposes, and gives an overview of old and new approaches to tourism policy modelling. The relevance of integrated models to, specifically, tourism policy analysis both internationally and in the South African context is discussed, followed by an illustrative empirical simulation of an exogenous inbound tourism expansion of 10%, against the background of the relationship between tourism and economic development. Furthermore, the indirect effects of an input–output model are also presented for comparison. The results confirm that the integrated approach is a more accurate tool for policy analysis.

Keywords: applied general equilibrium model; tourism satellite accounts; integrated model; tourism policy; events; South Africa

JEL classification: C67; C68; D57; D58; I32; N70; N77; O20; O29; O55

Because of recent developments in the South African tourism sector, South African tourism policy makers are currently faced with possibly their most acute need for tourism policy analysis and understanding. This is occasioned by the significant increase in the hosting of major events such as the FIFA

Confederations Cup, the 2009 British and Irish Lions tour, the DLF Indian Premier League (IPL), the Super 14 Rugby Championship, the Vodacom Tri Nations and the 2010 FIFA World Cup, to name but a few. The 2010 FIFA World Cup, for example, was the largest sporting event ever hosted in South Africa and investment demanded the construction of stadiums, improvement of infrastructure and access routes, as well as development of skills. However, the development of the tourism industry is not merely spurred by one-off events, it is also part of the South African government's Accelerated and Shared Growth Initiative (ASGISA). This economic strategy has identified tourism as a key sector for driving growth and reducing poverty.

Historically, tourism policy analysis in South Africa has posed challenges to accurate measurement. The primary reason for this is that tourism is not designated as an 'industry' in standard economic accounts. However, as recently as May 2009, South Africa launched its inaugural tourism satellite account (TSA), making it possible to measure the full effect of tourism on the country's economy. The aim of this paper is to follow an integrated approach using TSAs and applied¹ general equilibrium (AGE) models as tools for tourism policy analysis in South Africa. The integrated model consists of an innovative integration of tourism analysis, within an AGE modelling framework, to assist the formation of those government policies relating to tourism. Integrated models are formal economic models that extend, rather than replace, TSAs (Blake *et al*, 2000). They allow the full potential of the detailed data contained in the TSA to be realized and facilitate the assessment of tourism's overall economic impact, the analysis of tourism policy and tourism forecasting.

The challenge facing economic policy makers at all levels of government (as well as private business institutions operating for profit) is that limited resources must be allocated to areas that are most likely to achieve success in scenarios with the greatest probability of being realized (Cameron and Naudé, 2008). In order to assist and inform policy makers in this task, economic models play an important role. As indicated by Baumol and Blinder:

'economic theory does make unrealistic assumptions . . . but this propensity to abstract from reality results from the incredible complexity of the economic world . . . abstraction from unimportant details is necessary to understand the functioning of anything as complex as the economy.'

(Baumol and Blinder, 2005, p 11)

Economic models are mathematical representations of the economy designed to be simplifications of a complex reality. They combine those behavioural relationships believed to be responsible for the bulk of macroeconomic fluctuations, while omitting those deemed less important. This process of differentiation allows economists/modellers to make predictions that are reasonably accurate and that can be understood more easily and communicated to policy makers and other stakeholders (Coletti and Murchison, 2002). Moreover, models can provide key perceptions for analysis of comprehensive packages of economic and non-economic policy instruments within a consistent framework. Insights generated by modelling can help in evaluating various

policy options. At the same time, however, policy options which seem technically and even economically feasible at the sectoral level may lose their attraction when the policy maker discovers their potential effects on the economy as a whole, or vice versa.

According to Dervis *et al* (1992, p 131), there is no doubt that the techniques of development planning have acquired a wide field of potential real-world application. Over the years, policy planning, formulation and assessment have been carried out by relying on unassisted intuition (Jerome, 2004). More recently, however, policy makers have started to integrate the use of quantitative modelling tools in the policy formulation process, in order to account for the 'real-world' effects of their policies. Jerome (2004, p 2) argued that 'models provide a logical abstract template to sort out complicated chains of cause and effect, and influence between the numerous interacting variables in an economy'. Because economic models have a logically consistent framework, the policy maker has been provided with a valuable tool, representative of the economic sector with which ideas and policy proposals can be tested (Hazel and Norton, 1986). Economic models have therefore added significant value through qualitative assessments, since they include more structural and institutional features of the economy, and are useful in measuring the size of the response to policy initiatives.

Business risk, sector-specific institutional barriers and market imperfections can all frustrate the economic process. When they exist, these hindrances certainly will not disappear by themselves. Policies should thus aim to create a framework within which more economic opportunities become market possibilities (Cameron, 2005). Such policies require knowledge (which models can help to provide) of the extent to which these obstacles endure and can be removed cost-effectively.

In the longer term, technological evolution, as well as unforeseen changes in consumer behaviour and preferences, complicates any economic impact assessment (Cameron and Naudé, 2008). Ignoring the long-term impact of short-term decisions cannot be cost-effective, except by accident. The dynamic challenge of sequential decision making is to link short-term decisions and long-term goals with enough flexibility to cope with the uncertainties (Gorbet, 1973; Maxwell, 1975, 1976).

Finally, economic models help settle debates that cannot be settled by theory alone. Economic theory often suggests that potentially offsetting influences are at work in the economy. When combined with statistical methods, models help economists/policy makers quantify the relative importance of each factor, thereby providing an estimate of the net impact of these offsetting influences (Coletti and Murchison, 2002).

The paper begins, in the following section, by providing a brief overview of both old and new approaches to tourism policy modelling. Thereafter, the integrated approach to tourism policy modelling is discussed, while stressing the relevance of integrated models specifically to tourism policy analysis, both internationally and in the South African context. This is followed by a description of the modelling approach, and then by an illustrative empirical simulation against the background of the relationship between tourism and economic development. Next, an outline of the policy implications is given, followed finally by some concluding comments.

Tourism policy modelling: a brief overview

AGE modelling has, since the 1970s, been widely used in mixed economies by policy analysts in addressing contemporary policy issues. However, due to the complexity of interaction that characterizes tourism policy, there is still considerable debate in the economic profession regarding the value and appropriateness of using broad AGE models for policy analysis. Therefore, in order to contextualize the advantages (or disadvantages) of integrated models (as opposed to broad AGE models), an understanding of the limitations of current approaches to tourism policy modelling (for example, cost–benefit analysis, input–output, multiplier methods, etc) is needed, and how an integrated approach can get around these limitations.

Inadequacies in formal (old) approaches to tourism policy modelling

Tourism is a proven, growing economic catalyst. But, to benefit from the development of tourism, stakeholders and policy makers (for example, investors and governments) must understand the impact of changes, such as shifts in government policy or merely chance events, on the industry and economy overall. Such insight has led to the development of various quantitative modelling tools to assist in identifying the magnitude of policy impacts on a country's economy. Economic modelling has, therefore, developed into a critical tool in government policy, planning and budgeting processes.

Economic impact analyses of tourism range from simple comparisons of trends in tourism activities with those of key economic indicators through to cost–benefit analyses (CBA), proportional multiplier methods, input–output models and linear programming models (Wattanakuljarus and Coxhead, 2008, p 932). Of these techniques, the predominant approach taken to evaluate the economic impacts of tourism has been based on input–output analysis (Fletcher, 1989, 1994; Briassoulis, 1991; Johnson and Moore, 1993; Frechtling, 1999; Crompton *et al*, 2001; Tyrrell and Johnston, 2001). Input–output analysis is an analytical framework with the fundamental purpose of analysing the interdependence of industries in an economy (O'Connor and Henry, 1975, p 1). In its most basic form, an input–output model consists of a system of linear equations, each one of which describes the distribution of an industry's (for example, tourism) product throughout the economy (Cameron, 2003).

Despite being a widely accepted and useful means of economic impact analysis, the input–output approach is limited in that it does not reveal the personal income distribution effects across different household income segments (Holland and Wyeth, 1993) and does not consider industry occupation, skills and wages and the resulting income effects. Therefore, using this approach to assess economic impacts will not allow for a clear picture of which household income groups are benefiting/suffering and which are not from the specified issue under review (Cameron, 2003). Moreover, for use in policy making, input–output models may be too simplistic and do not take account of the effect of changes in relative prices, or of structural change (Naudé and Brixen, 1993).

Arguments have also been advanced in favour of using a social accounting matrix (SAM) to generate multipliers (Wagner, 1997). However, this approach is open to the same types of criticisms levelled here against the input–output

approach in that, while they provide a convenient framework to incorporate intersectoral linkages, they suffer from their inability to consider the behavioural responses of producers and consumers with respect to changes in prices (Alavalapati and Adamowicz, 2000). Alternatively, in the past a contingent valuation approach has been employed to examine the effects of tourism (Lindberg and Johnson, 1997). This approach, however, does not account for intersectoral linkages of the economy (Alavalapati and Adamowicz, 2000).

These formal (old) approaches are seriously inadequate as a means of estimating the economy-wide impact of tourism-related (policy or other) changes. They are based on extremely unrealistic assumptions, and on incomplete representations of the ways economies work (Briassoulis, 1991), ultimately providing misleading results. In nearly all cases, the changes in economic activity which they predict are much greater than the net increase in activity in the economy overall, when all of the relevant effects are taken into account (Dwyer *et al*, 2004). The results obtained from these (old) models are hazardous when used for policy purposes, because they are systematically biased.

In reality, economies are general equilibrium systems (or integrated wholes), in which an overall balance must be preserved and in which direct alongside indirect and feedback mechanisms are important (Dwyer *et al*, 2004). For this reason, some researchers have used an AGE model to examine the economic effects of tourism (Copeland, 1991; Adams and Parmenter, 1995; Zhou *et al*, 1997). The AGE approach not only accounts for intersectoral linkages but also permits the prices of inputs to vary with respect to changes in output prices, and accommodates the indirect effects of a policy change on the overall economy (Dervis *et al*, 1982; Shoven and Whalley, 1992). Thus, for use in tourism policy modelling, these dated methodologies have been superseded.

From the above discussion, it is clear that the formal (old) approaches to tourism policy modelling are limited in their capability of providing useful insight into important policy problems, since they do not present an especially useful framework for understanding and managing structural change. The implication is that an integrated approach to tourism analysis and forecasting is required, bringing together different methods of examining the future.

Out with the old, in with the new

Since the mathematization of economics, which was started in the 17th century by William Petty and Gregory King (Stone, 1985) and which culminated in the 1950s and 1960s in the elegant general equilibrium theories of Arrow–Debreu and Khan and McKenzie (Debreu, 1991), the toolkit of researchers, economists and policy makers has expanded considerably, thereby improving their capacity and role as policy analysts significantly.

A powerful tool for policy analysis is the AGE model (Dervis *et al*, 1982). This can be described as ‘an economy-wide model that includes the feedback between demand, income and production structure and where all prices adjust until decisions made in production are consistent with decisions made in demand’ (Dervis *et al*, 1982, p 132). Usually, the behaviour of economic agents is derived explicitly from microeconomic optimization. Based on microeconomics, AGE models provide an important tool for answering complex questions about

the interactions within an economic system in a coherent and consistent way. In addition, AGE models are very effective at describing market inefficiencies and the burdens caused by price-distorting measures. Moreover, AGE models can be used to describe the economy at a disaggregated level by detailing many different sectors and markets (Bovenberg and Goulder, 1991, p 201). Rutten (1991, p 143) has described AGE models as reflecting 'the heart of economic science'.

By including relative prices, the feedback effects between demand and income and the relevant institutional structure of the economy, AGE models are an improvement on the input–output and linear programming models used previously. Shapiro and Taylor (1990, p 863) argue that planning tools such as social cost–benefit analysis and linear programming have proved unable to blueprint economic development in market economies with individuals and firms attempting to maximize their own objective functions. Subsequently, AGE models have been applied in an increasing number of developed and developing countries (Dixon and Parmenter, 1996). There is, however, only limited literature applying such models to tourism questions (Dwyer *et al*, 2004).

In tourism policy modelling it is important to recognize the *integrated* or general equilibrium² nature of the economy (Dwyer *et al*, 2004, p 309). In general equilibrium models, households, firms and markets are synthesized into a model of the equilibrium of the economy as a whole. AGE models are similar but specified for many households, sectors and factors and are data-based. There are many simultaneous equations using a big database of matrices (see Figure 1). AGE analysis proceeds on the basis that events in one sector of the economy will have flow-on impacts on the other sectors of the economy. In turn, the impacts on these other sectors may have noticeable feedback effects on the original sector. In effect, general equilibrium analysis captures the impacts of a policy change or specific event on all parts of the economy by incorporating feedback from all those, while recognizing economy-wide constraints. Using AGE models not only has the advantage that general equilibrium effects are taken into account but also that the interaction of different measures can be studied and quantified (Clark *et al*, 2004). Further, the complexity of micro–macro interrelationships can be explained relatively better through an AGE modelling framework.

In addition, AGE models have become workhorses for policy analysis since they are particularly suited for answering 'what if' questions: what if productivity in agriculture increases; what if foreign tourist expenditures fall; what if emissions are taxed? Policy makers (especially tourism policy makers) typically are interested in the direct and indirect effects of specific policy measures, but often these effects are studied only in partial settings. AGE models have the advantage that the possible effects of specific policy measures can be examined without the excessive simplification and aggregation of partial equilibrium analysis (Iqbal and Siddiqui, 2001).

Since the 1990s there has been a considerable increase in the use of AGE models in developing, as well as developed, countries to study a variety of policy issues. Early AGE models were used to examine the issues of the day such as macroeconomic stability and the opening-up of a country's economy. Currently, however, the challenges have shifted to the labour market, environmental

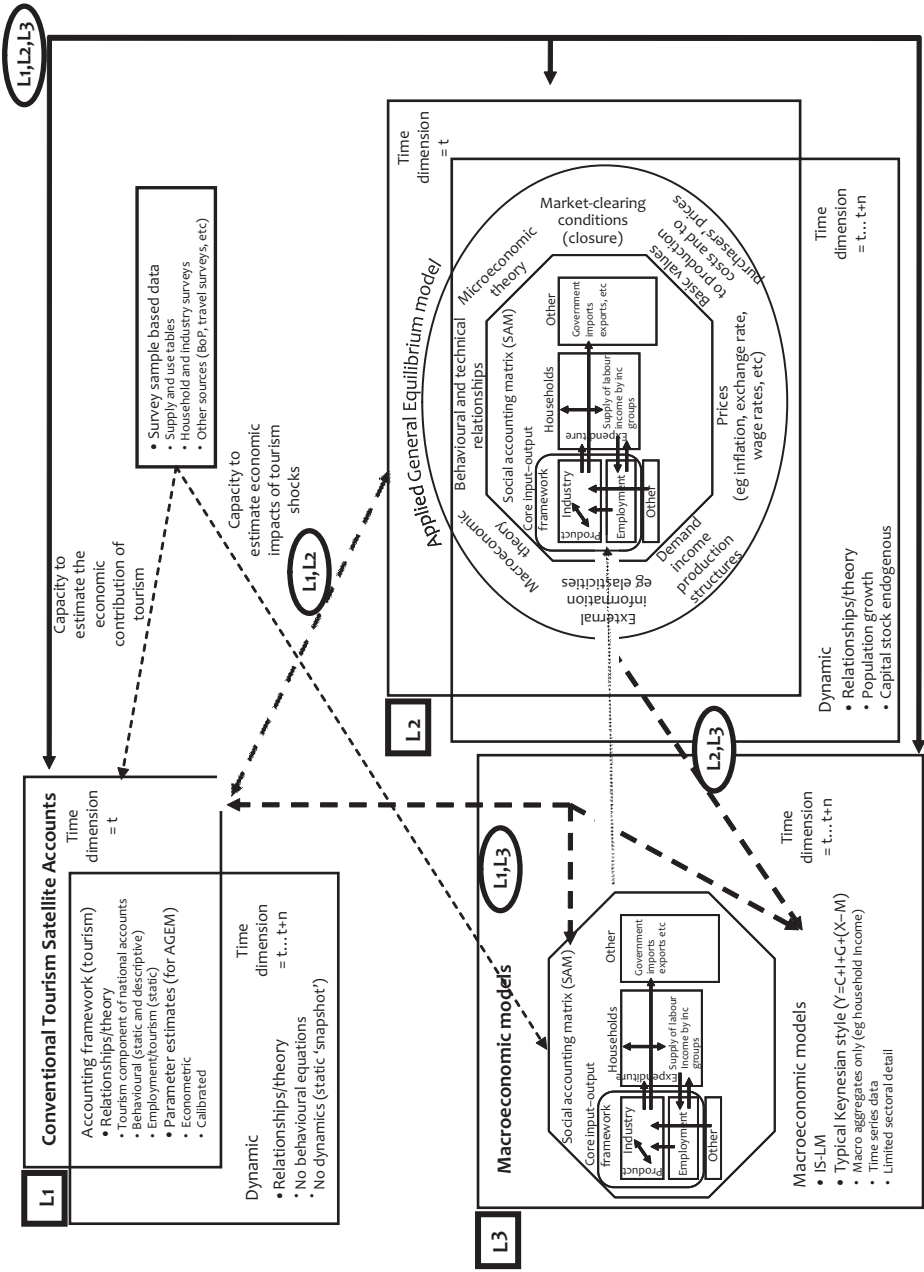


Figure 1. Stylized representation of interaction between TSAs and other (AGE and macro) models.
 Source: Adapted from Cameron (2005, p 1).

questions and policy, social and subnational issues. The advantages of AGE models for such policy analysis, compared to traditional macroeconomic models, are now widely acknowledged (for example, Borges, 1986; Bandara, 1991; Cameron and Naudé, 2008). General equilibrium models allow for consistent comparative analysis of policy scenarios and they incorporate microeconomic mechanisms and institutional features within a consistent macroeconomic framework, while avoiding the representation of behaviour in reduced form (Zalai, 1982). This allows analysis of structural change under a variety of assumptions.

There also exist some weaknesses associated with AGE models. These include: the lack of empirical validation; the number of assumptions and estimates on which the models are based; the comparative static nature of the majority of the models as opposed to the more scarce dynamic models; and, in particular, the inadequate treatment of the foreign sector through the treatment of net trade flows (Borges, 1986). Tourism satellite accounts (TSAs), on the other hand, represent another means of measuring the contribution of tourism to the economy, this time in a manner that is consistent with a country's system of national accounts (Dwyer *et al*, 2004; Ahlert, 2009). Since TSAs are based on an input–output/SAM structure, they represent a form of static 'snapshot' of the tourism sector, with the rest of the economy as a backdrop (WTO, 1999). However, AGE models go much further than TSAs in that, with them, it is possible to tell what impact a tourism-related change will have on variables (for example, GDP, employment, etc) in the economy (Blake *et al*, 2001). TSAs alone cannot be used for this purpose. Consequently, there is a demonstrated need for AGE models to be complemented and extended through integration with TSAs as a tool for tourism policy analysis purposes.

More recently, some studies have attempted to combine and integrate the various strands of modelling to capture both the macro- and microeconomic effects of policy changes on the economy, as well as on the various role players in the economy, and to overcome some of the limitations and drawbacks associated with each method when applied independently (for example, Odoki *et al*, 2001; Agénor *et al*, 2002; Bourguignon *et al*, 2002; Burniaux and Truong, 2002; Coletti and Murchison, 2002; Blake *et al*, 2006; Ahmed and O'Donoghue, 2007). It has become clear that different combinations or integrations of model types are needed when dealing with different issues. At present, AGE models designed to assess the economic impacts of alternative policies in South Africa tend not to incorporate specific linkages with tourism. The next section outlines an approach for constructing this linkage and illustrates the implications of such relations on policy and economic impact assessments.

The integrated approach

Information about current and forecast levels of tourism and its contribution to the economy is important for policy making by governments and private business institutions. Traditional forecasting methods (even when given the limitations and problems highlighted above) can provide reasonable forecasts in the context of predictable changes. However, forecasting becomes problematic in the context of both predictable changes and less predictable domestic or international shocks (Blake *et al*, 2006, p 292). This section

demonstrates the ways in which an integrated model, incorporating a conventional TSA in an AGE modelling framework for South Africa, can be used to examine and evaluate tourism-related issues more successfully.

Integrating the TSA within an economy-wide framework

TSAs provide accurate measures of the size of tourism sectors, the nature of demand for tourism, the nature of supply in tourism sectors and the direct contribution of tourism to GDP and employment (Blake *et al.*, 2001). It thus provides detailed data on tourism activities that are not generally available in national accounts. This is because national accounts provide data classified according to production activities and commodities, and tourism spans many of these standard classifications. Though TSAs represent a major step forward in the measurement of the economic size of tourism, they do not assess the whole impact of tourism, the reason being that the TSA is not a model but an accounting framework. Moreover, TSAs do not include information on anything other than the tourism industry (Tribe and Airey, 2007, p 92). Thus, there is a need for TSAs to be embodied in an economy-wide framework to capture these wide-ranging effects.

When measuring the economic impact of tourism, input–output models have often been used in the past. While these models capture some of the economic impact of tourism successfully, they do not capture all of the economic impact, leading to estimates that are not only unreliable but also heavily biased. AGE models have their historical origins in input–output methodology, but have been further developed to overcome the many shortcomings of input–output models. In particular, AGE models allow prices to vary and resources to be reallocated between production sectors. Integrated models build on this framework by including tourism data from TSAs to provide a consistent means of modelling tourism in the entire economy (Blake *et al.*, 2001, p 3). TSAs can therefore be complemented³ and extended by the use of AGE models to study the impact of tourism towards a specific country.

With relatively few countries having published ‘full’ TSAs and several other countries being in the process of developing or piloting TSAs, applications of this accounting framework are very limited for many countries. A 2009 report published by the United Nations World Trade Organization (UNWTO, 2009) would suggest that only 26 countries have compiled a proper TSA. This might explain why relatively few integrated models are described in the literature and why there is a need for the increased development of such tools for policy.

Conversely, AGE models have a well-established record of providing detailed estimates of the effects of a range of actual or possible tourism-related events on economies (for example, Adams and Parmenter, 1995; Dwyer *et al.*, 2000; Blake and Sinclair, 2003; Blake *et al.*, 2003). Moreover, AGE models are now well known in policy modelling and have, since 1993, been used with increased frequency in South Africa (see, for example, Naudé and Coetzee, 2004). These models can quantify the effects of policy changes, such as changes in value-added tax or air passenger duty, as well as of a range of optimistic and pessimistic scenarios relating to the future of the economy (Blake *et al.*, 2006, p 299). One of the major features of AGE modelling is its attempt to combine theory and policy in such a way that the analytic foundation of policy evaluation

work is improved. Consequently, integrated models also provide an important tool for policy analysis and can be used to provide additional forecasts of possible but, in some cases, less predictable events that cannot be taken into account by more traditional forecasting models (Blake *et al.*, 2006).

Due to the complexity of interaction that characterizes tourism policy, a coherent and systematic approach or mechanism is needed for analysis of the multitude of implications that can arise from tourism policy formulation (Cameron and Naudé, 2008). Moreover, the complexity of the relationship of tourism to the economy, such as the interaction between the demand and supply side of tourism, government and private business revenue implications, balance of payments, price or inflation levels, consumer welfare and aspects such as pro-poor tourism and environmental implications, would suggest that policy makers take an integrated approach to address many of these aspects and so ensure a richer and more informative analysis. Integrated models provide just such a mechanism.

Coletti and Murchison (2002, p 21) suggest two reasons for following an integrated approach to policy analysis. The first concerns the uncertainty regarding the correct economic hypothesis (Selody, 2001). The second reason for an integrated approach to policy analysis stems from the fact that, being a simplification of a complex reality, no one model can answer all questions. A model's structure varies according to its intended purpose.

Issues related to tourism policy typically require a medium- to long-term perspective. Thus, a clearer representation of the equilibrating forces in the economy is necessary (Poloz *et al.*, 1994). How consumers and producers in the model form their expectations about future economic conditions (such as changes in prices and income levels) is particularly important (Coletti and Murchison, 2002). Pure forecasting models, which typically fail to isolate this path, can yield misleading answers when there is a change in policy framework, particularly when the new framework does not reflect the average behaviour of policy over recent history (Longworth, 2002). Moreover, the integrated models provide the opportunity to assess the potential long-term growth of tourism in response to changes in the economy (such as population growth and changing education levels) that are highly predictable, as well as the short-term impact of macroeconomic changes such as currency market crises and natural disasters (Blake *et al.*, 2000, p 11). A third reason, put forward by Blake *et al.* (2006), for using integrated models in tourism analysis and policy formulation rests partly on what the users of their output wish to learn.

Integrated models include not only those sectors in an economy related to tourism, but also the entire range of sectors in the economy, covering primary and secondary activities as well as services, and are able to take full account of the interrelationships that occur between all of the sectors. They are able to trace the effects of changes in non-tourism activities on tourism-related sectors, as well as the effects of changes in tourism on the remainder of the economy. They quantify the macroeconomic impacts of alternative scenarios on income, employment, welfare, the balance of trade and government revenue, as well as on individual sectors of the economy (Blake *et al.*, 2006).

In summation, it is believed that a broader approach to tourism analysis and forecasting is required, bringing together different methods of examining the future. Therefore, in order to motivate the need for an integrated approach for

examining and forecasting tourism in South Africa, it is important to understand the relationship between conventional TSAs and modelling techniques that incorporate relative price and/or aggregate economic responses.

Exploiting synergies and complementary aspects of TSAs and AGE models

Due to the interest by policy makers in the link between economic growth and development and aspects such as income distribution and pro-poor tourism, especially in the developing and transition countries, the focus of economic modelling needs to include a more comprehensive capability to analyse questions related to these aspects within an economy-wide framework for policy analysis and formulation purposes (Davies, 2004). In this context, the application of TSAs combined with other macro and/or AGE models can provide much greater insight into the implications of economy-wide policy decisions and the impact of such policies on distributional and tourism-related issues, as well as vice versa.

TSAs are based primarily on data from supply and use tables, as well as large representative survey-based samples (for example, from annual household surveys to annual, quarterly or monthly industry surveys, in addition to administrative data from external sources). These same tables and surveys also inform certain parameters and assumptions when constructing SAMs for AGE models. Figure 1 provides a stylized illustration of the relationship between TSAs, input–output, SAM, AGE and other macroeconomic models and common data between the approaches. The shortcoming of the structure of SAMs and AGE models is that they do not embody a defined and detailed tourism sector, whereas TSAs are sets of accounts that provide exactly such detail. The main advantage in this context of TSAs, therefore, is that they offer the opportunity for consistent definitions and data use, and they do much of the disaggregation of tourism-related sectors (Tribe and Airey, 2007). On the other hand, however, where a TSA does not exist, AGE models can provide some of the information on input and output relationships, which can be used in the construction of a TSA (Dwyer *et al.*, 2000).

TSAs take no account of possible factor constraints or the impacts that changing prices and wages might have on other (non-tourism) industries, nor do they contain any behavioural equations specifying how each sector responds to external shocks, including shocks normally affecting the sector directly and shocks transmitted through intersectoral linkages via change in prices, wages exchange rates and other variables. As such, TSAs are of partial equilibrium nature only (Cameron and Naudé, 2008). SAMs and AGE models in turn track inter-industry relationships, which are based ideally on realistic behavioural assumptions, and allow for resource constraints and prices. Moreover, they can provide fully simulated economic impacts and welfare estimates (Tribe and Airey, 2007). It is therefore apparent that these approaches can complement each other in the quest to understand these issues better in the context of economy-wide as well as macro and micro level analysis for less developed and transitional economies.

The relationship and context (see Figure 1) between TSAs, input–output tables, SAMs and AGE models can therefore be summarized as follows (Cameron, 2003, p 1):

- (1) Input–output analysis is an analytical framework with the fundamental purpose of analysing the interdependence of industries in an economy and that records economic transactions irrespective of the social background of the transactors. A TSA is based on an input–output/SAM structure.
- (2) A SAM comes from input–output tables, national income statistics and household income and expenditure statistics, and is thus broader than an input–output table and typical national accounts, showing more detail about all kinds of transactions in an economy.
- (3) An AGE model comes from a SAM, coupled with a conceptual framework that contains the behavioural and technical relationships among variables within and among sets of accounts. The aim of AGE modelling is to convert the abstract representation of an economy into realistic, solvable models of actual economies. In brief, an AGE model has the benefit that it can be used, therefore, for a more detailed and realistic evaluation of the economy-wide effects of policy changes or other economic impacts than either an input–output analysis or SAM.

The integration approach used to combine or merge these two techniques implies constructing a single model that consists of all elements of the various layers applied. For example, an integrated combination (L1, L2) would mean that an AGE model could be constructed with a virtual TSA embedded in it (Blake *et al*, 2001) and with full capabilities with regards to industries, households, taxes and transfers. As an example, based on the illustration in Figure 1, three combinations of layers indicated by the square blocks [1], [2] and [3] can be defined. The TSA is labelled as L1, the AGE model as L2 and the macroeconomic block (representing various other macromodelling approaches) as L3.

Therefore, for example, an integrated combination can be found indicated in the illustration as (L1, L3), which implies that a TSA will be used in combination with a macroeconomic/econometric model to study a specific topic. Although less common, such combinations can be found in the literature (for example, Blake *et al*, 2006; Jackson *et al*, 2008). The more general approach would be layer combinations of (L1, L2) and (L1, L2, L3), indicating combining a TSA with an AGE model and, in the last case, combining, for example, a macroeconomic model, an AGE model and a TSA. Integration/layering between AGE and macroeconomic/econometric models also exists (for example, Cooper *et al*, 1985; Bourguignon *et al*, 1989; Breece *et al*, 1994; Meagher, 1996), as indicated by the combination (L2, L3).

It would seem that integrated models (as opposed to any single model or framework in isolation) appear to be cleaner and more transparent. They may also be more applicable when the aim of the study is to understand the direction and relative magnitude of distributional and other effects in the context of a full microeconomic analysis within an economy-wide framework. A further strength of the integrated models is their flexibility. As demonstrated in Figure 1, the integrated models usually contain certain core components of the model structure and can be expanded by extending the scope of the model to suit the circumstances of the tourist origin/destination country or region. However, the data requirements and rapid structural change in transitional economies pose

a challenge to the application of both AGE models and TSAs in these types of economies.

Therefore, it can be concluded that the relationship between conventional TSAs and other models may be described as complementary in the sense that, no matter how the various techniques are combined or integrated, the resulting analysis possible is richer and more informative than that possible when conducted as analyses with each type of model in isolation. However, it must be noted that the specific topic for the analysis at hand would determine the detail of how this relationship is leveraged, from an individual TSA or macro model, to various combinations/integration of such models. To combine these type of models, just for the sake of being able to do so, will be an expensive and time-consuming undertaking, while not necessarily providing greater insight into the specific questions being analysed.

Tourism in the South African integrated model

An important consideration for modelling any tourism-related issue is to consider the current tourism structure in South Africa based on the underlying framework (databases) used in the integrated model. These databases include a base year SAM, tourism data and parameters (shares and elasticities) associated with production and consumption functions. Accordingly, the integrated model for South Africa combines the tourism demand data provided by the South African TSA (Statistics South Africa, 2009) for 2005 (which specifies 19 and 17 tourism-characteristic and tourism-connected industries and commodities, respectively) with the most recent published SAM (benchmark data set) for South Africa (Statistics South Africa, 2002, 2004); these in addition to other sources of data.

Tourism already is included implicitly in the supply and use tables and, therefore, in the central framework of the SAM. The TSA is developed to make tourism explicit; that is, to extract the tourism shares from the supply and use table, therefore not interfering with the intermediate consumption part of the use table (Van de Steeg and Steenge, 2008). A most important contribution of the TSA framework is the construction of a final expenditure vector (see Table 1) specific to tourism. The tourism final expenditure vector denotes the consumption of visitors in the economy of reference of all kinds of goods and services from various standard industries.

Fortunately, the benchmark SAM (2002) contains tourism expenditures and demands for tourism by residents and foreign tourists. Furthermore, the data of tourism receipts from residents and foreign tourists recorded in the TSA (2005) are used to disaggregate (see Table 1). Twenty-nine of the 103 commodities in the South African SAM are classified as being tourism related, and both foreign and domestic tourism are classified as being expenditure on these 29 commodities. Table 1 shows the shares of domestic and foreign tourist expenditure as a percentage of total commodity demand, as well as showing how both foreign and domestic tourism spending is shared across these commodities. Notably, foreign/tourist expenditure is weighted much more heavily towards accommodation, while domestic expenditure is weighted more towards the food and services sectors. Column 9 shows the final estimated share of tourist expenditure in each sector in the economy. From this column it is

Table 1. Estimated share of tourist expenditure for tourism-characteristic and tourism-connected industries in the benchmark SAM.

Sectors	Industry type	Share based on domestic household expenditure (%)	Tourist spending on major items				Final estimated share of tourist expenditure (%)	
			Transport (32.2%)	Accommodation (29.7%)	Food (24.6%)	Entertainment (9.2%)		Gifts (4.2%)
Agricultural products	Food	3.32					2.17	
Meat products		7.72		1			5.03	
Fish products		0.89		1			0.58	
Fruit and vegetable products		1.41		1			0.92	
Oil and fat products		1.14		1			0.74	
Dairy products		2.43		1			1.59	
Grain mill products		3.39		1			2.21	
Bakery products		2.01		1			1.31	
Sugar products		0.77		1			0.50	
Confectionary products		0.78		1			0.51	
Other food products		1.35		1			0.88	
Beverages and tobacco products		12.60		1			8.21	
Wearing apparel		Hardware	6.35				1	2.54
Handbags			0.15				1	0.06
Footwear			2.08				1	0.83
Published and printed products		Chemicals	1.15				1	0.46
Recorded media products			0.18				1	0.07
Petroleum products	5.63		1				9.14	
Pharmaceutical products	3.15			1			4.27	
Soap products	3.67			1			4.98	
Rubber tyres	0.84			1			1.36	
General hardware products	0.31						0.12	
Motor vehicle parts	1.14			1			1.84	
Jewellery	0.37						0.15	
Accommodation	Services		4.62		1			6.26
Transport services		6.87	1			1	11.15	
Communications		5.39	1				8.76	
FISIM + Insurance services		10.47		1			14.20	
Other services/activities		9.80				1	9.16	
<i>Sum of household expenditure</i>		299,539	19,86%	21,91%	37,83%	10,60%	100,00	
<i>Ratio adjusted</i>			1,62	1,36	0,65	0,93	0,40	

Source: Authors' own calculations based on data from the South African Tourism Satellite Account (2005) and Statistics South Africa SAM (2002).

evident that the services industry is the largest contributor (50%) of tourist expenditure in South Africa. Other large sectors in the economy include petroleum products (9.1%), beverages and tobacco products (8.2%) and meat, soap and pharmaceutical products (5%). By comparing columns 3 and 9, the difference in expenditure patterns of domestic households and those of non-residents/tourists can clearly be seen.

A key point about the TSA for South Africa is that, unlike TSAs of most other countries (which are used independently), it now forms part of a larger, integrated model (linked to an existing AGE model for South Africa) for tourism, as depicted in Figure 1. Thus, the key drivers of tourism that are included in the TSA are included in an integrated model with forecasting capabilities. The integrated model then quantifies the effects of tourism policy (or any other) forecasts on a range of macroeconomic variables for South Africa, as well as on every sector of the economy. Moreover, the impacts of such changes across households, income and employment are included in the results. By this means, each component of the overall model is integrated fully with the others.

Tourism and economic growth implications: an illustrative integrated analysis for South Africa

In order to illustrate the usefulness of integrated models in the tourism context for South Africa, a scenario was selected that was quite topical in South Africa and of extreme relevance to economic policy makers and infrastructure planners.

From 1 June to 1 July 2010, South Africa hosted the FIFA Soccer World Cup, which brought in more than 200,826 soccer fans to the country (25% more than for the same period in 2009). This was the largest sporting event ever hosted in South Africa. Investment in the run-up to the event entailed the construction of stadiums and improvement of infrastructure and access routes, as well as the development of necessary skills. Questions have been raised regarding the potential implications of such events on the output of the sectors involved and on the economy overall. At the same time, the national government has implemented a number of nationally-based macroeconomic strategies to address unemployment and poverty, such as the Growth, Employment and Redistribution (GEAR) strategy⁴ and, more recently, the Accelerated and Shared Growth Initiative for South Africa (ASGISA),⁵ in which tourism has been identified as a key sector for driving growth and reducing poverty. This policy initiative, alongside government and the private sector's investment in a tourism marketing and development drive, will see the value of the South African Tourism industry receive an extra boost.

However, the question above is not a straightforward one to answer and only a very crude attempt to do so with a basic AGE model can be made without conducting some extensive expansion to the model and the database itself. The whole issue of the hosting of major events in South Africa is a major research topic in itself and the authors do not want to attempt to go into too much detail as part of this study. However, it does serve to illustrate a relevant tourism economic application of an existing South African integrated model.

Before investigating the potential implications of the current policies of

tourism promotion in order to help drive growth, reduce poverty and generate new capacity, a brief summary of the relationship between tourism and economic development, in the South African context, is provided in the following section.

Tourism and economic development

Tourism is characterized by high growth and, with the exception of the airline sector, low protectionism. It provides increasing per capita income, foreign currency and government revenue that can be used to promote the growth of manufacturing. Tourism also generates employment and enables some members of the population to move from the informal sector to higher-paid jobs in the formal sector (Sinclair, 1998).

Concerning the latter, South Africa is a case in point where the formal tourism sector provides major opportunities for the informal sector. Tourist enterprises attract domestic and international tourists and create opportunities for small entrepreneurs and economic linkages, such as agriculture, hunting, handicraft production and a wide range of service industries. Moreover, a wide range of opportunities for historically disadvantaged groups exists, ranging from small guesthouses, shebeens (local 'pubs' or taverns) and restaurants with local cuisine, through community tour guiding, music, dance and story-telling, arts and crafts, traditional hunting and medicine to laundry, gardening and speciality agriculture (Department of Environmental Affairs and Tourism, 1996). Tourism also provides particular opportunities for local economic development in rural areas, where it can provide people with an alternative to moving to urban areas.

In an early study of tourism and developing countries, Erbes (1973, p 4) concluded that 'the development of the tourism sector is, *a priori*, a no less rational choice, economically speaking, than any other'. None the less, the question remains as to whether South Africa is obtaining an optimal return from tourism. According to the 2009 edition of WTTC's *The Economic Impact of Travel and Tourism*, tourism, the fourth largest and fastest growing industry in South Africa, directly contributed 8.7% (US\$22.9 billion) to GDP and employed more than 1,052,000 people (7.8% of total employment or 1 in every 12.8 jobs) in 2009 and has a projected 12% yearly growth rate for the next few years. In addition, export earnings from international visitors and tourism goods are expected to generate 13.1% of total exports (US\$14.3 billion) for 2009.

At the micro level, South Africa hosted the FIFA Soccer World Cup in 2010, an event widely recognized as an especially powerful and efficient stimulant of the tourism industry. According to Zeng and Luo (2008), three outcomes of the Soccer World Cup on South Africa's tourism industry are possible. The first is the 'legacy effect'. The three stages of the 'legacy effect' are before, during and after the event. 'Before the event' is a preparation stage. 'During the event' generates tourism demand at its peak, while 'after the event' is the continuation of attracting more tourists, which can last for some years (Zeng and Luo, 2008, p 122). The 'legacy effect' of hosting the Soccer World Cup includes the creation of world-class sporting facilities, improved infrastructure and skills development, which has certainly benefited South Africa's tourism industry since hosting the event in 2010.

It can be concluded, therefore, that although the return South Africa has obtained from tourism in the past is limited, with current developments (for example, hosting of major sporting events and positive macroeconomic policy shifts) the country could gain greater and more sustainable returns from it.

An illustrative integrated analysis of selected tourism policy responses

According to statistics from the World Travel and Tourism Council (WTTC, 2009), the average annual growth rate of inbound tourism to South Africa is around 8.4%. For illustrative purposes, the authors simulate the effects of a successful past tourism promotion policy by assuming that inbound tourism grows by an additional 10 percentage points per annum due to the number of major events. Thus, we impose an exogenous inbound tourism expansion of 18.4%, by using a modified version of the 'IDCGEM' for illustrative purposes. The IDCGEM is an AGE model of the South African economy, based closely on the Australian ORANI-F⁶ model (Horridge *et al*, 1993). A very brief outline of the model is given below from Horridge *et al* (1995).

The integrated model contains 103 single commodity producing industries, 2 margin commodities, 24 household categories (consisting of the 4 major race groups, each of which is divided into 6 income groups) and 13 labour occupations. The SAM database used at that time (see Coetzee *et al*, 1997) was compiled based on the work of Van Seventer *et al* (1992). Data were also supplied for the occupational and race disaggregation of employment and for the race and income-level disaggregation of the household sector, as well as the provincial sectoral share estimates of GDP.

In addition to the database alteration described above, the IDCGEM's theoretical structure was also enhanced to cater for the various tourism categories. The enhancements involved both additions and modifications to the behavioural equations in the model, as well as the model parameters used in those equations. The resulting integrated model (modified IDCGEM integrated with the TSA for South Africa) is unique in the way the tourism-related industries (see the section below on tourism sector treatment) are treated in the model. In the model, industries pay factors of production in return for factor services, pay taxes and purchase intermediate inputs. Labour is mobile between sectors, but capital is specific to the sector in which it is employed. Labour (in total) and capital in each sector is not fixed in supply, as the 'open' nature of the South African economy allows changes in wages (and rental rates of capital) to induce changes in the supply of factors in South Africa. Exports and imports occur for each of the 103 commodities (except where data show these flows to be zero).

A more detailed technical description of the basic model can be found in Horridge *et al* (1993), as the basis of the model is the ORANI-F model.

Integrated model mechanics. A number of the structural features were introduced in the integrated model. These structural features include the following:

- *The labour market.* The integrated model contains more disaggregated specifications of the labour market and of the household sector than does ORANI-F. The workforce is disaggregated by occupation, and segmentation by population group is recognized. The model's nested production functions

specify an industry's aggregate labour input as a CES combination of occupation-specific labour inputs, each of which is a CES combination of labour drawn from the different population groups (Coetzee *et al*, 1997). Therefore, if relative wages change, employers will substitute between occupations and between population groups. The household sector in the integrated model is also disaggregated by population group. Within each population group are recognized income levels, defined as divisions of the group's income distribution. With these labour market and household disaggregations, the model can project the effects of increased inbound tourism on the distribution of employment and income in South Africa.

- *International trade.* The transformation option is adopted for non-traditional exports, rather than the composite non-traditional downward sloping demand curve adopted in ORANI-F. This implies that domestic and export production of these commodities is determined through a production frontier curve. If domestic producers want to export more (without a change in technology), they will have to reduce domestic production, and vice versa.
- *Export and domestic markets.* Domestic production is allocated to export and domestic markets according to a CET function. Two distinct treatments also exist for export commodities: (i) downward-sloping demand curves for individual traditional exports and for a composite non-traditional export; and (ii) downward-sloping demand curves for each export commodity with a transformation function for export production (that is, the commodities exported differ from those sold on the domestic market and producers switch between domestic production and export production based on the relative price of producing for each market).
- *Tourism demand.* A constant elasticity of demand function is used to give tourism demand in the model. A parameter equal to the base level of tourism demand is used, except where tourism demand shocks are introduced into the model through changing this parameter. Moreover, a composite price of goods and services used by tourism is introduced, where foreign tourists are interested in how their composite price changes relative to a real exchange rate ϕ_i .

Model closure applied and other assumptions. The general closure assumptions for the illustrative short-run comparative-static simulations conducted are:

- the numeraire is the world average price of all goods
- capital stock is assumed fixed in each industry
- no relative change in government consumption expenditure is assumed
- slack labour markets for all labour categories are assumed
- average real wages are kept constant – so wage rates adjust with inflation
- household consumption moves with disposable income for all households
- the industrial structure of private investment responds to changes in relative rates of return.

The trade balance, current account deficit (or foreign savings), terms of trade and real devaluation are determined endogenously, since the effects on these macroeconomic variables are the main concerns of policy makers in South Africa. For the specific scenario to model an exogenous inbound tourism expansion of 10%, certain industry-specific assumptions had to be made, over

and above the general closure described above. Therefore, the assumptions are that:

- tourism goods and services under these circumstance will continue to be exported – knowing that in practice this is not necessarily the case, but the current treatment of the tourism industry in the model assumes imports and exports for these sectors;
- tourism consumption can be set exogenously according to a tourism boom or growth – this can, however, be switched to an endogenous variable if the effects on tourism are considered.

As with any attempt to simplify and quantify real world processes and actions with a mathematical representation, a host of assumptions must be made. This is captured by the well-known broad assumption *ceteris paribus* – all other things assumed constant. Therefore, this implies some of the following (non-exhaustive) more detailed assumptions below:

- Assumption of no mitigation: no change in the production technology of tourism for these sectors is effected to mitigate the impacts of the higher consumption from additional tourists.
- Assumption that the addition to the international tourist intake exhibits expenditure patterns and a national distribution identical to those of the existing intake.

Tourism sector treatment. The integrated model's tourism sector(s) is an aggregate sector(s) made up of accommodation for visitors, restaurants and similar services, railway, road, water and air passenger transport services, transport equipment rental, travel agencies and other reservation services, cultural services, sports and recreational services, tourism-connected products and other non-specific products. As such, the tourism detail contained in the sectoral detail of this specific model is not sufficient for an in-depth analysis, but will serve the purpose of illustrating the applicability of integrated models for tourism policy analysis in the current South African context. The structure of the model does not allow implicitly for switching of tourism goods and services. Figure 2 illustrates the type of tourism collectives built into the model to investigate specific tourism-related issues.

Typically, tourism can be thought of as a bundle of goods and services combined together with a fixed proportion or Leontief technology, as depicted in Figure 2. This is because tourists, for instance, cannot substitute transportation for food, hotels or other services. This is the same assumption used by Blake and Gillham (2001). Outbound tourism demanded by households is a function of disposable incomes. Inbound tourism demanded by foreigners, however, is a function of tourism prices and exchange rates (Wattanukuljarus, 2006, p 13).

Analysis of the national level impacts of the scenario. The national level impacts of the simulation are presented in Table 2 for both the integrated (column 3) and input–output (column 2) model. This illustrative analysis focuses mainly on two variables, that of overall economic output measured by GDP and employment. The sectoral effects (of which the aggregates are also included in Table 2) focus on value added and employment and the household effects on their real

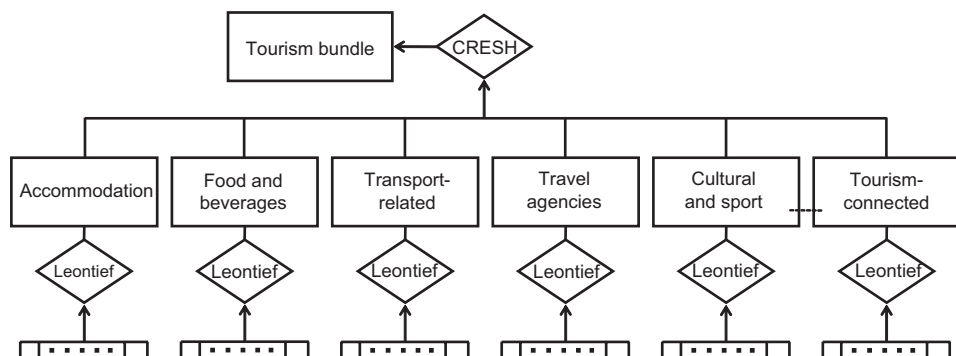


Figure 2. Example of tourism-specific model technical adjustments.

Source: Adapted from Wattanakuljarus (2006, p 35).

consumption expenditure. The results are presented in annualized percentage-change format.

Table 2 shows that the total effect that additional tourism growth has on the economy is dissimilar for the different models. The main points of difference are:

- Some tourism sectors (as well as for total GDP) have significantly higher increases in value added in the integrated model than the input–output model suggests, the reason for this being that the initial stimulus of foreign tourism expenditures is reinforced by domestic expenditures as firms benefiting from the initial expenditures increase their own expenditures on tourism and private households which have increases in income spend more on domestic tourism (induced effects).
- Tourism sectors, such as rail and water transport, have a lower value-added increase than suggested by the input–output model, the reason being that foreign tourists' expenditures in these sectors constitute relatively small proportions of overall expenditure. Resources are reallocated to other sectors that are able to pay higher wages, with the result that these reallocation effects outweigh the induced effects experienced from higher incomes.
- Non-tourism industries have a decline in sector value added that the input–output model overlooks completely, as it does not include price crowding-out effects and resource allocation. In the input–output model, there is no direct stimulus from the foreign tourism expenditures. Indirect and induced effects are positive, but are outweighed by resource allocation effects.

It should be noted that the South African TSA does not include domestic same-day visits (see Statistics South Africa, 2009). This data gap has some implications for scenario conclusions. For one, it undermines the understanding of the domestic market; therefore, it is very difficult to say with any certainty what contribution domestic tourism makes to total tourism and to the economy. This implies that the current results from the model might actually represent a skewed view of the actual *total* impact of increased tourism.

The cause–effect logic of the simulation would be that as a result of

Table 2. Summary of results for scenario (national and sectoral level impacts).

	Input–output model	Integrated model
Macroeconomic effects		
Gross domestic product (GDP)	1.42	0.56
Employment	1.98	0.82
Average real wage rate	1.17	0.00
Tourism consumption	10.00	10.00
Domestic absorption	0.99	4.26
Consumer price index	1.47	2.82
Government consumption	0.00	0.00
Exports (volume index FOB)	–	–5.50
Export price index	1.39	1.42
Imports (volume index CIF)	–	2.42
Import price index	1.10	0.00
Sector effects		
<i>Value added (price)</i>		
Natural resources	1.81	0.40
Manufacturing	1.33	2.11
Services	1.55	3.17
<i>Employment (volume)</i>		
Natural resources	0.61	–1.64
Manufacturing	0.58	–2.33
Services	0.65	1.78
Household effects		
Real household consumption	0.96	4.18

Notes: FOB = free on board; CIF = cost, insurance and freight.

Source: Integrated and input–output model simulations conducted by the authors.

exogenous inbound tourism expansion, total production increases and is propagated through the inter-industry input–output linkages. Since producers are assumed to maximize profits, employment gain is the result of increased outputs. The employment gain in turn leads to a greater wage bill being paid to labour, with the resulting feedback of increasing household income.

The increase in household income in turn leads to higher demand for final products due to lower household budget pressures, placing upward pressure on domestic prices. In order to achieve equilibrium in both the demand and supply side of the economy, prices have to increase even further, and the spiral effect leads to even more production, more employment, etc, until all endogenous variables reach equilibrium values. The result is that GDP ends up at 0.56% higher per annum than compared to the base case, while employment increases even more by 0.82%. Domestic consumption benefits to the extent that it is 4.26% higher and the resulting general domestic price increase that needs to take place is approximately 2.82%.

The combined increase in household income and production output causes imported commodity volumes to increase by approximately 2.42%, while the imported price index stays constant as South Africa is assumed a price taker in the international market. One would expect higher domestic prices to

dissipate some of the competitive advantage on the export front and to feed through to the international market to some extent (for example, an increase in the export price index of 1.42%). Accordingly, and as theory predicts, the higher costs of domestic goods lead to a decrease in demand from foreign countries, and therefore a decrease in total domestic exports (-5.50%).

Table 3 provides some detail on an aggregated (since the model actually has 103 sectors) level. Nominal wages all increase in tandem with national inflation (2.82%, as in Table 2), bearing in mind the assumption that the real wage rate is kept constant. Since the world price of goods is kept fixed (the numeraire by assumption), no change in national or sectoral level import prices will be observed. From Table 2, it is clear that at the sectoral level there are losers as well as winners resulting from an increase in tourism. After the service industries directly catering for tourists (84, 94-96), the trade and repairs industry exhibits the largest increase in output (1.22%). This is due possibly to the relative share of tourist expenditure in the income base of these sectors, as well as the fact that these industries are affected directly by an increase in tourism. In terms of the transport sectors, both road passenger transport services and other transport services (including freight) experience significant increases (0.29% and 0.32%, respectively). Because of its link to the strongly stimulated service industries directly catering for tourists, food, beverages and tobacco is the obvious example of the sectors which experience the indirect benefits of increased tourism. Electricity, gas and water is a less obvious example. Its growth prospects are enhanced by the expansion of investment induced by the additional tourism.

Sectors which experience output declines following the expansion of tourism are those comprising traded-goods industries, which are affected adversely by the higher domestic prices in their specific industries that the expansion of tourism generates, and which affects the exports of those products adversely. The main examples are the traditional exporters (agriculture; mining; non-metallic mineral products; and basic and fabricated metal products) and the import-competing sectors such as textiles, clothing and footwear. Agriculture, forestry and fishing (a traditional exporter), which might be expected to experience a significant decline because of the increase in imports, are saved indirectly to some extent from major declines by the increase in tourists' demand (indirectly) for their outputs. A detailed analysis and understanding of the dynamics driving the results in each sector would need to be analysed and is beyond the scope of this paper.

The above scenario and results must be interpreted in the context of the assumptions. In real economic life, firms will adjust to circumstances and may, for instance, switch to catering to the foreign market, change their efficiency of production processes and various other innovations. All of these innovations and mitigating actions could also be modelled to obtain a better understanding of the potential overall implications for this scenario.

Tourism intensity versus dependency. Although the direct effect of an increase of tourism volumes would affect both economic output (growth) and employment, the reality is that the rest of the economy might be very much dependent on tourism for its continued existence. The question then remains as to what extent the South African economy (including the manufacturing industries) is

Table 3. Aggregate sectoral level impacts (structural effects for the integrated model only).

Sector annualized % change	I-O model	Value added		Exports		Imports		Employment	
		Volume	Price	Volume	Price (Rand)	Volume	Price (foreign currency)	Volume	Nominal wage
Agriculture, forestry and fishing (industry 1)	3.85	-0.26	0.89	-3.77	0.96	1.67	0.00	-0.89	2.82
Mining (2-4)	0.44	-1.14	0.16	-1.05	0.26	-0.60	0.00	-2.01	2.82
Food, beverages and tobacco (5-19)	1.61	0.61	3.06	-11.27	3.05	9.11	0.00	2.40	2.82
Textiles, clothing and footwear (20-31)	1.53	-1.80	2.18	-8.21	2.17	6.27	0.00	-2.42	2.82
Wood, wood products, paper and paper products (32-37)	1.33	-1.58	2.25	-8.42	2.23	3.09	0.00	-2.46	2.82
Chemicals, petroleum and coal products (38-46)	2.30	-0.85	1.81	-6.71	1.75	2.75	0.00	-2.15	2.82
Non-metallic mineral products (47-54)	1.27	-1.34	2.09	-7.88	2.07	2.80	0.00	-2.17	2.82
Basic and fabricated metal products (55-60)	0.72	-3.05	1.37	-5.28	1.37	0.48	0.00	-5.87	2.82
Transport equipment other than aircraft (61-73)	0.88	-2.93	0.00	0.00	0.00	0.00	0.00	0.00	2.82
Aircraft (74)	0.45	-0.42	0.00	0.00	0.00	0.00	0.00	0.00	2.82
Other machinery and equipment (75-76)	0.63	-2.70	1.68	-6.38	1.66	1.03	0.00	-4.13	2.82
Miscellaneous manufacturing (77-78)	1.49	-0.91	1.47	-5.74	1.49	4.44	0.00	-3.18	2.82
Electricity, gas and water (79-80)	1.34	0.68	3.42	0.00	0.00	0.00	0.00	2.28	2.82
Construction (81-82)	0.84	-0.20	2.21	-4.23	1.12	0.00	0.00	-0.37	2.82
Trade and repairs (83)	1.28	1.22	3.48	-12.81	3.49	0.00	0.00	2.31	2.82
Railway transport (86, 88)	0.05	0.01	0.06	-0.21	0.06	0.12	0.00	0.03	2.82
Road transport (87, 89-90)	0.95	0.29	1.13	-4.20	1.13	2.38	0.00	0.63	2.82
Water transport (91)	0.28	0.08	0.33	-1.24	0.33	0.70	0.00	0.19	2.82
Air transport (92)	0.25	0.08	0.30	-1.12	0.30	0.64	0.00	0.17	2.82
Other transport (incl. freight) (85, 93)	1.04	0.32	1.24	-4.61	1.24	2.61	0.00	0.70	2.82
Service industries directly catering for tourists (84, 94-96)	2.05	3.54	11.19	-39.87	11.00	6.73	0.00	8.49	2.82
Other service industries (97-103)	1.08	1.65	2.93	-11.04	2.97	5.77	0.00	1.96	2.82
Industry average	1.17	-0.81	2.25	-7.74	2.06	3.21	0.00	-1.11	2.82

Source: Integrated and input-output model simulations conducted by the authors.

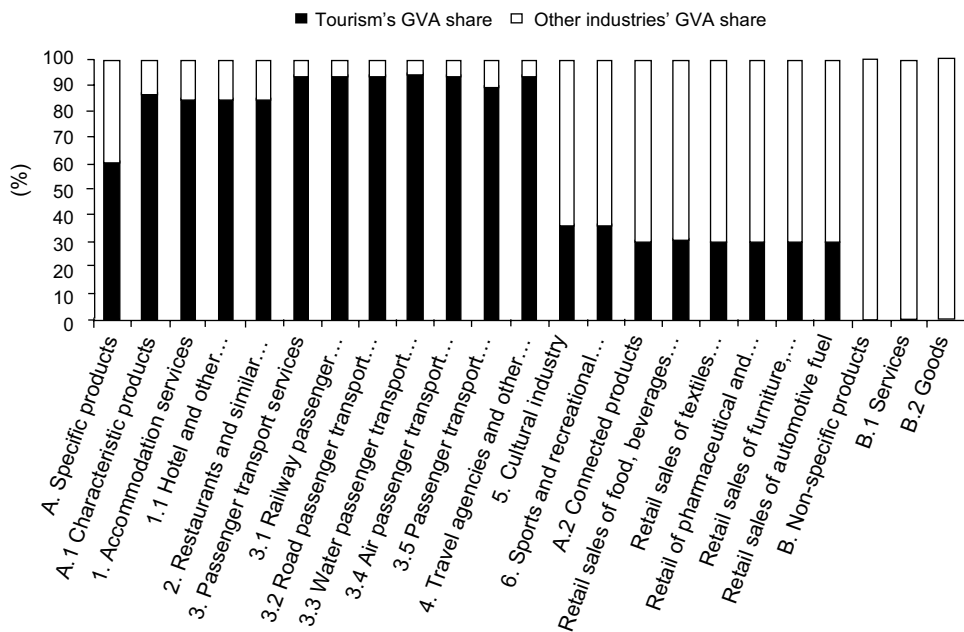


Figure 3. Share (tourism and other) of gross value added by major industry, 2005.

Source: Data from Statistics South Africa (2009, p 35).

dependent on the tourism sector for its operation and survival. To this end, the tourism sector should be viewed as an enabling industry without which few other industries would be able to survive.

The launch, in 2009, of South Africa's inaugural TSA (see Statistics South Africa, 2009) has finally provided information regarding tourism dependency for the South African economic sectors. The report indicates that, at the aggregate national level, a decline in tourism might not only have adverse economic impacts in terms of reduction in value added or GDP, but also in terms of reduced growth rates in value added and reduced growth rates in per capita income. At a sectoral level (see Figure 3), the report (and various other sources) indicates that, for example for 2005, if tourist figures were to decline, the retail sector (where approximately 30% of GDP arises from tourism) could suffer serious losses in value added (GDP) due to the high intensity of, and dependence on, tourism in this specific sector. The TSA therefore clearly shows the importance of the tourism industry.

Comparing the results obtained in this study with the relative magnitudes found in the draft TSA report for South Africa, as well as other sources, it would seem that the findings from the integrated model might well be plausible from a magnitude point of view.

If the structure of tourism in South Africa is investigated, it is evident that tourism and other related categories together account for approximately 30% of total tourism consumed in the national economy. Furthermore, in the modern economy, many activities produce relative high value added (economic

definition) for relatively low inputs of tourism (that is, the ratio of tourism consumption to value added is low). This would then lead, at a superficial level, to conclude that such an activity has low tourism intensity and, therefore, large changes in the tourism input will reflect small changes in the value-added measurement of output. In reality, though, such activities may well be very dependent on tourism for their operations or survival, and the previous conclusion may be totally the opposite for, although using relatively little tourism, if tourism is not available, these activities might cease to exist. An example would be accommodation services and travel agencies and other reservation services sectors. An alternate example could be the retail sector. Here, although retail sales of food, beverages and tobacco products is very tourism intensive, the activity has the ability in theory to switch easily from servicing foreign tourists/consumers to alternatively servicing local consumers, which would then imply that, although the activity is tourism intensive, it is less tourism dependent than some other cases. Unfortunately, readily available quantifications of tourism dependency per sector are not available and tourism intensity per sector is used as a proxy. As illustrated above, this causes, potentially, the introduction of a bias in the determination of economic costs per sector or activity.

A full analysis of the results of this scenario is not presented in this study. Rather, the focus is placed on the tourism–economy interaction aspects relevant to the main purpose of this paper, namely, the relevance of integrated models to inform tourism policy analysis, while there is a demonstrated and very real need to have such a policy tool – now probably more than ever before in the history of South African tourism planning and development.

Policy implications

The following implications have surfaced from this research.

Firstly, the modelling results (as compared to the input–output method) clearly show that an integrated approach is valid and necessary for policy analysis purposes, since the impact of tourism according to the integrated approach is significantly different to that of the input–output results. The input–output model overestimated the total GDP effect, underestimated the total effect on tourism sectors and missed completely the negative effects on non-tourism sectors. Therefore, the integrated approach gives policy makers greater variety and accuracy to work with in terms of forecasting and determining the impact of specific events on the economy. Through this approach, TSAs can also become a much more effective decision-making tool, since they increase the application value.

Secondly, based on the discussion of the first implication, it is of the utmost importance that destinations implement a sustainable growth plan and, therefore, policy. The latter implies a gradual increase in tourist numbers and, especially, spending. The integrated approach is useful, especially in terms of forecasting foreign arrivals. The results can be used by South African Tourism (South African Marketing Agency) to adapt their strategy, if required. The focus should therefore remain on an increase in spending; for the latter support, research by Uys (2003) makes the case in this regard. Hence, barriers to growth

must be identified and dealt with, especially by the various government agencies. These include political stability, creating proper infrastructure, price competitiveness, improved service, dealing with crime, effective marketing and increased budgets and marketing campaigns, to name but a few. This implication also requires greater industry cooperation and communication, since the aspects raised above cannot be done in isolation.

Thirdly, from a policy perspective, major events such as the 2010 FIFA World Cup can be used successfully to grow and sustain tourism, especially if hosted during off-peak seasons, as major events lead to infrastructure development, marketing spin-offs and media visibility, greater intersectoral linkages, income generation and job creation, to name but a few of the benefits. Therefore, it is important for the country to develop an event strategy that targets major events to be hosted in future. The integrated approach can be a useful tool in deciding which events to target.

Finally, tourism marketers have to be more focused in segmenting markets. Markets with a high yield should be targeted since these markets have the greatest impact on growth and poverty alleviation. Again, the integrated approach can assist in determining the yield per market.

Conclusion

Given the small number of full TSAs available, and in many cases only in very recent years, the integration of TSAs with AGE models is a relatively new development in tourism. To this end, this paper makes an important contribution by highlighting the strengths that an integrated approach brings. Moreover, it illustrates the need for integrated models as tools for policy makers in South Africa through the fact that economic models (and, more specifically, integrated models) can provide key perceptions for analysis of comprehensive packages of economic and non-economic policy instruments within a consistent framework. Insights generated by this modelling can help in evaluating various policy options. To this end, the integrated model represents an innovative and noteworthy means of combining TSAs, input–output tables and economic modelling. The approach expands on the TSA's measurement of tourism's economic size to provide estimates of tourism's economic impact, including many effects that are not captured in input–output models (Blake *et al.*, 2000, p 18). The integrated model also provides an important tool for policy analysis, enabling the complex interactions in the economy that result from policy actions to be traced through a general equilibrium framework and assessed. The ability to have quantitative estimates of the effects of policy demonstrates the relevance and importance of integrated models for tourism analysis purposes.

The conclusion derived from this research is that, though there are various cost–benefit analyses (CBA), proportional multiplier methods, input–output, AGE and other macro models for the South African economy that have been applied in various areas of economic study since the 1990s, it seems that there is a paucity of applications focusing on tourism interactions for the South African specific context. Recent high-profile developments in the South African tourism sector illustrate the need to have integrated models with a tourism focus available to analyse, for example, the economic impacts of large sporting

events, such as the 2010 Soccer World Cup. One of the reasons for this is that such events have economic impacts on various levels of the economy and policy makers in governmental departments, such as, for example, the newly established South African Department of Tourism, Department of Trade and Industry (DTI), National Treasury and Department of Transport, to name but a few, that could benefit in having the ability to analyse various potential policy responses to mitigate, for example, the effects of a potential shortfall in production capacity and resources (which could be exacerbated by such events).

The results presented here for South Africa provide an example of the integrated model's capabilities. The paper illustrated an application of an integrated model in this context by modelling a sustained 10% growth in tourism and attempted to quantify answers to the question of what the potential impacts could be of hosting major events and the associated tourism policy intervention. The results from the simulation indicated that the overall GDP of the country could increase by 0.31%, while employment could increase by as much as 0.56%. The magnitude of these results seems to be supported by similar studies in Thailand, Australia and the USA.

In conclusion, future research should aim to construct or enhance an integrated model for South Africa with a more detailed treatment of tourism sectors (that is, incorporate dynamics, regional differences, household distributions and different types of labour). Such research would be an interesting and productive development in this area.

Endnotes

1. In the literature on the topic of general equilibrium models, references to both 'applied' and 'computable' general equilibrium models can be found being used interchangeably. The former refers to the broader concept of the theoretical framework applied in practice, while the latter refers more specifically to the actual model applied on a computer with a specific piece of software, such as GAMS (General Algebraic Modelling System) or GEMPACK (General Equilibrium Modelling PACKage).
2. For more detail, see Arrow (1951, 1953, 1974), Arrow and Debreu (1954), Debreu and Scarf (1963) and Hahn (1973).
3. See, for example, Blake *et al* (2001).
4. The South African Government introduced the GEAR strategy in 1996. The long-term vision of GEAR was to create a competitive, fast-growing economy; sufficient jobs for all job seekers; to redistribute income; to provide health, education and other services to all; to secure the home environment; and to create a productive place in which to work.
5. The South African Government introduced the ASGISA strategy in 2004 to become a national shared growth initiative. The core objective of this strategy is to halve poverty and unemployment by 2014, through the achievement of an average GDP growth rate of 6% or more.
6. ORANI-F is a static, economy-wide general equilibrium model augmented with some simple dynamic relationships. Schematically, the model can be represented as $F[Z_1(t), Z_2(t), Z(0)] = 0$, where $Z_1(t)$ and $Z_2(t)$ are vectors of the values of endogenous and exogenous variables at time t and $Z(0)$ is a vector of initial conditions (Adams and Parmenter, 1995, p 986).

References

- Adams, P.D., and Parmenter, B.P. (1995), 'An applied general equilibrium analysis of the economic effects of tourism in a quite small, quite open economy', *Applied Economics*, Vol 27, pp 985–994.
- Agénor, P.-R., Izquierdo, A., and Fofack, H. (2002), 'IMMPA: a quantitative macroeconomic framework for the analysis of poverty reduction strategies', working paper, World Bank, Washington, DC.

- Ahlert, G. (2009), 'Estimating the economic impact of an increase in inbound tourism on the German economy using TSA results', *Journal of Travel Research*, Vol 47, No 3, pp 225–234.
- Ahmed, V., and O'Donoghue, C. (2007), 'CGE-microsimulation modelling: a survey,' MPRA Paper No 9307, Munich.
- Alavalapati, J.R.R., and Adamowicz, W.L. (2000), 'Tourism impact modelling for resource extraction regions', *Annals of Tourism Research*, Vol 27, No 1, pp 188–202.
- Arrow, K.J. (1951), *Social Choice and Individual Values*, John Wiley, New York.
- Arrow, K.J. (1953), 'Le rôle des valeurs boursières dans la répartition la meilleure des risqué', *Econometrie*, Vol 40, pp 41–47.
- Arrow, K.J. (1974), 'General economic equilibrium: purpose, analytic techniques, collective choice', *The American Economic Review*, Vol 64, No 3, pp 253–271.
- Arrow, K.J., and Debreu, G. (1954), 'Existence of an equilibrium for a competitive economy', *Econometrica*, Vol 22, pp 265–290.
- Bandara, J.S. (1991), 'Computable general equilibrium models for development policy analysis in LDCs', *Journal of Economic Surveys*, Vol 5, No 1, pp 4–27.
- Baumol, W., and Blinder, A. (2005), *Microeconomics: Principles and Policy*, 9th edition, Thomson South-Western, Mason, OH.
- Blake, A., and Gillham, J. (2001), 'A multi-regional CGE model of tourism in Spain', paper presented at the European Trade Study Group Annual Conference, September, Brussels.
- Blake, A., and Sinclair, M.T. (2003), 'Tourism crisis management: US response to September 11', *Annals of Tourism Research*, Vol 30, No 4, pp 813–832.
- Blake, A., Durbarray, R., Sinclair, T., and Sugiyarto, G. (2000), 'Modelling tourism and travel using tourism satellite accounts and tourism policy and forecasting models', Tourism and Travel Research Institute Discussion Paper 2001/4, Nottingham.
- Blake, A., Durbarray, R., Sinclair, M.T., and Sugiyarto, G. (2001), 'Modelling tourism and travel using tourism satellite accounts and tourism policy and forecasting models', Discussion Paper 2001/4, Tourism and Travel Research Institute, Nottingham University, Nottingham.
- Blake, A., Sinclair, M.T., and Sugiyarto, G. (2003), 'Quantifying the impact of foot and mouth disease on tourism and the UK economy', *Tourism Economics*, Vol 9, No 4, pp 449–465.
- Blake, A., Durbarray, R., Eugenio-Martin, J.L., Goo-roochurn, N., Hay, B., Lennon, J., Sinclair, M.T., Sugiyarto, G., and Yeoman, I. (2006), 'Integrating forecasting and CGE models: the case of tourism in Scotland', *Tourism Management*, Vol 27, pp 292–305.
- Borges, A.M. (1986), 'Applied general equilibrium models: an assessment of their usefulness for policy analysis', *OECD Economic Studies*, Vol 7, pp 7–43.
- Bourguignon, F., Branson, W.H., and De Melo, J. (1989), 'Macroeconomic adjustment and income distribution: a macro-micro simulation model', Mimeo, OECD Development Centre, Paris.
- Bourguignon, F., Pereira Da Silva, L., and Stern, N. (2002), 'Evaluating the poverty impact of economic policies: some analytical challenges', Mimeo, World Bank, Washington, DC.
- Bovenberg, A.L., and Goulder, L.H. (1991), 'Introducing intertemporal and open economy features in applied general equilibrium models', *De Economist*, Vol 139, No 2, pp 186–203.
- Breece, J.H., McLaren, K.R., Murphy, C.W., and Powell, A.A. (1994), 'Using the Murphy model to provide short-run macroeconomic closure for ORANI', *Economic Record*, Vol 70, No 210, pp 292–314.
- Briassoulis, H. (1991), 'Methodological issues: tourism input-output analysis', *Annals of Tourism Research*, Vol 18, pp 435–449.
- Burniaux, J.-M., and Truong, T.P. (2002), 'GTAP-E: an energy-environmental version of the GTAP model', GTAP Technical Paper No 16, Purdue, West Lafayette, IN.
- Cameron, M.J. (2003), 'The relationship between input-output (IO) analysis, social accounting matrices (SAM) and computable general equilibrium (CGE) models in a nutshell', Global Insight Southern Africa Internal Working Paper, Pretoria.
- Cameron, M.J. (2005), 'Spatial economic analysis: on the need for sub-national economic models and data in South Africa', *Journal of Development Perspectives*, Vol 1, No 1, pp 146–163.
- Cameron, M.J., and Naudé, W.A. (2008), 'Electricity supply shocks and economic development: the impact and policy implications of South Africa's power outages', paper presented at the UNU-WIDER Conference on Southern Engines of Global Growth: Africa and CIBS, 5–6 September, Johannesburg, South Africa.
- Clark, M., Dent, S., and Watts, G. (2004), 'Influence of travel decision parameters in a CGE model incorporating tourism', Office of Economic and Statistical Research Working Paper, Queensland.

- Coetzee, Z.R., Gwarada, K., Naudé, W.A., and Swanepoel, J. (1997), 'Currency depreciation, trade liberalisation and economic development', *South African Journal of Economics*, Vol 65, No 2, pp 165–190.
- Coletti, D., and Murchison, S. (2002), 'Models in policy-making', *Bank of Canada Review*, Spring, pp 19–26.
- Cooper, R., McLaren, K., and Powell, A. (1985), 'Short-run macroeconomic closure in applied general equilibrium modelling: experience from ORANI and agenda for further research', in Piggott, J., and Whalley, J., eds, *New Developments in Applied General Equilibrium Analysis*, Cambridge University Press, Cambridge.
- Copeland, B.R. (1991), 'Tourism, welfare and de-industrialisation in a small open economy', *Economica*, Vol 58, pp 515–530.
- Crompton, J., Lee, S., and Shuster, T. (2001), 'A guide for undertaking economic impact studies: the Springfest example', *Journal of Travel Research*, Vol 40, No 1, pp 79–87.
- Davies, J. (2004), 'Microsimulation, CGE and macro modelling for transition and developing countries', paper presented at the WIDER International Conference on Inequality, Poverty and Human Well-Being, 30–31 May, Helsinki.
- Debreu, G. (1959), *Theory of Value*, John Wiley and Sons, New York.
- Debreu, G. (1991), 'Mathematization of economic theory', *American Economic Review*, Vol 81, pp 1–7.
- Debreu, G., and Scarf, H. (1963), 'A limit theorem on the core of an economy', *International Economic Review*, Vol 4, pp 235–246.
- Department of Environmental Affairs and Tourism, South Africa (1996), 'The development and promotion of tourism in South Africa' (<http://www.info.gov.za/whitepapers/1996/tourism.htm>, accessed 17 January 2010).
- Dervis, K., De Melo, J., and Robinson, S. (1982), *General Equilibrium Models for Development Policy*, Cambridge University Press, Cambridge, 526 p.
- Dervis, K., De Melo, J., and Robinson, S. (1992), *Applying General Equilibrium*, Cambridge University Press, Cambridge.
- Dixon, P.B., and Parmenter, B. (1996), 'Computable general equilibrium modelling for policy analysis and forecasting', in Amman, H.M., Kendrick, D.A., and Rust, J., eds, *Handbook of Computational Economics, Volume I*, Elsevier Science Publishers, North-Holland, pp 3–85.
- Dwyer, L., Forsyth, P., Madden, J., and Spurr, R. (2000), 'Economic impacts of inbound tourism under different assumptions regarding the macroeconomy', *Current Issues in Tourism*, Vol 3, No 4, pp 325–363.
- Dwyer, L., Forsyth, P., and Spurr, R. (2004), 'Evaluating tourism's economic effects: new and old approaches', *Tourism Management*, Vol 25, No 3, pp 307–317.
- Erbes, R. (1973), *International Tourism and the Economy of Developing Countries*, Organisation of Economic Cooperation and Development, Paris.
- Fletcher, J.E. (1989), 'Input–output analysis and tourism impact studies', *Annals of Tourism Research*, Vol 16, pp 514–529.
- Fletcher, J.E. (1994), 'Input–output analysis', in Witt, S., and Moutinho, L., eds, *Tourism Marketing and Management Handbook*, second edition, Prentice-Hall International, UK, pp 480–484.
- Frechling, D. (1999), 'Estimating the multiplier effects of tourism expenditures on a local economy through a regional input–output model', *Journal of Travel Research*, Vol 37, No 4, pp 324–332.
- Gorbet, F.W. (1973), 'Econometric models: some comments on their use in policy analysis', *Bank of Canada Review*, October, pp 3–14.
- Hahn, F.H. (1973), *On the Notion of Equilibrium in Economics*, Cambridge University Press, Cambridge.
- Hazel, P.B.R., and Norton, R.D. (1986), *Mathematical Programming for Economic Analysis in Agriculture*, Macmillan, New York.
- Holland, D., and Wyeth, P. (1993), 'SAM multipliers: their interpretation and relationship to input–output multipliers', in Otto, D.M., and Johnson, T.G., eds, *Microcomputer-based Input–Output Modelling: Applications to Economic Development*, Westview Press, Boulder, CO, pp 181–197.
- Horridge, J.M., Parmenter, B.R., and Pearson, K.R. (1993), 'ORANI-F: a general equilibrium model of the Australian economy', *Economic and Financial Computing*, Vol 3, No 2, pp 71–172.
- Horridge, J.M., Parmenter, B.R., Cameron, M., Joubert, R., Suleman, A., and De Jongh, D. (1995), 'The macroeconomic, industrial, distributional and regional effects of government spending programs in South Africa', COPS/Impact Working Paper No G-109, Monash University, Melbourne.

- Iqbal, Z., and Siddiqui, R. (2001), 'Critical review of literature on computable general equilibrium models', MIMAP Technical Paper Series No 9, Pakistan.
- Jackson, C., Kotsovos, D., and Morissette, C. (2008), 'Linking the Canadian Tourism Satellite Account and the Canadian System of Environmental and Resource Accounts to measure the environmental impact of tourism in Canada: an exploratory study for two pilot industries', paper presented at the 9th International Forum on Tourism Statistics, 4–5 May, Paris.
- Jerome, A. (2004), 'A survey of macroeconomic models for policy analysis and forecasting in South Africa', paper presented at the 9th Annual Econometrics Modelling for Africa Conference, 30 June – 2 July, Cape Town.
- Johnson, R.L., and Moore, E. (1993), 'Tourism impact estimation', *Annals of Tourism Research*, Vol 20, pp 279–283.
- Lindberg, K., and Johnson, R.L. (1997), 'The economic value of tourism's social impacts', *Annals of Tourism Research*, Vol 24, pp 90–116.
- Longworth, D. (2002), 'Inflation and the macro-economy: changes from the 1980s to the 1990s', *Bank of Canada Review*, Spring, pp 3–18.
- Maxwell, T. (1975), 'Validation of macroeconomic models: some reflections on the state of the art', *Bank of Canada Review*, November, pp 9–16.
- Maxwell, T. (1976), 'Assessing the performance of macroeconomic models in policy analysis', *Bank of Canada Review*, May, pp 3–11.
- Meagher, G.A. (1996), 'Forecasting changes in the distribution of income: an applied general equilibrium approach', in Harding, A., ed, *Microsimulation and Public Policy*, North-Holland, Amsterdam, pp 361–384.
- Naudé, W.A., and Brixen, P. (1993), 'On a computable general equilibrium model for South Africa', *South African Journal of Economics*, Vol 61, No 3, pp 153–165.
- Naudé, W.A., and Coetzee, Z.R. (2004), 'Globalisation and inequality in South Africa: modelling the labour market transmission', *Journal of Policy Modeling*, Vol 26, pp 911–925.
- O'Connor, R., and Henry, E.W. (1975), *Input-Output Analysis and Its Applications*, Charles Griffin and Company Ltd, London.
- Odoki, J.B., Kerali, H.R., and Santorini, F. (2001), 'An integrated model for quantifying accessibility-benefits in developing countries', *Transportation Research Part A*, Vol 35, No 7, pp 601–623.
- Poloz, S., Rose, D., and Tetlow, R. (1994), 'The Bank of Canada's new quarterly projection model (QPM): an introduction', *Bank of Canada Review*, Autumn, pp 23–38.
- Rutten, F.W. (1991), 'Introduction', *De Economist*, Vol 139, No 2, pp 141–146.
- Selody, J. (2001), 'Uncertainty and multiple perspectives', in Klöckers, H.-J., and Willeke, C., eds, *Monetary Analysis: Tools and Application*, European Central Bank, Frankfurt, pp 31–46.
- Shapiro, H., and Taylor, L. (1990), 'The state and industrial strategy', *World Development*, Vol 18, pp 861–878.
- Shoven, J.B., and Whalley, J. (1992), *Applying General Equilibrium*, Cambridge University Press, New York.
- Sinclair, M. (1998), 'Tourism and economic development: a survey', *Journal of Development Studies*, Vol 34, No 5, pp 1–51.
- Statistics South Africa (2002), *Final Social Accounting Matrix 1998*, No 04-03-02, Statistics South Africa, Pretoria.
- Statistics South Africa (2004), *Overview of the 1998 Social Accounting Matrix*, Statistics South Africa, Pretoria.
- Statistics South Africa (2009), *Draft Tourism Satellite Account for South Africa (D0405.7), 2005*, Statistics South Africa, Pretoria.
- Stone, R. (1985), 'The disaggregation of the household sector in the national accounts', in Pyatt, G., and Round, J., eds, *Social Accounting Matrices: A Basis for Planning*, The World Bank, Washington, DC, pp 145–185.
- Tribe, J., and Airey, D. (2007), *Developments in Tourism Research*, Elsevier, Oxford.
- Tyrrell, T., and Johnston, R. (2001), 'A framework for assessing direct economic impacts of tourist events: distinguishing origins, destinations, and causes of expenditures', *Journal of Travel Research*, Vol 40, No 1, pp 94–100.
- UNWTO (2009), 'TSA data around the world – world summary', UNWTO Department of Statistics and Tourism Satellite Account (TSA), Madrid.
- Uys, M.C. (2003), 'A sustainable marketing strategy for Dutch tourists to South Africa', unpublished Masters Dissertation, North-West University, Potchefstroom Campus, Potchefstroom.

- Van de Steeg, A.M., and Steenge, A.E. (2008), 'Integrating the TSA and input-output methodology in tourism impact studies', paper presented at the Intermediate Input-Output Meeting 2008, 8-10 July, Sevilla, Spain.
- Van Severter, D.E.N., Eckert, J.B., and Roukens De Lange, A. (1992), 'The structure and compilation of a provisional social accounting matrix for South Africa', *Development Southern Africa*, Vol 9, No 2, pp 243-255.
- Wagner, J. (1997), 'Estimating the economic impacts of tourism', *Annals of Tourism Research*, Vol 24, No 3, pp 592-608.
- Wattanukuljarus, A. (2006), 'The nationwide economic and environmental impacts of tourism: a computable general equilibrium approach for Thailand', The Economy and Environment Program for Southeast Asia (EEPSEA), International Development Research Centre, Canada.
- Wattanukuljarus, A., and Coxhead, I. (2008), 'Is tourism-based development good for the poor?: A general equilibrium analysis for Thailand', *Journal of Policy Modeling*, Vol 30, No 6, pp 929-955.
- WTO (1999), *Tourism Satellite Account (TSA): The Conceptual Framework*, World Tourism Organization, Madrid.
- WTTC (2009), *The Economic Impact of Travel and Tourism - Country Report: South Africa*, World Travel and Tourism Council, London.
- Zalai, E. (1982), 'Computable general equilibrium models: an optimal planning perspective', *Mathematical Modelling*, Vol 3, No 5, pp 437-451.
- Zeng, K., and Luo, X. (2008), 'China's inbound tourist revenue and Beijing Olympic Games 2008', *China and World Economy*, Vol 16, No 4, pp 110-126.
- Zhou, D., Yanagida, J.F., Chakravorty, U., and Leung, P. (1997), 'Estimating economic impacts of tourism', *Annals of Tourism Research*, Vol 24, No 1, pp 76-89.