Module9 Price and Volume Measures

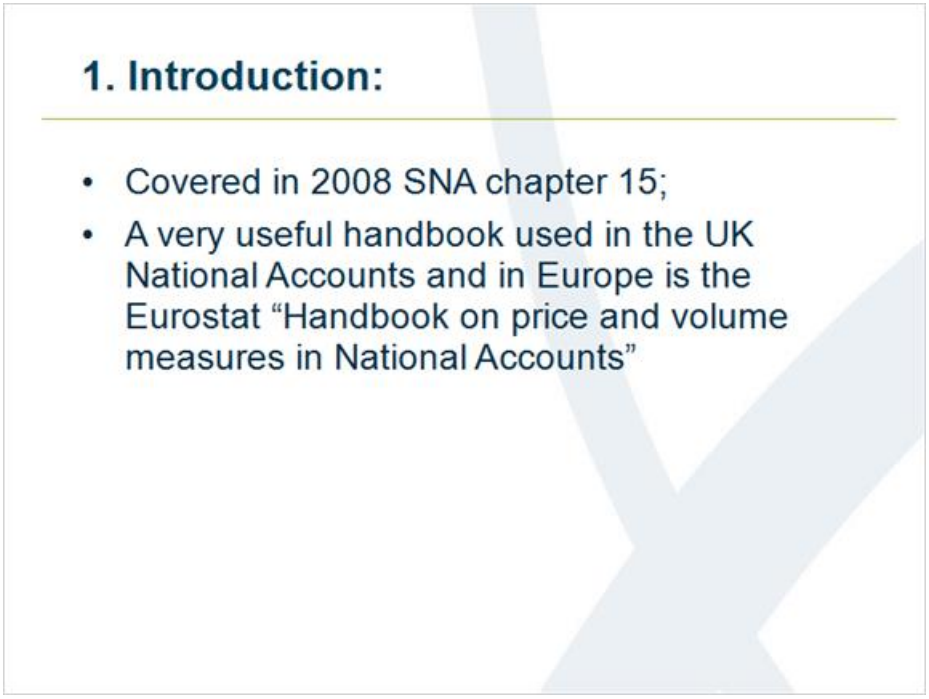
1. Price and Volume

1.1 Session 4.2:

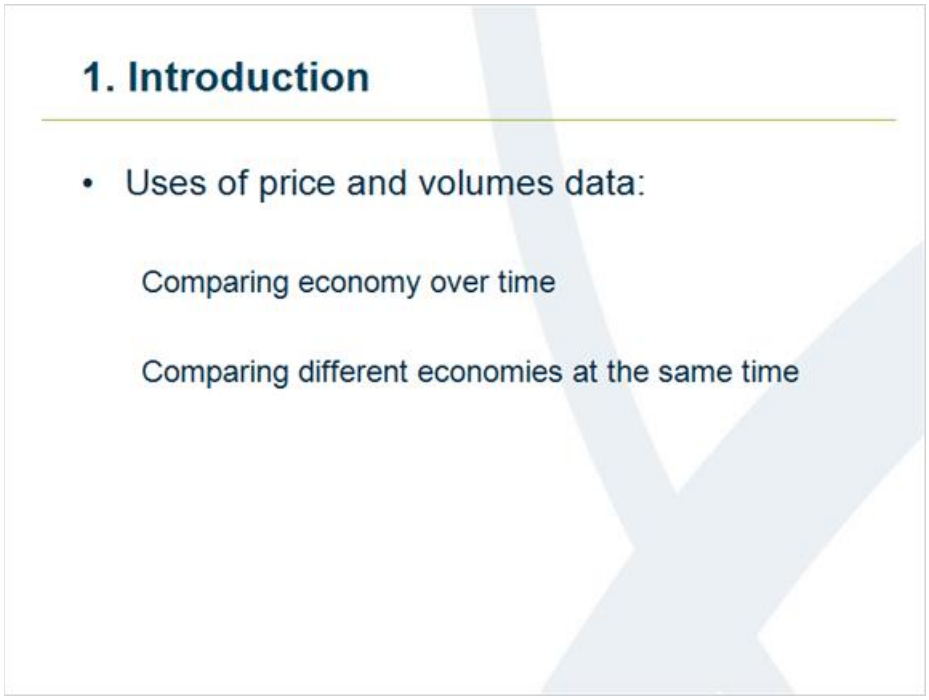
Notes:

1.2 Content

1.3 1. Introduction:

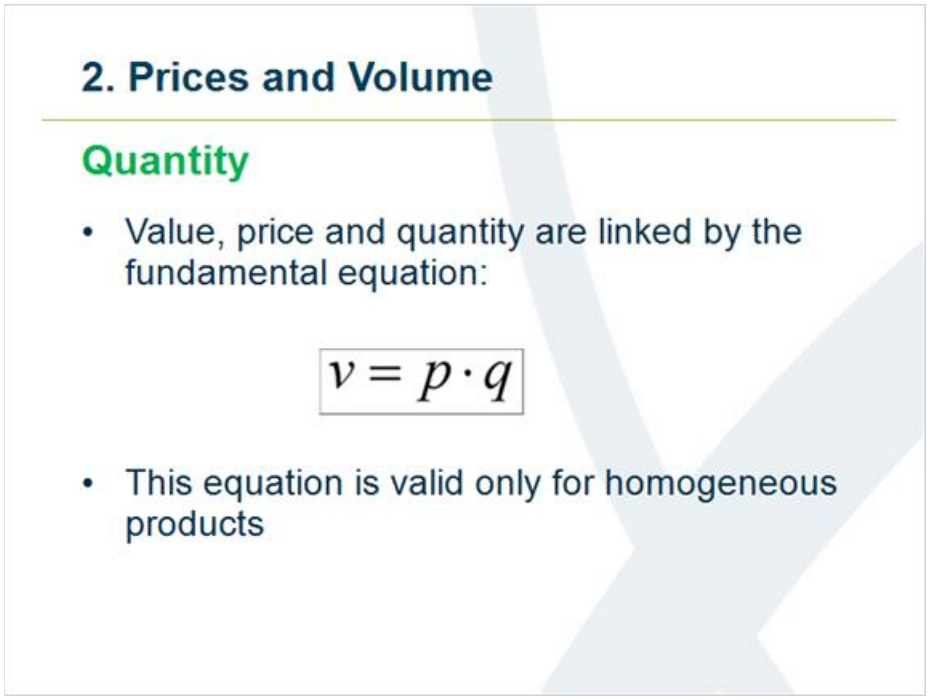


1.4 1. Introduction

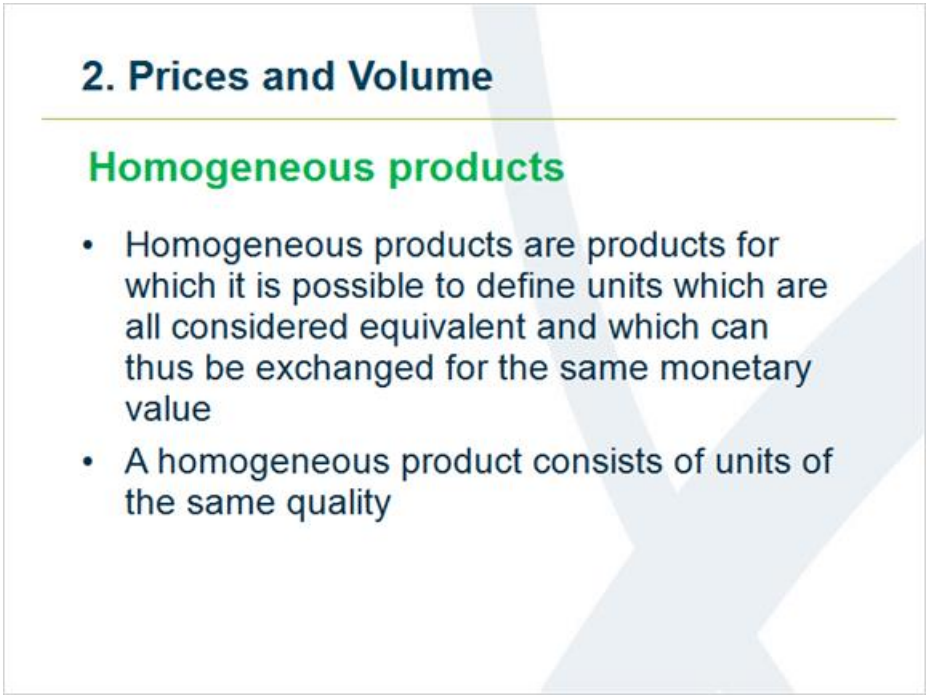


1.5 1. Introduction

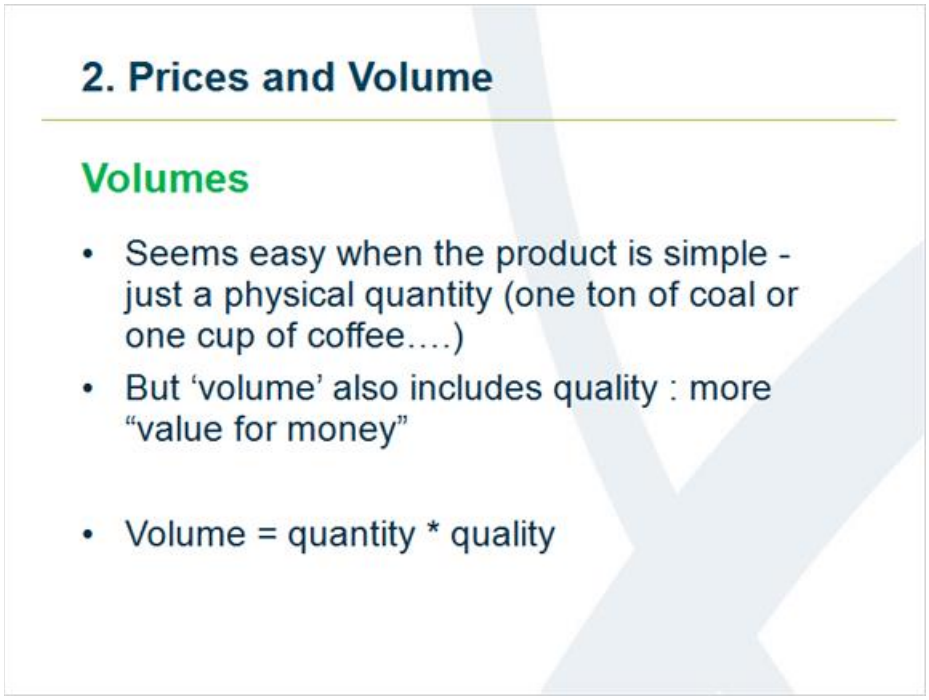
1.6 Quantity



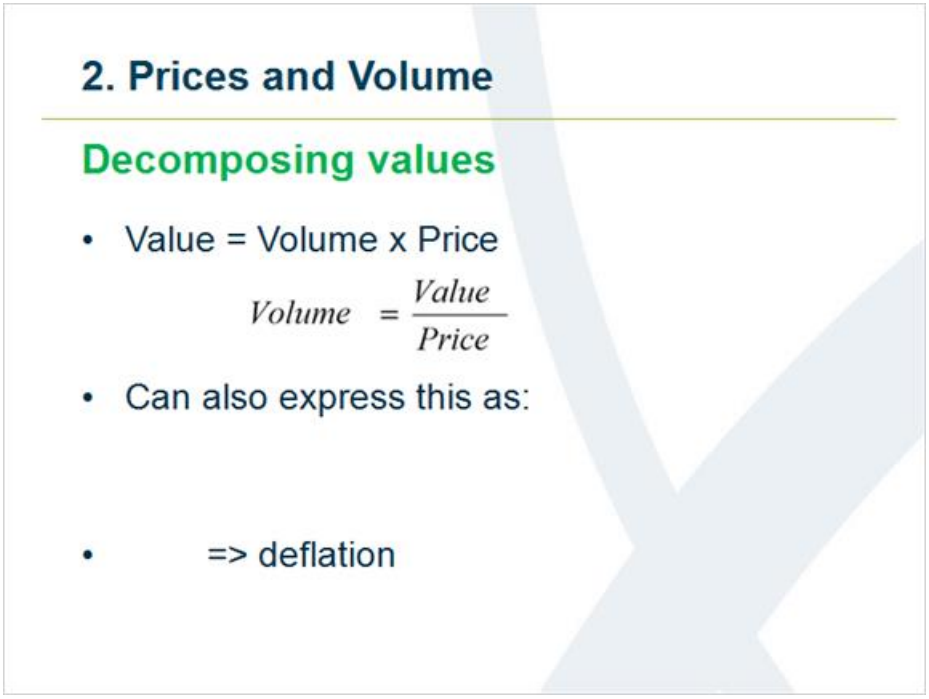
1.7 Homogeneous products



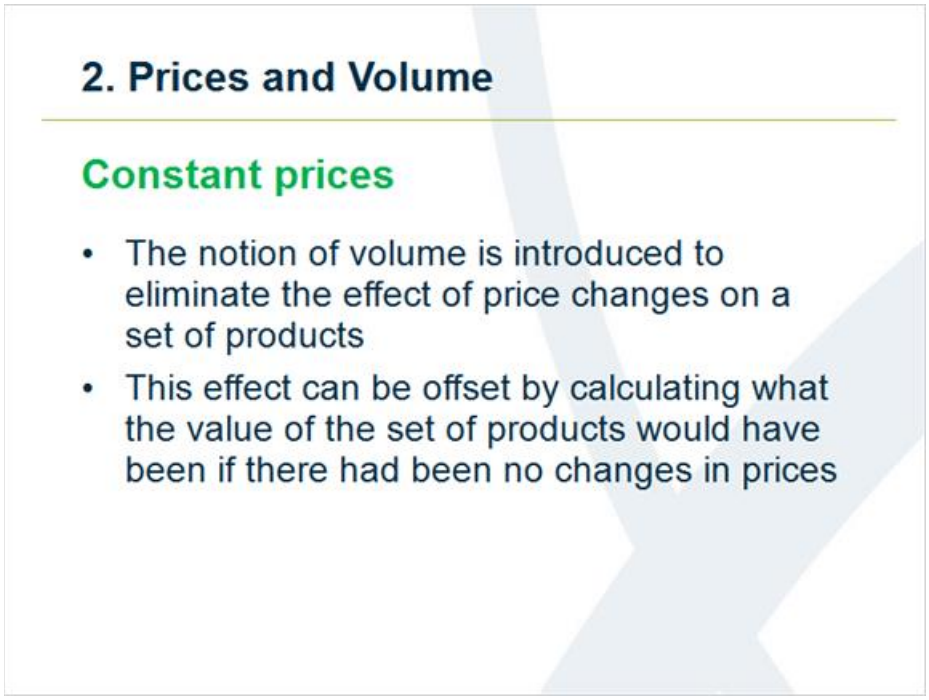
1.8 Volumes



1.9 Decomposing values



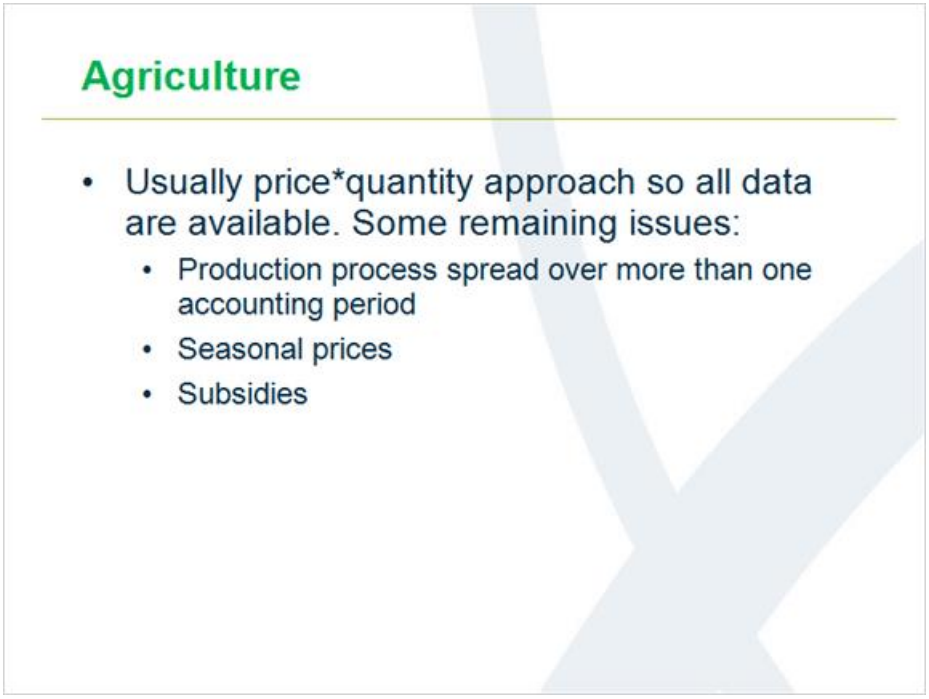
1.10 Constant prices



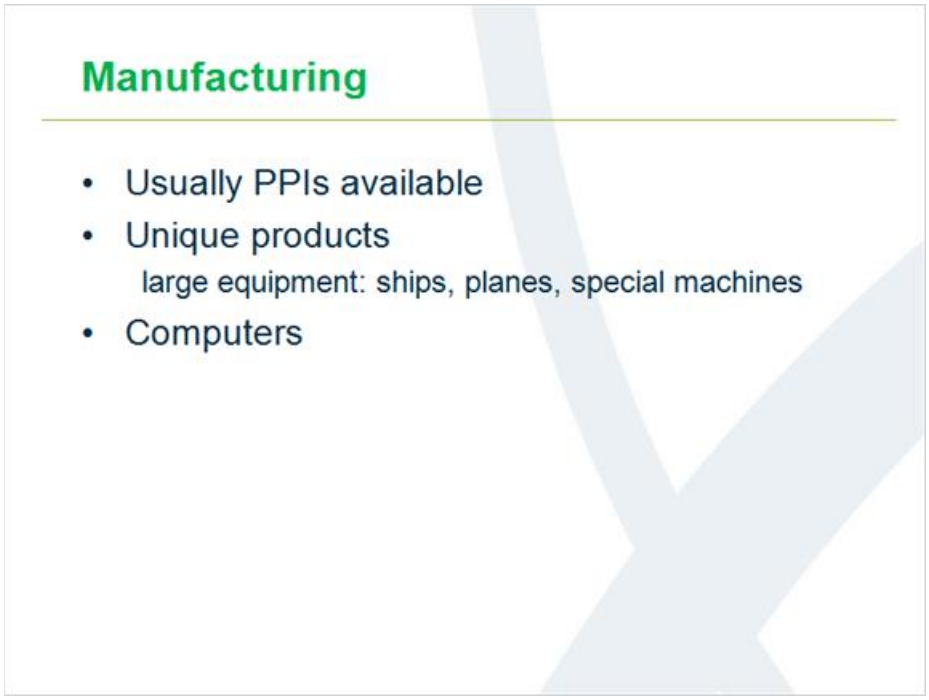
1.11 Deflators for market output

1.12 Deflators for market output

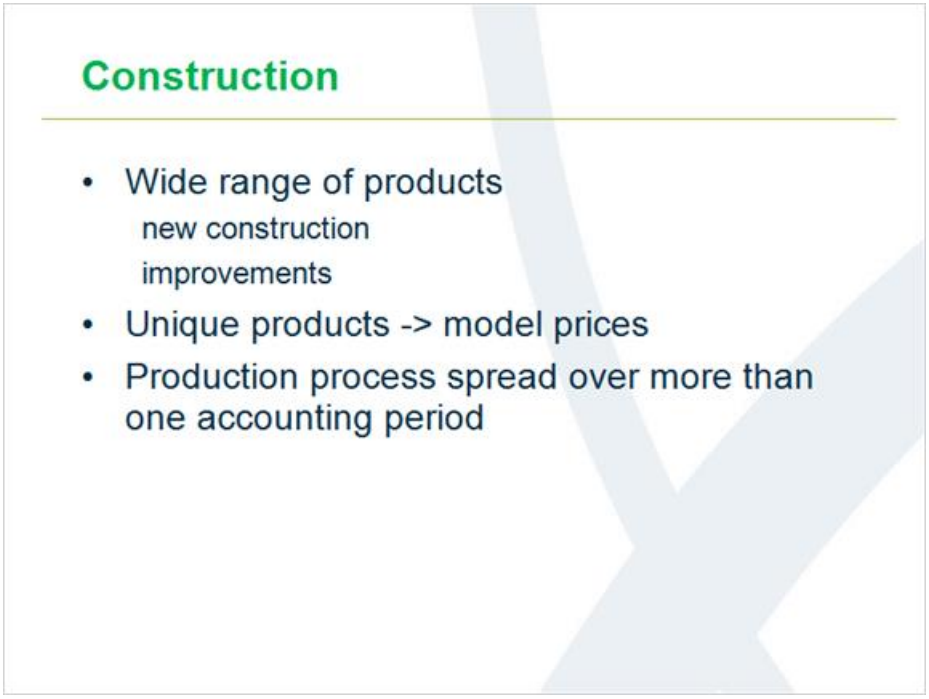
1.13 Agriculture



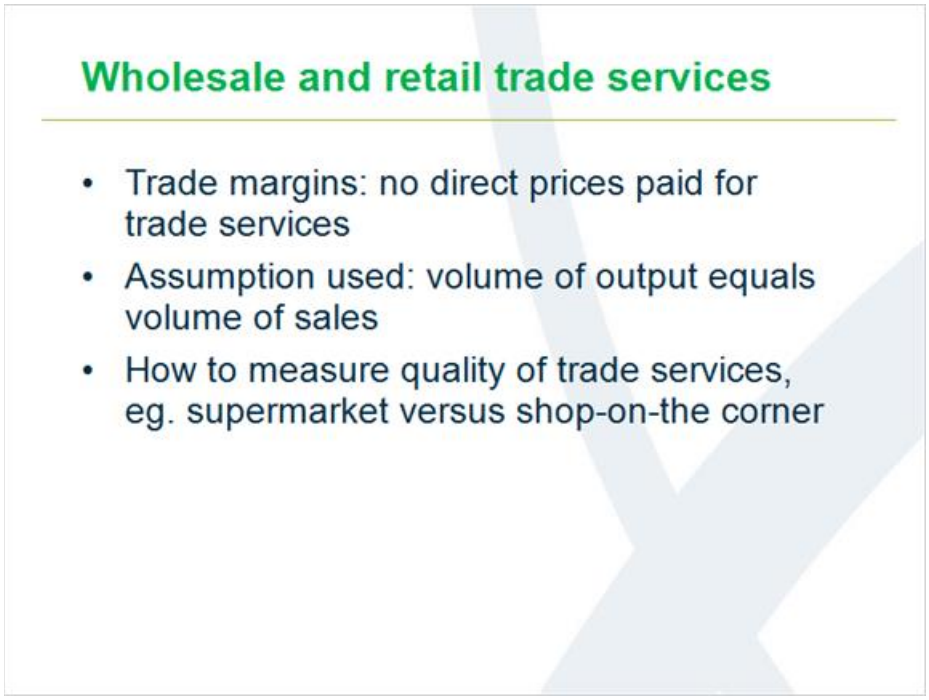
1.14 Manufacturing



1.15 Construction

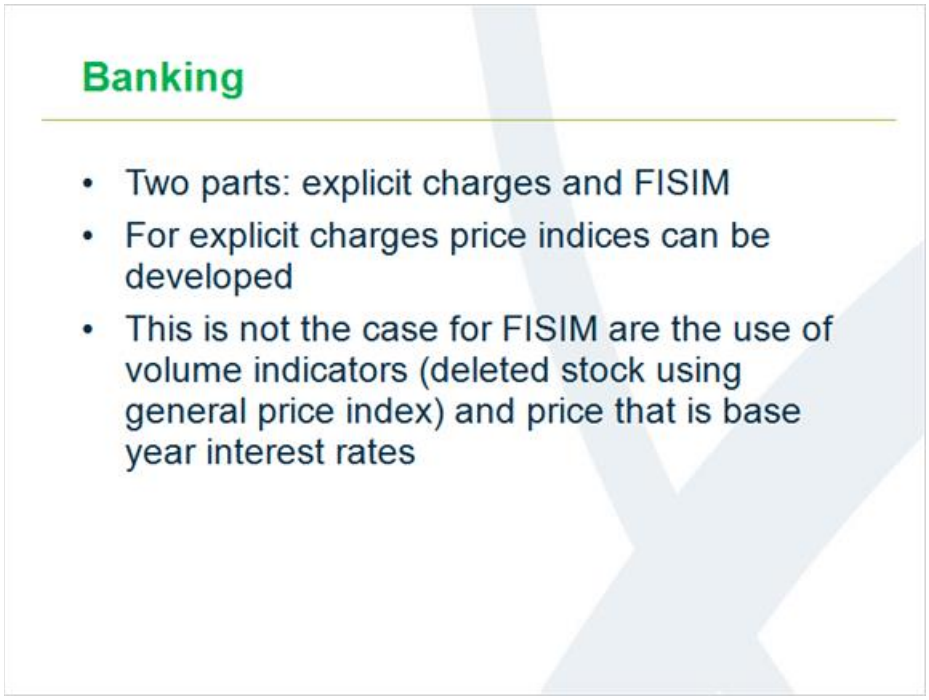


1.16 Wholesale and retail trade services



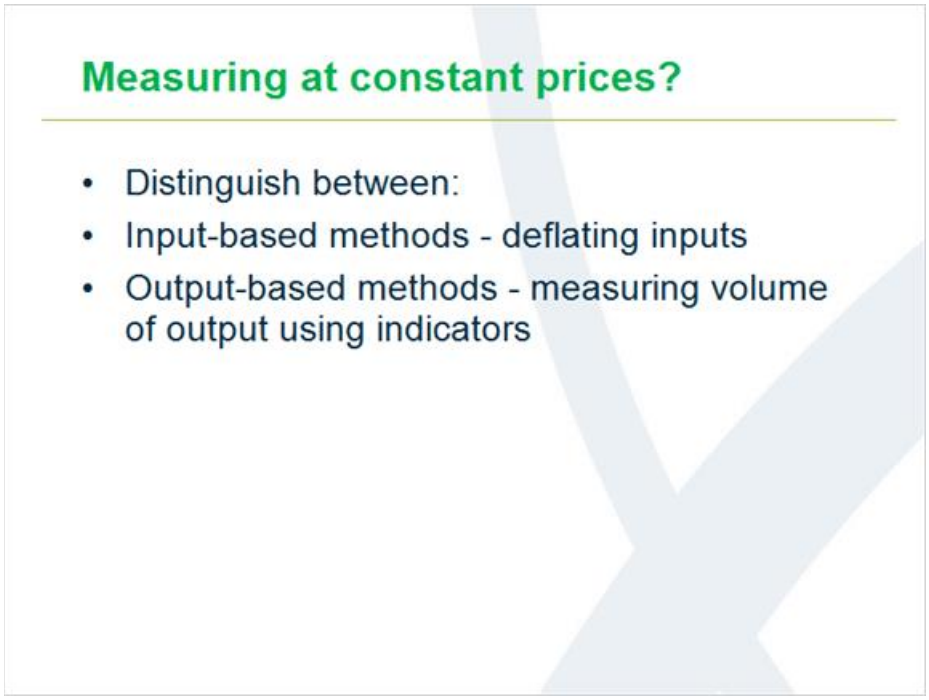
1.17 Transport and communication

1.18 Banking

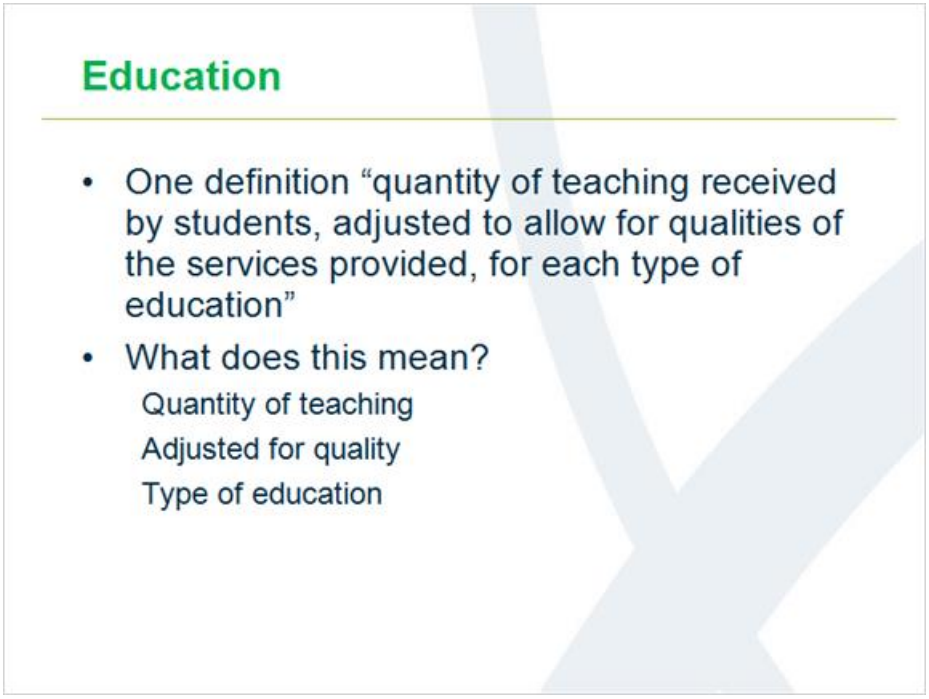


1.19 Non-market services

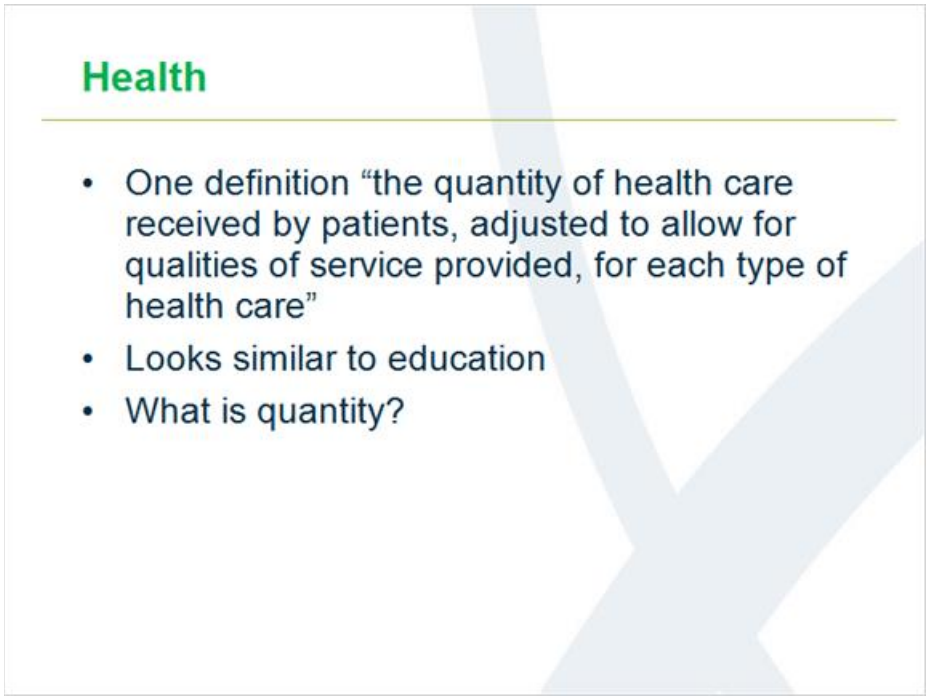
1.20 Measuring at constant prices?



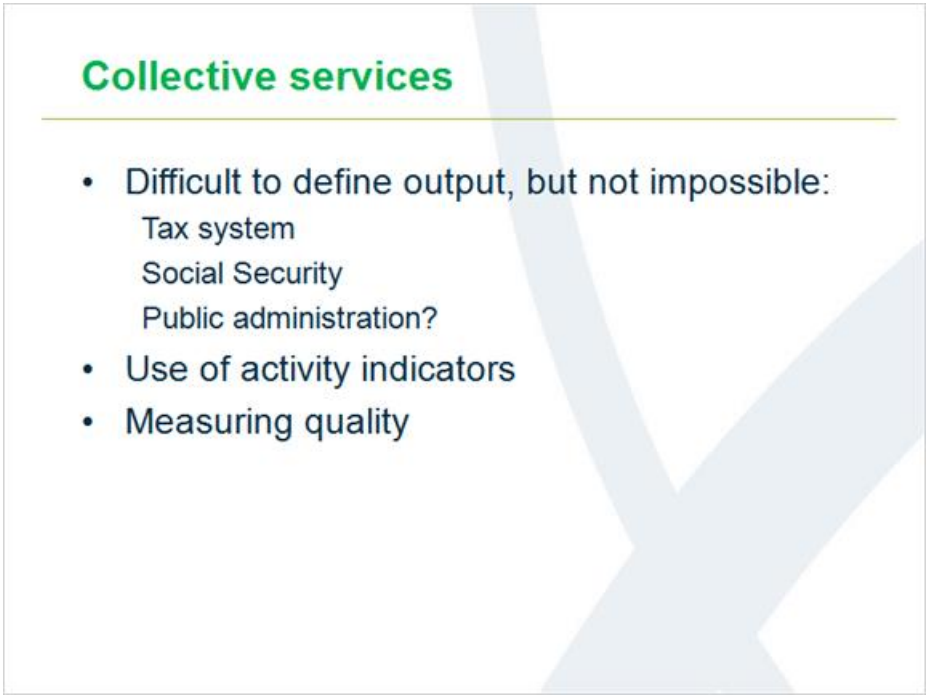
1.21 Education



1.22 Health



1.23 Collective services



1.24 4. Quality change in price indices

1.25 4. Quality change in price indices

1.26 Comparing base and current periods

5. Price and Volume indices

Comparing base and current periods

- The value of a set of products in the current period is: $v^1 = \sum_i p_i^1 \times q_i^1$
- The volume can be defined as $Vol = \sum_i p_i^0 \times q_i^1$
- The volume index is: $IVol = \frac{\sum_i p_i^0 \times q_i^1}{\sum_i p_i^0 \times q_i^0}$

1.27 5. Price and Volume indices

5. Price and Volume indices

Table 1 Car Production

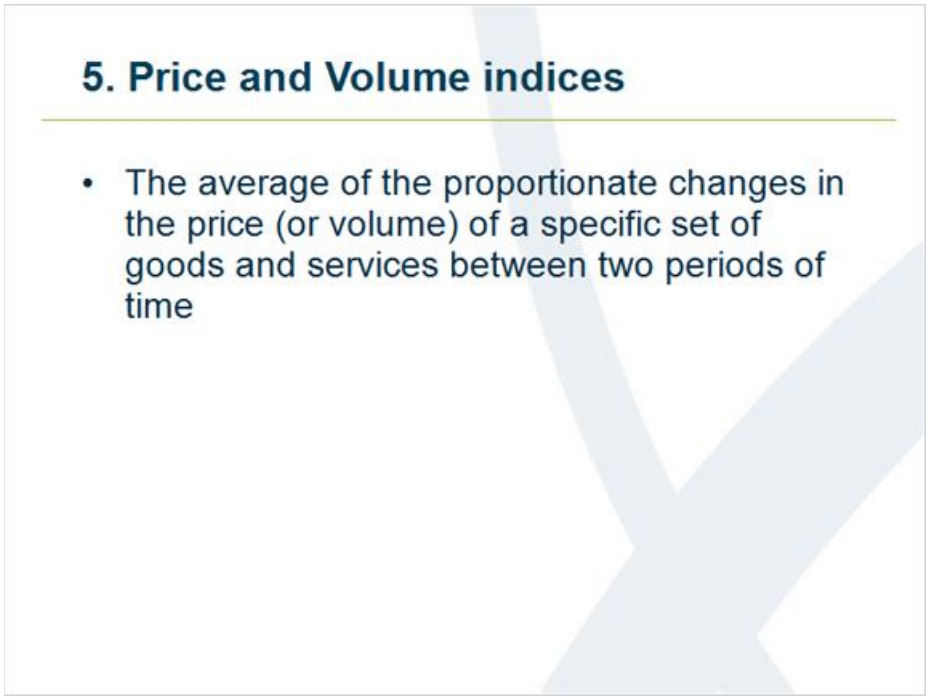
	Year 0			Year 1			
	Price (000 $/un.) (1)	Quantity (No.) (2)	Value (000 $) (3) = (1)*(2)	Price (000 $/un.) (4)	Quantity (No.) (5)	Value (000 $) (6)=(4)*(5)	Value (year 0 $) (7)=(1)*(5)
Model A	20	15	300	40	24	960	480
Model B	10	15	150	20	6	120	60
Σ		30	450		30	1,080	540

Values in column (6) are in current prices showing a 140 percent increase over year 0 (index = 1080/450 = 240)

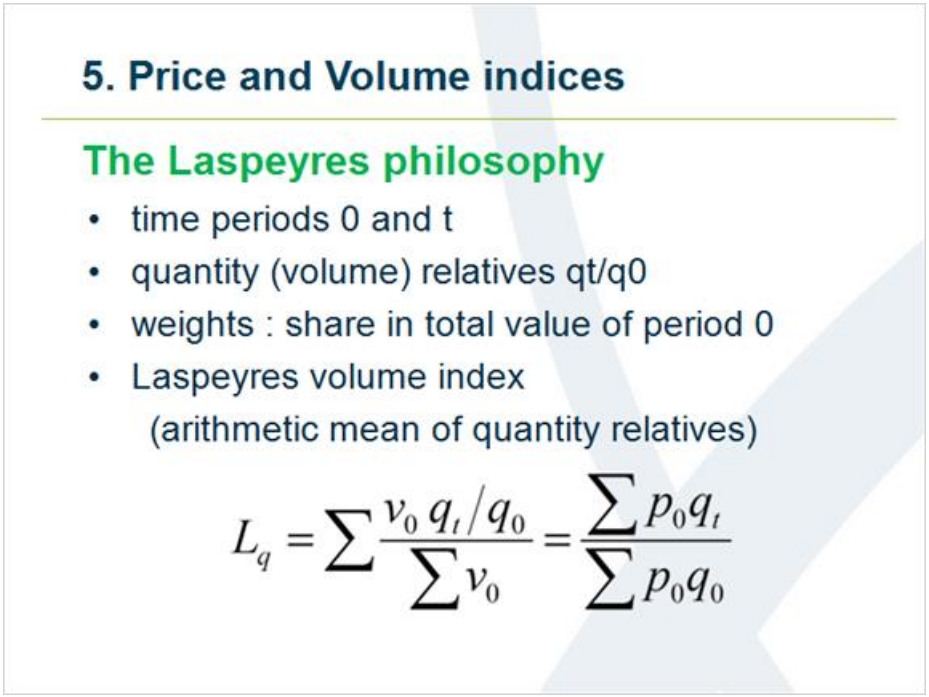
Values in column (7) are at constant prices of year 0, they reflect changes in quantity and/or quality.

- ➢Values at constant prices are an aggregated volume measure, expressed in money terms and additive

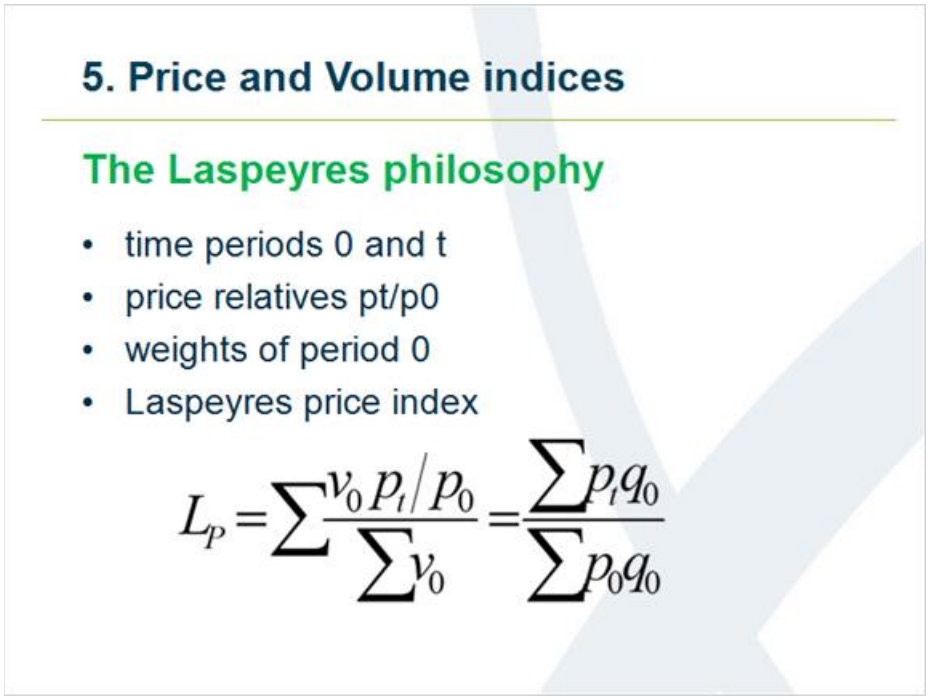
1.28 5. Price and Volume indices



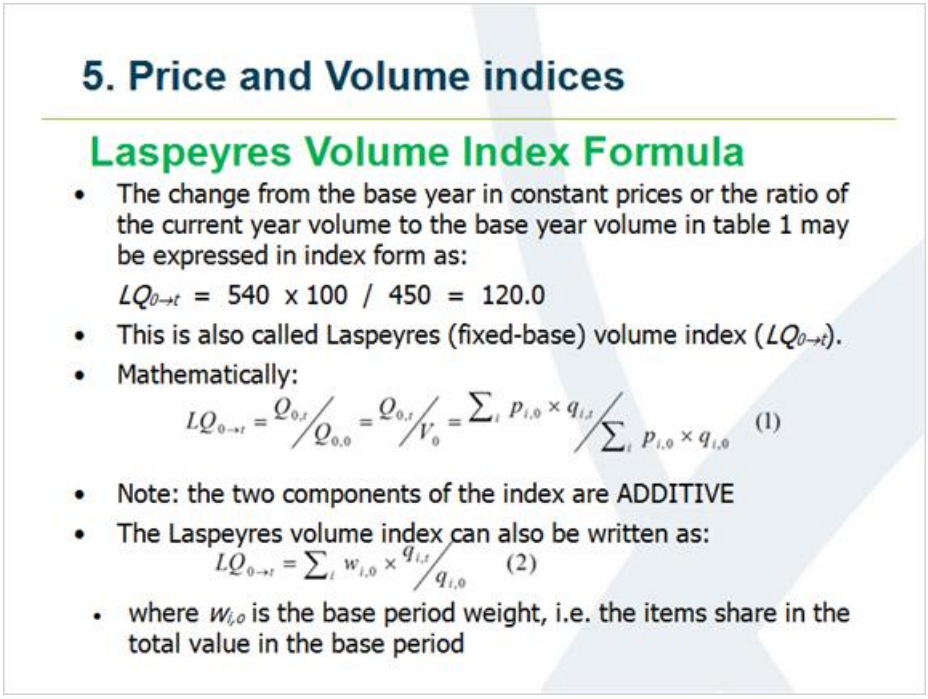
1.29 The Laspeyres philosophy



1.30 The Laspeyres philosophy



1.31 Laspeyres Volume Index Formula



1.32 The Laspeyres philosophy

5. Price and Volume indices

The Laspeyres philosophy

Table 2

	Year 0				Year 1		
	Price (000 $/un.)	Quantity (No.)	Value (000 $)	Weight (w_0)	Quantity (No.)	Quantity relatives (QR)	w_0*QR
	(1)	(2)	(3) = (1)*(2)	(4)=(3)/Σ(3)	(5)	(6)=(5)/(2)	(7)=(4)*(6)*100
Model A	20	15	300	66.7%	24	1.6	107
Model B	10	15	150	33.3%	6	0.4	13
Σ		30	450		30		120

1.33 Paasche Price Index Formula

Paasche Price Index Formula

- To factor the change in the value of car production from year 0 to year 1 arising from **price** changes.
  - take the ratio of the value of output in current prices in year 1 to the value of output in year 1 measured in constant prices (prices of year 0) (and multiply it with 100 to convert to an index form):

$PP_{0\to t}$ = 1080 x 100 / 540 = 200.0

Shows 100 percent increase or doubling in prices

The above ratio is also called the Paasche price index ($PP_{0\to t}$). Algebraically:

$$PP_{0\to t} = V_t / Q_{0,t} = \sum_i p_{i,t} \times q_{i,t} \Big/ \sum_i p_{i,0} \times q_{i,t} \quad \text{or} \quad (1)$$

$$PP_{0\to t} = 1 \Big/ \sum_i w_{i,t} \times p_{i,0} / p_{i,t} \quad (2)$$

where $w_{i,t}$ is the current period weight, i.e. the items share in the total value in the current period

1.34 Paasche Price Index Formula

Paasche Price Index Formula

According to the later formulation, $PP_{0\to t}$ is derived as follows from the data in table 1:

Table 3

	Year 0 Price (000 $/un.)	Price (000 $/un.)	Value (000 $)	Year 1 Weight (w_1)	Price relatives (PR)	w_1*PR
	(1)	(2)	(3)	(4)=(3)/Σ(3)	(5)=(1)/(2)	(6)=(4)*(5)*100
Model A	20	40	960	88.9%	0.5	0.44
Model B	10	20	120	11.1%	0.5	0.06
Σ			1,080			0.50
$PP_{0\to t} = 1/\Sigma(w_1 * PR) = (1/0.5) \times 100$						200.00

- The ratio of any aggregate in current prices to the aggregate in constant prices yields an implicit Paasche price deflator
- Price measures for the main national accounts aggregates are (always) derived implicitly

1.35 Value, Volume and Price Indexes

5. Price and Volume indices

Value, Volume and Price Indexes

The change in the current price value of car production from year 0 to year 1 in our example can be expressed algebraically as:

$$V_t / V_0 = \sum_i p_{i,t} q_{i,t} / \sum_i p_{i,0} q_{i,0}$$

Multiplying and dividing by $\Sigma_i \, p_{i,0} q_{i,t}$ gives:

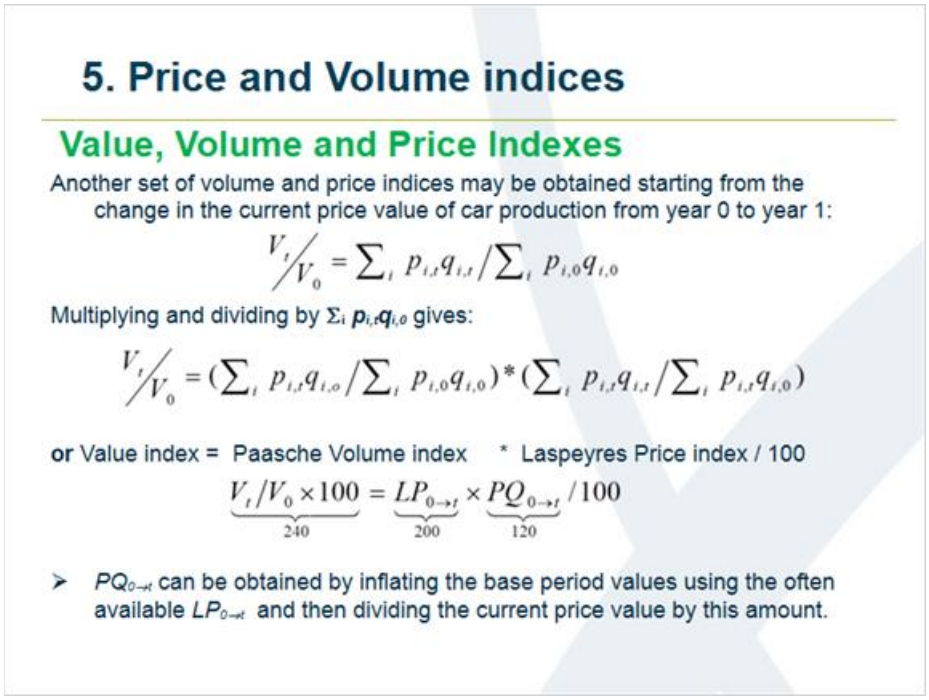
$$V_t / V_0 = (\sum_i p_{i,0} q_{i,t} / \sum_i p_{i,0} q_{i,0}) * (\sum_i p_{i,t} q_{i,t} / \sum_i p_{i,0} q_{i,t})$$

Value index = Laspeyres Volume index * Paasche Price index / 100

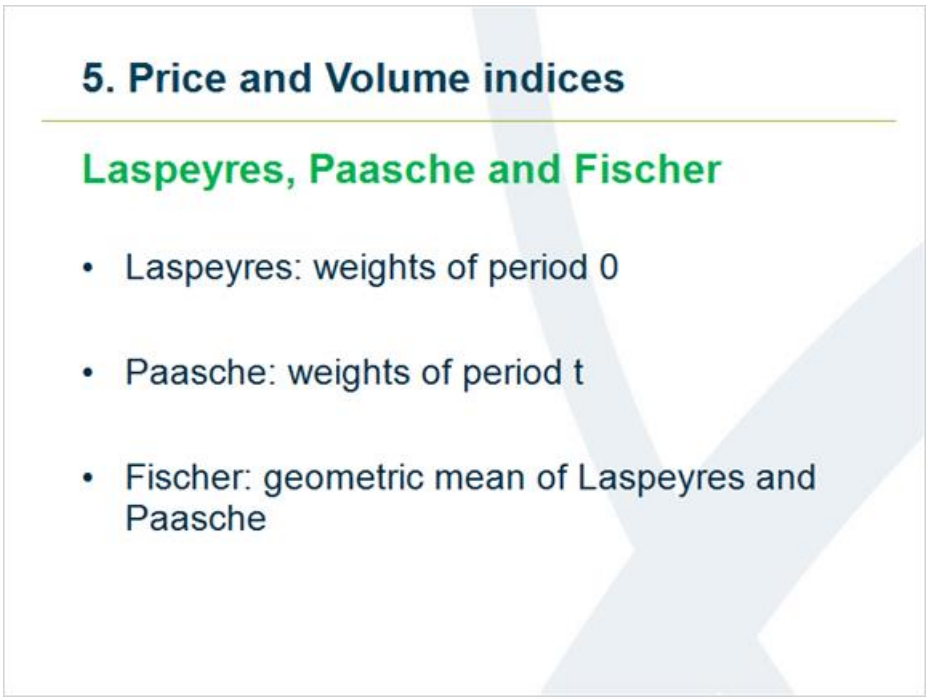
$$\underbrace{V_t / V_0 \times 100}_{240} = \underbrace{LQ_{0\to t}}_{120} \times \underbrace{PP_{0\to t}}_{200} / 100$$

- The volume and price effects of value change are multiplicative
- When V_t and V_0 are known and $PP_{0\to t}$ is available the Laspeyres volume index can be derived indirectly from above formula – a process called price deflation

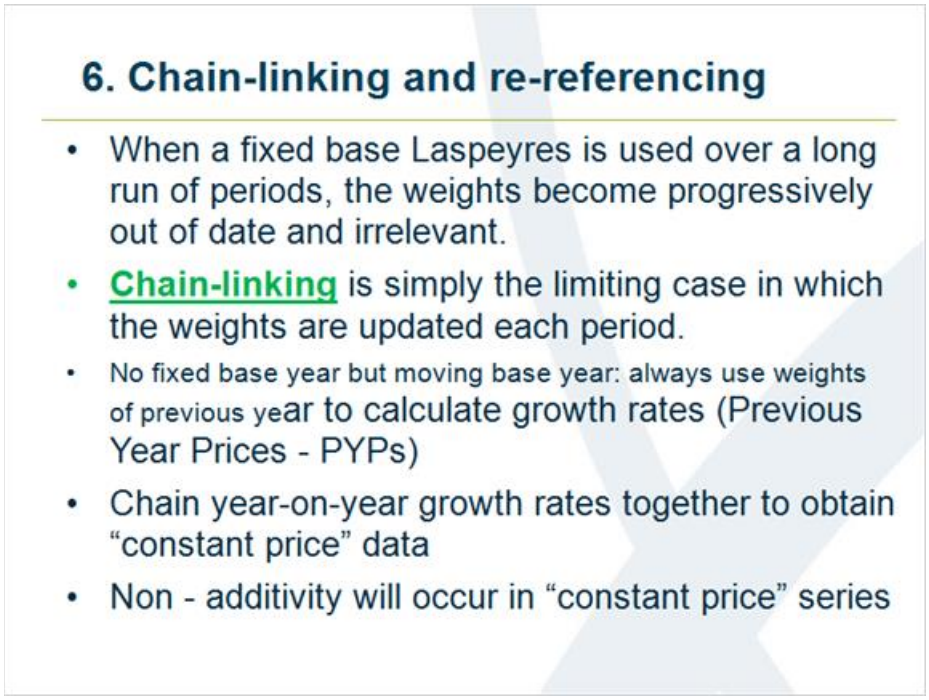
1.36 Value, Volume and Price Indexes



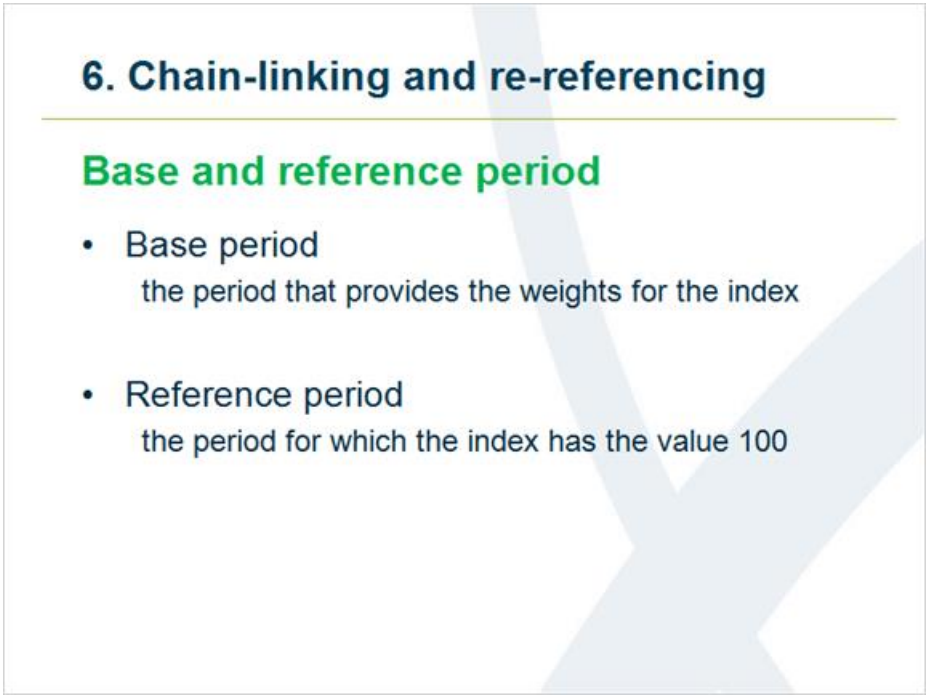
1.37 Laspeyres, Paasche and Fischer



1.38 6. Chain-linking and re-referencing



1.39 Base and reference period



1.40 Re-Referencing

6. Chain-linking and re-referencing

Re-Referencing

Table 6

	2000	2005	2010	2011
Index (reference period 2000=100)	100	110	120	130
Growth rate *(percent)*		*10.0*	*9.1*	*8.3*
New Index (reference period 2010=100)	83.3 (100/120)	91.7 (110/120)	100 (120/120)	108.3 (130/120)
Growth rate *(percent)*		*10.1*	*9.1*	*8.3*

Note:

- Growth rate remains the same
- Re-referencing shifts focus to new reference year
- Values of the other periods are now compared with the value in this year

1.41 6.Change of Base Year. Effect on growth rates

6.Change of Base Year. Effect on growth rates

Table 7

	2000	2005	2010	2011	Growth rate (percent) 2000-05	2005-10	2010-11
Values in current prices							
Wool							
Price	5	10	20	22	*100.0*	*100.0*	*10.0*
Quantity	4	5	6	7	*25.0*	*20.0*	*16.7*
Value	20	50	120	154	*150.0*	*140.0*	*28.3*
Mutton							
Price	15	10	5	4	*-33.3*	*-50.0*	*-20.0*
Quantity	11	10	8	7	*-9.1*	*-20.0*	*-12.5*
Value	165	100	40	28	*-39.4*	*-60.0*	*-30.0*
TOTAL							
Value	**185**	**150**	**160**	**182**	***-18.9***	***6.7***	***13.8***
Values in constant prices of 2000							
Wool	20	25	30	35	*25.0*	*20.0*	*16.7*
Mutton	165	150	120	105	*-9.1*	*-20.0*	*-12.5*
TOTAL	**185**	**175**	**150**	**140**	***-5.4***	***-14.3***	***-6.7***
Values in constant prices of 2005							
Wool		50	60	70		*20.0*	*16.7*
Mutton		100	80	70		*-20.0*	*-12.5*
TOTAL		**150**	**140**	**140**		***-6.7***	***0.0***
Values in constant prices of 2010							
Wool			120	140			*16.7*
Mutton			40	35			*-12.5*
TOTAL			**160**	**175**			***9.4***

1.42 7. Double v. Single deflation/extrapolation

7. Double v. Single deflation/extrapolation

Best method: double deflation/extrapolation

- GVA is derived as output less intermediate consumption at constant prices, both obtained separately

Alternative method:

Single extrapolation

- GVA is extrapolated using output data
- GVA is extrapolated using employment data

Single deflation

- GVA is deflated using output deflator
- GVA is deflated using the wage index
- GVA is deflated using a general price index, e.g. CPI

1.43 7. Illustration of Double Deflation Method

7. Illustration of Double Deflation Method

Double Deflation – Example

	2003							
	Current prices			Price indexes		Constant (2000) prices		
	GO (000 $) (1)	IC (000 $) (2)	GVA (000 $) (3)=(1)-(2)	PPI (2000=100) (4)	ICI (2000=100) (5)	GO (000 $) (6)=(1)/(4)*100	IC (000 $) (7)=(5)*100	GVA (000 $) (8)=(6)-(7)
Mining	7,300.0	3,800.0	3,500.0	210.0	215.0	3,476.2	1,767.4	1,708.7
Manufacturing	12,800.0	6,300.0	6,500.0	185.0	206.0	6,918.9	3,058.3	3,860.7
Total	**20,100.0**	**10,100.0**	**10,000.0**	----	----	**10,395.1**	**4,825.7**	**5,569.4**

	2000 Current prices	2003	
	GVA (000 $) (9)	GVA volume index (2000=100) (10)=(8)/(9)*100	GVA implicit deflator (2000=100) (11)=(3)/(8)*100
Mining	1,735.0	98.5	204.8
Manufacturing	3,680.0	104.9	168.4
Total	**5,415.0**	**102.9**	**179.6**

GO: Gross Output
IC: Intermediate Consumption
GVA: Gross Value Added
PPI: Producer Price Index
ICI: Intermediate Consumption price Index

1.44 7. Illustration of Single Indicator Methods

7. Illustration of Single Indicator Methods

Primary data

Date	Output at current prices (1)	Intermediate consumption current (2)	Value added current prices (3)=(1)-(2)
2000	3,200	2,400	800
2001	2,940	2,100	840
2001	3,680	2,700	980

Date	Output at constant 2000 prices (4)	Paasche price deflator for output (5)=(1)(4)*100	Output volume index (6)=(4) / 3200 * 100
2000	3,200	100.0	100.0
2001	3,000	98.0	93.8
2002	3,100	118.7	96.9

1.45 7. Illustration of Single Indicator Methods

7. Illustration of Single Indicator Methods

Single extrapolation

Date	Value added 2000	Laspeyres volume index output (6)			Value added constant 2000 prices (7)=800*(6) / 100
2000	800	100.0	800*1.000	=	800.0
2001	.....	93.8	800*0.938	=	750.0
2002	.....	96.9	800*0.969	=	775.0

Single deflation

Date	Paasche price deflator for output (5)	Value added current prices (13)=(1)-(2)			Value added constant 2000 prices (14)=(13)(5) * 100
2000	100.0	800.0	800/1.000	=	800.0
2001	98.0	840.0	840/0.980	=	857.1
2002	118.7	980.0	980/1.187	=	825.5

1.46 Thank you