

EPA143A – Week Six

Questions

INPUT-OUTPUT ECONOMICS

Required readings:

Justin Kitzes. 2013. 'An Introduction to Environmentally-Extended Input-Output Analysis.' *Resources* vol. 2: 489-503

EPA143A LECTURE NOTE W-6.

The EXERCISES W-6.1, W-6.2 and W-6.3 for Week 4 are given below.

EXERCISE W-6.1

Consider the following input-output matrix:

Table 1
An input-output table
(billions of euro)

	Agriculture	Mining	Manufacturing	Services	Final demand	Total demand
Agriculture	10	0	35	25	40	110
Mining	1	2	60	7	10	80
Manufacturing	50	28	80	42	100	300
Services	25	10	35	56	174	300
Value added	24	40	90	170		
Gross output	110	80	300	300		

1. Calculate the **A**-matrix corresponding to Table 1 (in 5 digits). Coefficient $a_{32} = 0.35$. What does this technical coefficient mean?

2. Calculate the Leontief inverse $\mathbf{L} = [\mathbf{I} - \mathbf{A}]^{-1}$. In excel you can use the @minverse command. First, create the 4 x 4 matrix (for \mathbf{L}); then type in @minverse(...); and finish by CTRL-SHIFT-ENTER.
3. Coefficient $l_{11} = 1.27817$. What does this coefficient mean? Coefficient $l_{24} = 0.12233$. What does this coefficient mean?
4. Calculate the backward production linkages of the four industries. Which industry has the strongest backward production linkages? Explain why this is the case.
5. Let us define the (1x4) vector of jobs ℓ_j per unit of gross output in industry j :

$$\ell = [0.10 \quad 0.05 \quad 0.20 \quad 0.60]$$

ℓ_i = the number of jobs (in millions) per € 1 billion of gross output in industry i . Calculate the total job creation \mathbf{E} caused by an €1 billion increase in final demand and gross output of industry j we pre-multiply the Leontief inverse with vector ℓ using: $\mathbf{E} = \ell \times [\mathbf{I} - \mathbf{A}]^{-1}$.

6. For which industry is the indirect job creation highest? Explain your answer.

EXERCISE W-6.2

Consider the following input-output matrix:

Table 2
An input-output table
(billions of euro)

	Ag	HI	CGI	WRT	OS	Final demand	Total demand
Agriculture	1000	50	800	100	200	450	2600
Heavy industry	500	2000	800	300	0	100	3700
Consumer goods manufacturing	100	250	1200	200	500	2650	4900
Wholesale, retail & transportation	200	200	400	100	300	200	1400
Other services	200	100	300	200	550	1450	2800
Value added	600	1100	1400	500	1250		
Gross output	2600	3700	4900	1400	2800		

1. Calculate the Leontief inverse and calculate the backward production linkages of the five industries.
2. Consider the following vector **f**: **f** = [0.50 0.80 0.40 0.30 0.10]

f_j is the direct emission intensity of industry j . $f_1 = 0.50$, which means that agriculture is emitting 0.5 million tonnes of CO_{2eq} per €1 billion of gross output and final demand for agricultural goods. Calculate the total (direct + indirect) emissions **F** associated with an increase in final demand for good j per unit of output of industry j , using: **F** = **f** × [**I** – **A**]⁻¹.

EXERCISE W-6.3

Consider the following input-output table for France (2015):

Table 3
Input-Output Table: France (2015)
(billion Euros)

	Ag	Mi	Man	EGW	Con	WRT	Info	FIRE	Govt	Serv	FD	Demand
Ag	11	0	34	0	0	0	1	0	1	3	35	85
Mi	0	0	21	9	2	0	0	0	0	0	-30	4
Man	17	1	197	10	55	35	30	7	27	31	305	716
EGW	2	0	21	30	3	10	13	7	12	11	27	136
Con	0	0	2	2	20	4	11	8	6	2	207	261
WRT	13	1	101	8	24	100	37	8	30	25	261	609
Info	2	0	52	13	30	77	195	45	150	36	413	1014
FIRE	3	0	20	5	10	44	64	97	40	18	236	536
Govt	0	0	3	2	1	2	4	1	4	1	701	720
Serv	0	0	10	3	4	18	33	16	28	28	412	552
VA	37	2	255	53	113	319	625	347	422	395		2566
GO	85	4	716	136	261	609	1014	536	720	552	2566	7201

Source: OECD statistics.

Notes: Ag = agriculture; Mi = mining; Man = manufacturing; EGW = electricity, gas & water supply; Con = construction; WRT = wholesale trade, retail trade and transportation and storage; Info = ICT and professional business services; FIRE = finance, insurance & real estate; Govt = public administration and defense; Serv = other services including education, health care, arts & entertainment and food and accommodation. VA = gross value added; GO = gross output or supply. FD = final demand.

The input-output table for France is available on brightspace as an excel-file.

1. Calculate the backward production linkages using the Leontief inverse $\mathbf{L} = [\mathbf{I} - \mathbf{A}]^{-1}$.
2. Derive the vector of value-added intensities from Table 3.
3. Calculate the value-added multipliers for French industries in 2015. Compare these with the German value-added multipliers (in the Lecture Note). Are there any major differences in multipliers?
4. Calculate the total employment effects for French industries in 2015. Compare these with the German employment multipliers (in the Lecture Note). Are there any major differences in multipliers?
5. Calculate the total GHG intensities for French industries in 2015. Compare these with the German GHG intensities (in the Lecture Note). Are there any major differences in multipliers?
6. Derive the reclassified, production-chain based GHG quantities by industry for France in 2015, using $\mathbf{P} = \hat{\mathbf{F}} \times \mathbf{y}$. Which industries have high indirect GHG emissions (embodied in intermediate input use) ?