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THE IMPACTS OF TEMPORARY AND ANTICIPATED TOURISM SPENDING

BY

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THE IMPACTS OF TEMPORARY & ANTICIPATED TOURISM SPENDING

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Abstract

Part of the local economic impact of a major sporting event comes from the associated temporary tourism expenditures. Typically demand-driven Input-Output (IO) methods are used to quantify the impacts of such expenditures. However, IO modelling has specific weaknesses when measuring temporary tourism impacts; particular problems lie in its treatment of factor supplies and its lack of dynamics. Recent work argues that Computable General Equilibrium (CGE) analysis is more appropriate and this has been widely applied. Neglected in this literature however is an understanding of the role that behavioural characteristics and factor supply assumptions play in determining the economic impact of tourist expenditures, particularly where expenditures are temporary (i.e. of limited duration) and anticipated (i.e. known in advance). This paper uses a CGE model for Scotland in which agents can have myopic- or forward-looking behaviours and shows how these alternative specifications affect the timing and scale of the economic impacts from anticipated and temporary tourism expenditure. The tourism shock analysed is of a scale expected for the Commonwealth Games to be held in Glasgow in 2014. The model shows how "pre-shock" and "legacy" effects – impacts before and after the shock – arise and their quantitative importance. Using the forward-looking model the paper calculates the optimal degree of pre-announcement.

Key words: economic impact, CGE modelling, mega-events

JEL classifications: C68, L83, R11 and R13.

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1. Introduction

One of the reasons for hosting a major (mega) sporting event, such as the Olympics, Paralympics or Commonwealth Games, is the expected resultant stimulus to economic activity. One source of such a stimulus is the additional, temporary, tourism expenditure associated with the event.[2] The standard way to quantify this impact is to use demand-driven multiplier analysis in which the initial exogenous tourism stimulus generates further expansions in output and employment through linked intermediate and household consumption expenditures. The more sophisticated variants of this approach use Input-Output (IO) (Burgan and Mules, 1992; Fletcher, 1989; and Gartner and Holecek, 1983) or Social Accounting Matrix (SAM) analysis (Daniels *et al*, 2004; Wagner, 1997).

However, estimates using models of this sort have been criticised on two primary grounds. The first criticism focusses on the central assumption embedded in this general approach. This is that the local economy faces no supply constraints so that any variation in exogenous demand results in linear changes in economic activity with no impact on prices. This seems unreasonable for the analysis of a temporary increase in tourism demand which typically puts pressure on existing tourist-facing facilities (e.g. hotels, restaurants, etc.). This pressure generates short-run price increases and accompanying displacement effects which reduce the scale of the overall economic impact (Dwyer et al, 2000; 2006). The second, related, criticism concerns the fact that the increase in economic activity predicted by the ex ante multiplier models has been difficult to detect in ex post econometric studies (Matheson, 2008).

These criticisms have led some authors to argue for the use of Computable General Equilibrium (CGE) models in the ex ante appraisal of the impact of mega events (e.g. Dwyer et al, 2004) and recent years have seen a number of such applications (Blake, 2005; Li et al., 2013; and Madden, 2002). CGE models retain the sectoral detail of IO and SAM approaches but additionally incorporate appropriate supply-side constraints. Capital and labour are scarce, so that when demand increases prices react to reflect this scarcity and economic behaviour adjusts in a profit and utility maximising manner. Introducing these constraints

[2] This is only part of the total demand-side stimulus to local economic activity which could result from hosting a major sporting event. For example, Fourie and Santana-Gallego (2011) produce empirical support for a tourism stimulus in the years before the event, while Rose and Spiegel (2011) find evidence that bidding for or hosting an Olympic Games has a positive impact on the nation's subsequent exports. Li and Blake (2009) examine the effect of other expenditure related to staging the Beijing Olympics such as stadia and transport infrastructure. There might also be supply-side stimuli to economic activity through improved transport infrastructure or health benefits driven by increased sports participation, for example. However, these supply-side effects are typically given second-order importance to demand-side disturbances in economic impact studies.

severely reduces the predicted impact on aggregate economic activity of the exogenous demand shock. However, whilst the tourism stimulus accompanying a mega sporting event is clearly exogenous to the local economy, it is typically not unexpected. That is to say, these events are pre-announced. Therefore forward-looking agents (both firms and consumers) can adjust their behaviour in response to the expected price changes that accompany the temporary tourism injection (Blake, 2009).

This paper investigates the impact of a temporary tourism demand shock in a multi-period regional CGE model. Specifically we use the AMOS model of the Scottish economy and simulate the effect of a £100 million exogenous increase in tourism expenditure occurring for one year. This is in line with the tourism shock that might accompany the hosting of the Commonwealth Games in Glasgow in 2014 (Scottish Government, 2014). An important aim of the paper is pedagogic: we are particularly interested in the sensitivity of the simulation results to the nature of factor supply constraints and behavioural assumptions imposed within the model. Our particular focus is on the impact of adopting forward-looking behaviour and its interaction with the degree of pre-announcement of the mega event. A key finding is that pre-announcement typically increases the economic impact of the temporary tourism shock in a forward looking model, a result which is at variance with the work presented in Blake (2009).

2. Model

AMOS is a single-region (stand-alone) CGE model parameterised on Scottish data for 2009.[3] In the present application, AMOS has twenty five commodities/sectors, which are listed in Table A1 in Appendix A. The model has three domestic institutional groups – households, government and corporations – and two exogenous transactors – the rest of the UK (RUK) and the rest of the world (ROW). Commodity markets are assumed to be competitive. Financial flows are not explicitly modelled, but it is assumed that the interest rate is exogenous to the model.

All simulations are run in a multi-period setting. The periods are interpreted as years, given that annual data have been used both for the benchmark Social Accounting Matrix (SAM) dataset and for parameterising behavioural relationships. The model is assumed to begin in steady-state equilibrium. This implies that with no exogenous shocks the initial values are

[3] AMOS is an acronym for A Macro-micro model Of Scotland. The model database is a Social Accounting Matrix (SAM) for Scotland for 2009, built around a set of IO accounts produced by the Scottish Government (2013). This section provides an overview of the model with full details available in Lecca et al (2013).

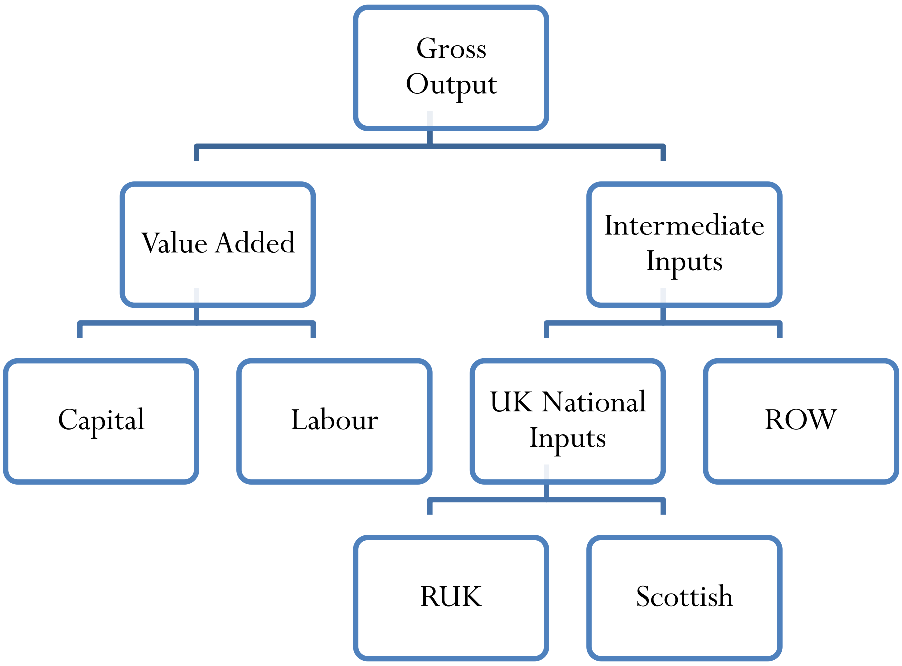
replicated over all subsequent time periods. Long-run equilibrium is achieved when all markets are fully adjusted. In the present application of the model this occurs where the returns to capital are equalised across all sectors. Since the disturbances in this case are temporary and we assume no hysteresis effects, in all simulations the long-run equilibrium is identical to the initial steady-state.

As we are primarily concerned about the timing of economic impacts under temporary and anticipated demand shocks, a key feature of the model is the updating of the factors of production (labour and capital) between periods and the alternative specifications for the way in which agents make these decisions (i.e. backward or forward-looking). We begin by first describing the sectoral production structure which is common to both the backward and forward-looking versions of the model. We then examine the differences in the models' treatment of the supply of factors and their dynamics.

The AMOS framework allows a degree of flexibility in the choice of key parameter values and model closures. A constant feature of the model, however, is that producers are assumed to minimise costs using a nested multi-level production function, with a constant elasticity of substitution (CES) aggregation function at each point, so that there can be input substitution in response to relative price changes.

The production structure for each sector is given in Figure 1 and shows how sectors combine inputs to generate sectoral output. Gross output is given by a CES combination of intermediate inputs and value added. Intermediate goods can be either produced locally or imported, with imported goods imperfect substitutes for domestically produced items (Armington, 1969). Labour and capital combine in a CES production function to produce value added. With CES at each stage of the production hierarchy, sectors will change their use of inputs in response to changes in the relative prices of those inputs.

Figure 1: The production structure in the AMOS Model



There are four components of final demand: household consumption, investment, government expenditure and exports. In both the backward- and forward-looking versions of the model, government expenditure remains constant in real terms while exports are determined by the terms of trade and the export price elasticity.

In the backward-looking specification, consumption is a linear function of real disposable income whilst in the forward-looking case the household's consumption decisions optimise its lifetime utility subject to a lifetime wealth constraint. This optimisation is carried out in two stages. In the first stage, the representative consumer determines the optimal time path of consumption in each period (t) of the simulation. The solution of the inter-temporal problem is given in equation (1)

$$\frac{C_t}{C_{t+1}} = \left[\frac{PC_t \cdot (1+\rho)}{PC_{t+1} \cdot (1+r)}\right]^{-\left(\frac{1}{\sigma}\right)} \qquad (1)$$

where C is the consumption composite good, PC is the aggregate price of consumption, ρ is the rate of consumer time preference, σ is the constant elasticity of marginal utility and r is the (exogenous) interest rate. In the second stage of the optimisation, consumption is allocated across goods/services (eq. 2), before then solving for within period domestic and imported consumption good demand through a CES function (eqs. 3 and 4):

$$H_{i,t} = \beta_i^{\rho_i^c} \cdot \left(\frac{PC_{i,t}}{PQ_{i,t}} \right)^{\rho_i^c} \cdot C_t \tag{2}$$

$$H_{i,t} = \gamma_i \cdot \left[\phi_i^r \cdot HR_{i,t}^{\rho_i^A} + \left(1 - \phi_i^r\right) \cdot HM_{i,t}^{\rho_i^A} \right]^{\frac{1}{\rho_i^A}} \tag{3}$$

$$\frac{HR_{i,t}}{HM_{i,t}} = \left[\left(\frac{\phi_i^r}{\left(1 - \phi_i^r\right)} \right) \cdot \left(\frac{PM_{i,t}}{PR_{i,t}} \right) \right]^{\frac{1}{1-\rho_i^A}} \tag{4}$$

Where for sector *i*, H_i is total household consumption, PQ_i is the commodity price, and β_i is the share parameter for commodity. HR_i, HM_i, PR_i and PM_i are the domestic and import consumption quantities and prices respectively, for commodity i while γ_i and ϕ_i^r are the CES parameters of the consumption problem identifying the scale and the share parameters respectively.

The dynamic budget constraint ensures that the discounted present value of consumption does not exceed total household wealth, where there is a distinction between financial and non-financial assets (Lecca et al., 2013). The rate of household saving is exogenous and is not linked directly to investment. This is a standard assumption in regional CGE models where equality between savings and investments need not be maintained.

Capital stock is fixed both in total and in its sectoral composition in the first period but each sector's capital stock is subsequently updated between periods through investment. In the backward-looking version this is achieved via a recursive capital stock adjustment procedure which is shown in equation (5). Investment, I_i, equals depreciation plus some fraction of the gap between actual and desired capital stock for sector *i*:

$$I_{i,t} = v \cdot \left[KS^*_{i,t} - KS_{i,t} \right] + \delta \cdot KS_{i,t} \quad (5)$$

where v is the speed of adjustment of capital between the actual and desired level (KS_i and KS_i^* respectively) and δ is the rate of depreciation of sectoral capital stock[4]. In the forward-looking case, the time path of investment is obtained through the tax-adjusted Tobin's *q* (Tobin, 1969). This adjustment path will differ from that in the backward-looking case as the firms' dynamic investment decisions are the outcome of solving an inter-temporal optimisation problem. With assumed quadratic capital adjustment costs, sectors do not instantaneously adjust their capital stock but make a series of investments over time.

Within the model, a single Scottish labour market with perfect sectoral mobility is imposed where the real wage is determined via an econometrically parameterised bargaining function (Layard *et al*, 1991). Under this wage curve specification, the regional real consumption wage is directly related to workers' bargaining power, which is inversely related to the unemployment rate. The function takes the following form:

$$\ln\left[\frac{w_t}{cpi_t}\right] = B - \psi \ln(u_t) \quad (6)$$

where *w* is the nominal wage, *cpi* is the consumer price index, u is the unemployment rate, ψ is the elasticity of the real wages with respect to the level of unemployment and *B* is a parameter calibrated to ensure equilibrium in the base year[5]. In the simulations performed in this paper we do not permit migration so that the size of the labour force is assumed fixed over the simulation window.

3. Simulation strategy

In September 2014, it is expected that a local audience of one million spectators will watch eleven days of sporting competition hosted by the 2014 Glasgow Commonwealth Games. In

[4] The speed of adjustment in the investment equation is taken to be the same for all sectors, although in practice some sectors, e.g. air transport, might be unable to adjust their capital stocks as quickly as others, e.g. cafes (Dwyer *et al*, 2000).

[5] Other labour market configurations are available within the AMOS modelling framework, which include a flow-equilibrium migration function. However, these alternative labour market closures are not used in this paper.

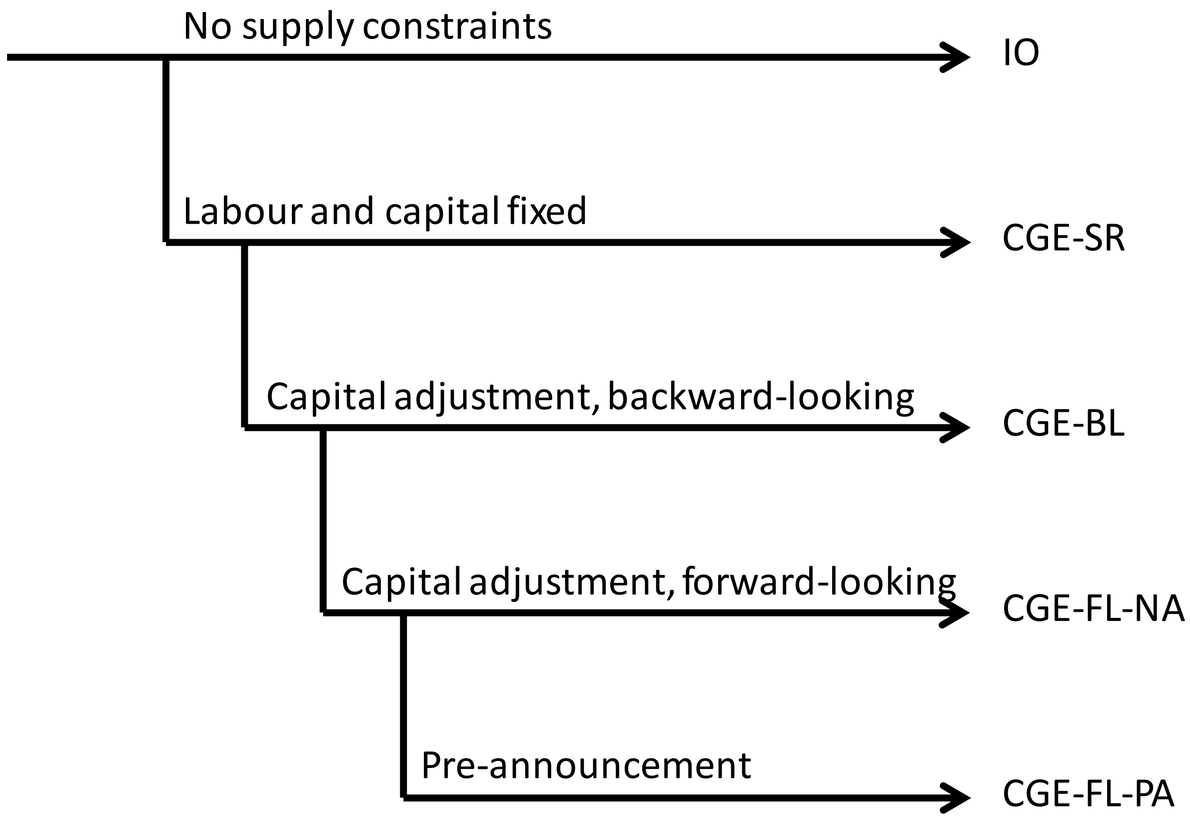
this paper we focus on identifying the scale and timing of the impact on the Scottish economy caused by the temporary tourism demand from non-Scottish residents which will arise from hosting such a mega-event. [6] . There is a potential effect from the switching of expenditure by Scottish residents attending the games, but its net effect is likely to be close to zero for the Scottish economy as a whole (Allan et al, 2007).[7] The Scottish Government has recently used the figure of £100 million when describing the scale of possible tourism spending in 2014 from the Glasgow Commonwealth Games (Scottish Government Social Research, 2014). For the purposes of this paper, therefore, this figure is used.

For each simulation we measure the impact of the increased tourism expenditure over 50 periods (years). The tourism disturbance is introduced in period 10. It is a one-off exogenous direct tourism demand shock of £100 million spent on domestic (Scottish) output. The sectoral pattern of this demand stimulus is assumed to mirror the base year non-domestic tourist spending in Scotland (Scottish Government, 2013). The detailed direct expenditure breakdown is given Table A.1 in Appendix A. The sectors that are the main direct recipients of the increase in tourism expenditure are accommodation, food and beverage services, and wholesale and retail. In total these three sectors receive 74% of the direct expenditure.

Our simulation strategy is outlined in Figure 2. The range of simulation results is designed to show the impact of varying the supply-side constraints and the extent of flexibility that economic agents are allowed in the model. After the IO simulation, which acts as a benchmark, the CGE simulations are sequenced primarily to identify the effect of increasing the scope for production and consumption adjustment and the degree of rationality that the model attributes to firms and consumers. We are particularly interested in the implications of forward-looking behaviour on the size and temporal distribution of the aggregate economic impact of temporary tourism expenditure.

[6] There are clearly other likely demand and supply-side impacts. See footnote two.
[7] The situation would be very different if the focus were the increase in activity in the city of Glasgow, where the games are located. Then geographical switching of expenditure by Scottish visitors to the games would be an important determinant of the total impact (Allan et al, 2007).

Figure 2: Alternative model specification and simulation names



We begin by implementing a Type I Input-Output multiplier model which we refer to simply as IO.[8] In this analysis there are no resource constraints: the supply-side of the economy responds passively to any exogenous demand shocks. Industries supplying intermediate inputs adjust in a linear fashion and the labour market has excess supplies of labour at the existing wage rate. The method generates a timeless impact. As Miller and Blair (2009, p. 653) note:

> "In the standard input-output model there is no consideration of the fact that production takes time; results are independent of time in the sense that f_{new} leads to x_{new} … [via the IO multiplier process]. This is generally interpreted in something like the following fashion: 'new demands, f_{new}, next period will lead to new outputs, x_{new}, next period'."

[8] The Type I multiplier reflects present Scottish Government practice in quantifying the impact of final demand stimuli. However, for comparison purposes we also calculate Type II multipliers. The Type II multipliers endogenise not only the demand for intermediate inputs but also household consumption. Their value can therefore never be less than the corresponding Type I multiplier.

In the IO interpretation we therefore assume the impact is concentrated solely in period 10: there is no requirement to adjust capacity before the demand shock and the economy returns to its original equilibrium in period 11.[9]

We then run four CGE simulations. In all cases the labour force is fixed over the whole 50 periods, with the real wage determined by the wage curve specified in equation (6). Therefore any increase in employment reduces the unemployment rate, increases the real wage and thereby triggers supply-side substitution and competitiveness effects. The four simulations differ in respect of the degree of adjustment allowed to household consumption and also the capital stock. The capital stock adjustment occurs in all sectors through changes in net investment.

The first CGE simulation is a standard short-run specification, labelled as CGE-SR here, where there is no capital adjustment either in anticipation of, or in response to, the temporary demand shock. There is also no shifting of consumption across periods. This implies that the simulation results only deviate from the initial equilibrium in period 10. As soon as the temporary tourism expenditure demand shock is withdrawn, the economy immediately returns to the initial equilibrium. In the second CGE simulation, labelled CGE-BL, the economic agents make backward-looking adjustments. This implies that they fail to anticipate the shock even if it is pre-announced and then subsequently react in a recursive way. This implies that there will be no change in the equilibrium in the first 9 periods, but in period 10 and subsequent periods there will be economic impacts. This is because in this case we allow firms to adjust their capital stock in period 10 in line with equation (5) generating an increase in capital stock which generates subsequent legacy effects.[10]

The third and fourth CGE simulations both adopt forward-looking behaviours by firms and households. The two forward-looking simulations differ in that in the first, labelled CGE-FL-NA, there is no pre-announcement. This means that again for the first 9 periods the simulation results do not deviate from the initial equilibrium. However, once the tourism stimulus has occurred, economic agents know that it is temporary but react in a fully forward-looking manner from that point on. In the second forward–looking CGE simulation the fact that the stimulus will occur in period 10 is announced in period 1. This simulation is

[9] If one felt that in reality it would take a longer time for the demand impacts to cascade through the system then the effects on economic activity could be distributed across periods subsequent to period 10 but the cumulative total would remain unchanged.

[10] We have studies similar legacy effects with backward-looking investment behaviour in the analysis of the impact of new energy developments (Allan et al. 2008).

labelled CGE-FL-PA. In this case we expect some change in activity in the first 9 periods in anticipation of the temporary demand stimulus.

In all cases results are reported as deviations from the initial equilibrium values. For each of the simulations we give four representations of the impact. In Table 1 we report the impact on a range of key economic variables in period 10, the year in which the temporary tourism stimulus takes place. In Table 2, we give the period-10 change in output broken down by sector. Table 3 reports the undiscounted cumulative change in GDP and employment over the full 50 year period. Finally Figures 2, 3 and 4 show the period by period adjustment to GDP, employment and investment respectively for the backward and forward-looking CGE simulations.

4. Simulation results from alternate IO and CGE model specifications

In this section we report the simulation results for the five model specifications outlined in Section 3. Recall that the IO model represents a system with no supply constraints whilst the CGE models embody varying degrees of supply restrictions and behavioural assumptions. The total economic impact in period 10, as measured using the Type I Input Output (IO) model, is shown in the first column of Table 1; GDP increases by 0.066% and employment by 0.098%. This result reflects an output multiplier of 1.38, a GDP multiplier of 1.36 and an employment multiplier of 1.22. Table 2 shows that in the IO case all sectors benefit from the increase in tourism demand, with the proportionate impact greatest in the accommodation, food and beverage services and recreational services sectors. In these sectors, output increases by 1.606%, 0.520% and 0.232% respectively.

Recall that in the IO simulation, the full impact is assumed to occur in the period of the disturbance (period 10). Therefore the results shown in Table 1 for the GDP and employment impacts are the same as those for the cumulative impacts reported in Table 3 where they are reported as absolute values. For the Type I IO simulation, the £100 million tourism expenditure generates a direct and indirect increase in GDP of £68 million and an increase in employment of 2,440.

Table 1: The period-10 percentage change in key economic variables from their base year values*

	IO	CGE-SR	CGE-BL	CGE-FL-NA	CGE-FL-PA
GDP	0.066	0.010	0.012	0.008	0.014
Consumer Price Index	-	0.088	0.095	0.057	0.045
Unemployment Rate	-	-0.265	-0.303	-0.200	-0.264
Total Employment	0.098	0.017	0.019	0.013	0.017
Nominal Gross Wage	-	0.115	0.125	0.077	0.071
Real Gross Wage	-	0.027	0.030	0.020	0.026
Replacement cost of capital	-	0.037	0.057	0.011	0.011
Households Consumption	-	0.021	0.025	-0.047	-0.037
Investment	-	-	0.080	-0.037	-0.054
Capital Stock	-	-	-	-	0.009
Export RUK	-	-0.059	-0.067	-0.033	-0.032
Export ROW	-	-0.074	-0.082	-0.046	-0.042
Multipliers					
Output	1.383	0.435	0.508	0.275	0.363
GDP	1.357	0.213	0.244	0.160	0.286
Employment	1.224	0.211	0.242	0.159	0.211

* The various model set-ups are explained in Figure 2.

For the IO simulation, the remaining entries in the first column of Table 1 are blank, which reflects the assumption of passive supply. The IO model imposes fixed prices and wages rates and here treats all the other elements of final demand, aside from tourism expenditure, as unchanged. Also given that we are using a Type I multiplier, household consumption is also taken to be constant. The only variable where there is some ambiguity is in the change in the unemployment rate. Although with an increase in employment we would expect a reduction in unemployment, IO is simply silent on the assumed dynamics of the labour market.

Of the standard solely demand-driven models, the Type I multiplier impacts used in these calculations give the most conservative estimates. The Type I approach takes no account of any increase in consumption that would accompany the rise in household income associated with expansion in employment (Miller and Blair, 2009). Models using the Type II IO or SAM multipliers would give much higher impacts. For example, the Type II output, GDP and employment multipliers in this case are 2.71, 2.04 and 1.65 respectively.

In the first CGE simulation we assume that there is no adjustment to the capital stock either before or after the tourism expenditure disturbance. It is the conventional short-run simulation CGE-SR. It is a model that would apply most appropriately in a situation where there was a change of venue for the mega-event so late that it could not affect investment and household consumption decisions.[11] The results are reported in the second column of Tables 1, 2 and 3. The most obvious aspect of these results is that the assumption of restricted supplies of capital and labour severely reduces the predicted impact of the tourism shock. GDP and employment increase by 0.010% and 0.017% respectively. This is less than 20% of the impact modelled using IO.

The reasons are very straightforward. The stimulus to employment generates an increase in the real wage of 0.027% which is achieved through a rise in the nominal wage of 0.115% and an increase in the consumer price index of 0.088%. The higher prices reduce competitiveness so that exports to the rest of the UK and the rest of the world (RUK and ROW) fall. Whilst the increase in tourism expenditure increases household consumption, it crowds out exports, thereby limiting the positive impact on overall economic activity. The output, GDP and employment multipliers again show the total impact in period 10 in these variables as measured against the direct values embedded in the tourism shock. Note that all these multipliers are considerably less than one. This implies that the total impact on the Scottish economy is less than the direct impact.

The sectoral breakdown of output changes under the CGE-SR simulation are given in column 2 of Table 2. Note that the impact on the sectors strongly directly affected by tourism expenditure, such as accommodation and food and beverage services, is lower than in the IO result, reflecting the impact of short-run capacity restrictions. However, much more importantly, there are also output reductions in the majority of other sectors, caused by crowding out generated by higher nominal wages and prices. As was stated earlier, in this simulation all the impacts occur in period 10. Therefore for CGE-SR the cumulative effect reported in column two of Table 3 is again simply the absolute values that correspond to the proportionate changes shown in Table 1.

[11] Such a model configuration might also be the most appropriate for a tourism shock generated by a temporary unexpected natural disaster, such as the UK outbreak of foot and mouth disease.

Table 2: The period-10 percentage change in sectoral outputs from their base year values*

	IO	CGE-SR	CGE-BL	CGE-FL-NA	CGE-FL-PA
Agriculture, forestry and fishing	0.079	0.005	0.004	0.003	0.013
Mining	0.011	-0.018	-0.020	-0.011	-0.013
Food, drink and tobacco	0.096	0.007	0.003	0.011	0.024
Textile, leather, wood and paper	0.088	0.003	0.000	0.011	0.018
Chemicals	0.062	-0.004	-0.008	0.004	0.010
Rubber, plastic, cement and iron	0.032	-0.051	-0.049	-0.043	-0.040
Computer, electrical and transport equipment	0.016	-0.055	-0.058	-0.047	-0.046
Electricity, gas and water	0.018	-0.018	-0.021	-0.025	-0.022
Construction	0.012	-0.024	0.017	-0.050	-0.058
Wholesale and retail	0.101	0.049	0.050	0.026	0.037
Land transport	0.123	0.052	0.050	0.043	0.055
Water transport	0.063	-0.005	-0.016	-0.002	0.006
Air Transport	0.033	-0.007	-0.009	-0.017	-0.013
Post and support transport services	0.073	-0.013	-0.017	-0.006	0.002
Accommodation	1.606	1.410	1.411	1.379	1.452
Food & beverage services	0.520	0.433	0.434	0.389	0.424
Telecommunication	0.057	0.005	0.006	-0.006	0.001
Computer and information services	0.026	-0.044	-0.038	-0.035	-0.036
Financial services	0.015	-0.026	-0.029	-0.020	-0.022
Real estate	0.031	0.018	0.022	-0.006	-0.002
Professional services	0.041	-0.034	-0.033	-0.023	-0.021
Research and development	0.014	-0.087	-0.091	-0.059	-0.055
Public administration	0.008	0.011	0.013	-0.001	0.000
Recreational services	0.232	0.186	0.187	0.157	0.173
Other services	0.055	0.025	0.025	-0.004	0.005

* The sectors are defined in Table A1 in Appendix A and the various model set-ups are explained in Figure 2.

Results from the backward-looking CGE simulation, CGE-BL, are shown in column 3 of Tables 1, 2 and 3. The impact in period 10 is similar to that for the short-run simulation CGE-SR, though the GDP and employment increases of 0.012% and 0.019% are slightly higher. This is because in the backward-looking case firms' investment decisions are affected by the changes in activity occurring in period 10. Specifically, firms attempt to adjust their capital stock, based upon present prices and output. In period 10 the price of capital is falling relative to labour and output generally is rising. There is therefore an increase in investment of 0.080%, which is an additional stimulus to demand in period 10 that is not present in the standard short-run simulation, CGE-SR. This is reflected in the sectoral results shown in Table 2. Whereas in the short-run simulation GCE-SR the period-10 output in construction falls by 0.024%, in the backward-looking simulation CGE-BL it increases by 0.017%.

The higher investment in period 10 generates an addition to the capital stock that comes into service in period 11 and delivers a supply-side stimulus to the economy. This positive stimulus remains but at a falling level as the capital stock gradually returns to its original value. The temporal evolution of the GDP figures is shown in Figure 2. Whilst GDP change peaks in period 10, there is a continuing positive impact driven by the increased capacity laid down in the period of the tourism shock. The employment results show a similar pattern over time. However, because the increased investment, and the subsequent excess capacity, reduces the capital rental rate relative to the wage, the employment figures shown in Figure 3 are less strongly maintained than GDP in the post-shock period.

Figure 2: Period-by-period changes in Scottish GDP following a £100 million tourism expenditure shock in period 10. Figures are shown for % changes from base year values for the backward looking CGE model (CGE-BL) and the forward-looking CGE models without (CGE-FL-NA) and without (CGE-FL-PA) pre-announcement.

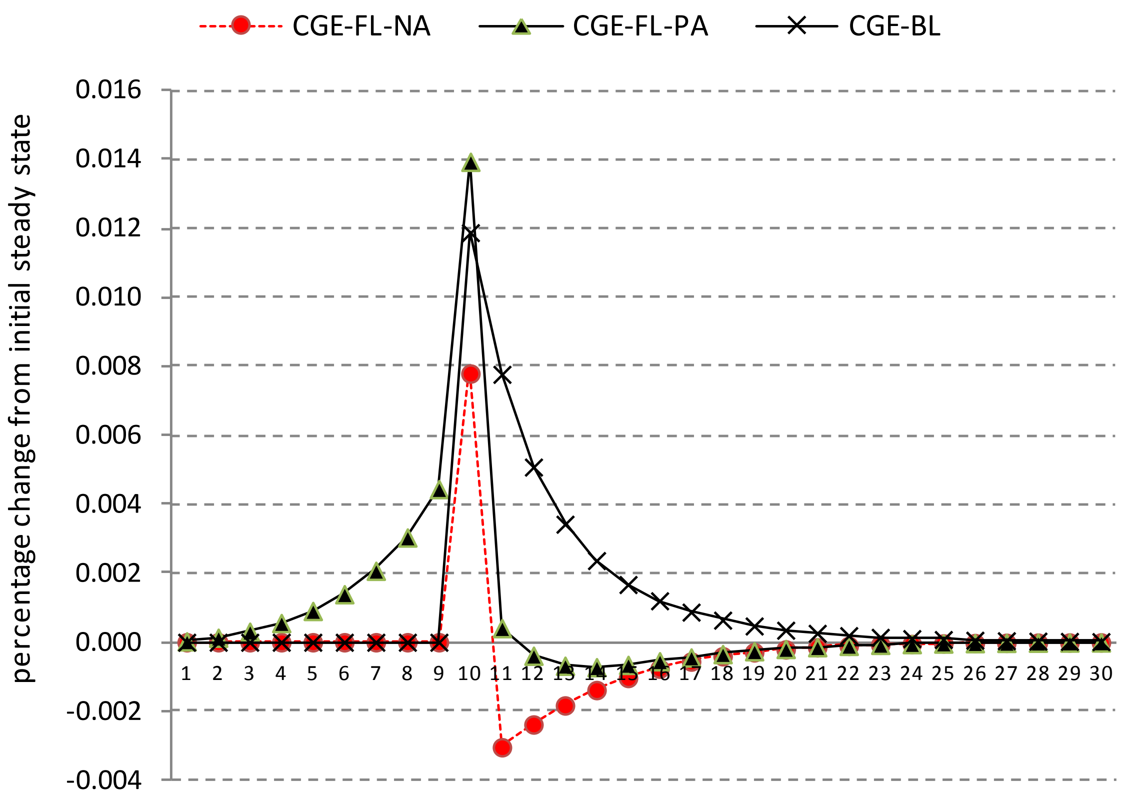
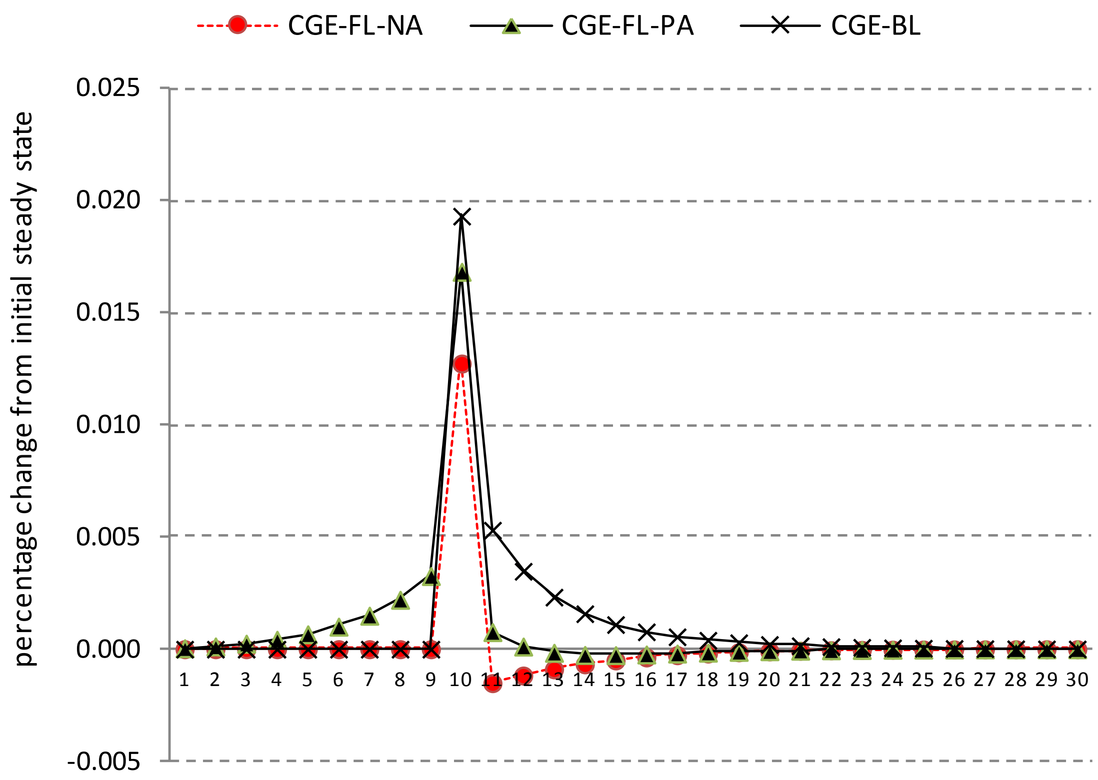
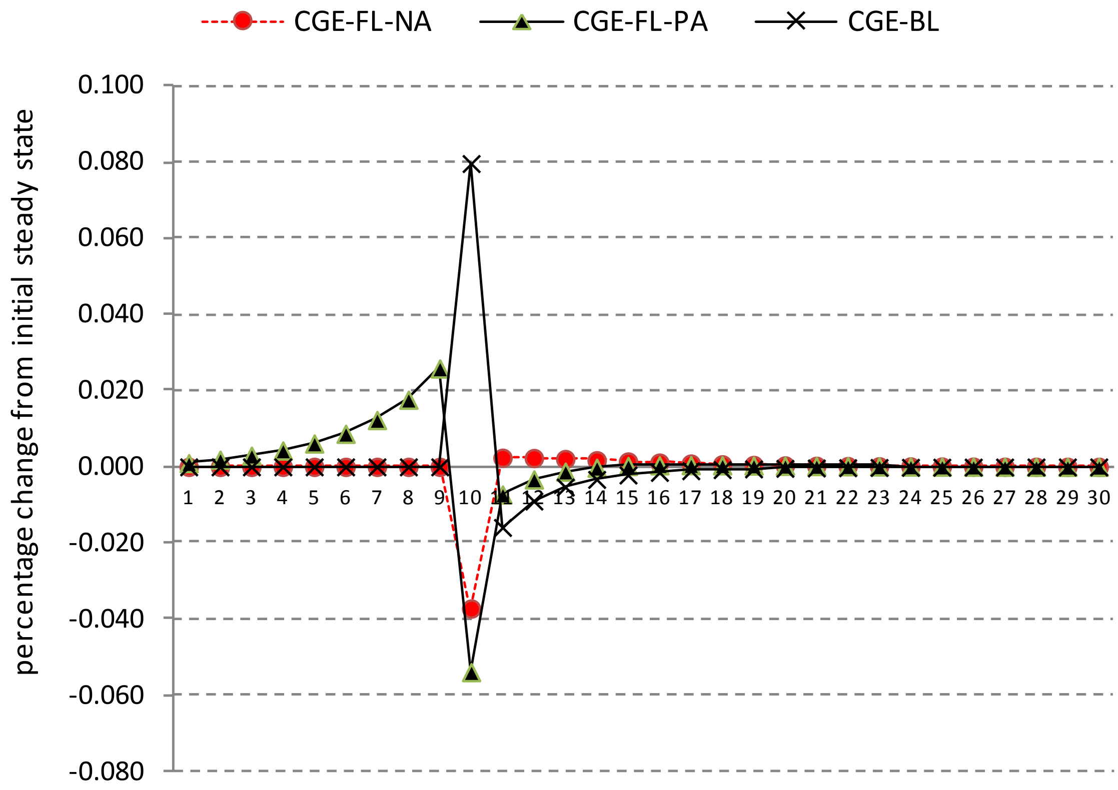


Figure 3: Period-by-period changes in Scottish employment following a £100 million tourism expenditure shock in period 10. Figures are shown for % changes from base year values for the backward looking CGE model (CGE-BL) and the forward-looking CGE model without (CGE-FL-NA) and with (CGE-FL-PA) pre-announcement.



The investment figures are presented in Figure 4 and reveal the investment spike in period 10 and subsequent disinvestment as the capital stock gradually readjusts. However, the negative demand-side effects of the disinvestment are clearly not large enough to offset the supply-side stimulus from the continuing higher level of capacity. This is reflected in the cumulative GDP and employment results reported in column 3 of Table 3. In this backward-looking simulation the cumulative GDP impacts are £37.5 million. Whilst this is around 55% of the IO value, it is over three and a half times as large as the value for the short-run simulation CGE-SR, where these legacy effects are not available. In the CGE-BL simulation over 65% of the undiscounted GDP impact occurs subsequent to period 10. For the employment impact the result is less sanguine; cumulatively 895 employee years are generated, less than 40% of the 2440 employee years reported in the IO simulation.

Figure 4: Period-by-period changes in Scottish aggregate investment following a £100 million tourism expenditure shock in period 10. Figures are shown for % changes from base year values for the backward looking CGE model and the forward-looking CGE model with and without pre-announcement.



The period 10 simulation results for the forward-looking CGE model with no pre-announcement, CGE-FL-NA, are shown in column 4 of Table 1. Again, the period 10 results are very similar to those for the short-run and backward-looking models, except slightly smaller. GDP and employment increase by 0.008% and 0.013% respectively. The reason is that in this case forward-looking firms and households reduce their consumption and investment expenditures in the period of the shock because of the relatively high wage and intermediate input costs generated by the exogenous increase in tourism demand. Whilst firms and households were not able to plan for the increase in tourism expenditure, they are aware it is a temporary shock and therefore will adjust subsequent expenditure. This implies that in period 10 there is crowding out in household consumption, investment and exports. In terms of sectoral effects, as reported in column 4 of Table 2, the most prominent result is the 0.050 reduction in construction and the much lower increase in wholesale and retail when compared to the previous models.

The subsequent impact of the lower investment in period 10 on GDP and employment is shown in Figures 2 and 3. Note that in this case there is a sizable reduction in GDP in the periods subsequent to the tourism shock as a result of the lower capital stock. This is also reflected in the employment figures, although again the impact is less extreme. Figure 4 shows the path of investment. After the 0.037% reduction in investment in period 10 there are subsequent small increases. However, their effect on aggregate demand is not large enough to offset the negative supply-side impact of the lower capital stock. The cumulative undiscounted results for the simulation CGE-FL-NA are shown in column 4 of Table 3. They indicate a negative cumulative GDP effect of £4.7 million and a small 167 employment increase.

The results for the last simulation are given in column 5 of Table 1. This is for the model where agents are forward looking and the tourism stimulus is pre-announced by 10 periods (CGE-FL-PA). Of all the CGE simulations, this is the one that gives the highest impact in period 10. GDP and employment increase by 0.014% and 0.017%. This is to be expected given that firms have brought forward investment expenditure to have greater capacity so as to be able to take advantage of the temporary tourism expenditure injection. Capital stock is 0.009% higher and as a result the consumer price index only increases by 0.045% and there is relatively low crowding out of RUK and ROW exports. However, as we would expect, the period-10 investment and household consumption expenditures are 0.054% and 0.037% lower respectively than in the base period.

The sectoral output impacts are shown in column 5 of Table 2. Compared to the other CGE simulations, output increases strongly in those sectors which experience the demand shock e.g. accommodation and food, drink and tobacco. These are sectors in which the capital stock has increased proportionately the most through prior investment. However, note also the big fall in construction of 0.058%, the largest for all the simulations. It is clear that even though there is pre-announcement, period-10 output still falls in 11 of the 25 sectors.

The time paths for GDP and employment are given in Figures 2 and 3. The striking characteristic of the results with the CGE-FL-PA variant of the model is the build-up of economic activity in advance of period 10. This increase in activity is driven by investment and household consumption decisions' being brought forward. In period 11 there is still a continuing small stimulus. However, after period 11 both GDP and employment are lower than their base year values: there is a negative economic hangover, rather than positive legacy effects. The time sequence of investment expenditure is shown in Figure 4. Note the build-up of investment prior to period 10, the large negative value for period 10 itself, and the subsequent disinvestment until the initial capital stock level is reached.

The cumulative values are given in column 5 of Table 3. For this simulation the cumulative undiscounted increase in GDP is £23 million and employment is 635. These figures are around a third and a quarter the IO values. It is clear that the opportunity for forward-looking agents to adjust capacity as a result of pre-announcement relaxes some of the supply constraints operating in the period of the shock. It also increases impact by bringing forward investment expenditure although the accompanying result is negative legacy effects. However, forward-looking behaviour in itself does not necessarily enhance the effect of temporary demand shocks on the regional economy. The lowest cumulative stimulus is given by the forward-looking model with no pre-announcement, where GDP effects are actually negative. Also the largest cumulative impact from the CGE models comes with backward-looking investment behaviour which is clearly sub-optimal ex post, from the firms' perspective.

Table 3 Cumulative undiscounted absolute changes in key economic variables over the 50-periods of the simulation*

	IO	**CGE-SR**	**CGE-BL**	**CGE-FL-NA**	**CGE-FL-PA**
Cumulative GDP change (£m)	67.6	10.6	37.5	-4.7	23.0
Cumulative employment (year) change	2440	421	895	167	635

* The various model set-ups are explained in Figure 2.

5. Varying the degree of pre-announcement

In Section 4 we consider only one level of pre-announcement. That is that the event is announced 10 years in advance. We report that, in the context of the forward-looking model, the ten-period pre-announcement significantly increases the local economic impact, as measured against no preannouncement.[12] However, it is of interest to test the sensitivity of the results to varying the degree of pre-announcement. To this end, we run the forward-looking model 20 times. In each simulation we pre-announce in period zero the period in

[12] Recall that the results generated using the short-run and backward-looking simulation models, CGESR and CGEBL, are completely unaffected by pre-announcement.

which the tourism consumption injection will take place. The demand shock is then entered for each time period between zero and 19. Therefore with no preannouncement, the cumulative result is shown under period zero, with one period pre-announcement under period 1, etc. In this paper we only report the GDP impacts but similar analysis could be carried out for other relevant variables, such as employment or household income.

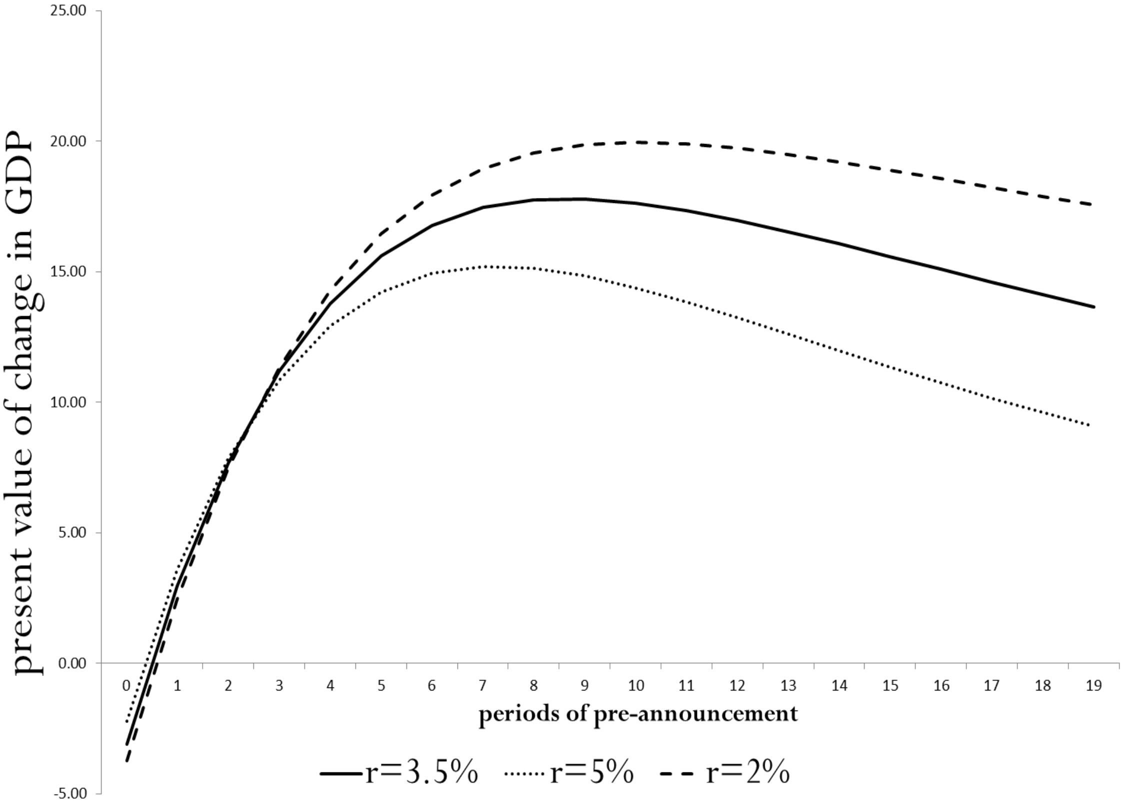
For the forward-looking model, the undiscounted cumulative GDP impact increases continuously with the degree of pre-announcement, but at a decreasing rate. However, in considering the optimal pre-announcement period it is more useful to calculate the present value of the GDP changes that accompany the tourism shock. The present value of a tourism shock announced in period zero that will take place in period T, PV_{GDP}^{T}, is given as:

$$PV_{GDP}^{T} = \sum_{t=0}^{49} \frac{GDP_t^T}{(1+r)^t} \tag{7}$$

where GDP_t^T is the difference between GDP in time period t and the base period value for the simulation with a pre-announcement of T periods, and r is the discount rate.

The GDP present values of the tourism shock with alternate levels of pre-announcement and discount rates are shown in Figure 5. The central calculations use the 3.5% real discount rate recommended in the HM Treasury Green Book (HM Treasury, 2003). It is clear that the degree of pre-announcement has a big influence on the present value of the GDP change generated by the tourism shock. In the case under consideration here, with no pre-announcement this value is negative, whilst with the optimal 9-year pre-announcement it stands at just below £18 million. Increasing the level of preannouncement from 3 years to 9 years more than doubles the discounted benefit to GDP. We also show in Figure 5 the sensitivity of the results to changes in the discount rate. Decreasing the discount rate to 2% increases the optimal degree of pre-announcement to 10 periods whilst increasing the discount rate to 5% reduces the optimal degree of pre-announcement to 7 periods.

Figure 5: Present value of GDP changes varying the degree of pre-announcement, £millions (2009 prices)



It is important to be clear how these data should be interpreted. Imagine that the only benefit for the country hosting the Commonwealth Games were the economic stimulus generated by tourism spending. If the organising committee wished solely to maximise the GDP benefit to a host country similar to Scotland, it would decide and announce the venue 9 years before the event. If the lead time were greater, the actual undiscounted GDP benefit would be higher but would be delivered at a later date which would have a smaller present value.

However, with these results, once the decision has been taken concerning the venue, there is no advantage to withholding that information. For example, imagine that a decision has been taken that 15 years hence an event comparable to the Commonwealth Games will take place in Glasgow. It is not optimal to hold back that information for six years, on the basis that the present value of the increase in GDP is maximised with a nine year pre-announcement. What needs to be compared in that situation is the present value of the 15 year pre-announcement against the present value of a nine year pre-announcement made in 6 years' time. If the pre-announcement is delayed for 6 years, this reduces the present value of the £18 million optimal figure by 18.65%.[13] However, the longer preannouncement only reduces the present value by 12.43%, as against the optimal nine year value.

The arguments presented here are strongly intuitive. The more advanced warning the economy is given of the temporary demand shock, the easier it is to smooth consumption expenditure and augment the capital stock to exploit the expenditure injection. This reduces crowding out and increases the real GDP impacts. However, Blake (2009), using a very similar CGE approach, comes to the opposite conclusion. He states: "The implications for policy makers are that … the benefits of tourism are … lower when a tourism boom is anticipated and this is of particular concern when considering the benefits of future events … such as major sporting and other special events" (Blake, 2009, p. 627). It is difficult to understand how this result was achieved. It is justified with the statement that "Tourism demand shocks rely on increases in prices to provide welfare benefits" (Blake (2009, p. 626). The implication appears to be that price smoothing achieved through appropriate forward-looking behaviour facilitated by pre-announcement is welfare reducing. However, this seems inconsistent with Blake's own analysis that the maximum increase in GDP is achieved, as in our model, under the Input-Output simulations where there are no changes in prices.

The model in Blake (2009) does not have the exact same structure as our own but it shares many common features and it is unclear why the two models operate in such a different manner. The Blake model is a national (UK) model, which implies a requirement to meet certain macroeconomic constraints which do not typically operate in a regional (Scottish) model. Further, Blake (2009) gives no explicit account of how the labour market is treated and no employment figures are reported for his simulations. This is itself curious, given that the employment effect of the tourism stimulus is often a key policy interest.[14] Finally, the key parameter values might well be very different for some key sectors. It is a puzzle that the two studies come up with such radically different conclusions. More comments on Blake (2009) are given in Appendix B. However, we are confident over our results as they apply to an open regional economy.

[13] This is calculated as $(1-(1/1.035)^6)$x100

[14] Blake (2009, p. 617) suggests that it is appropriate for CGE models to have natural rate long-run characteristics but the particular features of the short-run labour market are not given. It might be that the labour supply is fixed in both the short and long run.

6. Conclusions

This paper analyses the economic impact of the additional extra-regional tourism expenditure generated by a mega sporting event. Specifically, it uses ex ante multi-sectoral modelling techniques to quantify the employment and GDP effects on the Scottish economy of the tourism expenditure which might be associated with the Glasgow 2014 Commonwealth Games. The results add to a growing body of evidence that the incorporation of realistic supply-side constraints severely reduces the predicted impact of temporary demand shocks on local aggregate economic activity. All the Computable General Equilibrium (CGE) simulations produce much lower impacts than conventional Type I Input-Output (IO) analysis. However, the simulations also show that the scale and timing of these effects depend upon the degree to which economic agents are forward-looking and the extent of pre-announcement of the event.

A key characteristic of the temporary tourism expenditure stimulus accompanying mega sporting events is that it is predictable, in terms of size and timing. Where agents are backward looking, they interpret the temporary change in tourism expenditure as though it were permanent. This means that there is investment in capacity which will subsequently be underutilised. Although the cumulative impact on Scottish economic activity is much less than with the Type I IO model, this is the CGE simulation which gives the highest cumulative economic effect.

Where forward-looking CGE models are used, the size and timing of local investment and consumption expenditure can be adjusted in an attempt to maximise the benefits, and minimise any costs, from the demand shock. Where there was no pre-announcement, we found the cumulative impact on Scottish GDP was negative. The positive effect during the period of the shock is more than offset by subsequent negative legacy effects generated by the lower post-shock capital stock. However, the pre-announcement of the tourism stimulus has a positive impact on the size of the subsequent economic effects. Where a 3.5% discount rate is used a nine-period pre-announcement maximises the present value of the subsequent changes in Scottish GDP.

In presenting this work it is important to stress that this is an area that would repay much further investigation. First, in this paper we have assumed that agents are either completely backward-looking or forward-looking with perfect foresight. It is clear that actual agents will be somewhere in between. It seems wholly unrealistic to model agents' behaviour in this case as completely backward-looking. This implies that firms in tourism industries are not aware that the increase in demand is only temporary (though firms in linked industries might be less well informed). However, the forward-looking behaviour we model has perfect foresight. This means that the agents not only know the size and timing of the shock but can accurately model the operation of the economy and the reaction of other agents to the shock. Clearly this is asking too much. The first indicative projections of the additional tourism expenditure from outwith Scotland expected to be generated by the Commonwealth Games were only available less than 4 months before the Games started. Further there must be some uncertainty about any prior estimate of the direct tourism expenditures and also the way in which the Scottish economy will react.

A second area of future research concerns the optimality of the nine-period pre-announcement level. Even in the particular case analysed in this paper, this number is dependent on GDP being the key variable, the discount rate being HM Treasury's 3.5% and there being no other considerations regarding pre-announcement. In this respect, it is often the case that mega events are accompanied by prior expenditure on stadia, transport links and other forms of infrastructure (Kuper, 2014). The degree of pre-announcement is likely to depend on the cost implications of longer lead times with these projects. This also raises the issue that in this paper the tourism shock is considered in isolation. If there are other construction projects occurring in advance of the mega event, this will increase the cost, and therefore reduce the benefit, of moving investment forward in the tourist sectors.

A third important issue is that regional economies are likely to react differently to the tourism shock. The degree of openness of the economy and its technical flexibility are likely to be important considerations. This is a key area for further work.

Appendix A: Sectoral definitions and direct impacts

Table A.1: Sector classification and the sectoral breakdown of the £100 million direct tourism expenditure shock

Sector	*Sector in Scottish IO tables*	*Sector name*	*Direct tourism expenditure disturbance (£m)*
1	1-5	Agriculture, forestry and fishing	0.78
2	6-9	Mining	0.29
3	10-10	Food, drink and tobacco	1.80
4	21-26	Textile, leather, wood and paper	1.78
5	27-32	Chemicals	2.93
6	33-37	Rubber, plastic, cement and iron	0.16
7	38-46	Computer, electrical and transport equipment	0.80
8	47-51	Electricity, gas and water	0.25
9	52-54	Construction	0.24
10	55-57	Wholesale and retail	16.97
11	58-59	Land transport	3.02
12	60	Water transport	0.33
13	61	Air Transport	0.17
14	62-63	Post and support transport services	0.49
15	64	Accommodation	36.24
16	65	Food & beverage services	20.32
17	66-69	Telecommunication	0.90
18	70-71	Computer and information services	0.01
19	72-74	Financial services	0.85
20	75-77	Real estate	2.27
21	78-81; 83-91	professional services	1.31
22	82	Research and development	0.00
23	92-96	Public administration	1.52
24	97-100	Recreational services	5.97
25	101-104	Other services	0.59
		Total	100.00

Appendix B: More detailed comments on the model used and simulation results reported in Blake (2009).

We have outlined in the text possible reasons why our results differ so radically from those of Blake (2009), such that they would suggest diametrically opposite policy implications. In this Appendix we give other differences between the models and apparent puzzles with the results.

Blake (2009, p.617) outlines two possible capital adjustment mechanisms: "depending on whether investment becomes available for productive use in the year that the investment takes place, or in the following year." It is standard for investment that takes place in one period to update the capital stock in the subsequent period. Although this is not made explicit in the written text, and no explanation is given for the choice, equation (1), page 619 and Figure 1, page 623 show investment as simultaneously augmenting supply capacity in the same period as it is created. This means that Figure 1 reports that for the forward looking model with no pre-announcement, there is a positive investment spike in tourism sectors in the period of the tourism expenditure shock. This contrasts with our own simulations where investment actually falls in that period because of the higher prices and wages and the knowledge that the demand shock is temporary. In fact there are elements of the Blake no-preannouncement forward-looking simulation which are similar to our backward-looking simulation.

Also some of the other simulation results that are reported in Blake (2009) seem strange, which might reflect particular parameter values. We are concerned here only with the simulations which compare directly with our own. These are the simulations 1 and 2 as reported in Figure 1, 2 and 3 of Blake (2009). Simulation 1 has no pre-announcement and simulation 2 has a 10-period pre-announcement. The first puzzle concerns the relationship between output and capital stock in the hotel and other accommodation sectors. In simulation 2, the simulation with preannouncement, the additional capital stock is significantly higher (it looks like four times as much) as in simulation 1, the simulation with no preannouncement. This is as we would expect. However, output in the same sector is reported as greater in simulation 1, than simulation 2. At the very least this requires some explanation. Why does the simulation with the lower capacity in the sector receiving the shock end up with the larger increase in output in that sector?

A second concern is the relationship between the output and capital stock of the other tourism sectors, air transport and land transport. There are no detailed data but a visual comparison of the graphs suggests that the percentage changes in output appear to be identical to the percentage change in capital stock. This might represent a transcription error – the same set of data might have been entered in both sets of figures. On the other hand, these sectors might have been modelled as having Leontief (fixed coefficient) technologies at all points in the nested production function. Although it is not fully clear, it might be that the only degree of flexibility in the production functions of all the sectors is in the production of value added and that the substitution elasticities are zero (or close to zero) for these sectors. This would mean these sectors act with very limited possibility of increasing output in the short-run. Again, at the very least these are unusual results and would benefit from an explanation.

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