# Multi Regional Input Output model

#### Note this is only a proof of concept data is totally made up

import os  
import pandas as pd  
import numpy as np  
import copy  
#from openpyxl import load\_workbook  
   
cwd = os.getcwd()  
cwd = os.chdir(r'C:\Users\jojoseph\Desktop\Python Models\Python\IO')  
  
print (os.getcwd())

C:\Users\jojoseph\Desktop\Python Models\Python\IO

### Load the input data

##### Input data located in ‘reg\_soc\_acc\_mat’ It will need to be copied to your working directory

#opening the social account matrix excel files from IMPLAN -(89 sectors summarized from study area data/study area explorer )  
new\_MRIO= 'new\_MRIO.xlsx'# open file with social account matrices  
reg\_soc\_acc\_mat=pd.ExcelFile(new\_MRIO)  
print (reg\_soc\_acc\_mat.sheet\_names)  
  
#region3=reg\_soc\_acc\_mat.parse('region2')

['region0']

### Load aggregated sector names

#sector\_names = np.loadtxt('aggregated\_sector\_names.txt', usecols=1, delimiter="\'", dtype=str)[...,None]  
sector\_names = np.loadtxt('aggregated\_sector\_names.txt', usecols=1, delimiter="\'", dtype=str)  
  
sector\_names

array(['Agriculture', 'Mining', 'Construction', 'Durable Goods MFG',  
 'Nondurable Goods MFG', 'Trade, Transportaiton & Utilities',  
 'Information', 'Finance, Insurance & Real Estate',  
 'Professional & Business Services', 'Education & health Services',  
 'Leisure & Hospitality', 'Other Services', 'Government',  
 'Other Nonproducing Sectors'],  
 dtype='<U33')

## Read in reference matrices excel sheet

reference\_matrices = 'reference\_matrices.xlsx'  
ref\_mat=pd.ExcelFile(reference\_matrices)  
print (ref\_mat.sheet\_names)

['Sheet1', 'IndAggMat', 'ConvFact', 'MRSAM\_mult']

### Multi Region SAM multiplier

mrsam\_mult\_df = pd.read\_excel(ref\_mat,'MRSAM\_mult', skiprows=2, usecols = "C:UH")  
mrsam\_mult\_df

1

2

3

4

5

6

7

8

9

10

…

PI3

PI4

PI5

PI6

HH1

HH2

HH3

HH4

HH5

HH6

0

1.115473

0.007422

0.002036

0.003018

0.233903

0.001576

0.026853

0.000707

0

0.001407

…

0.000582

0.000807

0.000491

2.962485e-04

0.004782

0.000882

0.000604

0.000838

0.000510

0.000308

1

0.082254

1.050348

0.000741

0.023355

0.017605

0.057254

0.014521

0.015370

0

0.000346

…

0.000121

0.000189

0.000120

6.409873e-05

0.001122

0.000252

0.000126

0.000197

0.000124

0.000067

2

0.023870

0.016998

1.002141

0.001582

0.005645

0.011959

0.075809

0.005898

0

0.001944

…

0.000137

0.000222

0.000122

6.535571e-05

0.001905

0.000346

0.000142

0.000231

0.000126

0.000068

3

0.271561

0.002096

0.000820

1.009114

0.057339

0.000515

0.006717

0.000285

0

0.000604

…

0.000191

0.000270

0.000138

8.221320e-05

0.001935

0.001100

0.000198

0.000280

0.000143

0.000085

4

0.006459

0.003171

0.004560

0.005610

1.083815

0.001907

0.013748

0.001371

0

0.003210

…

0.000875

0.001302

0.000600

3.550982e-04

0.011055

0.001244

0.000909

0.001351

0.000623

0.000369

5

0.017214

0.001380

0.001754

0.006918

0.004537

1.009796

0.014923

0.003683

0

0.001286

…

0.000267

0.000572

0.000347

1.362379e-04

0.004232

0.000649

0.000277

0.000594

0.000360

0.000141

6

0.026051

0.005356

0.007505

0.011918

0.011387

0.012447

1.091851

0.002326

0

0.005321

…

0.000434

0.001048

0.000455

2.062243e-04

0.018267

0.001918

0.000451

0.001088

0.000473

0.000214

7

0.001722

0.001313

0.001927

0.000758

0.001175

0.000616

0.000802

1.066433

0

0.001343

…

0.000016

0.000038

0.000025

1.569124e-05

0.004713

0.000044

0.000016

0.000040

0.000026

0.000016

8

0.000901

0.001139

0.001703

0.000271

0.000877

0.000535

0.000683

0.000488

1

0.001172

…

0.000010

0.000024

0.000020

6.026703e-06

0.004166

0.000138

0.000011

0.000025

0.000021

0.000006

9

0.000786

0.003396

0.000171

0.000119

0.000290

0.000269

0.000199

0.000546

0

1.056485

…

0.000005

0.000013

0.000007

2.903939e-06

0.000363

0.000014

0.000006

0.000013

0.000007

0.000003

10

0.000061

0.000119

0.000038

0.000018

0.000054

0.000033

0.000081

0.000542

0

0.001380

…

0.000004

0.000005

0.000005

2.901632e-06

0.000089

0.000010

0.000004

0.000005

0.000006

0.000003

11

0.000110

0.001020

0.000017

0.000033

0.000034

0.000065

0.000033

0.000101

0

0.000530

…

0.000001

0.000002

0.000002

9.956247e-07

0.000020

0.000003

0.000001

0.000002

0.000002

0.000001

12

0.000084

0.000196

0.000070

0.000047

0.000076

0.000052

0.000105

0.000070

0

0.000124

…

0.000015

0.000018

0.000021

1.266344e-05

0.000159

0.000030

0.000016

0.000019

0.000022

0.000013

13

0.003649

0.000920

0.000449

0.000251

0.001604

0.000548

0.000804

0.000472

0

0.002653

…

0.000015

0.000033

0.000022

1.207173e-05

0.001072

0.000038

0.000015

0.000034

0.000023

0.000013

14

0.021319

0.032809

0.004830

0.002345

0.009574

0.004901

0.005007

0.003542

0

0.010209

…

0.000171

0.000302

0.000219

1.195468e-04

0.010802

0.000771

0.000178

0.000313

0.000227

0.000124

15

0.066084

0.104604

0.014226

0.006566

0.026143

0.013457

0.013130

0.009866

0

0.023118

…

0.000399

0.000685

0.000473

2.707908e-04

0.031663

0.001748

0.000414

0.000711

0.000491

0.000281

16

0.000994

0.001331

0.000475

0.000221

0.000727

0.000648

0.001119

0.001145

0

0.001662

…

0.000024

0.000033

0.000028

2.336864e-05

0.001122

0.000062

0.000025

0.000035

0.000029

0.000024

17

0.002877

0.010425

0.001137

0.001491

0.002210

0.001511

0.002165

0.003287

0

0.002824

…

0.000132

0.000148

0.000143

1.065146e-04

0.001922

0.000223

0.000137

0.000153

0.000148

0.000111

18

0.004218

0.001406

0.002020

0.000921

0.001731

0.000654

0.000905

0.000595

0

0.001424

…

0.000034

0.000070

0.000076

2.257031e-05

0.004933

0.000172

0.000035

0.000072

0.000079

0.000023

19

0.005011

0.060440

0.000493

0.001468

0.001144

0.003428

0.000961

0.000940

0

0.000096

…

0.000017

0.000022

0.000018

1.117224e-05

0.000219

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0.000023

0.000018

0.000012

20

0.011293

0.050822

0.002511

0.002373

0.008065

0.005273

0.007144

0.003959

0

0.004188

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0.000262

0.000294

0.000352

2.142539e-04

0.004914

0.000477

0.000272

0.000305

0.000366

0.000223

21

0.003485

0.005876

0.001938

0.001979

0.018338

0.006683

0.012544

0.007879

0

0.010264

…

0.000135

0.000224

0.000141

8.641271e-05

0.004573

0.000336

0.000140

0.000232

0.000147

0.000090

22

0.000540

0.000567

0.000241

0.000181

0.000496

0.000439

0.000713

0.002049

0

0.000392

…

0.000041

0.000063

0.000043

2.844977e-05

0.000563

0.000076

0.000043

0.000066

0.000045

0.000030

23

0.000712

0.000974

0.000477

0.000184

0.000572

0.000322

0.000431

0.012376

0

0.000752

…

0.000023

0.000048

0.000032

1.525851e-05

0.001130

0.000059

0.000024

0.000050

0.000033

0.000016

24

0.000960

0.000812

0.000685

0.000940

0.005338

0.002220

0.004053

0.002612

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0.001279

…

0.000140

0.000178

0.000114

8.575875e-05

0.001640

0.000330

0.000146

0.000184

0.000118

0.000089

25

0.002523

0.001584

0.001081

0.002875

0.019120

0.006195

0.015281

0.009841

0

0.001564

…

0.000141

0.000178

0.000123

7.032236e-05

0.002593

0.000418

0.000146

0.000185

0.000128

0.000073

26

0.001244

0.001350

0.000894

0.000333

0.001548

0.000710

0.001240

0.000810

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0.001941

…

0.000028

0.000054

0.000040

1.588696e-05

0.002156

0.000121

0.000029

0.000056

0.000042

0.000017

27

0.000576

0.001092

0.000589

0.000331

0.000680

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0.000513

0.000382

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0.001483

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0.000043

0.000084

0.000067

3.769068e-05

0.001412

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0.000087

0.000069

0.000039

28

0.000997

0.001607

0.000758

0.000260

0.000881

0.000527

0.002096

0.019761

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0.001517

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0.000029

0.000051

0.000041

2.039202e-05

0.001808

0.000098

0.000030

0.000053

0.000043

0.000021

29

0.001636

0.002029

0.000590

0.001029

0.001423

0.000779

0.006463

0.002142

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0.006223

…

0.000141

0.000181

0.000162

1.004711e-04

0.001347

0.000373

0.000146

0.000188

0.000168

0.000104

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522

0.003792

0.002830

0.002936

0.004255

0.005317

0.006892

0.006459

0.002196

0

0.002445

…

0.004292

0.005073

0.008899

2.346608e-02

0.005082

0.004695

0.004458

0.005264

0.009242

0.024372

523

0.004890

0.004284

0.004598

0.004872

0.006872

0.007225

0.006766

0.002796

0

0.004206

…

0.008313

0.007043

0.006683

1.383806e-02

0.009385

0.007999

0.008634

0.007309

0.006940

0.014372

524

0.000765

0.000699

0.000878

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0.000944

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0.001017

0.000423

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0.000668

…

0.001229

0.001052

0.000968

2.908885e-03

0.001861

0.001347

0.001277

0.001092

0.001006

0.003021

525

0.004617

0.004027

0.004790

0.004280

0.006067

0.006892

0.006670

0.002618

0

0.003751

…

0.005812

0.004905

0.008106

1.983040e-02

0.009803

0.006089

0.006036

0.005090

0.008418

0.020596

526

0.007478

0.006816

0.007899

0.007468

0.009825

0.010063

0.009627

0.004166

0

0.006449

…

0.015440

0.015317

0.015453

1.860017e-02

0.016362

0.015437

0.016035

0.015894

0.016048

0.019318

527

0.017266

0.013224

0.013768

0.018916

0.025338

0.030958

0.028219

0.009685

0

0.011878

…

0.018762

0.018067

0.015978

8.820766e-02

0.025210

0.015946

0.019486

0.018747

0.016594

0.091612

528

0.006069

0.004536

0.004287

0.007306

0.009508

0.012076

0.010602

0.003582

0

0.003925

…

0.006484

0.006590

0.005583

2.093204e-02

0.007631

0.005720

0.006734

0.006838

0.005798

0.021740

529

0.005260

0.004478

0.005358

0.005055

0.006754

0.007982

0.007546

0.002910

0

0.004230

…

0.007365

0.006421

0.004086

2.371863e-02

0.010927

0.006395

0.007649

0.006663

0.004243

0.024634

530

0.008304

0.006863

0.007755

0.008718

0.011379

0.013128

0.012342

0.004567

0

0.006097

…

0.013242

0.013648

0.012276

3.577460e-02

0.014328

0.011847

0.013753

0.014162

0.012749

0.037155

531

0.000348

0.000252

0.000271

0.000402

0.000475

0.000621

0.000572

0.000191

0

0.000221

…

0.000660

0.000572

0.000307

2.139143e-03

0.000478

0.000322

0.000685

0.000594

0.000319

0.002222

532

0.004976

0.003576

0.003355

0.005790

0.007391

0.010624

0.008112

0.002595

0

0.003013

…

0.004542

0.004430

0.004047

1.268942e-02

0.005337

0.004072

0.004717

0.004597

0.004203

0.013179

533

0.003733

0.002523

0.002069

0.004909

0.003853

0.005964

0.003961

0.002237

0

0.002325

…

0.003497

0.003356

0.002897

5.630594e-03

0.003951

0.003253

0.003632

0.003482

0.003008

0.005848

534

0.211105

0.208128

0.191150

0.085573

0.269038

0.163948

0.193643

0.154669

0

0.383858

…

0.002373

0.005684

0.003820

1.374736e-03

0.295193

0.008851

0.002465

0.005898

0.003967

0.001428

535

0.011677

0.012597

0.010758

0.008988

0.028580

0.015028

0.014126

0.008351

0

0.032360

…

0.012752

0.006085

0.005481

1.262157e-03

0.016914

0.344659

0.013244

0.006314

0.005692

0.001311

536

0.011838

0.004383

0.003639

0.030775

0.007856

0.006554

0.007217

0.002922

0

0.003343

…

0.317130

0.039845

0.002454

1.803673e-03

0.004913

0.013991

0.329365

0.041345

0.002549

0.001873

537

0.065828

0.032158

0.029004

0.157128

0.044234

0.039952

0.034783

0.022565

0

0.023088

…

0.083380

0.375494

0.003766

4.127731e-03

0.035545

0.023047

0.086597

0.389628

0.003911

0.004287

538

0.038281

0.053775

0.038690

0.027266

0.058400

0.043947

0.065661

0.043195

0

0.038277

…

0.035561

0.025397

0.465560

1.600859e-02

0.075721

0.096947

0.036933

0.026353

0.483502

0.016626

539

0.228363

0.165972

0.169113

0.258242

0.328479

0.419359

0.378294

0.132603

0

0.147138

…

0.249567

0.254007

0.225730

6.955669e-01

0.300664

0.222912

0.259195

0.263568

0.234429

0.722412

540

0.100878

0.180909

0.378850

0.009940

0.040547

0.024720

0.045924

0.018371

0

0.032603

…

0.000471

0.001125

0.000649

2.626350e-04

0.046405

0.001568

0.000489

0.001168

0.000674

0.000273

541

0.003775

0.004751

0.007274

0.002479

0.007231

0.005639

0.005169

0.001742

0

0.006694

…

0.003134

0.001520

0.001256

2.996093e-04

0.003580

0.070142

0.003255

0.001578

0.001304

0.000311

542

0.003258

0.000945

0.000893

0.008916

0.002076

0.001793

0.002246

0.000594

0

0.000612

…

1.056336

0.007008

0.000518

3.631151e-04

0.000924

0.002611

0.058510

0.007272

0.000538

0.000377

543

0.018416

0.008788

0.010877

0.044880

0.010196

0.011482

0.010704

0.003983

0

0.003805

…

0.014494

1.061179

0.000691

7.600705e-04

0.006202

0.003567

0.015054

0.063482

0.000717

0.000789

544

0.009879

0.013433

0.011772

0.007372

0.014777

0.013533

0.025508

0.010255

0

0.008249

…

0.009673

0.006821

1.105398

3.761450e-03

0.016770

0.022484

0.010046

0.007078

0.109460

0.003907

545

0.051082

0.032565

0.038714

0.058126

0.068261

0.109981

0.105942

0.024251

0

0.026011

…

0.045840

0.045807

0.038454

1.117040e+00

0.053694

0.040015

0.047609

0.047531

0.039936

0.121557

546

0.285034

0.360750

0.539536

0.085242

0.277095

0.168869

0.215830

0.154465

0

0.370638

…

0.002555

0.006117

0.004006

1.470187e-03

1.320183

0.009345

0.002654

0.006348

0.004160

0.001527

547

0.013828

0.015580

0.016450

0.010226

0.031881

0.018559

0.017317

0.008953

0

0.034637

…

0.014134

0.006769

0.005986

1.388626e-03

0.018184

1.381674

0.014680

0.007024

0.006216

0.001442

548

0.013721

0.004824

0.004111

0.036106

0.009021

0.007585

0.008619

0.003181

0

0.003573

…

1.315340

0.042311

0.002691

1.960161e-03

0.005275

0.015003

1.366086

0.043904

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552 rows × 552 columns

## Get the Change in Industry Demand

### extract the first data column (sales) from the users data (Industry spending)

#IndustrySpending  
IndustrySpending = pd.read\_excel(new\_MRIO,'region0', usecols = "C")

### multiply it against the MRSAM\_mult multipliers

IndustryOutput = np.matmul(mrsam\_mult\_df,IndustrySpending)  
IndustryOutput

array([[ 2.41337005e+09], [ 1.37289862e+09], [ 6.57417105e+09], [ 1.36317602e+09], [ 6.17539706e+09], [ 1.01885896e+10], [ 2.66891287e+10], [ 1.38736657e+10], [ 8.56466157e+09], [ 7.76391829e+07], [ 3.42519227e+07], [ 1.10941651e+07], [ 7.77848617e+07], [ 1.86482219e+08], [ 2.66919132e+10], [ 1.14166827e+11], [ 2.70608550e+09], [ 1.28692542e+09], [ 2.73139174e+08], [ 1.18600826e+08], [ 2.17183711e+09], [ 2.36061849e+09], [ 5.44715068e+08], [ 4.14482559e+08], [ 6.06394840e+08], [ 1.15442020e+09], [ 4.47845473e+08], [ 2.39489560e+08], [ 7.69438257e+08], [ 1.18691658e+09], [ 2.61618637e+09], [ 8.65154042e+08], [ 3.92816970e+09], [ 3.08850768e+09], [ 4.02687316e+07], [ 1.37128741e+08], [ 4.35026005e+08], [ 2.26458357e+10], [ 4.67268006e+07], [ 1.03877554e+08], [ 5.15228922e+07], [ 5.14989269e+09], [ 1.71697847e+09], [ 7.17309756e+06], [ 6.08376145e+09], [ 6.26686497e+09], [ 3.53773072e+08], [ 6.59393539e+08], [ 1.79206394e+08], [ 2.08747804e+09], [ 1.25108124e+08], [ 1.18458506e+09], [ 3.73436401e+08], [ 6.47833308e+08], [ 3.97225107e+08], [ 3.60001718e+08], [ 4.68417752e+09], [ 2.69297336e+08], [ 4.29979157e+08], [ 2.65038194e+09], [ 3.45350703e+08], [ 1.58437559e+08], [ 4.29240864e+09], [ 1.77355507e+09], [ 3.07460481e+09], [ 4.21201134e+08], [ 1.27615135e+10], [ 8.53997298e+08], [ 7.88976405e+08], [ 7.60321639e+09], [ 3.70659484e+09], [ 3.34765847e+09], [ 5.91134051e+08], [ 1.55054929e+09], [ 4.33571505e+09], [ 4.17783130e+09], [ 1.12637571e+09], [ 8.81559350e+08], [ 9.48664943e+08], [ 5.60051724e+07], [ 8.69777007e+09], [ 9.91581666e+09], [ 5.40982448e+10], [ 6.60649168e+09], [ 7.22923613e+08], [ 1.09368959e+09], [ 5.76229106e+07], [ 8.28089873e+08], [ 2.27507697e+08], [ 7.54723628e+08], [ 2.72353460e+08], [ 3.68072771e+08], [ 1.00598658e+08], [ 4.28113823e+08], [ 2.33094332e+08], [ 7.12566257e+08], [ 1.28670170e+08], [ 4.88841797e+07], [ 3.21897523e+07], [ 3.07182856e+07], [ 1.08620280e+07], [ 4.93490259e+07], [ 1.09240321e+08], [ 4.61189265e+09], [ 3.16911216e+09], [ 2.01127445e+08], [ 3.93355986e+08], [ 2.67893005e+08], [ 7.86910673e+07], [ 8.52339124e+08], [ 4.38198170e+08], [ 8.12893848e+07], [ 7.40547122e+07], [ 3.14317116e+08], [ 2.02745311e+08], [ 9.60096695e+07], [ 7.12220304e+07], [ 1.83748526e+08], [ 6.15019258e+08], [ 7.06186382e+08], [ 2.50648743e+08], [ 4.37041529e+08], [ 3.28882275e+08], [ 1.56429460e+07], [ 5.31835583e+07], [ 8.19403689e+07], [ 5.40678840e+07], [ 3.44784511e+07], [ 3.37199942e+07], [ 1.86184346e+08], [ 1.53318913e+09], [ 1.06931174e+09], [ 2.31806286e+06], [ 1.40445618e+09], [ 1.82956752e+09], [ 3.37033326e+08], [ 2.10969516e+08], [ 2.42378638e+07], [ 5.09312246e+08], [ 5.13711593e+07], [ 3.05846751e+08], [ 9.98797569e+07], [ 1.06200363e+08], [ 1.34779945e+08], [ 1.09710570e+08], [ 1.82378044e+08], [ 7.68258839e+07], [ 1.71808747e+08], [ 1.05658406e+09], [ 8.22623945e+07], [ 4.79920511e+07], [ 1.58155605e+09], [ 7.08768974e+08], [ 8.70059551e+08], [ 8.21002879e+07], [ 3.05367555e+09], [ 3.78540845e+08], [ 6.68883275e+08], [ 2.45311645e+09], [ 1.04819593e+09], [ 1.02994346e+09], [ 1.53859016e+08], [ 3.16342836e+08], [ 1.21730145e+09], [ 1.01149130e+09], [ 2.38813195e+08], [ 1.72228420e+08], [ 1.25845917e+08], [ 1.57180581e+07], [ 1.50174742e+08], [ 1.37353154e+08], [ 9.98717010e+08], [ 3.38627450e+08], [ 2.02523414e+08], [ 3.38952131e+08], [ 2.15107513e+07], [ 2.37210488e+08], [ 1.23101065e+08], [ 4.15494374e+08], [ 2.04939977e+08], [ 3.27102230e+08], [ 1.24845151e+08], [ 1.19884595e+08], [ 1.86788954e+08], [ 5.52760914e+08], [ 4.13418189e+07], [ 4.04191736e+07], [ 1.52954892e+07], [ 1.87527538e+07], [ 4.78533905e+06], [ 0.00000000e+00], [ 4.25790951e+07], [ 5.20957493e+08], [ 1.03572863e+09], [ 6.27754028e+07], [ 3.22475389e+08], [ 9.24338627e+07], [ 5.48291722e+07], [ 4.62871593e+08], [ 2.28377666e+08], [ 2.21459463e+07], [ 3.62448152e+07], [ 1.29519965e+08], [ 1.19591165e+08], [ 8.77121542e+07], [ 2.10254591e+08], [ 7.82589784e+07], [ 1.66032760e+08], [ 2.98491998e+08], [ 1.01915934e+08], [ 3.25120926e+08], [ 2.44032251e+08], [ 7.94557242e+07], [ 5.42327716e+07], [ 4.74425593e+07], [ 2.43654120e+07], [ 3.45623772e+07], [ 4.03943582e+07], [ 8.97080019e+07], [ 6.07255833e+08], [ 5.17713973e+08], [ 2.73184458e+06], [ 7.10931677e+08], [ 7.81031583e+08], [ 3.84895003e+07], [ 1.04846177e+08], [ 1.70072059e+07], [ 2.44279065e+08], [ 2.46203715e+07], [ 6.59679904e+07], [ 9.85176197e+06], [ 4.78662255e+07], [ 7.11547762e+07], [ 5.89011241e+07], [ 1.16131223e+08], [ 3.94530625e+07], [ 6.37302951e+07], [ 6.09902504e+08], [ 4.94847444e+07], [ 2.46664540e+07], [ 7.58152515e+08], [ 4.10910982e+08], [ 5.62007615e+08], [ 6.56146601e+07], [ 1.45351803e+09], [ 1.34226766e+08], [ 3.28529729e+08], [ 1.21892239e+09], [ 4.71247514e+08], [ 5.12083420e+08], [ 7.38249018e+07], [ 1.79869675e+08], [ 5.74449676e+08], [ 5.06584490e+08], [ 1.66350221e+08], [ 1.10815733e+08], [ 5.57836051e+07], [ 6.29645095e+06], [ 6.58494579e+07], [ 7.57364591e+07], [ 4.16844764e+08], [ 1.52269480e+08], [ 9.17876684e+07], [ 1.55518563e+08], [ 6.23181296e+06], [ 1.10824911e+08], [ 6.26795628e+07], [ 1.19393314e+09], [ 1.28412842e+09], [ 1.27872584e+09], [ 6.53945014e+08], [ 6.25334007e+08], [ 8.18466171e+08], [ 2.29873143e+09], [ 4.77181910e+08], [ 8.58805871e+07], [ 9.63936695e+07], [ 2.70698834e+07], [ 5.01780223e+06], [ 1.30097059e+08], [ 1.63358262e+08], [ 1.01848329e+10], [ 5.04944159e+09], [ 6.65314253e+08], [ 2.17535462e+09], [ 4.79749664e+08], [ 2.11830222e+08], [ 1.68501940e+09], [ 9.62161942e+08], [ 1.38429652e+08], [ 2.03357239e+08], [ 4.78319090e+08], [ 6.01806985e+08], [ 3.26096939e+08], [ 1.24360207e+08], [ 4.43768643e+08], [ 8.28599453e+08], [ 1.64482479e+09], [ 4.30665713e+08], [ 9.55874444e+08], [ 7.52525049e+08], [ 7.14131991e+07], [ 1.10856252e+08], [ 1.91490233e+08], [ 2.10382225e+08], [ 2.82527705e+08], [ 1.50987270e+08], [ 5.71351253e+08], [ 2.91238253e+09], [ 3.41625019e+09], [ 1.73700025e+07], [ 3.38945389e+09], [ 3.88303674e+09], [ 2.52321049e+08], [ 5.07758538e+08], [ 1.45712222e+08], [ 1.19059220e+09], [ 1.90882476e+08], [ 5.47004691e+08], [ 1.77344947e+08], [ 2.59774190e+08], [ 3.35548709e+08], [ 2.57722919e+08], [ 6.19890934e+08], [ 2.28557571e+08], [ 6.23913013e+08], [ 2.57963088e+09], [ 8.33363944e+08], [ 1.06288932e+08], [ 3.89262154e+09], [ 2.21231575e+09], [ 3.38884632e+09], [ 4.72911795e+08], [ 7.62565379e+09], [ 6.94713348e+08], [ 2.46184325e+09], [ 6.57331484e+09], [ 2.66020094e+09], [ 2.63430775e+09], [ 3.53471728e+08], [ 9.96612418e+08], [ 2.47112519e+09], [ 2.75341666e+09], [ 6.81210269e+08], [ 4.23675059e+08], [ 4.59655698e+08], [ 4.69402674e+07], [ 5.75361046e+08], [ 3.45014342e+08], [ 2.15472576e+09], [ 7.62806864e+08], [ 4.82774756e+08], [ 8.76505084e+08], [ 3.08365871e+07], [ 5.59199760e+08], [ 3.19038316e+08], [ 2.47752045e+09], [ 7.95172902e+08], [ 1.89917788e+09], [ 2.73976246e+08], [ 1.63702035e+09], [ 1.33678996e+09], [ 4.62413283e+09], [ 9.29552295e+08], [ 3.00574306e+08], [ 1.83556250e+08], [ 8.14744868e+07], [ 3.92305091e+07], [ 3.21157987e+08], [ 4.29297901e+08], [ 7.27721140e+09], [ 1.28729351e+10], [ 6.97007475e+08], [ 1.19130944e+10], [ 1.12998217e+09], [ 4.30979937e+08], [ 1.75077598e+09], [ 2.54644994e+09], [ 3.50952008e+08], [ 5.76187629e+08], [ 8.40805310e+08], [ 1.29289469e+09], [ 5.90750127e+08], [ 4.03208226e+08], [ 1.19970556e+09], [ 3.39123816e+09], [ 4.95783519e+09], [ 1.47808477e+09], [ 3.32212055e+09], [ 4.29439214e+09], [ 1.23307388e+08], [ 3.10332611e+08], [ 6.55355952e+08], [ 6.27833659e+08], [ 3.10790118e+08], [ 1.60944832e+08], [ 1.74096012e+09], [ 7.45184389e+09], [ 8.72051452e+09], [ 2.83097238e+07], [ 9.40135113e+09], [ 1.06422466e+10], [ 1.72111684e+09], [ 9.35802171e+08], [ 2.69493077e+08], [ 2.72312182e+09], [ 3.70670632e+08], [ 7.84706118e+08], [ 4.62184611e+08], [ 6.30467922e+08], [ 8.79924244e+08], [ 6.65471727e+08], [ 1.01604532e+09], [ 5.23732549e+08], [ 7.59878594e+08], [ 5.82023021e+09], [ 1.02378808e+09], [ 3.00804531e+08], [ 1.04930183e+10], [ 7.66574102e+09], [ 6.83882449e+09], [ 2.50481914e+09], [ 2.32102829e+10], [ 1.86983354e+09], [ 6.40585428e+09], [ 1.73910351e+10], [ 6.54855506e+09], [ 6.72631298e+09], [ 1.01544586e+09], [ 2.20676532e+09], [ 7.67056253e+09], [ 5.78311416e+09], [ 1.23724509e+09], [ 9.06358896e+08], [ 8.86314300e+08], [ 1.23122623e+08], [ 7.87255011e+08], [ 9.77135827e+08], [ 6.16163699e+09], [ 2.10687223e+09], [ 1.44135623e+09], [ 2.05025807e+09], [ 1.51500041e+08], [ 1.22928982e+09], [ 9.07180686e+08], [ 1.41136221e+10], [ 8.51549925e+09], [ 1.04322081e+10], [ 4.47523663e+09], [ 8.28428726e+09], [ 9.78164475e+09], [ 2.60579601e+10], [ 2.96616137e+09], [ 1.55008679e+09], [ 5.11967476e+08], [ 2.44401368e+08], [ 2.44812589e+08], [ 1.98076420e+09], [ 1.52182305e+09], [ 1.98929671e+10], [ 3.93278912e+10], [ 2.30551095e+09], [ 1.63101572e+10], [ 1.13620610e+10], [ 1.65836499e+09], [ 2.01010277e+10], [ 1.05618202e+10], [ 2.26014192e+09], [ 1.87803174e+09], [ 6.75829730e+09], [ 7.06069553e+09], [ 4.61928888e+09], [ 3.49385937e+09], [ 3.52677884e+09], [ 1.58538302e+10], [ 1.55180319e+10], [ 4.16434944e+09], [ 1.82893885e+10], [ 1.04857622e+10], [ 7.25188378e+08], [ 2.38962821e+09], [ 2.92832847e+09], [ 4.00403309e+09], [ 1.29468592e+09], [ 1.10060285e+09], [ 1.50564650e+09], [ 2.71447024e+10], [ 1.49794105e+10], [ 2.91479591e+08], [ 3.45667736e+10], [ 4.11215324e+10], [ 4.30680214e+09], [ 4.41527979e+09], [ 1.57645915e+09], [ 1.16227682e+10], [ 1.92888791e+09], [ 1.90989425e+09], [ 2.73888554e+09], [ 2.85082263e+09], [ 3.91962697e+09], [ 3.00914683e+09], [ 1.13201054e+10], [ 4.75044431e+09], [ 8.93370598e+09], [ 2.28708809e+10], [ 3.83957879e+09], [ 2.97602174e+09], [ 3.79303412e+10], [ 2.83516088e+10], [ 3.00477170e+10], [ 5.54915751e+09], [ 8.83860254e+10], [ 5.75303919e+09], [ 7.72991779e+09], [ 5.90961576e+10], [ 2.32637255e+10], [ 3.03782170e+10], [ 4.73012041e+09], [ 1.36570842e+10], [ 3.05242810e+10], [ 2.81074125e+10], [ 7.00321121e+09], [ 5.19193075e+09], [ 6.26943308e+09], [ 7.78299132e+08], [ 5.24334700e+09], [ 7.84988587e+09], [ 2.34216927e+10], [ 7.94603748e+09], [ 6.14394894e+09], [ 9.95643125e+09], [ 4.51539357e+08], [ 5.82222393e+09], [ 3.57746209e+09], [ 6.36035979e+10], [ 1.00887203e+10], [ 4.92049009e+09], [ 2.27565735e+10], [ 6.07695613e+10], [ 2.61349269e+11], [ 1.12017886e+10], [ 2.44203808e+09], [ 1.04182106e+09], [ 4.73297685e+09], [ 1.48115807e+10], [ 5.06838774e+10], [ 6.70904568e+10], [ 1.11457453e+10], [ 5.39750013e+09], [ 2.46928107e+10], [ 6.96461230e+10], [ 2.84201535e+11]])

### Load the aggregation matrix

#aggregation\_matrix = np.loadtxt('aggregation\_matrix.txt')  
aggregation\_matrix = pd.read\_excel(ref\_mat,'IndAggMat', skiprows=2, usecols = "C:CM")  
aggregation\_matrix

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14 rows × 89 columns

### Load the Impact Conversion Factors

impact\_conversion\_matrix = pd.read\_excel(ref\_mat,'ConvFact', skiprows=1, usecols = "O:S")

### Calculate the other values based on the impact conversion factors

sales = []  
Employment=[]  
Employee\_Compensation=[]  
Proprietors\_Income=[]  
Other\_Property = []  
Indirect\_Business\_Tax = []  
  
sal = IndustryOutput  
for k in range(0,89):  
 sales.append(sal[k][0])  
 Employment.append(float((sal[k][0] \* impact\_conversion\_matrix['Employment'][k])/1000000))  
 Employee\_Compensation.append(float((sal[k][0] \* impact\_conversion\_matrix['Employee Compensation'][k])))  
 Proprietors\_Income.append(float((sal[k][0] \* impact\_conversion\_matrix['Proprietors\' Income'][k])))  
 Other\_Property.append(float(sal[k][0] \* impact\_conversion\_matrix['Other Property Type Income'][k]))  
 Indirect\_Business\_Tax.append(float(sal[k][0] \* impact\_conversion\_matrix['Indirect Business Tax'][k]))  
  
#sales

### now multiply by the aggregation matrix.

aggregated\_dict={}  
aggregated\_dict['Industry']=sector\_names  
aggregated\_dict['Sales'] = np.matmul(aggregation\_matrix, sales)  
aggregated\_dict['Employment'] = np.matmul(aggregation\_matrix, Employment)  
aggregated\_dict['Employee\_Compensation'] = np.matmul(aggregation\_matrix, Employee\_Compensation)  
aggregated\_dict['Proprietors\_Income'] = np.matmul(aggregation\_matrix, Proprietors\_Income)  
aggregated\_dict['Other\_Property'] = np.matmul(aggregation\_matrix, Other\_Property)  
aggregated\_dict['Indirect\_Business\_Tax'] = np.matmul(aggregation\_matrix, Indirect\_Business\_Tax)  
#aggregated\_dict

### Calc Value Added and Labor Income and add to output

Value\_Added=[]  
Labor\_Income=[]  
  
for i in range(0,14):  
 Value\_Added.append(aggregated\_dict['Employee\_Compensation'][i] + aggregated\_dict['Proprietors\_Income'][i] + aggregated\_dict['Other\_Property'][i] + aggregated\_dict['Indirect\_Business\_Tax'][i] )  
 Labor\_Income.append(aggregated\_dict['Employee\_Compensation'][i] + aggregated\_dict['Proprietors\_Income'][i] )  
   
aggregated\_dict['Value\_Added'] = Value\_Added  
aggregated\_dict['Labor\_Income'] = Labor\_Income

### Build the output.

#### This will write out a spreadsheet to your working directory

cwd = os.chdir(r'C:\Users\jojoseph\Documents\GitHub\reg\_soc\_acc\_mat')  
!jupyter-nbconvert regMatrix.ipynb --to markdown  
!pandoc regMatrix.md -t docx -o regMatrix.docx

[NbConvertApp] Converting notebook regMatrix.ipynb to markdown [NbConvertApp] Writing 62227 bytes to regMatrix.md