Compilation of valuation matrices

Regional Course on Supply and Use Tables
Chiba, Japan
20-24 January 2020

Benson Sim
United Nations Statistics Division

Outline of presentation

- What is the valuation matrix?
- Relationship between basic prices and purchasers' prices
- Transformation of the use table from purchasers' prices to basic prices
- Estimating valuation matrices in practice

What is the valuation matrix?

Introduction

Fundamental SUT product identity

Supply = Demand

Introduction

Output is measured @ basic prices

Reflects revenue producers receive

≠ ?

Intermediate and final use tables are valued @ purchasers' prices

Reflects what purchasers pay

The valuation matrix

Output @ basic prices

+

Valuation matrix

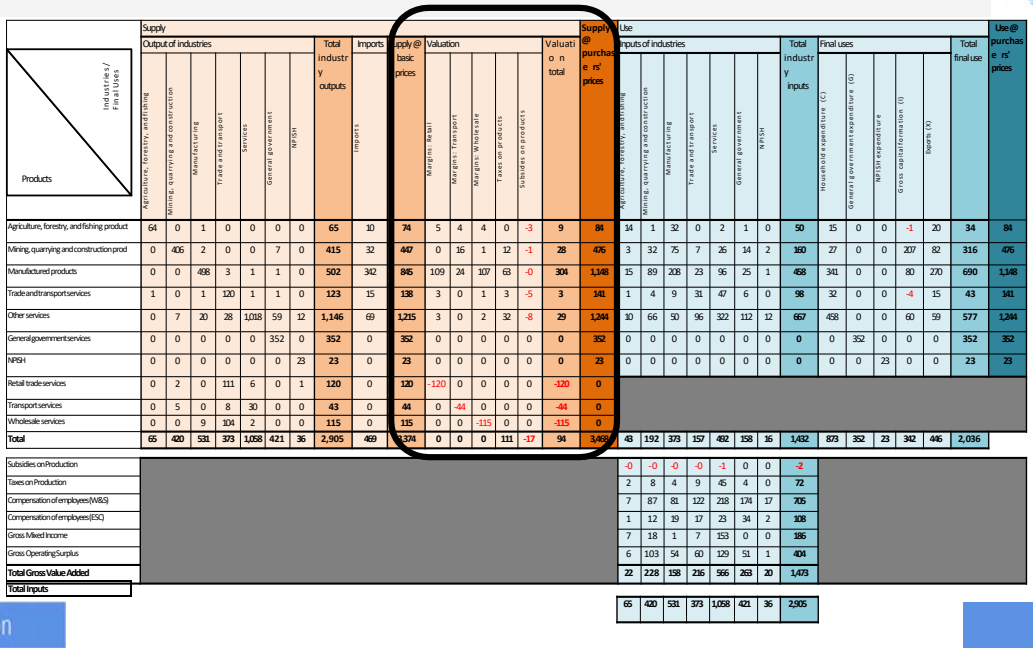
=

Output @ purchasers' prices

=

Intermediate and final use tables are valued @ purchasers' prices

Supply and use tables @ purchasers' prices



Industries / Final Uses / Products	Supply: Output of industries: Agriculture, forestry, and fishing	Mining, quarrying and construction	Manufacturing	Trade and transport	Services	General government	NPISH	Total industry outputs	Imports	Supply @ basic prices	Valuation: Margins: Retail	Margins: Transport	Margins: Wholesale	Taxes on products	Subsidies on products	Valuation total	Supply @ purchasers' prices	Use: Inputs of industries: Agriculture, forestry, and fishing	Mining, quarrying and construction	Manufacturing	Trade and transport	Services	General government	NPISH	Total industry inputs	Final uses: Household expenditure (C)	General government expenditure (G)	NPISH expenditure	Gross capital formation (I)	Exports (X)	Total final use	Use @ purchasers' prices
Agriculture, forestry, and fishing product	64	0	1	0	0	0	0	65	10	74	5	4	4	0	-3	9	84	14	1	32	0	2	1	0	50	15	0	0	-1	20	34	84
Mining, quarrying and construction prod	0	406	2	0	0	7	0	415	32	447	0	16	1	12	-1	28	476	3	32	75	7	26	14	2	160	27	0	0	207	82	316	476
Manufactured products	0	0	498	3	1	1	0	502	342	845	109	24	107	63	-0	304	1,148	15	89	208	23	96	25	1	458	341	0	0	80	270	690	1,148
Trade and transport services	1	0	1	120	1	1	0	123	15	138	3	0	1	3	-5	3	141	1	4	9	31	47	6	0	98	32	0	0	-4	15	43	141
Other services	0	7	20	28	1,018	59	12	1,146	69	1,215	3	0	2	32	-8	29	1,244	10	66	50	96	322	112	12	667	498	0	0	60	59	577	1,244
General government services	0	0	0	0	0	352	0	352	0	352	0	0	0	0	0	0	352	0	0	0	0	0	0	0	0	0	352	0	0	0	352	352
NPISH	0	0	0	0	0	0	23	23	0	23	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	23	0	0	23	23
Retail trade services	0	2	0	111	6	0	1	120	0	120	-120	0	0	0	0	-120	0															
Transport services	0	5	0	8	30	0	0	43	0	44	0	-44	0	0	0	-44	0															
Wholesale services	0	0	9	104	2	0	0	115	0	115	0	0	-115	0	0	-115	0															
Total	65	420	531	373	1,058	421	36	2,905	469	3,374	0	0	0	111	-17	94	3,468	43	192	373	157	492	158	16	1,432	873	352	23	342	446	2,036	
Subsidies on Production																		-0	-0	-0	-0	-1	0	0	-2							
Taxes on Production																		2	8	4	9	45	4	0	72							
Compensation of employees (W&S)																		7	87	81	122	218	174	17	705							
Compensation of employees (ESC)																		1	12	19	17	23	34	2	108							
Gross Mixed Income																		7	18	1	7	153	0	0	186							
Gross Operating Surplus																		6	103	54	60	129	51	1	404							
Total Gross Value Added																		22	228	158	216	566	263	20	1,473							
Total Inputs																		65	420	531	373	1,058	421	36	2,905							

Supply and use tables @ purchasers' prices

USE	Use														
	Inputs of industries								Final uses						
Industries / Final Uses / Products	Agriculture	Mining, construction	Manufacturing	Trade and transport	Services	Government	NPISH	Total industry inputs	HHFCe	GFCe	NPISHCe	GCF	Exports	Total final use	Use @ purchasers' prices
Agriculture, forestry, and fish	14	1	32	0	2	1	0	**50**	15	0	0	-1	20	**34**	**84**
Mining, quarrying and constr	3	32	75	7	26	14	2	**160**	27	0	0	207	82	**316**	**476**
Manufactured products	15	89	208	23	96	25	1	**458**	341	0	0	80	270	**690**	**1,148**
Trade and transport services	1	4	9	31	47	6	0	**98**	32	0	0	-4	15	**43**	**141**
Other services	10	66	50	96	322	112	12	**667**	458	0	0	60	59	**577**	**1,244**
General government services	0	0	0	0	0	0	0	**0**	0	352	0	0	0	**352**	**352**
NPISH	0	0	0	0	0	0	0	**0**	0	0	23	0	0	**23**	**23**
Retail trade services															
Transport services															
Wholesale services															
Total	**43**	**192**	**373**	**157**	**492**	**158**	**16**	**1,432**	**873**	**352**	**23**	**342**	**446**	**2,036**	
Subsidies on Production	-0	-0	-0	-0	-1	0	0	**-2**							
Taxes on Production	2	8	4	9	45	4	0	**72**							
Compensation of employees	7	87	81	122	218	174	17	**705**							
Compensation of employees	1	12	19	17	23	34	2	**108**							
Gross Mixed Income	7	18	1	7	153	0	0	**186**							
Gross Operating Surplus	6	103	54	60	129	51	1	**404**							
GVA	**22**	**228**	**158**	**216**	**566**	**263**	**20**	**1,473**							
Total Inputs	**65**	**420**	**531**	**373**	**1,058**	**421**	**36**	**2,905**							

Supply and use tables @ purchasers' prices

SUPPLY	Supply										Valuation						
	Output of industries								Imports								
Products \ Industries / Final Uses	Agriculture, forest	Mining, quarrying	Manufacturing	Trade and transpo	Services	General governme	NPISH	Total output	Imports	Supply @ basic prices	Retail margins	Transport margins	Wholesale margin	Taxes on products	Subsides on produ	Valuation total	**Supply @ purchasers' prices**
Agriculture, forestry, and fishing produ	64	0	1	0	0	0	0	**65**	10	**74**	5	4	4	0	-3	**9**	**84**
Mining, quarrying and construction pr	0	406	2	0	0	7	0	**415**	32	**447**	0	16	1	12	-1	**28**	**476**
Manufactured products	0	0	498	3	1	1	0	**502**	342	**845**	109	24	107	63	-0	**304**	**1,148**
Trade and transport services	1	0	1	120	1	1	0	**123**	15	**138**	3	0	1	3	-5	**3**	**141**
Other services	0	7	20	28	1,018	59	12	**1,146**	69	**1,215**	3	0	2	32	-8	**29**	**1,244**
General government services	0	0	0	0	0	352	0	**352**	0	**352**	0	0	0	0	0	**0**	**352**
NPISH	0	0	0	0	0	0	23	**23**	0	**23**	0	0	0	0	0	**0**	**23**
Retail trade services	0	2	0	111	6	0	1	**120**	0	**120**	-120	0	0	0	0	**-120**	**0**
Transport services	0	5	0	8	30	0	0	**43**	0	**44**	0	-44	0	0	0	**-44**	**0**
Wholesale services	0	0	9	104	2	0	0	**115**	0	**115**	0	0	-115	0	0	**-115**	**0**
Total	**65**	**420**	**531**	**373**	**1,058**	**421**	**36**	**2,905**	**469**	**3,374**	**0**	**0**	**0**	**111**	**-17**	**94**	**3,468**

Key observations

Product identity

Supply @ basic prices

+

ΣMargins

+

Taxes less subsidies on products

=

Use @ purchasers' prices

Margin products (retail, wholesale, transportation)

Zero values in use tables

- Not strictly necessary, especially for directly purchased transportation services

Balanced

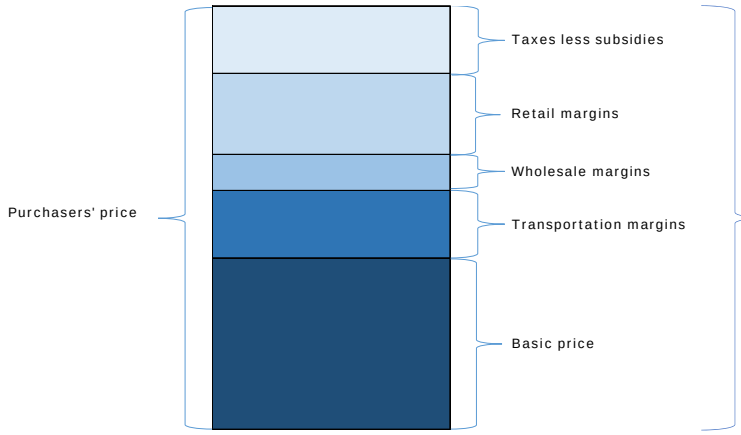
- Balancing item is negative entry in the valuation matrix = the total margin available

Relationship between basic price and purchasers' price

Valuation

Basic prices
+
Taxes on products excluding invoiced VAT
-
Subsidies on products
=
Producers' prices
+
VAT not deductible by the purchaser
+
Separately invoiced transport charges
+
Wholesalers' and retailers' margins
=
Purchasers' prices

Purchases' price vs. basic price



Applies to each cell in intermediate inputs and final uses table

From purchasers' prices to basic prices

From aggregate margin to detailed estimate

Purchasers' prices SUTs show measurable aggregate sum of margins on all use categories

For certain analytical purposes, the SUTs (specifically, the use tables) need to be converted into basic prices

Constituent margins and taxes less subsidies of each cell in the use tables must be calculated

Solution?

- Use a table of margin rates to calculate initial margins
- Prorate to match observable aggregate by product
- Update table of margin rates on an ongoing basis

Creating basic price estimates, illustration

	Purchaser	Margins		Basic
		Trade	Transportation	
Commodity 1	1,000	50	100	850
Commodity 2	2,000	100	200	1,700
Commodity 3	3,000	150	300	2,550
Commodity 4	4,000	200	400	3,400
Commodity 5	5,000	250	500	4,250
Commodity 6 (Trade)	0	0	0	750
Commodity 7 (Transportation)	0	0	0	1,500
	15,000	**750**	**1,500**	**15,000**

- For a non-margin product:
  - Basic = Purchaser – Sum of Margins on that cell
- For a margin product:
  - Basic = Sum of Margins corresponding to that margin product

Supply and use tables @ basic prices

	Supply										Use														
	Output of industries								Total industry outputs	Imports	Supply @ basic prices	Inputs of industries							Total industry inputs	Final uses					Total final use	Use @ basic prices
	Agriculture, forestry, and fishing	Mining,quarrying&gendconstruction	Manufacturing	Trade and transport	Services	Fictives	General government	NPISH				Agriculture, forestry, and fishing	Mining,quarrying&gendconstruction	Manufacturing	Trade and transport	Services	Fictives	General government	NPISH	Household expenditure (C)	General government expenditure (G)	NPISH expenditure	Gross capital formation (I)	Exports (X)		
Agriculture, forestry, and fishing products	64	0	1	0	0	0	0	0	65	10	74	12	1	29	0	1	0	1	0	44	13	0	0	-1	18	30	74
Mining, quarrying and construction products	0	406	2	0	0	0	7	0	415	32	447	2	30	71	7	24	0	13	2	150	25	0	0	195	77	297	447
Manufactured products	0	0	498	3	1	0	1	0	502	342	845	11	66	153	17	28	42	19	1	337	251	0	0	59	198	508	845
Trade and transport services	1	0	1	120	1	0	1	0	123	15	138	1	4	8	30	8	38	6	0	96	32	0	0	-4	14	42	138
Other services	0	7	20	28	896	0	59	12	1,024	69	1,093	6	58	31	75	207	54	91	7	529	447	0	0	59	58	564	1,093
Fictives	0	0	0	0	0	122	0	0	122	0	122	4	6	18	19	53	0	18	5	122	0	0	0	0	0	0	122
General government	0	0	0	0	0	0	352	0	352	0	352	0	0	0	0	0	0	0	0	0	0	352	0	0	0	352	352
NPISH	0	0	0	0	0	0	0	23	23	0	23	0	0	0	0	0	0	0	0	0	0	0	23	0	0	23	23
Retail trade services	0	2	0	111	6	0	0	1	120	0	120	2	9	22	3	4	7	3	0	50	35	0	0	8	27	70	120
Transport services	0	5	0	8	0	30	0	0	43	0	44	1	3	8	1	2	1	1	0	17	9	0	0	8	9	27	44
Wholesale services	0	0	9	104	2	0	0	0	115	0	115	2	9	21	2	4	6	3	0	47	34	0	0	8	26	68	115
Total intermediate consumption	**65**	**420**	**531**	**373**	**906**	**152**	**421**	**36**	**2,905**	**469**																	
Subsidies on Products												-1	-1	-2	-2	-2	-2	-1	-0	-10	-5	0	0	-1	-2	-8	-1
Taxes on Products												1	8	15	5	10	6	5	0	49	32	0	0	11	19	62	111
												1	**7**	**13**	**3**	**8**	**4**	**4**	**0**	**40**	**27**	**0**	**0**	**10**	**17**	**54**	**94**
Subsidies on Production												-0	-0	-0	-0	-1	0	0	0	-2							
Taxes on Production												2	8	4	9	45	0	4	0	72							
Compensation of employees (W&S)												7	87	81	122	218	0	174	17	705							
Compensation of employees (ESC)												1	12	19	17	23	0	34	2	108							
Gross Mixed Income												7	18	1	7	153	0	0	0	186							
Gross Operating Surplus												6	103	54	60	129	0	51	1	404							
Total Gross Value Added												**22**	**228**	**158**	**216**	**566**	**0**	**263**	**20**	**1,473**							
Total Inputs												**65**	**420**	**531**	**373**	**906**	**152**	**421**	**36**	**2,905**							

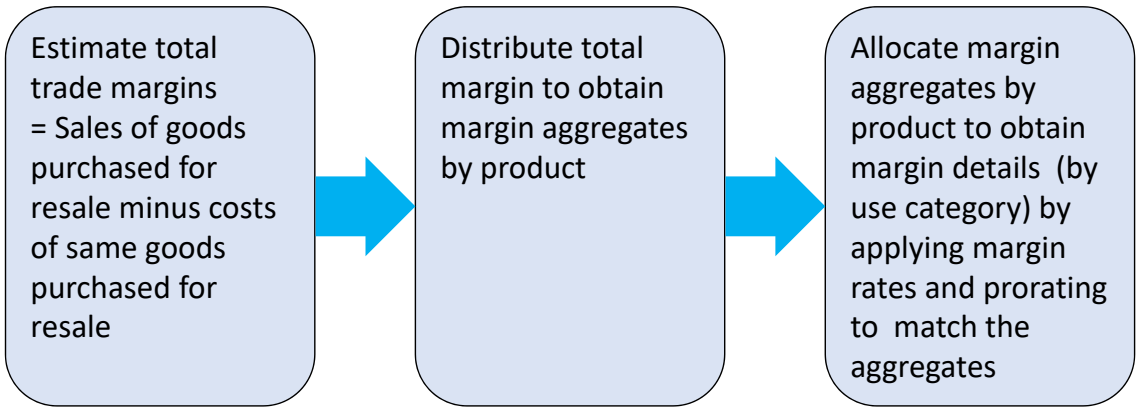
- No valuation matrix in the supply table
- Margin services and taxes and subsidies on products appear explicitly in the use tables
- All products remain balanced (supply=use)
- Output, Imports, GVA matrices remain unchanged

Estimating valuation matrices in practice

Example of margins in the SUTs

- Wholesale (8)
  - farm products
  - petroleum and petroleum products
  - food, beverages and tobacco products
  - personal and household goods
  - motor vehicles, motor vehicle parts and accessories
  - building materials and supplies
  - machinery, equipment and supplies
  - miscellaneous products
- Retail (11)
  - motor vehicles and parts
  - furniture and home furnishings
  - electronics and appliances
  - building materials, garden equipment and supplies
  - food and beverages
  - health and personal care products
  - automotive fuels
  - clothing and clothing accessories
  - sporting and leisure products
  - miscellaneous products
  - household fuels
- Transportation and storage (13)
  - Natural gas distribution
  - Transportation of crude oil and other commodities by pipeline
  - Transportation of natural gas by pipeline margins
  - Grain storage
  - Air freight transportation
  - Rail freight transportation
  - Water freight transportation
  - Truck transportation services for general freight
  - Truck transportation services for specialized freight
  - Water transportation support
  - Road transportation support
  - Freight transportation arrangement
  - Other transportation

General steps to estimate margins



Estimating margins – Illustrative example

STEP 1: Build Output, input, and final uses tables

	Margin	Use at purchasers' prices					
		Ind1	Ind2	Ind3	HHFCe	Exports	Other
Product1		12,079	1,003	28,552	73	1,239	318
Product2		2,410	30,446	70,744	7,038	24,201	121
Product3		11,246	65,766	152,826	16,843	28,141	42,406
Product4		1,329	3,607	8,351	30,251	7,768	38,219
Product5		5,978	58,071	30,754	74,861	207,376	53,935
Product6		3,705	6,004	17,655	18,899	52,951	0
Trade services	-200,000						

STEP 2: Distribute total margin to obtain margin aggregates by product

	Margin	Use at purchasers' prices					
		Ind1	Ind2	Ind3	HHFCe	Exports	Other
Product1	15,000	12,079	1,003	28,552	73	1,239	318
Product2	10,000	2,410	30,446	70,744	7,038	24,201	121
Product3	60,000	11,246	65,766	152,826	16,843	28,141	42,406
Product4	5,000	1,329	3,607	8,351	30,251	7,768	38,219
Product5	80,000	5,978	58,071	30,754	74,861	207,376	53,935
Product6	30,000	3,705	6,004	17,655	18,899	52,951	0
Trade services	- 200,000						

STEP 3: Allocate margin aggregates by product to obtain margin details

Blueprint of margins

Ind1	Ind2	Ind3	HHFCe	Exports	Other
29%	27%	30%	29%	32%	29%
2%	4%	5%	7%	1%	8%
20%	20%	19%	24%	19%	17%
2%	4%	2%	4%	0%	3%
21%	18%	24%	19%	24%	17%
35%	35%	31%	32%	35%	28%

Blueprint * Use at purchasers' prices

Ind1	Ind2	Ind3	HHFCe	Exports	Other	Total
3,503	271	8,566	21	397	92	12,849
48	1,218	3,537	493	242	10	5,548
2,249	13,153	29,037	4,042	5,347	7,209	61,038
27	144	167	1,210	0	1,147	2,695
1,255	10,453	7,381	14,224	49,770	9,169	92,252
1,297	2,101	5,473	6,048	18,533	0	33,452

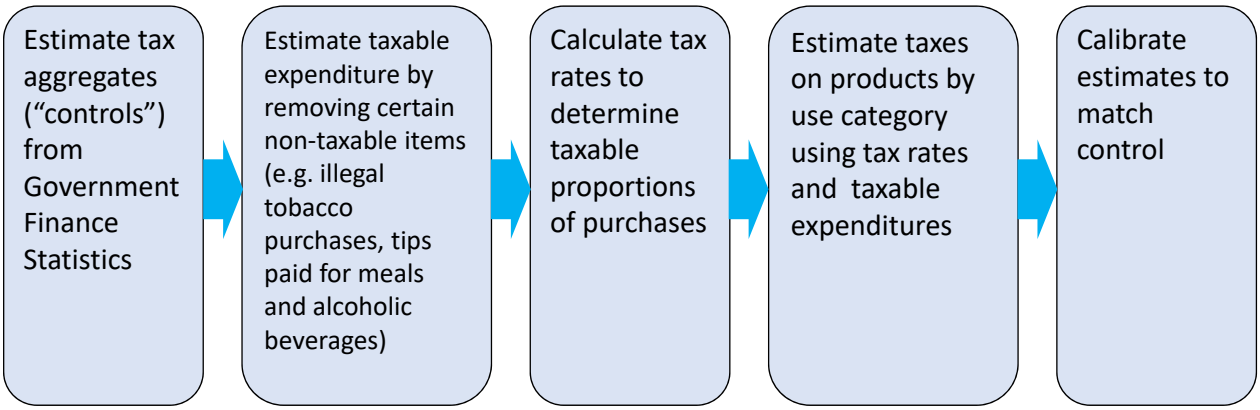
Prorate to equal margin aggregates

Ind1	Ind2	Ind3	HHFCe	Exports	Other	Total
4,089	316	9,999	25	463	108	15,000
87	2,195	6,376	888	436	17	10,000
2,211	12,930	28,543	3,973	5,256	7,087	60,000
49	268	310	2,245	0	2,128	5,000
1,089	9,065	6,401	12,335	43,160	7,951	80,000
1,163	1,885	4,908	5,424	16,621	0	30,000

Example of taxes on products

- Federal (9)
  - Federal trading profits
  - Federal gas tax
  - Federal excise tax
  - Federal duty tax
  - Federal environment tax
  - Federal air transportation tax
  - Federal custom import duties
  - Federal sales tax (GST and HST)
  - Aboriginal trading profits
- Provincial (9)
  - Provincial environment tax
  - Provincial gallon tax
  - Provincial trading profits
  - Provincial gas tax
  - Provincial land transfer tax
  - Provincial amusement tax
  - Other provincial consumption taxes
  - Provincial sales tax
  - Provincial harmonized sales tax (HST)
- Municipal (3)
  - Municipal land transfer tax
  - Municipal amusement tax
  - Municipal sales tax

General steps to estimate taxes on products



Calculating applicable tax rates

- In order to determine what portion of the purchase of a product by businesses and households is taxable, tax rates are created to determine the taxable proportions of the cells in the use table
- These rates represent a translation from the legislation into the SUT framework
- They indicate what proportion of a purchase of a product is not taxable
- Everything is initially assumed to be 100% taxable
- Tax rates are created for exemptions, rebates, and input tax credits for each combination of product and industry and final use category
- These amounts are then deducted from the 100% to arrive at a final taxable proportion

Taxes on products – illustrative example

Taxable Proportion (TP) formula:

TP =

$(1 - non\ taxable)$

$* 1 - exempt - zero\ rated - POS\ rebate$

$*(1 - ITC)$

$*(1 - sector\ rebate)$

$* 1 - other\ rebate$

- The table on the right shows the tax rate values for "Snack food products" for a) HFCE and b) Bakeries and tortilla manufacturing

		Snack food products	Snack food products
		HHFCe	Use by bakeries industry
Non-taxable	Excluded or discounted from any tax treatment.	0%	
Zero-rated	Taxable at a rate of 0%. (companies that produce zero-rated supplies can claim ITCs on inputs used to produce them)	11%	11%
Exempt	Good or service is exempt from tax	0%	0%
POS rebate	Tax rebate applied at the point-of-sale	0%	0%
Other rebate	Product-specific VAT rebates other than point-of-sale	0%	0%
Input tax credit (ITC)	Tax credit given to companies that pay VAT on goods/services used in production to produce taxable goods/services.	0%	100%
Sector rebate	VAT rebates that specific public/private sector institutions (e.g. municipalities) or categories of consumers (e.g. First Nation communities, diplomats) are entitled to regardless of the product purchased.	0.45%	0%
Taxable proportion	Proportion of expenditure (less sales taxes) that is subject to tax	88.60%	0%

Estimation

- Non-sales taxes such as tobacco taxes, liquor taxes, and environment taxes, are allocated based on the expenditure weights after applying the taxable proportions

- Sales taxes (incl. VAT), are determined as follows:
  - $TAX = Expenditure \times \frac{LR_i \times TP_i}{\sum LR_i \times TP_i + 1}$, where
  - LR_i = Legal rate for government level *i*
  - TP_i = Taxable proportion for government level *i*

Summary

- The valuation matrix bridges the valuation difference between the domestic and foreign supply in basic prices, and the consumption in purchasers' prices
- The use table can be transformed from purchasers' prices into basic prices by calculating margins, taxes on products, and subsidies on products for every cell in the use table
- The valuation matrices may be estimated using a combination of survey data and calculated rates

sna@un.org