

GTAP conference

Warsaw 2019

CGE ANALYSIS OF MEGA EVENTS: A TIMELY ISSUE

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Temporary version. For citation please check for an updated version.

Abstract:

Computable General Equilibrium models are more and more frequently used to evaluate the impact of large sport and culture events. However, the analysis of existing CGE applications suggests a number of methodological features that may lead to misleading policy recommendations.

In this paper, we concentrate on a series of issues that are linked with the time feature of CGE models, that is, how models deal with time and the duration and sequence of economic phenomenon. The proposed contribution aims at examining these various assumptions and evaluate their impact on the model results based on a reference CGE model.

We review for instance the question of dynamicity. Many existing models are still static. In some applications, the multiperiodicity is accounted for through a set of independent simulations, losing the interlinks between the different periods. It seems useful to produce quantitative results which show how much the model results are impacted by dynamic linkage, for this particular topic of applications.

We also analyse the time concentration of visitors' expenditures shocks. Time concentration is a striking aspect of events, and one can wonder whether the annual periodicity, generally used in CGE, is suitable to represent phenomenon with such a time pattern. Using a model that neglects the time concentration of the phenomenon risks provoking errors of large magnitude.

We also consider how infrastructures are often accelerated rather than generated by the event and how infrastructure legacy impacts span on an even longer period. We discuss the various modelling approaches available to represent these legacy impacts.

Interestingly, a more accurate consideration of time issues makes some other methodological questions apparent. This relates mostly to issues linked with capital accumulation, namely: capital lifetime, productivity of event related infrastructures and likely costs increase of these infrastructures compared with normal infrastructure provision. We analyse these issues and argument for the need to properly account for a whole set of more realistic assumptions in the models.

Our conclusions strongly suggest that a proper representation of time in CGE evaluation of mega events can drastically impact on the results of the models, and increase their realism. Once this is done, we observe that other methodological issues become much more visible. Some of these appear much contingent and depend on variables that are highly undetermined... such questions certainly deserve to be set on the research agenda of economists interested in providing realistic economic impact studies of mega events.

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Introduction

In the recent years, CGE has been increasingly used for the evaluation of the economic impact of so-called mega-events. This evolution recognizes the limitations of the main competing paradigm: Input-Output multipliers. And CBA, another competing approach, still needs to establish its credibility in this area. CGE has now been applied to more than 24 events of various sizes like Olympics, Rugby or Football World Cup or Formula One Grand Prix. Until recently, these works had not been subject to close scrutiny. Instead Massiani (2018b) performs a critical survey of existing applications and suggests that, in some cases, the quantitative results obtained tell more on the assumptions, sometimes implicitly, made by the analysts than on the real economic phenomenon at stake. This mostly relates to the transfer of “habits”, with insufficient consideration of the specificities of the object of analysis. Application of the method should instead correctly recognize the specificities of events that divert, by many aspects, of more traditional topics of application of CGE. CGE originates mainly from international trade analysis and it is important to check whether the transfer of this approach to new fields of application is performed suitably. With this transfer, the methodological focus should shift on novel issues like the correct representation of substitution effects in consumers’ and government’s spending, or the adequate temporal framework to represent a phenomenon that has a peculiar time pattern.

In this context, the purpose of this paper, is to examine the most prominent issues in the CGE analysis of mega-events and to propose possible modelling solutions. In order to keep this article at a reasonable length, we focus on a group of issues that are all linked with how time is represented in the models and on how this could highly influence its results. Interestingly, when more proper consideration of time features is implemented in the models, other issues become apparent, these relate mostly to capital life duration, cost and productivity.

In order to shed light on these issues, a first section presents the available CGE analysis and examine the specificities of mega events that should be considered in economic modelling.

In a second section, we focus on a set of issues that are linked with how time is represented in CGE models analysing mega events.

In a third section, we discuss how other issues become more apparent once a more proper temporal framework is implemented and suggest some solutions for those.

Globally, our analysis suggest that model results are highly sensitive to the way in which such assumptions are handled, and that electing the most accessible or habitual approach may lead to distorted results.

A growing number of applications

CGE is becoming a real challenger for the long-time dominating Input-Output models. Looking for existing studies (we looked at paper in English, French, Portuguese, German, Spanish, Dutch and Italian, and incidentally found papers in other languages : Polish, Greek and Chinese), one can now find more than 30 papers that applied this formal framework to more than 24 events (Table 1).

Table 1 – Existing CGE Studies

FIFA World Cup	
2002 Japan Korea	(Lee, Moon, and Mjelde 2010)
2010 South Africa	(Bohlmann and Van Heerden 2005), (Bohlmann and Van Heerden 2008), (Saayman and Rossouw 2008)
2014 Brazil	(Domingues, Betarelli Junior, and Magalhães 2011) (Domingues, Betarelli Junior, and Magalhães 2010)
2022 Australian Bid	(Access Economics 2010)
UEFA Football Cup	
Euro 2012	(Borowski et al. 2010), (Borowski et al. 2011), (Borowski et al. 2013), (Borowskiego et al. 2012)
Car and Motor races	
Victoria GP	(Industry Commission 1996)
Victoria GP 2005	(ACG in Victorian Auditor General Office 2007)
Australia GP	(Dwyer, Forsyth, and Spurr 2006)
Benally Motocross 2000	(Dwyer et al. 2005)
Australia 2011	(Ernst & Young 2011)
Commonwealth Games	
2006 Commonwealth games	Pre-study : KPMG study referred in post study ^a Post-study: (KPMG 2006)
Rugby World Cup	
2003 Australia	(URS Finance and Economics 2004)
2011 New Zealand	(Ministry of Business, Innovation and Employment 2012)
Olympics	
2012 London	(Blake 2005), (PriceWaterHouseCoopers 2005)
2008 Peking	(Shantong Li and Duan 2005), (Shina Li, Blake, and Cooper 2011), (Shina Li 2012), (Shina Li 2013), (Shina Li, Blake, and Thomas 2013)
2016 Rio	(Haddad and Haddad 2010)
2004 Athens	(Zonzilos, et al. 2015) (Zonzilos, et al., 2015b) ^b
2000 Sydney	(New South Wales Treasury 1997), (Madden and Crowe 1998a, 1998b), (Centre for Regional Economic Analysis and Arthur Andersen 1999), (Madden 2002, 2006, 2010), (Giesecke and Madden 2007, 2011)
Expo	
Expo 2002 candidature	(Giesecke and Madden 1997) ^a
Expo 2015	(Socci and Severini 2016) ^a (Felici et al. 2018)
South Pacific Games	(Narayan 2003)
Cricket world championship	(PriceWaterhouseCoopers 2015)
America's cup	(m.e. consulting 2017)
"events" in general	Giesecke. & Madden, J.R. (1996) ^a Giesecke, and Madden, J.R. (2009) ^a
Hypothetical tourism inflow	
Increase of foreign tourism by £1bln	(Blake 2009)
Glasgow 2014 Commonwealth Games	(Allan, Lecca, and Swales 2014) ^c

Table Notes : a - These documents were not available to us

b - Dynamic stochastic general equilibrium

c - Tourism shock comparable to the Games

In a survey of these studies, (Massiani 2018b) reviews the main results obtained. They appear moderately supportive of mega events and, most important, they did not capture all the specificities of events as a distinct

economic phenomenon. They seemed as well to rely too heavily on well-established habits rooted in the CGE community, which may become misleading when applied to events.

Focusing on existing models, the formulation of precise critiques is made uneasy due to the general low level of documentation of existing models : with few exceptions (for instance Borowski et al. 2010) the technical documentation is scant. We find, for instance, papers that do not mention the software and main model specifications used for simulation (Blake 2005). Major aspects of the models are sometimes not documented. For instance, Allan notes “*Blake (2009) gives no explicit account of how the labor market is treated (...)*” (Allan, Lecca, and Swales 2014).

This difficulty expressed, we discuss the documented aspects of existing models, and how they could be modified to better represent the specificities of mega events.

It is necessary to recognize the specificity of mega events

It is useful at this stage to analyse what makes mega-event a specific economic phenomenon that dictates specific modelling approach.

First, **mega events are a package**. These events consist in a set of rights and obligations that cannot be untangled. They provide a stimulus for touristic flows, but this comes with a series of commitments that have their own costs and benefits. This relates to infrastructures that may or may not bring social benefits, this is accompanied by strict deadlines that may increase costs (and thus reduce the funds available for other investments). This relates also to royalties and any other kind of payments between the host economy and foreign institutions.

Second, events are specific by their **time pattern**. On the one side, mega events concentrate important effects, namely event visitors, on a very concentrated time span. On the other side, other effects, in particular infrastructure building are spread on a long time span. In parallel, mega events economic flows are known far in advance and can be anticipated. Eventually, events tend to shift investment in time: they accelerate investments in the preceding years at the cost of reducing, potentially, investments in the latter stage. All these various elements illustrate how the time pattern of economic phenomenon triggered by events is specific.

Third, events exhibit a **strong sectorial concentration**. Most of the effects concentrate in two sectors: tourism and building. This probably rules out the use of models with low sectorial disaggregation.

Forth, **the counterfactual of mega events is unobservable**. A situation that is not unique in its own but that dictates caution. For instance, the use of the resources in the no event situation is unobserved and speculative. This is a fairly common situation when dealing with public policy evaluation.

In a survey examining how these specificities are, or are not, considered properly in CGE applications, Massiani (2018a) identifies 13 issues that deserve attention and proposes temporary modelling solutions.

- 1: Mega events are often modelled as truncated economic phenomenon;
- 2: Attribution criteria should be applied to identify which part of the economic shock is really caused by the event;
- 3: Cost overruns should be considered, they increase the funding requirement for a given formation of capital;
- 4: Productivity impacts should be realistic;
- 5: Public funding mechanism should be explicit and their impact on the result analyzed;
- 6: Substitution effects in private consumption should be based on realistic and consumption;
- 7: Private investment funding mechanisms should be explicit;
- 8: Time pattern should be realistic;
- 9: Dynamicity of the model seems necessary;
- 10: Sectorial decomposition should be adequate;

- 11: Factor mobility should be realistic;
- 12: Territorial scale should be adequate;
- 13: Welfare measures are necessary and should be defined exhaustively.

The investigation of all these aspects exceeds the reasonable length of a single paper. However some of these issues share communalities. To delimitate the scope of the paper, we focus on a group of issues that are all linked with time and its representation in the models and how it can condition the results of the model. Successively, this analysis creates relevant side effects and make unconcealable other issues that we will also explore.

Some timely issues

We review two series of questions, first the introduction of dynamicity of the model. It seems a prerequisite for a proper consideration of time issues. Second we examine how to introduce various temporal features of mega events in a dynamic model.

Dynamicity, a must ?

Dynamic models exhibit obvious advantages at the cost of some modelling complications. A minimal form of dynamicity could however be necessary if reliable estimates are wanted (Blake 2009). Considering the need to include the infrastructure build up phase and the tourism legacy, the effect of mega events will span on various years. Some of these effects, typically infrastructure building, will accumulate on several years so that a dynamic approach seems appropriate. Surprisingly, many existing models are static (Victorian Auditor General Office 2007; Bohlmann and Van Heerden 2008; Saayman and Rossouw 2008 although in this case not a annual period; Shina Li, Blake, and Thomas 2013). In other applications, the multiperiodicity of the model is accounted for through a set of independent simulations (pre, event, post) simulations (KPMG 2006; Centre for Regional Economic Analysis and Arthur Andersen 1999 and other early works on Sydney Olympics), losing the interlinks between the different periods. Determining how much this parsimonious setting will alter the results compared with a dynamic setting deserves investigation. In all cases, multiperiodicity appears highly recommendable, ideally in the form of a dynamic model (Giesecke and Madden 2007 and successive works on Sydney; Borowski et al. 2013; Blake 2005; Access Economics 2010).

In this context, a dynamic model seems like a must. Implementing a dynamic model is not in itself a novelty. It seems however useful to produce numerical results which quantify, for our topic of investigation, how much the model results are impacted by dynamic linkage.

This however may be the most obvious time related issue, we now examine in detail other issues.

A specific time pattern

This issue has two dimensions: the time concentration of the shock and its anticipation by economic agents

Concentration in time

The first aspect is the most striking, and one may wonder whether the general annual periodicity used in CGE are suitable to represent phenomenon with such a peculiar time pattern. A 100 million euro increase in tourism expenditures does not impact the economy in the same way when it is concentrated on a few weeks and when it, fictively, impacts the economy in a one year period.

In existing studies, all models except one are based on yearly data with no specific adjustment for the peculiar time pattern of the event. Only Saayman and Rossouw make an adjustment – although not in the form one would expect - for peculiar time considerations in their simulation of the South African World Cup: *“although the two scenarios are implemented over a period of 1 year, the impact is simulated as a once-off event that plays itself out over a period of about 2-3 years. The results are then annualised and the impact can*

therefore be discounted back to reflect annual adjustments over the 1-year period.“ (Saayman and Rossouw 2008).

In a particularly neat treatment, Winston recalls how most of economic models actually deal with flows (product per amount of time), whose real periodicity should be considered for proper analysis while the conventional annuity of economic modelling may distort results (Winston 1982, 2008). Actually, there is interest from CGE modellers for analysis of how time should be considered in the model : for instance time requirements of consumption are taken into account in some models (Ferri, Moltó, and Uriel 2009) and numerous models entail preference for the present, discount, savings (Lisenkova 2016). But the question of model periodicity is a bit less common, although a growing number of models use infra-annual data (Kutlina-Dimitrova 2017; Verikios 2016; and a model quoted in Dixon et al. 2012). They illustrate that using annual statistic as the basic input for models does not imply using an annual model. Considering that many applications of CGE refer to a tourism shock that is concentrated on a few weeks, it would certainly be instructive to observe how a model run on a monthly period would provide a different, arguably more realistic, picture than a similar model based on yearly data. Arguably, the simple rescaling of the model to a different periodicity (for instance monthly data) may not be a perfect solution. But using a model that neglects the time concentration of the phenomenon certainly risks provoking errors of much larger magnitude.

Anticipation

Another feature is the long pre-event period, where economic agents form anticipations. This deals with two aspects: infrastructure and consumption.

The case for infrastructure, can apparently be handled modestly, by splitting the infrastructure shocks in yearly amounts. This can represent a parsimonious solution compared with the alternative where the model does endogeneize the formation of event related investment. This latest solution is also difficult to handle. For public investment infrastructure spending is hardly anything but exogenous. For private capital, when present, event related investment seems to obey different rules compared with ordinary investment.

Relating to anticipation of the tourists' consumptions, the issues has been covered extensively in studies of mega events in Scotland (Allan, Lecce and Swales, 2014). Interestingly the authors find that the backward looking model, has the largest impact on GDP. This intriguing result, and other suggest more attention for these questions and careful consideration for their analysis.

To conclude on time patterns to consider in assessment of mega events, we can mostly suggest that a dynamic model is a must and that infra-annual periodicity for the event period provides more realistic results. Once these changes are implemented, however, the model is not settled: other questions that were not highly apparent become too visible to be ignored.

From time to capital and costs

Touching a single element of the modelling framework may not be sufficient. Other elements of the model have to be modified as well, as if the correction of some distortion makes other contradictions in the models too apparent. For instance, once a model is made dynamic, one has to consider a realistic capital lifetime and, thus, the question of capital productivity has to be considered with far more attention: some approximation on this parameter can become highly distortive when the model considers that the capital can affect productivity for several decades (Farmer and Wendner 2004).

In the next paragraphs, we review such issues that become more apparent when the representation of time in models is improved. Mostly they relate to capital: its lifetime, its productivity, its cost.

Realistic productivity impacts

Many studies assume an arbitrary productivity shock generated by the mega event. One could wonder if other approaches, with more empirical foundations could be more helpful.

The impacts on productivity are arbitrary

Three main assumptions can be found in the literature (Table 2 illustrates this more in detail).

1. Fixed productivity increase: for instance, in South African studies, the productivity increases in the sectors that directly receive investments (e.g. construction).
2. Calibrated return functions,
3. For some infrastructure types, no increase is supposed. For instance, Domingues and his co-authors consider that sport stadia do not impact productivity (Domingues, Betarelli Junior, and Magalhães 2010, 10).

Table 2 – productivity shock assumptions in CGE studies of mega events

Fixed increase in productivity	
• Productivity of dedicated sectors (transport, construction, communication)	
South Africa world cup	<i>“It was decided to shock the capital stock of the construction and transport industries with an increase of 10 percent, the capital augmenting technological change in construction by 5 percent and the capital-augmenting transport technological change in the transport industry by 10 percent. This was done in order to simulate the effect of the increased activity in the construction industry due to the improvement and building of new stadiums, and infrastructure in general.”</i> (Bohlmann and Van Heerden 2005)
	<i>“Scenario 2: 5% increase in transport sector productivity. And in the construction and communication industry by 2% each.”</i> ² (Bohlmann and Van Heerden 2008)
• General productivity increase	
Sydney Olympics	<i>“0,05 % increase of labor productivity in the post-Olympic period.”</i> (New South Wales Treasury 1997, 10) This assumption was not maintained in latter studies.
Calibrated rate of return	
Brazil world cup: other than sport venue	Other infrastructures: <i>“based on 12,9 % return rate of infrastructure investment determines the impact of capital formation on sectorial productivity”</i> (Domingues, Betarelli Junior, and Magalhães 2011).
Euro 2012	<i>“TFP increases thanks to anticipated investments in transport. This impact is modelled based on econometric estimates.”</i> (Borowski et al. 2013) In the event year, TFP increases of 0,35% circa (figure 5) Additionally: increased transport infra increases FDI and thus available capital.
No impact on productivity	
Brazil world cup: sport venues	Domingues (2010) p. 10 consider that sport stadia do not impact productivity
Sydney Olympics	No impact in most recent applications

Several questions emerge:

1 - With few exception (Brazil World Cup in Domingues 2010, p. 10 ; Rio Olympics (Haddad and Haddad 2010), most studies omit the main benefits of transport infrastructure: increase in productivity. This omission contrasts with what appears in other economic impacts studies of infrastructures, and, strikingly, in CGE studies of infrastructures (Bröcker 2004, 2002). To say it differently, there is a striking difference between the

² The author, in page 4 of his article, refers to the paper “Predicting the economic impact of the 2010 FIFA World Cup on South Africa”, Department of Economics Working Paper Series 2006-11”. We could not have access to this paper. The author kindly made us accessible a Master thesis. Although this latest publication provides more detail on the approach, we could not find an in depth justification of this quantification.

CGE literature on mega-events which basically neglects ex post productivity benefits of transport infrastructure, and the corresponding literature on transport investment which sees productivity impacts as the key element.

2 - in various applications, the authors assume that the sector that produces the investment increase its productivity. For instance if more is spent in the building sector, the productivity of the building sector will be increased. There is room for interrogation (unless the existing works were misinterpreted) on why the sectors that receive investments would experience an increase in productivity. If more buildings are constructed does it mean that the productivity of the building sector increases, or that more capital is available in this sector, or rather that more capital is available for other sectors?

3 – Event infrastructure is different in nature compared with other public infrastructures. This relates to two types of infrastructures.

1. Sport venues. It would be difficult to assume that sport stadia have a similar impact on productivity compared with other public expenditures. To be on the safe side, one may assume that they do not constitute productive capital. This view is expressed by Madden: *“an assumption that the new Olympic venues would not have any residual value after the Games,”* (Madden, 2010). The author however claims that this assumption *“was initially treated with scepticism, but its veracity was borne out after the Games when the venues could not even cover their upkeep and required government subsidies”*. An alternative, more optimistic assumption, is that the availability of sport infrastructures increases physical activity, health and labour productivity (Murphy and Bauman 2007).
2. Transport infrastructures. For these, there is a presumption that their productivity will be lower than other infrastructures; they often will serve traffics to venues, and serve background transport demand less than usually. However these productivity impacts should be considered based on a case by case basis.

Base the productivity effect of mega events on solid theoretical and empirical elements

Estimating the impact of events on productivity appears thus as a key parameter. Our survey however suggests that the theoretical and empirical foundations of the current practice is limited. Two streams of research could be considered. The first one would be to look for realistic productivity impact estimates based on usual two factors production function, the second one would be to use the public capital paradigm. Elaborating on this latest stream of research, CGE analysis of mega events could, with due consideration for the singularities of each specific event, consider how such events affect the amount of public capital available and hence the productivity in the economy.

To handle this aspect, CGE analysts have now acquired a relevant experience in the modelling of public capital. The largest area of application of public capital relates to infrastructure economics. Conrad examines the *“The productivity effect of infrastructure”* (Conrad 1997). Seung and Kraybill use an extended Cobb-Douglass function (Seung and Kraybill 2001 using the model in ; Glomm and Ravikumar 1994). Chen and Haynes analyse transportation capital in the US based on *“separated public capital accounts in the US social accounting matrix (SAM)”* (Chen and Haynes 2013).

Elaborating on the methodology used by those scholars, it seems attractive and possible to represent the change in public capital implied by mega-events. From an empirical point of view, estimates of public capital are now widely available (taking Italy as an example : (Mastromarco and Woitek 2006; Destefanis and Sena 2009; Di Giacinto, Micucci, and Montanaro 2009; Marrocu and Paci 2010; Roxas, Cristofaro, and Piroli 2012; Farhadi 2015; Millemaci and Ofria 2016; Kamps 2006). Using the public capital paradigm, one could then measure the impact of infrastructure provided in the specific context of mega events.

Cost overruns do impact capital formation

Cost overruns are an issue for the productive effects of mega events infrastructure investments.

There are actually two mechanisms that risk being confounded.

1. Actual Costs are higher than anticipated ex ante. It is frequently observed that ex ante cost are underestimated (Andreff 2012; Flyvbjerg and Stewart 2012; Preuss, Andreff, and Weitzmann 2019). There is a risk in non considering the discrepancy between ex ante and ex posts costs.
2. Infrastructure costs are higher than they would be in a “no event” situation. There are a number of reasons: fixed deadlines, regulator capture etc. (Flyvbjerg 2011). To this, one could add that concentrating infrastructure provision in a given period can increase cost due to increasing marginal costs assumption present in some models (Borowski et al. 2013, 95).

Considering these mechanisms, there could well be three costs’ estimates to consider: ex ante cost estimate, cost of similar infrastructure in a no event situation, actual ex post costs. Suppose a stadium is planned to cost 100 million. Its actual cost in a no event situation could be 120; underestimates are also frequent in the no event situations. After the infrastructure is built its cost is 150. A possible reason is that strict deadlines impacted the costs. An analyst may consider that only the two extreme figures, 100 and 150, are relevant for our purpose. But, to provide a realistic assessment, the “no event” cost, 120, is necessary: a CGE model should consider that 150 were spent but the increase in capital stock corresponds to a 120 investment. In other words, cost increase reduce funding available for other investments and reduce capital available to the economy, a mechanism that should be accounted for in the assessment.

To implement this consideration, two pieces of information are necessary, the actual cost and the cost a similar infrastructure would have in ordinary circumstances. When no such data are available, ex post data are available, provision for cost increase could be based, in absence of better solution, on literature finding as in (Flyvbjerg and Stewart 2012). Once a more realistic quantification of costs is available, the question becomes a modelling question. Is the model sufficiently realistic to account for the real effect of these cost overruns? If providing 1 euro of infrastructure is more expensive in mega event contexts than in other contexts, the model should both consider larger costs, but also that the amount of public capital created is lower than in other circumstances.

It thus appears that questions related to the cost of capital provision become important when a more proper consideration of time in event impact assessment is implemented. In the case of static models, with short term closure, for instance, these questions would be covert.

Model simulations

From our analysis emerges the need to quantify how various possible methodological amendments can impact the results of a CGE model. A possibility would be to use a reference CGE model and introduce, step by step, possible improvements, so as to indicate which changes have the largest impacts on results. Another possibility is to rely on pre-existing models that represent one “realisation” of the CGE practitioner’s community modus operandi. To our best knowledge, open source models are still rare in this area. We however have access to a model that was developed during a post doc on mega events in our University, and whose results were published (Sartori 2017b, 2017a). This model is a three periods model (prevent, event year, post event), coded in GAMS, based on GTAP SAM for Italy aggregated on 10 sectors. It used CES, CET, Armington elasticities based on GTAP and text books’ values. Demand functions are of Linear Expenditure System type. Unemployment is modelled with a Philips’ curve.

Numerical results showing how changes to this simple model can profoundly alter the results of simulations, will be presented in updated versions of this paper. Preliminary findings indicate that many of the investigated issues can have a drastic impact on the results.

Conclusions and future works

Our analysis suggests that many issues have not yet received sufficient attention for CGE analysis of mega events. By many aspects, there is the risk that specificities of mega events are not sufficiently considered. Related to this is also the risk that practitioners transfer habits that may be adequate in traditional fields like, typically, international trade, to a radically different topic.

It becomes possible to test how much proposed changes to the modelling approach can impact and ideally improve the model. This helps researchers in directing their efforts to modelling options that most impact the results. And may provide an opportunity for increasing the validity of policy recommendations on the interest of holding a mega event.

The issues covered in this paper are however only part of the issues that touch the validity of current CGE modelling of mega events. These others as well probably deserve attention in future research.

Acknowledgement. We acknowledge the kind support of CS 576 of Cortona (Arezzo- Italy) for creative residence during summer 2018.

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