

THE METHODOLOGICAL CHALLENGE OF THE CGE ANALYSIS OF MEGA EVENTS'  
ECONOMIC IMPACT

Jérôme MASSIANI<sup>1</sup>

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**ABSTRACT**

Mega events are perceived as an opportunity to foster regional development. Yet many impact assessment methods routinely used to inform the policy maker exhibit strong limitations. The most influential method, IO appears based on discussible implicit assumptions like the assumed additionality of the financial flows related to the event, or the lack of constraints on resources. In this context, CGE methods experience a growing popularity in the evaluation of mega event impacts.

In this paper, we present a systematic and critical review of more than 30 papers in the field. We examine the main conceptual issues of these papers. Our analysis suggests an excessive reliance of practitioners on habits deeply rooted in the CGE community and that more consideration of the specific features of mega events is necessary, if one wants CGE results to provide useful guidance to policy making in this area. We provide a number of recommendations for future applications of the method to this kind of policy.

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<sup>1</sup> Università Ca' Foscari, Dipartimento di Economia, Cannaregio 873, 30121 Venezia. [j.massiani@unive.it](mailto:j.massiani@unive.it)

## **SOMMARIO**

I mega eventi sono percepiti come un'opportunità per favorire lo sviluppo regionale. Tuttavia, fra i diversi metodi regolarmente utilizzati per informare il decisore politico hanno forte limitazioni e possono generare risultati distorti, come ad esempio i metodi Input-Output che generano risultati discutibili basati su ipotesi molto opinabili (ad esempio il carattere addizionale, piuttosto che sostitutivo, dei flussi economici legati all'evento). In questo contesto, i metodi di Equilibrio Generale Calcolabile attraggono sempre maggiore attenzione da parte degli studiosi e, a volte, dei decisori.

In questo articolo, presentiamo una revisione sistematica e critica della letteratura disponibile in materia che ora supera trenta documenti. Esaminiamo i principali problemi concettuali di queste analisi. La nostra analisi suggerisce un'eccessiva fiducia degli analisti in abitudini solidamente radicate nella comunità degli studiosi e che una maggiore considerazione delle specificità dei mega eventi è necessaria, se si intendono produrre risultati utili alla definizione delle politiche in materia. Forniamo una serie di indicazioni per future applicazioni del metodo a questo tipo di intervento.

# THE METHODOLOGICAL CHALLENGE OF THE CGE ANALYSIS OF MEGA EVENTS' ECONOMIC IMPACT

## 1. 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 the still incipient nature of other methods like CBA. CGE has now been applied to more than 20 events of various sizes like Olympics, rugby or football World Cup, Formula one Grand Prix. This accompanies the general diffusion of CGE models among policy advisors: in various countries central or regional administrations maintain CGE models for evaluation purpose (Italy: Oranit, UK: HMRC CGE, in Tuscany: TUSCANI; Washington State: STAMP). This general development has only partially been subject to scrutiny: although various articles draw perspectives on the application of CGE we are not aware of the existence of any systematic review of available studies examining their results and their potential methodological issues.

Time has thus come to review more systematically the existing applications and formulate proposals for possible improvements. A relevant issue is whether applications of the method correctly recognize the specificities of such events that divert, by many aspects, of more traditional areas 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 shed light on such methodological issues.

In a first section, we examine the potential and the limits of CGE. In a second section, we present the results provided by CGE analysis of mega events. The next section explores the methodological issues and make apparent that applications are at risk of producing distorted results. A final section discusses and concludes on the need for practitioners to question deeply rooted habits and to better consider the specificities of mega events as an economic phenomenon.

## 2. CGE is a promising method, but its validity is open to discussion

In this section, we present the potential of CGE and the advantages generally portrayed by their proponents. The promises of CGE mainly rely on their claim of adequately representing the interlinkages between markets. This is suitably summarized by Brocker:

“all agents in the economy make mutually consistent plans, such that no agent (no firm, no household, no public institution) has an incentive to revise his or her plan. The approach is called general (in contrast to partial) because all market interactions are taken account of. (...), there are no “black holes” for payments to vanish in, nor mysterious fountains spitting money which agents receive. (...), all agents balance their budget; they expend exactly what they obtain. This does not preclude debt and credit, of course; but any debt and credit must be explicitly handled in the model, like sales and purchases of goods, services and factors of production.” (Bröcker, 2003)

Putting together these and other features, CGE appears to have a number of attractive advantages. These are well documented in CGE literature (Dwyer, 2015; Dwyer, Forsyth, & Spurr, 2006; Jago & Dwyer, 2006), and are therefore only summarized in the list below.

- Respects accounting identity
- Consistent with optimisation of consumers and producers
- Room for non-linearities in economic mechanisms (like non fixed technical coefficients)
- Considers intersectorial linkages
- Considers constraints on resources, typically factors.
- Substitution effects for private and public expenditures (expenditure has to substitute other uses)
- Considers opportunity costs corresponding to alternative use of resources
- Balance of payment constraints and currency effects
- Price effects (prices react and affect other variables)
- Relative price adjustments allowed.

Based on these properties, CGE appears adequately armored to provide realistic policy impacts' estimates. This adequacy can be illustrated by its capacity to unveil counterintuitive effects. Under various assumptions (like factors used close to capacity) one could conjecture that an increase in touristic flows could deteriorate the economic situation of a given community. This result, intriguing in its nature – but not remote from the familiar Dutch disease situation– has been observed in applications. Laffargue notes:

*“The most interesting general equilibrium mechanism in this context is the Coppeland effect (1991) [...]. Foreign tourists allocate a high proportion of their total spending to the consumption of non-traded goods and services. Their action increases the prices and outputs of these goods, which leads to a contraction of the traded goods sector.”* (Laffargue, 2011)

Empirically, Adams and Parmenter confirm the plausibility of this effect: an increase of tourism directed to Australia would harm Queensland economy, the most tourist intensive region of the country<sup>2</sup> (Adams & Parmenter, 1993, 1995). The possibility to obtain negative outcomes, or a negative recommendation for the policy maker increases the face value of the method compared with others. Together with the other advantages of CGE, these features contrast with the limitations of competing methods, namely Input Output and, to a lesser extent, CBA.

**Thus, Computable General Equilibrium approach appears to have a number of appealing features.** Rather than being an alternative to other methods it seems to provide a comprehensive, if not unifying, framework in which the various consequences of an expenditure program can, with proper attention, be considered. For this and other reasons, it is no surprise that jurisdictions are interested in recommending this method for the evaluation of expenditure programs, in general, and mega events' impacts in particular. In Australia, the State of Victoria recommends CGE for *“Major events that receive government funding of more than \$10 million”* (Victorian Auditor General Office, 2007). Although this recommendation is still isolated, the growing number of CGE studies commissioned by public administration confirms the rising credibility of this method among policy makers or, at least, among policy advisors.

How much such critics are justified will become clearer once we have presented the existing CGE analysis of mega events.

### 3. A flourishing field that deserves a lot of methodological attention

In this section, we present the various existing CGE studies of mega event and investigate whether the methodology they use is appropriate for this object. Our analysis suggests that the field is flourishing but many methodological issues must be solved before this method can provide proper policy recommendations.

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<sup>2</sup> Key reasons were that a large share of tourist expenditures would be captured by New South Wales tourist operators, and that Queensland Agricultural and Mining sectors would be hurt from currency appreciation triggered by increased touristic flows.

### *3.1 A growing number of applications*

We have browsed the existing documents on CGE study of Mega events, together with smaller events, in English and 6 other western languages (French, Portuguese, German, Spanish, Dutch and Italian) and incidentally in other languages. Table 1 displays the existing publications.

Table 1 – CGE Studies considered

<b>FIFA World Cup</b>		2003 Australia	(URS Finance and Economics, 2004)
2002 Japan Korea	(Lee, Moon, & Mjelde, 2010)	<b>Olympics</b>	
2010 South Africa	(Bohlmann, 2005) (Bohlmann & Van Heerden, 2008) (Saayman & Rossouw, 2008)	2012 London	(Blake, 2005) (PriceWaterHouseCoopers, 2005) (Shina Li, Blake, & Cooper, 2011) (Shina Li, Blake, & Thomas, 2013) (Shantong Li & Duan, 2005) (Haddad & Haddad, 2010) (J. A. Giesecke & Madden, 2011) (New South Wales Treasury, 1997) (John Madden & Crowe, 1998) (John Madden & Crowe, 1998) (Centre for Regional Economic Analysis & Arthur Andersen, 1998) (John Madden, 2006) (J. Giesecke & Madden, 2007) (John Madden, 2010)
2014 Brazil	(Domingues, Betarelli Junior, & Magalhães, 2011) (Domingues, Betarelli Junior, & Magalhães, 2010)	2008 Pekin	
<b>UEFA Football Cup</b>		2016 Rio	
Euro 2012	(Borowski et al., 2010) (Borowski et al., 2011) (Borowski et al., 2013) (Borowskiego, Boratyński, Borowski, Czerniak, & Plich, 2012)	2000 Sydney	
<b>Car and motor races</b>		<b>Expo</b>	
Victoria GP	(Industry Commission, 1996)	Expo 2002 candidature	(New South Wales Treasury, 1997)
Victoria GP 2005	(ACG in Victorian Auditor General Office, 2007)	<b>"events" in general</b>	(J. Madden & Giesecke, 1996) (J Madden & Giesecke, 2009)
Australia GP	(Dwyer et al., 2006)	<b>Hypothetical tourism inflow</b>	
Benalla Motocross 2000	(Dwyer, Forsyth, Spurr, & Ho, 2005)	Increase of foreign tourism demand by £1bn	(Blake, 2009)
Australia GP 2011	(Ernst & Young, 2011)	Tourism shock comparable to Glasgow 2014 Commonwealth Games	(Allan, Lecca, & Swales, 2014)
<b>Commonwealth Games</b>			
2006 Commonwealth games	Pre study: KPMG study referred in post study <sup>a</sup> Post study: (KPMG, 2006)		
<b>Rugby World Cup</b>			

Table notes:

a – this text was not available to us.

Small events CGE application can also be found: Aardklop National Arts Festival Potchefstroom festival (Wyk, Saayman, Rossouw, & Saayman, 2015), Klein Karoo national arts festival (Wyk, Saayman, & Rossouw, 2013) Taste of Tasmania Australian Wooden Boat Festival (J. R. Madden, Groenewold, Thapa, & Tourism, 2002), Cricket international series (URS Finance and Economics, 2007)

Parallel to this, we have also considered the application of the CGE paradigm to two fields of research strictly related to mega events: tourism and infrastructures.

For tourism, CGE appears as a flourishing area of research, various studies were performed back in the 1990's (J. R. Madden, Thapa, (Australia), & Analysis, 1999), the field gradually expanded with applications to Hawaii (Zhou, Yanagida, Chakravorty, & Leung, 1997), Zimbabwe (Mabugu, 2002), Fiji (Narayan, 2004), until it successively boomed in the most recent years with, just to name a few, papers on Sri Lanka (Fernando, Bandara, Smith, & Pham, 2015), Thaïlande (Ponjan & Thirawat, 2016), Singapore (Meng, 2014). The level of maturation of this field also materializes in the availability of at least one handbook on the topic (Meng & Siriwardana, 2017).

As far as infrastructure are concerned (Conrad, 1997; Dixon, Rimmer, & Waschik, 2017; Seung & Kraybill, 2001; Stroombergen, Adolf, 2007; Warr, Peter, Menon, Jayant, & Yusuf, Arief Anshory, 2010), CGE application has different features with a more limited number of application. As exemplified by Broecker, this literature concentrates on the productivity effects of infrastructure rather than on the consequences of the building phase. *“(the model) is confined to the regional welfare effects resulting from the use of the transport infrastructure. Effects from the construction phase, from financing and maintenance are not considered”*. (Bröcker, 2002). This limits the possibility of cross-fertilization across Megaevents and Infrastructures literature. And actually, only judging by the references used by mega event evaluation papers, the tourism literature is much more influential.

Turning back to available CGE studies of mega events, the 38 papers identified correspond to a smaller number of events (17, plus some papers on “events” in general or hypothetical event related touristic flows), with 10 publications focusing on Sydney Olympics. The field of research apparently developed due to a fortunate contingency: the attribution of 2000 Olympics to Sydney and the presence of a vivid, world leading, community of CGE scholars in South East Australia, with some preliminary experience: the evaluation of Australia Grand Prix (Industry Commission, 1996). For this reason, many of the existing papers correspond to various stages of CGE analysis of Sydney Olympics.

Before to examine the methodological issues present in these approaches, it seems more conducive for the readers' understanding to present the most salient results of the models.

### 3.2 Salient results: positive but “small” and, sometimes, negative and delusive effects

What are outcome of these investigations? The most manifest results of these analyses **relate to the outcome of the evaluation that can be positive or negative, and is usually found small**. For instance, Saayman and Rossouw find a *“positive impacts on the economy in terms of output and employment gains”* for South Africa World cup (Saayman & Rossouw, 2008). Borowski and his coauthors found that the euro 2012 tournament in Poland increased GDP of 27,9 bln PLN spread over the period 2008-2020 (Borowski et al., 2013). In some cases, enthusiastic multipliers are computed. Haddad and Haddad conclude *“For each US\$1 invested other US\$ 3.26 would be generated until 2027”*, but this study does not document, to our judgement, how substitution effects take place (Haddad & Haddad, 2010). Some qualitative statements are also enthusiastic : *“given proper long-term planning and vision FIFA 2010 could turn out to be the most profitable investment in this country's history”* (Bohlmann & Van Heerden, 2008), but the same article provides limited support to this conclusion and also states that the result was negligible on the whole. There are also some exceptions to these positive results: Li and her coauthors find that the tourism impact of Pekin 2008 generated a loss of *“US\$297 million brought by a US\$ 1,238 million decrease in international tourism”* to consumers (Equivalent Variation), due to a negative impact on tourism (Shina Li et al., 2011). When instead, the results are positive, most authors are usually careful in underlining that the impact is usually “small” compared with the economies considered. Madden concludes substantially that mega sporting events are unlikely to generate large economic benefits and writes about a *“modest positive impact on the state hosting the Games”* (John Madden, 2006). Bohlmann and Van Heerden find that *“the real economic impact was found to be negligible given the relatively short time period under consideration”* – a statement made although this study considers the infrastructure construction stage that runs on a few years (Bohlmann & Van

Heerden, 2008). On this point, one may however wonder whether the notion of large versus small impact of the mega event is actually sound. This qualification directs the attention toward an elusive quantification: **any quantity is small (or large) if compared with an adequately chosen aggregate**. It could be irrelevant that the effect is small: if the effect is positive (and the model is correctly defined) it means that financing the event provides higher socio economic returns than the counterfactual use of resources. If the model is realistic, the recommendation to hold the games is thus valid as long as the effect is positive, by any non-ridiculous amount.

An interesting characterization of the model results is to compute some response function, or to use a broader classification mainly in use in IO but adequate as well for CGE (John Madden, 2002), Dwyer 2004), of models multipliers. NSW treasury 1997: “*a multiplier of close to 1 for the MMRF Model utilized for the current study.*”

*Table 2 – Response functions or multipliers values resulting from CGE model*

	choc considered	Multiplier definition	Multiplier value
GDP multipliers			
(Dwyer et al., 2005) p 22	“Inbound” (international) tourism	Australian GDP/inbound tourism expenditures	0,232
(Lee et al., 2010)	194 bln won extra foreign tourism expenditure (low scenario)	GDP / extra foreign tourism expenditure	1,38
(KPMG, 2006)	\$2.9 billion total expenditure (tourism, construction, operation)	NPV of GSP increase on 20 years / expenditure	0,559 %GDP / bln AU\$
(Allan et al., 2014) p.12	100 mln £ extra foreign expenditures spent on Scottish goods	GDP in the event period/ extra expenditure	0,286 %GDP/100mln
(Ernst & Young, 2011) sc. 1	Total direct expenditure 30 mln Grand Prix	Victoria GSP / total direct expenditure	1,31 %GDP/mln AU\$
Consumption multipliers			
Haddad and Haddad (2010)	infrastructure investment	Aggregated expenditure/investment	3,26
Li, Blake and Cooper (2011)	international tourism demand	Change in Equivalent Variation/ increase in international tourist demand	Ex ante sc: 0,20 Ex post sc: 0,24
(Ernst & Young, 2011) sc. 1	Total direct expenditure 30 mln Grand Prix	Real private consumption/ direct expenditure	-0,5

The presentation of such diverse quantifying defies formulating conclusions. Strong differences could relate to the difference of the specific economic considered, but how much they owe to arbitrary choice of the modeler probably deserves attention.

Beyond these numerical results, some relevant patterns appear in the studies. A first pattern is that **repeated exposure to CGE analysis seems disenchanting**. In the most trivial meaning, this implies that ex post analysis is less optimistic than ex ante. Li, Blake and Cooper compare the ex-ante with the ex post evaluation of Pekin Olympics international touristic flows. The ex-ante central scenario provides an impact of +177 million \$ of Equivalent Variation while ex post analysis results in a loss of 297 million \$. This result reflects the reduced touristic inflow compared with forecast (Shina Li et al., 2011). This pattern is confirmed when a single event is put under scrutiny by a series of successive investigations. This relates to the Sydney Olympics with more than 10 papers, written by the same group of analysts. These papers pivot around a single modelling tool and exhibit generally positive results, except that the last papers produced reverses the outcome of the analysis and provide a negative evaluation, at least considering a key result: “*Real*



*consumption loss of 2.1 bl\$*". This circumstance is too unique to provide robust general conclusion<sup>3</sup> but it issues a warning on the validity of results that may be produced, even repeatedly on a time span of several years for a given event. In other words, one may wonder whether positive outcomes of initial studies did not just go through the disenchanting process of repeated scrutiny.

But these most salient results may not be the most important conclusions of our survey. These results are contingent upon a series of crucial methodological choices that need to be discussed.

#### **4. Methodological issues are numerous**

When considering methodological issues, a first aspect is that, with few exceptions models provide often limited documentation. This, coupled with the observation that CGE models are very assumption driven, raises some worry.

##### *4.1 The level of model documentation is not always high which is problematic when the results are strongly assumption driven*

Many papers provide limited documentation of the underlying economic mechanisms. With few exceptions (for instance Borowski et al., 2010), the level of documentation is limited. We find papers that do not mention the software and main model specification used for simulation (Blake 2005). Papers usually refer to pre-existing writings that document the model used, but they provide limited discussion on which elements of the originating model had to be reengineered for the specific application. However, it appears unreasonable that models built for other purposes (tariffs, trade, environmental regulation) do not require to be adapted to some specificities of mega events... or at least that their adaptation deserves some discussion.

Usually the only information provided on the models relate to the software/model in use, but no information is provided on the parameters used. It is possible that the models are implemented with default parameter values but this does not make it less worrying, especially when one considers that in many applications a given model is taken from a geographical area (for instance Brazil) and transferred to another country (for instance South Africa). It would be unfair to state that the analysts that build such models did not consider transferability issues, but it is still problematic that the reader does not have the information on how these parameters were set. Similarly, the authors are usually very quick on other crucial features of the model: how binding are resource constraints, which type of closure has been used (with, sometimes, indications of short or long term closures), what values are used for elasticities.

The low level of documentation provided is problematic considering how model results are strongly assumption driven. This assumption dependency is striking in the various studies of Sydney Olympics. For instance, the assumption about the source of funding for investments appears crucial. The assumptions of domestic funding for investment is also examined by (Domingues et al., 2011)<sup>4</sup> and by Madden and Crowe who note:

*"important feature of the simulation's assumed economic environment is that Pre-Event expenditure is domestically financed. While relaxing this assumption would add less than 0.01 percentage points to GDP, the major effect would be on the composition of GDP. The estimated increase in real private consumption would be over 80 per cent greater under a scenario where foreign financing were allowed. This increase would be significantly offset by a deterioration in the balance of trade" (John Madden & Crowe, 1998)*

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<sup>3</sup> We are aware of one study that estimates higher ex post impacts: "The Post-Games modelling has shown a small increase in (...) the NPV impact on GSP (5.9%)" (KPMG, 2006). However to our best knowledge the ex-ante study is not publicly available, making difficult an informed comparison of these two estimates.

<sup>4</sup> "assume-se que as fontes de recursos para esse investimento originam-se das famílias, que para isso diminuem seu consumo corrente" (it is assumed that the source of funding for these investments come from households, which have consequently to reduce current consumption).

In this context, it becomes striking that CGE analysts make strong assumptions without in depth discussion of their rationales and consequences. Saayman and Rossouw 2008 assume: 1) industries did not adjust the size of their capital stocks; 2) wage rates did not adjust; 3) no induced new investment by industries. This set of assumption is actually very strong, and their implications should better be investigated. Haddad and Haddad also use a very presumptive (and undocumented) “*changes in regional sectoral productivities*” e “*effects of productivity gains*” to model the effect of Rio Olympics (Haddad & Haddad, 2010).

The assumption driven feature of CGE models and the general lack of documentation of the models make it difficult to formulate an informed statement on the results. In this context, we propose however to proceed with a discussion of the methodological issues raised in current applications of CGE to mega events... at least for the most overt aspects of it.

We review in turn the following issues: many models do not actually evaluate mega events but an heavily truncated representation of these events. A realistic representation of mega events is necessary which should pivot on the realistic representation of substitution effects. The effects of mega events on productivity should be accounted for realistically, allowing for negative effects as well. Eventually the features of the chocked economy should be represented more realistically with specific attention for market conditions.

#### *4.1. Many models restrict Mega events to a single dimension, mostly a touristic manna*

Most of the existing analysis are based on a truncated representation of the mega events, mostly the tourism impact alone, without discussion of the limitations entailed by this assumption. Of all the studies collected, only a limited number (among which the series of studies on Sydney Olympics undertaken by COPS collaborators, Rio Olympics study by Haddad and Haddad 2010, London Olympic studies by Blake 2005, Pekin Olympics by Li and Duan, 2005) consider the whole Mega Event package, including both tourism and infrastructure spending. A couple of studies only deal with the infrastructure part (Bohlmann, 2005; Bohlmann & Van Heerden, 2008; Domingues et al., 2011). Other CGE analysis, a large majority, actually deal with tourism flow increase alone. Thus, these studies do measure the impact of a mega event, but the one of a touristic manna: a windfall that comes at no initial cost for the considered economy. The reality of mega events however is different. In the real world, this hypothetical increase in touristic arrivals comes at the cost of a set of infrastructure works and other obligations that may have a positive but also a negative effect on welfare. This limitation strongly impacts the results. Examining simulation outcomes, one finds that the impact of tourist flows are smaller than the impacts of other components of the event related shock. For instance, scrutiny of results in appendix of Giesecke and Madden’s analysis, indicates that the effect of tourist flows on GDP are much lower than the (recessive) effects of infrastructure building (J. Giesecke & Madden, 2007). Interestingly, one can observe that the most comprehensive assessments indicates that non tourism related sectors are the most impacted by the event (see the results of Madden 2002, where construction is the most impacted sector in the pre phase, the period whose impacts largely dominate on others). In a particular setting, where event anticipates infrastructure building rather than increasing it, Borowski and his co-authors also estimate that 77% of the Euro 2012 impact relies on infrastructure productivity impact (Borowski et al., 2013).

Focusing on single aspects of mega events may give rise to erroneous interpretation of a given study even in the circumstances where CGE analysts warn readers on this possible limitation. While the computational and theoretical consistency of the analysis is not discussed, the emerging message may provide misleading recommendations on the adequacy of holding a mega event, especially when the interpretative limitation imposed by the “tourism only” nature of the analysis is not stressed (such a key information would deserve to be mentioned already in the title of the paper, a condition that is seldom met). In reality, holding an event is not about receiving a tourism bonus for free, it is about a set of obligations that provide inseparable costs and benefits.

Unbundling the Mega event package and isolating what is arguably its most beneficial component is a first issue. But once this issue is overcome other issues appear.

When instead of a touristic manna, mega events are considered as a wider set of mechanisms, their translation into a CGE framework raises tough methodological questions. The first series of problems relates to the quantification of the economic flows actually modified by the mega event. This can be analyzed for three components of the mega events: foreign tourism, infrastructure expenditures, and locals' event consumption. The first aspect is dealt with in a specific field of literature (Lee, Song, & Mjelde, 2008; Teigland, 1999) and we propose to rather concentrate on the two latest aspects which, to our view, have received more limited attention.

## 4.2 Substitution effects

### 4.2.1 The key question of Household consumption substitution effects is usually overlooked.

A first issue relates to substitution effects in private consumption. How much of the tourists or locals' expenditures is actually additional vs. substitutive of other expenditures impacts considerably on the event impact assessment. To clarify, this does not mean that a mega event cannot increase consumption, but it means that when the event shocks the economy, the event related consumption has to be redirected from some alternative use. This question may however require closer scrutiny distinguishing two different questions. A first question relates to which part of the local private expenditures is actually additional for the considered economy. A second, related, question is which expenditure the substitutive consumption replaces.

How CGE practitioners usually represent substitution effects should be investigated. For instance, many analysts provide a straightforward answer. *"Australian households face an income constraint that means that (before considering any income effects) households attending the Games must substitute the expenditure they make on this activity for expenditure on other commodities"* (John Madden, 2002, p. 8). And the consideration of this mechanism is seen by Madden as a preeminent advantage of CGE over other methods that consider these expenditures as additional (John Madden, 2002, p. 8). Once that one has considered the substitutive, rather than additional nature of these expenditures, the effect of such expenditures becomes secondary. *"This sort of expenditure had little effect on the national results, as it represents displaced expenditure at this level"* (John Madden, 2006). But on the other side, Allan and his co-authors note that assumptions related to these effects have some effect: *"tourism has a much smaller import intensity than the displaced average household consumption"*. As a consequence, the shift in local consumption can impact various sectors in a different manner: *"the sector most strongly affected by the displaced household expenditure is the Private Business Services, then Wholesale and Retail, with Public Services"* (Allan, Dunlop, & Swales, 2007).

Two features emerge. First, the assumption of substitutive expenditures is dominant. Second, the discussion and documentation of this assumption is rather limited, with only one application that provides some detail on the computation used. The next question is what are the limitations of this setting and how they could be improved.

Substitution effects should be considered with more attention. There are actually two ways one could shed light on these aspects. Theoretically or Empirically. Theoretically, one could set up a micro-economic formalization that makes explicit the change in consumption basket resulting from the availability of a unique consumption opportunity. But such a formalization requires numerous parameters whose value, until some calibration takes place, can generate virtually any substitution pattern. Until such reaction function are not calibrated, their informative value is limited. Empirically, to our best knowledge, we find that only limited evidence have been collected by economists on this substitution effects. They mainly rely on surveys. BOP and Massiani and Pizziali use survey data collected among visitors in order to measure these effects, and find, with all caveats, that a large part of consumer expenditures is actually substitutive to other expenditures (BOP, 2011; Jerome Massiani & Pizziali, 2015). Survey data may however not provide sufficient evidence on such effects. Detailed consumer panels may provide more convincing results. As long as the demand system specification has not been collected in a situation where an "event" demand choc occurs, the adequacy of the model appears limited.

Based on these considerations one can draw some conclusions on how the local population consumption is considered in CGE models and on whether it is satisfactory. First, there is a general lack of documentation of these aspects in the literature. Second, a dominating practice is to consider that the expenditure is substitutive, but how and what it substitutes is much less informed. Third, there appears a strong temptation of relying on automatisms, or axioms of the CGE models, typically having predefined “shares” of various expenditures, may be an acceptable approximation for a vast array of policies, but it becomes at least problematic, when one of the effects of the policy is actually to change these “shares”. These interrogations cast doubt on the validity of the current practice of CGE practitioners... this calls for. The main problem in doing this is however that the theoretical consistency of the approach is vain, until there are no observations that show how consumption reacts to the holding of a mega event.

This concluded our analysis of visitors’ expenditures impact. This however represents only a part of the effects of mega events. What, instead, can be said about the other main component of mega events: infrastructure programs?

#### 4.2.2 infrastructure funding and substitution

**The impact of Infrastructure expenditures is far from trivial.** Dealing with infrastructure, current CGE approach appears questionable. A first problem relates to the exact quantification of infrastructure expenditures generated by the event. A second problem relates to how the funding mechanisms of these expenditures can be correctly represented in CGE models. We review in turn these different aspects.

**Identifying the scope and the cost of event related program is not straightforward.** In a first instance, an issue relates to the exact quantification of infrastructure expenditures generated by the mega event. A temptation is to rely on expenditures tagged as event related, (typically in a bid, or in a financial law). But this may be deceiving as there is some arbitrariness in the inclusion and quantification of a given expenditure in the event budget.

A **first problem is attributability**. A typical situation is where some infrastructures are tagged as event related but would have been constructed anyway. Some authors consider many expenditures tagged as “event” as additional expenditures caused by the event: *“should South Africa not have hosted the world cup, many government expenditures, including the R8 billion specifically earmarked for world cup stadia devt would not have occurred”* (Bohlmann & Van Heerden, 2008). Only experts of South Africa’s Public Finances could make a definite assessment of such an assumption, but, in the general case, one may wonder how much this assumption is grounded. KPMG also supposes expenditure is fully additional:

“Our analysis assumes that all of the capital expenditure has been undertaken due to the 2006 Games on the basis that:

- there is no substantive evidence suggesting that the capital works expenditure would have been undertaken anyway; and
- due to this uncertainty, there would be a considerable degree of arbitrariness implicit in any assumptions relating to brought forward capital expenditure.” (KPMG, 2006)

There is room for discussion on this practice and the argumentation brought on this point, if our interpretation is correct (argument in the first bullet seems contradictory, it states that the expenditures is additional because it would have been made anyway; the argument on the second point is weak: it states an alternate assumption would be arbitrary. If so, the retained assumption should be arbitrary as well). Not surprisingly, a different view is taken by other scholars. The problem has been analyzed precisely for Sydney Olympics. CREA and Arthur Andersen (1999) excluded 1 billion \$ of the expenditures considering that these projects would have been performed anyway. Latter, Madden selects the same assumption: “I excluded from the modelling exercise about \$1.1 billion of the expenditure listed by the OCA because it was judged that this expenditure would have occurred even (without the event)” (John Madden, 2006).

A slightly different assumption is to consider that the **event accelerated infrastructure building**. In some cases, this acceleration is considered equivalent to causation. Bohlmann and van Heerden 2008 seem to

consider a “majority” (to our best information, we could not identify which infrastructures were part of this majority) of event related expenditures as additional: “Although there is no doubt that these additional infrastructure developments would have occurred in time, it is assumed here that the hosting of the 2010 FIFA World Cup has shifted the majority of these expenditures sufficiently forward to be considered as supporting infrastructure for the tournament” (Bohlmann & Van Heerden, 2008). Following this line of reasoning, the question is then whether an acceleration of infrastructure building can be treated as an increase of infrastructure provision. An alternative view is used in the study of Poland Euro 2012, where event related investment is considered as shifted to an earlier period. In this setting, public investment increases in the years prior to the event and decreases in the following years.

To conclude on this point, the assumption of full attributability of earmarked expenditure should be questioned in empirical applications. Unless practitioners adequately question the available information, CGE outcomes are at risk of providing misleading results.

A second issue relates to the **quantification of the expenditures corresponding** to these infrastructure building. There are actually two issues: does the estimate cover exhaustively the various expenditures associated with the event. Is the quantification used reliable? Two points should be considered.

First, costs incurred for the mega events are often not considered in the event budget (this relates to security, many touristic promotion costs, renovation works in the host regions). This point may not be easy to deal with. Suppose one knows how much security expenditures have been generated by the event. Suppose these expenditures are funded by redirecting other public expenditures on the event. What should a CGE practitioner make with this information? On the one side, if the event shifts public expenditures from one expenditure item to another then there is no point in modelling its effect as long as they belong to the same modelled sector. On the other side, one could consider these resources become sterile, they do not provide services to the citizens. To be more precise, let us consider security expenditures, they normally allows users to attend the event in safety, which is, in a way a service, but this is just a requirement for holding the event rather than a benefit, while the reduction of public good provision in another sector of the economy is certainly a cost to citizens. This point deserve deeper investigation.

Second, costs estimates should be based on ex post data. A frequent statement in event related literature, relates to the cost overruns that usually occur in the model (Andreff, 2012; Flyvbjerg & Stewart, 2012). This is different to the increasing marginal costs assumption present in some studies (Borowski et al., 2013, p. 95). This latest effect relates to the basic market mechanism of supply and demand, and not to other mechanisms (deadlines to name the most important) that can determine a cost increase. The real world impact of such a situation is composite, in that it has to consider the funding source of these costs overruns. This point appears absent of many available applications, but it deserves further investigation, as it could drastically change the outcome of a given analysis.

The two latest questions we review cast serious doubts on the risk of providing naïve and misleading policy recommendation. It is true that the distortions introduced by these naïve representations may partly compensate one another (incompleteness of the budget would underestimate the impact, while adherence to planned rather than realistic costs would underestimate it) But this again is only part of the story, as other issues emerge when one wants to correctly consider how the financing mechanisms of the event should be considered in the model.

The public funding mechanism should impact the results but it will usually be overlooked in most CGE applications. The funding mechanism used for financing the event is important, however its consideration in CGE models is often questionable. Public funding can typically rely on three types of mechanisms: substitution to other expenditures, taxation of private agents, borrowing.

### **Current CGE approach to funding mechanism**

In the real world, the contribution of each funding mechanism will depend on a number of features of the economy: initial weight of public expenditures, taxpayers and politician perception of additional taxation, funding distribution schemes in federal systems, institutional constraints on public deficit. Additionally, the exact source of funding will generally be unknown not to say unquestioned, and budgetary documents will

provide deceiving, if any, information: a statement that the games will be funded without additional taxes could for instance be driven by electoral interest rather than actual budgeting positivism.

Faced with this indeterminacy, one may ask how CGE practitioners implement funding mechanisms in their models. Table 3 provides a partial answer, where the different funding mechanisms considered in various studies are presented. No approach appears dominating, expect probably the practice of not communicating the studies' assumption on this fundamental aspect.

*Table 3 – funding mechanisms considered in various studies*

Funding mechanism assumption	Studies
Increased taxation	<ul style="list-style-type: none"> <li>South Africa FIFA world cup</li> <li>0,5% increase in sales taxes, and another “high taxes” scenario. (Bohlmann &amp; Van Heerden, 2008)</li> </ul>
Transitory debt	<ul style="list-style-type: none"> <li>Commonwealth games 2006</li> <li>“assuming that the additional expenditure to prepare and undertake the Games will be deficit funded and repaid in future years“ (KPMG, 2006)</li> <li>“it is presumed that the accumulated deficit (net of ticket purchases and external funds e.g. sponsorships) will have to be funded via an increase in taxes, and that this will be recouped over a 15-year period, with an applied public sector borrowing rate of 4% real” (KPMG, 2006) p. 37</li> <li>Part of the mixed funding scenario (see below in this table)</li> </ul>
Reduction of other public expenditures	<ul style="list-style-type: none"> <li>Australia grand Prix 2011</li> <li>“Without the Grand Prix, these expenditures are assumed to be spent on Victorian public and community services” (Ernst &amp; Young, 2011)</li> <li>Euro 2012: anticipation of expenditures (Borowski et al., 2013)</li> </ul>
Mixed funding	<ul style="list-style-type: none"> <li>Sydney Olympics</li> <li>“Olympics expenditure not funded by Games revenues is modelled as being met by an increase in New South Wales state tax revenue” (John Madden, 2002)</li> <li>Brazil FIFA World Cup: (Domingues et al., 2011).</li> </ul>

With few exceptions, including Sydney and Brazil world cup studies, CGE papers are generally silent about how expenditure are financed (debt, reduced private consumption through taxation, reduced alternative public consumption). When instead the funding mechanism are considered, it appears to have a strong effect on the results. For instance, Domingues and his co-authors consider various funding sources for various expenditure items. The authors conclude “*the larger the use of public resources, the smaller the economic impact*”<sup>5</sup> (Domingues et al., 2011). In the most extreme case the authors find that budget balanced infrastructure program (simulation 5) reduces real GDP.

The assumption for Sydney games is more complex. In their main scenario, CREA and NSW 1997 posit (with some distinction between National and State funding) that public expenditures are financed by a reduction of (other) public capital expenditures and private savings (this results from the fixed trade balance assumption).

Based on this analysis, it appears that most studies usually do not discuss in depth the question of the funding mechanism at stake. This point however deserves more attention in that it actually can alter the outcome of a given analysis. In this situation, it then becomes necessary to discuss how CGE models could actually implement these mechanisms.

### **Proper consideration of funding mechanisms is a challenge**

Actually, in the favourable situation, where an analyst could **identify the funding mechanisms at stake**, the issues are numerous.

<sup>5</sup> “quanto maior a utilizacao de recursos publicos no financiamento dos investimento da copa 2014, menor seu impact economico” (The larger the use of public resources in the financing of the investment for 2014, cup, the smaller its economic impact).

**Extra taxation** corresponds to the easiest situation where an increase in the tax rate reduces private consumption and increases public investment. This is the assumption elected by Madden 2002 as a component of a mixed funding mechanism (*“Olympics expenditure not funded by Games revenues is modelled as being met by an increase in New South Wales state tax revenue”*) and by Bohlmann and Van Heerden 2008 (0,5 % increase in sales taxes, and another “high taxes” scenario). But an issue is that, at least based on informal consultation of CGE practitioners, the representation of taxation in CGE models is often simplistic, with flat rates used mostly. If practitioners then have solid reasons to elect extra taxation as the main funding vector, this calls for deeper analysis of how realistic the tax system of the economy is.

When instead **borrowing is considered, many issues arise**. while long term debt formation is a typical impact of mega events (consider the emblematic case of Montréal Olympics (Preuss, 2004) or the most recent Torino 2006 case (Massiani 2016)). In various, multiperiod, applications (John Madden, 2006)<sup>6</sup>, a transitory borrowing is considered with repayments and interest explicitly modelled, leaving unchanged the debt situation of agents at the end of the simulation. Brazil world cup simulations number 1 and 2 also assume funding through debt (Domingues et al., 2011). The issue becomes more problematic, when the model is has a single period and the actual funding mechanisms involve the formation of debt. Such an increase in debt should impact the welfare function considered. In such a situation the use of single period simulations is at risk of providing flawed results, at least as long as no satisfactory shadow social cost of debt can be implemented.

In the alternative situation, where mega events are **financed through substitution of other public expenditures**, two assumptions can be considered. A first one is that expenditures are reduced only in the same sector as the one where infrastructure spending is made (typically building). An alternative solution is that other sectors are impacted as well. In the first case, the expenditure shift will normally have a 0 effect in CGE calculations. In other words, if the event rearranges expenditures inside a single sector, the effect of the program is undetectable in typical CGE calculation. Worryingly, this also implies that the cost of infrastructure will not affect the evaluation: whether a stadium costs 1 bln euro or 2 billion euros, will just be the same for the analyst. A daring prospect indeed. Some CGE studies (CREA and NSW 1997), consider a reduction in alternative public spending to finance the mega event investment, but how these reductions are defined and implemented in the model is unclear.

The three funding mechanisms considered so far relate to public funding. This is only part of mega event financing: **private investment is also at stake**. Domingues and his coauthors provide a precise split of the funding among different entities based on Ministério do Esporte data (Domingues et al., 2011). But even in this case, this provides limited information on the mechanism behind this funding.

A first problem is that the distinction between private and public funding is sometimes elusive. Suppose private investors finance the construction of a highway extension, but obtain in compensation a longer concession on the network they manage. The appearance is that the private sector financed a highway extension. The reality is that the public sector had to renounce to the income on the concession for a number of years. So it is eventually the public sector that will have paid for the highway extension ((Jérôme Massiani, forthcoming), Forthcoming). The question gets even more cumbersome when one considers a fully new infrastructure. In this case, the private investor builds a new infrastructure and obtain a right on the operation incomes. The argument on whether there is a cost for public sector is getting more difficult: in absence of the private investment, would the investment just have taken place, and would the income ever have been generated?

These difficulties born in mind, we can concentrate on the simplest situation where the event generates a private investment that would not have taken place in the absence of the event. The question of the counterfactual use of these expenditures is then an open one... other investments, shareholders' remuneration? An interesting feature is that private investments make apparent that the outcome of the analysis will be strongly driven by the modelers' assumption on the monetary policy in place in the

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<sup>6</sup> Madden 2006 identifies borrowing (actually from reduced surplus) as the source of funding for New South Wales financing of Sydney Olympics. This assumption is based on the government claim that the money would come from borrowing (actually from reduced surplus) (Madden 2006, p 361).

investigated economy. For instance, Madden and Crowe 1999 suppose that the Australian external change policy imposes a fixed trade balance assumption that “*for private expenditures, (...) the change in national investment expenditure (...) is met largely out of domestic savings*”. The interesting point is that this assumption heavily determines the outcome of the policy: an increase in investment will increase savings and reduce consumption.

In conclusion on this point, the correct consideration of mega event funding is difficult. Official event budget provide misleading information, and the effect of private investments will heavily depend on the monetary policy implemented in the model. Finally, the correct translation in CGE syntax of the real economic mechanisms at stake requires an adequate level of investigation from the analysts.

We have investigated so far how the impacts of tourists, locals and investments expenditures are currently implemented by CGE practitioners, and which possible flaws this can generate. This is only part of the question. Another major issue is how the events impacts productivity. On this point, the productivity impact of mega events is at risk of arbitrariness.

### 4.3 The productivity impact

Yes. Using CGE we have to think in CGE terms, the question is then how much is lost in translation and how much of the models outcome derives from habitus or arbitrary assumptions. In a study of FIFA world cup in South Africa, the mega events translate into an x% change in capital or in productivity of the transport sector and building sector:

*“By comparing the proposed amounts to be spent on development of the relevant sectors, to the current level of expenditure, the percentage shock to the industries is computed.”* (Bohlmann, 2005)

*“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.”* (Bohlmann, 2005)

It is possible that infrastructure investment increases capital of this sector, but convincing arguments should be formulated on how extra expenditures converts into productivity increases number. More generally, some caveats should be expressed.

#### *The impact on productivity seems artificial*

Various studies assume productivity gains resulting from the event... Various assumptions are presented Table 4. It appears that there is large discretion in these assumptions with three main assumptions.

1. Productivity gains are based on assumed increases, these can be concentrated on some sectors, or distributed on the whole economy. 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?
2. Calibrated return functions,
3. No increase is supposed. For instance Domingues (2010) p. 10 consider (rightfully to our view) that sport stadia do not impact productivity.



Table 5 – productivity impact of mega events in various studies.

<b>Fixed increase in productivity</b>	
<b>Productivity of dedicated sectors (transport, construction, communication)</b>	
South Africa world cup	“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.” (Bohlmann, 2005)
	“Scenario 2: 5% increase in transport sector productivity. And in the construction and communication industry by 2% each.” 7(Bohlmann & Van Heerden, 2008)
<b>General productivity increase</b>	
Sydney Olympics	“0,05 % increase of labor productivity in the post-Olympic period.” (New South Wales Treasury, 1997, p. 10) This assumption was not maintained in the more recent assessments.
<b>Calibrated rate of return</b>	
Brazil world cup: other than sport venue	Other infrastructures: “based on 12,9 % return rate of infrastructure investment determines the impact of capital formation on sectorial productivity” (Domingues et al., 2011).
Euro 2012	“TFP increases thanks to anticipated investments in transport. This impact is modelled based on econometric estimates.” (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.
<b>No impact on productivity</b>	
Brazil world cup: sport venues	Domingues (2010) p. 10 consider that sport stadia do not impact productivity
Sydney Olympics	No impact in most recent publications

Generally, this panorama communicates a sense of weakness and unfoundedness. This is a critical aspect considering for instance that public economics has developed instruments that could be useful on this issue.

Mega events generate distortions in the provision of public capital, noticeably infrastructure. This can generate two types of effects. On the one side, improved infrastructures generate gains that are not considered (one exception relates to Brazil world cup Domingues 2010, p. 10). This setting is different from the one implemented in South African case studies where productivity only changes in the sectors that directly receives investments. This contrasts with many applications of CGE in related fields like transport economics. This aspect is important considering that usually these benefits account for a large share of the total benefits of a given infrastructure.

The other side of the medal is that the mega event can reduce productivity at least through two channels. First, mega events require infrastructures with limited productivity (typically “white elephants”). Second, these events usually entail an increase of capital costs compared with the normal conditions of infrastructure provision.

This leads us to two methodological conclusions. The first one is that the public capital paradigm seems fairly adequate to capture these effects. The second one, not fearing to be misunderstood, is that that mega events would probably reduce public capital, and hence productivity... a prospect that requires deeper analysis.

This suggests the need for deeper investigation. Many models features seem, as far as the limited level of documentation allows to know, based on arbitrary assumptions, on the implementation of deeply rooted

<sup>7</sup> 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.

habits rather than on a careful consideration of the specific features of the event. This curiously applies prominently to the most recent works, while the area had reached instead a higher level of scientific soundness in the initial phase with the repeated works on Sydney Olympics. Generally, the field seems to exhibit, dominance of undiscussed assumption, too limited consideration for epistemological issues, and lack of consideration of what makes a mega event a specific object of analysis.

## 5. Conclusions

Mega events can shift billion of euro of public expenditures. The potential of CGE to properly analyse the impact of such events can generate expectations. How did CGE address this topic and how can CGE respond these expectations? A first point is whether the available results are supportive of mega events, and the outcomes provide moderate support for mega events. A second point relates to whether the method fulfils its promises. Our view is that it does not, in that it is excessively assumption driven and is prone to large arbitrariness. A third question, is whether the method is worth applying further in this area, or whether more convincing alternative exists. On this point, we observe that this method is apt to make many questions apparent, that would otherwise stay covert, it thus has a large potential and, provided CGE practitioners accept the challenge of questioning deeply rooted habits, it has a strong potential to better inform decision in this area. We review more in detail these different points.

First, a majority of CGE studies do not evaluate mega events but rather fictional truncated mega event: apart from a limited number of applications, CGE measures the impact of a tourist mana, or an infrastructure program, without consideration of the set of duties and entitlements that actually constitute the very nature of mega event. This restriction, even when explicated by the authors, is quickly forgotten in the interpretation of the results. Bearing this in mind, CGE analysis of mega events, suggest positive but small benefits (there is room for discussion on what “small” means, considering that one can always choose an aggregate that makes a given quantity appear negligible) in many cases, but negative outcome also are not infrequent. Negative results are usually found when the study evaluated tourism flows and these were in some way hurdled (see the Peking example). An interesting pattern is that repeated analysis of a given event (Pekin, Sydney) usually reduces the estimated benefits and can produce a negative outcome.

Stepping back to the methodological issues, our review strongly suggests that mega events CGE analysis do not maintain its promises but rather has to make heavy compromises which makes it also prone to manipulations or misuses.

First, it appears that the field is dominated by a strongly axiomatic practice. We observed many methodological features in use in international trade study that seemed to be transferred to mega events without further consideration (e.g.: use of annual data for a phenomenon that is highly concentrated in time, use of Cobb-Douglass function when the assumption of fixed budget shares is visibly inadequate when local population consumption will face radically different consumption possibilities). Echoing the warning of Shoven and Whalley “*There is no single all-purpose, general-equilibrium model that can be used*” (Shoven & Whalley, 1984) does not seems superfluous.

Second, the available analysis are strongly assumption driven with limited attention on the discussion of the crucial assumptions. Modellers can typically select a (often implicit) financing mechanisms without discussion of this crucial assumption. The assumption on the financing of Sydney private investment is (combined with the choice of private consumption vs. GDP) capable of fully reverting the policy recommendation that results from the analysis.

Third and more important, CGE routinely violates its promises. For instance, CGE proponents claim that all expenditure will have a corresponding income – a basic requirement indeed, but some applications consider that mega events just make available some domestic money flows at no costs. CGE also promises that price reaction can be taken into account, but many applications consider a fixed price assumption for at least some crucial good or service e.g.: labour. CGE should represent adequately substitution effects through an adequately formulated representation of consumer behaviour, but the available studies rarely investigate substitutions effects, rely on deeply rooted habits that strongly restrict the behaviour of agents (e.g. the

constant budget shares of Cobb-Douglass), and seem to forget the limited micro foundation of using aggregated demand function

In this context, allowing for a bit of provocation, one could fear that the quantitative results of the model tell more about the model used - and analysts' conceptions - than about the real economic phenomenon under scrutiny. This goes beyond another critic formulated in the past about the cognitive, rather than normative, value of these models "*Whalley (1986;1988) (...) contends that these models are not intended to forecast the values of economic variables but rather to provide useful insights that may help policymakers to undertake more informed and presumably more desirable, policy actions.*" (Kehoe & Prescott, 1995).

More worryingly, our analysis and interaction with CGE scholars suggest that CGE has developed the conditions for being immune, or deaf, to criticisms from the outside. The intimidating technical apparatus, quite complex by many aspects, makes the paradigm hardly open to criticism from other communities. Additionally, the profession has developed pragmatic or routine solutions to complex issues, which constitute strong temptations, if not traps, for the analyst to neglect proper investigation on some model assumptions. For instance, creating an arbitrary set of scenarios is an apparently good defence from accusation of arbitrariness, but it could sometimes provide multiple implementation of arbitrariness rather than structured coverage of possible world conditions. Similarly, performing sensitivity analysis – a sound practice in its own – allows for less attention for elected parameter values (to quote a CGE practitioner "it is not so important to reflect on the value of this parameter, because we can do sensitivity analysis later"!).

In this context, there appears to be large room for discretion. Manipulation is also highly feasible (and would not easily be detected until more efforts on model documentation is exerted). Various hypothesis combinations can provide drastically different results: an economy with slack capital and labor, additionality of event related expenditures, arbitrary shock in productivity, can strongly increase the modeled impact. Additionally, the choice of the metric for evaluation will drastically change the conclusion of the analysis. Using private consumption as an assessment metric and assuming that private investment will finance private investment will provide a much more negative picture than examining the GDP and assuming international funding. But what if GDP increases through the accumulation of white elephants?

Hoping to be thought provocative we propose hereafter a table that displays set of assumptions that would allow the analyst to direct the result of an analysis.

*Table 6 - A manipulated or distorted CGE*

<b>Pro mega event</b>	<b>Against mega event</b>
Consider only the tourism impacts of the event	Consider only the infrastructure
Slack employment	Full employment
Strong sectorial mobility	Limited sectorial mobility
Fixed wage will increase impact on employment	
If Public infrastructure considered: the money would not have been spent without the event	Infrastructure spending comes at the expense of other infrastructures.
A large arbitrary increase in productivity	A large arbitrary decrease in productivity.
Constant or, better, decreasing average costs	Increasing marginal or average costs.
Use GDP as metric for evaluation.	Use private consumption to evaluate the event.
Post Event effects extend on ten years.	Post event effects extend on 5 years.
Investments created through monetary creation, and the model does not include the drawbacks of such money creation	Investment depresses private consumption, through strict investment financing rules.
And why not, slack capital	Full capital utilization
local population expenditures is additional, generous tourism assumptions	Local population expenditure is substitutive

In this context, the statement that the validity of the analysis relies on the competency and integrity of the analyst does not sound more reassuring than other similar recommendations like "the stability of the international financial systems relies on the competency and integrity of traders." A daring prospect, again. This obviously does not mean that one should doubt of the integrity of analysts, but that the profession should worry about the contingencies of assumptions and evaluation results.

The next question then is whether there are better alternatives. Input-Output as currently implemented leave less room to arbitrary assumption but they exhibit strong limitations (to mention one: the lack of consideration of substitution effects) that generate strong systematic overestimation of the event impact. True, some of these limitations could be corrected. Namely, IO applied only to injection, or to the net demand shock, would correct for the main distortions of the methods. This would however leave certain issues open: lack of constraints on resource, fixity of the technical coefficients and of relative prices. Whether such limitations are worse than the one implied by CGE is an open question, the risk being that with CGE the results could be highly dependent on the model assumptions

Still, a merit of CGE is that it provides an occasion to reflect on the assumptions that the modeler formulates on the economy. This contrasts with other methods whose axiomatic feature is even stronger: *“IO analysis avoids making assumptions about how the rest of the economy works by simply ignoring it”* (Jago & Dwyer, 2006). For instance, monetary policy is a key variable for the impact of mega events. This is apparent in statements like *“the Australian Government in conducting their macroeconomic policy may decide that Olympic construction, both publicly and privately financed, should crowd out public consumption in order that the Olympics has no effect on the nation’s external liabilities at the end of the Pre-event phase.”* (John Madden, 2006) *“The justification for the assumed low degree of external debt financing is that the Pre-Games phase was sufficiently long for the federal government to anticipate the increased demand for overseas borrowing and to act to constrain changes in the nation’s trade balance”* (John Madden, 2006), which appears highly influential in Madden’s results. Of the various available paradigms only CGE is likely to make such issues apparent, provided the analysts does not hide the problem under the carpet.

As Shoven and Whalley state “AGE is not without its own problems. ... on the other hand, there are no clearly superior alternative models available to policy makers who base their decision on efficient and distributional consequences of alternative policy changes” (Shoven & Whalley, 1992), this however requires that CGE practitioners accept to question well established habits to properly analyse mega events as a topic distinct from others.

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