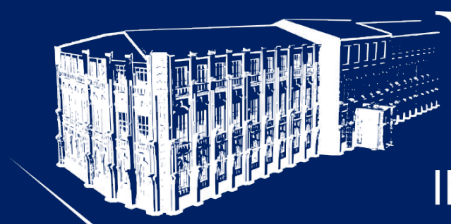


WESTMINSTER

INTERNATIONAL UNIVERSITY IN TASHKENT

An Accredited Institution of the University of Westminster (UK)

LECTURE 4
INDEX NUMBERS

Temur Makhkamov
Indira Khadjieva
QM Module Leaders
tmakhkamov@wiut.uz
i.khadjieva@wiut.uz

Office hours: by appointment
Room IB 205
EXT: 546

Lecture Outline

- To understand the concept of index number and its use in economics, finance and business
- To Represent data in terms of index numbers
- To understand some well-known indices sush as Consumer Price Index, Dow Jones Industrial Averages and the Nasdaq Index

Index Numbers

- Index number is the measure of change in a variable over time
- Index numbers allows relative comparisons over time
- They are typically used in economics to measure trends in a wide variety of areas including: stock market prices, cost of living, imports, exports, industrial or agricultural production and etc,.

Simple Index numbers

When an item is considered:

1) *Fixed base index*
2) *Chain base index*

When a group of items are considered:

1) *Simple mean index*
2) *Simple aggregate index*

AAPL Income Statement

Apple Inc. Common Stock (AAPL)

Nasdaq Listed **Nasdaq** 100

$142.65
+1.15 (+0.81%)
DATA AS OF OCT 01, 2021

Buy Sell

Summary | Chart | Conversations | Statistics | Historical Data | Profile | Financials | Analysis | Options | Holders | Sustainability

Show: **Income Statement** | Balance Sheet | Cash Flow

Annual | Quarterly

Income Statement

All numbers in thousands

Period Ending:	9/26/2020	9/28/2019	9/29/2018	9/30/2017
Total Revenue	$274,515,000	$260,174,000	$265,595,000	$229,234,000
Cost of Revenue	$169,559,000	$161,782,000	$163,756,000	$141,048,000
Gross Profit	**$104,956,000**	**$98,392,000**	**$101,839,000**	**$88,186,000**

Fixed Base Index

- ***Definition***: each value is compared with a value in the same (fixed) base period.

$$I_y = \frac{y_t}{y_0} \times 100$$

Where

I_y = index number of variable 'y'

Y_t = value of variable 'y' at time t

Y_0 = value of variable 'y' in the base period

AAPL Income statement: Fixed Base Index

	2017	2018	2019	2020
Total Revenue	229,234	265,595	260,174	274,515
Cost of Revenue	141,048	163,756	161,782	169,559
Gross Profit	**88,186**	**101,839**	**98,392**	**104,956**

	2017	2018	2019	2020
Total Revenue	229,234	265,595	260,174	274,515
	100	115,862	113,497	119,753
Cost of Revenue	141,048	163,756	161,782	169,559
	100	116,099	114,700	120,214
Gross Profit	**88,186**	**101,839**	**98,392**	**104,956**
	100	115,482	111,573	119,017

Chain Base Index

Definition each value is compared with a value in the preceding period

$$I_y = \frac{Y_t}{Y_{t-1}} \times 100$$

Where

I_y = index number of commodity 'y'

Y_t = value of commodity 'y' at time t

Y_0 = value of commodity 'y' in the base period

AAPL Income statement: Chain Base Index

	2017	2018	2019	2020
Total Revenue	229,234	265,595	260,174	274,515
Cost of Revenue	141,048	163,756	161,782	169,559
Gross Profit	**88,186**	**101,839**	**98,392**	**104,956**

	2017	2018	2019	2020
Total Revenue	229,234	265,595	260,174	274,515
		115,862	97,959	105,512
Cost of Revenue	141,048	163,756	161,782	169,559
		116,099	98,795	104,807
Gross Profit	**88,186**	**101,839**	**98,392**	**104,956**
		115,482	96,615	106,671

Hypothetical Index Composites

Date	Closing Price
01.05.2021	124.61
01.06.2021	136.76
01.07.2021	145.64
01.08.2021	151.60
01.09.2021	141.50
01.10.2021	142.65

Date	Closing Price
01.05.2021	625.22
01.06.2021	679.70
01.07.2021	687.20
01.08.2021	735.72
01.09.2021	775.48
01.10.2021	775.22

Date	Closing Price
01.05.2021	249.68
01.06.2021	270.90
01.07.2021	284.91
01.08.2021	301.88
01.09.2021	281.92
01.10.2021	289.10

Simple Aggregate Index

Date	APPLE	TESLA	MICROSOFT	SUM	Simple Aggregate Index
01.05.2021	124,61	625,22	249,68	999,51	100
01.06.2021	136,76	679,7	270,9	1087,36	108,8
01.07.2021	145,64	687,2	284,91	1117,75	111,8
01.08.2021	151,6	735,72	301,88	1189,2	119,0
01.09.2021	141,5	775,48	281,92	1198,9	119,9
01.10.2021	142,65	775,22	289,1	1206,97	120,8

Simple Aggregate Index

Definition the index is calculated by finding the ratio of the sum of the current values to the sum of the base values.

$$SMA = \frac{\sum P_c}{\sum P_o} \times 100$$

Where

P_c = the current value of an item,

P_0 = the base value of the item

n = number of items

Simple Mean Index

Definition the index is calculated by finding the average (mean) of all the individual price relatives

$$SMI = \frac{\sum \frac{P_c}{P_o}}{n} \times 100$$

Where

P_c = the current value of an item,

P_c = the base value of the item

n = number of items

Simple Mean Index

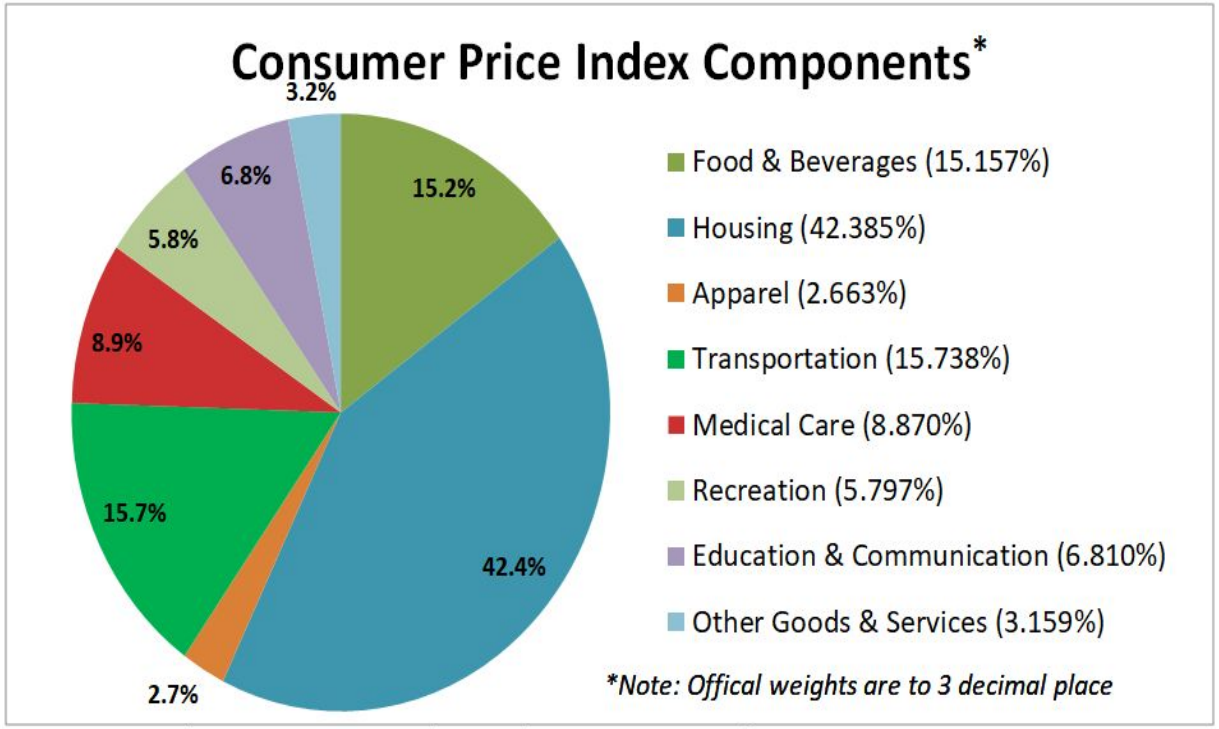
Date	APPLE	Fixed Base Index	TESLA	Fixed Base Index	MICROSOFT	Fixed Base Index	SUM	Simple Mean Index
01.05.2021	124,61	100	625,22	100	249,68	100	300	100,00
01.06.2021	136,76	109,75	679,7	108,71	270,9	108,50	326,96	108,99
01.07.2021	145,64	116,88	687,2	109,91	284,91	114,11	340,90	113,63
01.08.2021	151,6	121,66	735,72	117,67	301,88	120,91	360,24	120,08
01.09.2021	141,5	113,55	775,48	124,03	281,92	112,91	350,50	116,83
01.10.2021	142,65	114,48	775,22	123,99	289,1	115,79	354,26	118,09

The Consumer Prices Index

Consumer Price Index (CPI) - is defined as the change in the prices of a basket of goods and services that are typically purchased by specific groups of households.

CPI is the main index used

to measure Inflation



Source: BLS; The most recent annual reweighting was in December 2020

Dow Jones Industrial Averages

- The Dow Jones Industrial Average (DJIA) - price-weighted average of 30 blue-chip stocks that are generally the leaders in their industry.
- Widely followed indicator of the stock market since October 1, 1928.
- 30 most important market-leading companies on the American stock exchange and reflects their growth

The Nasdaq Index

- The Nasdaq 100 includes the shares of the 100 largest American and international companies as measured by their market capitalization which do not come from the financial sector and which are traded on the largest electronic stock exchange in the USA.
- The shares included in it are weighted according to market capitalization
- The index level represents the average of the shares included in it.
- Dividend payments are not considered when calculating the index.

Concluding remarks

Today, you learnt:

- The method of indexing data
- The different types of indices used to show the change of the data over time

Essential readings

- Jon Curwin…, “Quantitative methods…”, Ch 7
- Glyn Burton…, “Quantitative methods…”, Ch 8
- Richard Thomas, “Quantitative methods…”, Ch 5.1-5.3
- Mik Wisniewski…, “Foundation Quantitative…”, Ch 7
- Clare Morris, “Quantitative Approaches…”, Ch 7
- Louise Swift “Quantitative methods…”, Ch DD2.