

Regional Research Institute West Virginia University

Resource Document Series



Social Accounts for CGE in a Multi-Software Environment: Implan, GAMS and Excel

Amir Borges Ferreira Neto and Randall Jackson

RRI Resource Doc 2014-03

Date submitted: December 17, 2014

Key words/Codes: CGE, SAM, Spreadsheet, Excel, IMPLAN, GAMS;
C68, R13

Social Accounts for CGE in a Multi-Software Environment: Implan, GAMS and Excel*

Abstract

This resource document provides a method for streamlining the IMPLAN-GAMS SAM -> CGE workflow. We present the step-by-step procedure for constructing a Social Accounting Matrix (SAM) in IMPLAN, reading the data into GAMS, saving the SAM in spreadsheet format to facilitate subsequent direct editing, and using the edited spreadsheet SAM as input directly into GAMS for further CGE modeling.

Contents

1	Problem Context	2
2	Social Accounting Matrix	2
3	Softwares	3
3.1	From IMPLAN to GAMS	3
3.2	Loading the data in GAMS	3
3.3	From GAMS to Excel	4
3.4	From Excel back to GAMS	5

*Acknowledgements: This material is based upon work supported by the National Science Foundation under Grant No. 1235684 and USDA NIFA Award 2012-67009-19660.

1 Problem Context

IMPLAN is a well-known resource for economic modelling. Although it is quite useful, its structure was never intended to support all possible analyses with the dataset available. Many analysts rely, for example, on IMPLAN data to support Computable General Equilibrium modeling, which is commonly implemented in GAMS software. IMPLAN software enables the user to create a regional Social Accounting Matrix that can be exported in GAMS input format. However, users might wish to directly modify the SAM for their CGE models, perhaps to implement scenarios of sensitivity analyses. If one relies only on IMPLAN to generate the SAM, the process of direct editing can become cumbersome and potentially even fall beyond the reach of the IMPLAN software itself.

To facilitate direct editing, one can read and optionally aggregate the IMPLAN generated SAM into GAMS, then save it in spreadsheet format, where it can subsequently be edited directly and used as input to GAMS without having to revert to the IMPLAN representation. This document describes this procedure for the benefit of others who might wish to streamline their IMPLAN SAM – GAMS CGE workflow.

2 Social Accounting Matrix

The SAM can be summarized as in Figure 1:

Figure 1: Social Accounting Matrix

	Industries	Commodities	Factors	Institutions	Trade	Total
Industries		Make Matrix			Commodity Exports	Industry Output
Commodities	Use Matrix			Domestic Commodity Consumption		Domestic Commodity Output
Factors	Value Added					Value Added
Institutions		Domestic Commodity Sales	Factor Disbursements	Inter-Institutional Transfers	Commodity & Factor Services Exports	Institutional Receipts, Commodities, Factor
Trade	Commodity Imports		Factor Services Imports	Commodity Imports & Remittances	Trans-shipments	Services Imports, Remittances
Total	Industry Output	Domestic Commodity Output	Factor Outlay	Institutional Outlay	Commodity Factor Services Exports	

Source: Weisskoff(2000).

Composition of each SAM’s component are as follows:

- Industries and Commodities: list of industries and commodities considered;
- Factors: labor, capital, taxes, etc.;
- Institutions: households, firms, government, etc.;
- Trade: domestic and foreign;

3 Softwares

3.1 From IMPLAN to GAMS

IMPLAN allows the user to export the dataset in order to use it on a CGE Model. IMPLAN's user guide explains how to do so, but in short, after creating your model, follow the steps:

1. Go to User Preferences and activate the “Advanced Modelling” feature;
2. Go to the “IxC Social Accounting Matrix” tab;
3. Click on “Export” and select to Export to GAMS 26 file;

3.2 Loading the data in GAMS

David Holland, Leroy Stodick and Stephen Devadoss from Washington State University developed a code to read the 26 GAMS files and aggregate the 509 sector SAM (prior to 2007) to a friendlier model with less number of sectors. In their webpage it is possible to download the code used. They provide three pieces of code that go together: `check.gms`, `*Map.gms`, and `*Aggreg.gms`.

To change the sector's aggregation, from 509 sector to 30 sectors for example, you should change the file `*Map.gms`. It is also important to check if you model has 509 IMPLAN sectors or 440 IMPLAN sectors. If it has 440, then you must also change the `check.gms` file to fit the sectorial scheme of your model. It is worth mentioning that any change in the sectorial scheme in IMPLAN corresponds to changes in the GAMS file accordingly. For instance, if you also add (i.e., hijack) a non-existing sector you must also make this change in the `*.gms` files.

If all is right the `check.gms` file (the only one you should run) will run properly and a `SAM.gms` file will be generated.

3.3 From GAMS to Excel

To export the SAM you had on IMPLAN to Excel you just have to export it. The problem in doing so is that GAMS will export only the sectors that have some information, therefore we would have to check the data after exporting and placing it in the right columns and rows. To avoid this kind of problem, I modified the SAM and the code in a way that all cells would be populated and therefore exported.

In the file *Aggreg.gms before declaring the sub-matrices (e.g. Make, Use, I-Use, etc.) as parameters we created another SAM adding 0.0000000001 to every cell, as below:

```
***      Aggregate submatrices and assign new labels:
PARAMETER SAM1(R,RR);
SAM1(R,RR) = SAM(R,RR) + 0.0000000001;
```

To make sure the change is carried out through the calculations, in the code of *Aggreg.gms file, after declaring and defining SAM1, we changed every SAM for SAM1, such as:

```
*** Example
MAKE(AK,CK) = SUM((A,C)$ (SAM1(A,C)$ (MAP(AK,A)*MAP(CK,C))), SAM1(A,C));
```

In the end of the code below I included the following code that export the parameters calculated to Excel. Note that, this SAM has 35 activities and commodities, 3 factors and 10 institutions. Two important notes are:

- The heads of each sub-matrix appear next to it and therefore some manipulation is needed after exporting to excel
- Import and Export from Commodities (SIMPRT and SEXPRT, representing CIMPRT and CEXPRT) may have the problem of missing sectors that also must be adjusted.

Code:

```
execute_unload "SAM.gdx";
* By each column
* Activities
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=USE rng=SAM!a37';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=FD rng=SAM!a73';
* Commodities
```

```

execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=MAKE rng=SAM!ak1';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=IMAKE rng=SAM!ak78';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=SIMPRT rng=SAM!ak95';
* Factors
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=FS rng=SAM!bu78';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=FIMPRT rng=SAM!bu95';
* Institutions
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=IUUSE rng=SAM!by37';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=TRANSFER rng=SAM!by78';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=IIMPRT rng=SAM!by95';
* Trade
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=SEXPRT rng=SAM!cp37';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=FEXPRT rng=SAM!cp73';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=IEXPRT rng=SAM!cp78';
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=TRNSHP rng=SAM!cp95';
*Labor
execute 'gdxxrw.exe SAM.gdx o=C:/GAMS/SAM.xlsx par=LABOR rng=SAM!b100';

```

3.4 From Excel back to GAMS

Importing the SAM in Excel back to GAMS is straightforward if you have exported it from GAMS. To import it you must follow the steps:

1. Define and declare at least one set with all the variables (columns/rows) from the SAM in Excel;
2. Define and declare the one parameter – your SAM – to upload the spreadsheet data;
3. Use the code below to import the SAM.

Code:

```

SET K All columns and rows
/ List of K Commodities/Activities, Factors, Institutions and Trade/

PARAMETER SAM (K, KK)
$call gdxxrw input=C:\GAMS\SAM.xlsx output=C:\GAMS\data.gdx
par=SAM rng=sheetname!A1:CN96 cdim=1 rdim=1

```

```
$gdxin C:\GAMS\ data.gdx  
$load SAM  
$GDXIN ;
```

The Regional Research Institute's Technical Document 2014-04 brings some details on how to import a SAM from Excel and set up a CGE model.

References

Weisskoff,R. (2000) Missing Pieces in Ecosystem Restoration: The Case of the Florida Everglades. *Economic Systems Research*, 12(3):271-304.
http://www.agribusiness-mgmt.wsu.edu/Holland_model/
http://implan.com/index.php?option=com_content&view=article&id=809
http://www.gams.com/mccarl/mccarlhtml/gams_user_guide_2005.htm