INDEX NUMBERS

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AGENDA

I. Preliminary
II. Measures of dynamic
III. Linked Volumes
IV. Simple index numbers
V. Aggreagate index numbers

PRELIMINARY

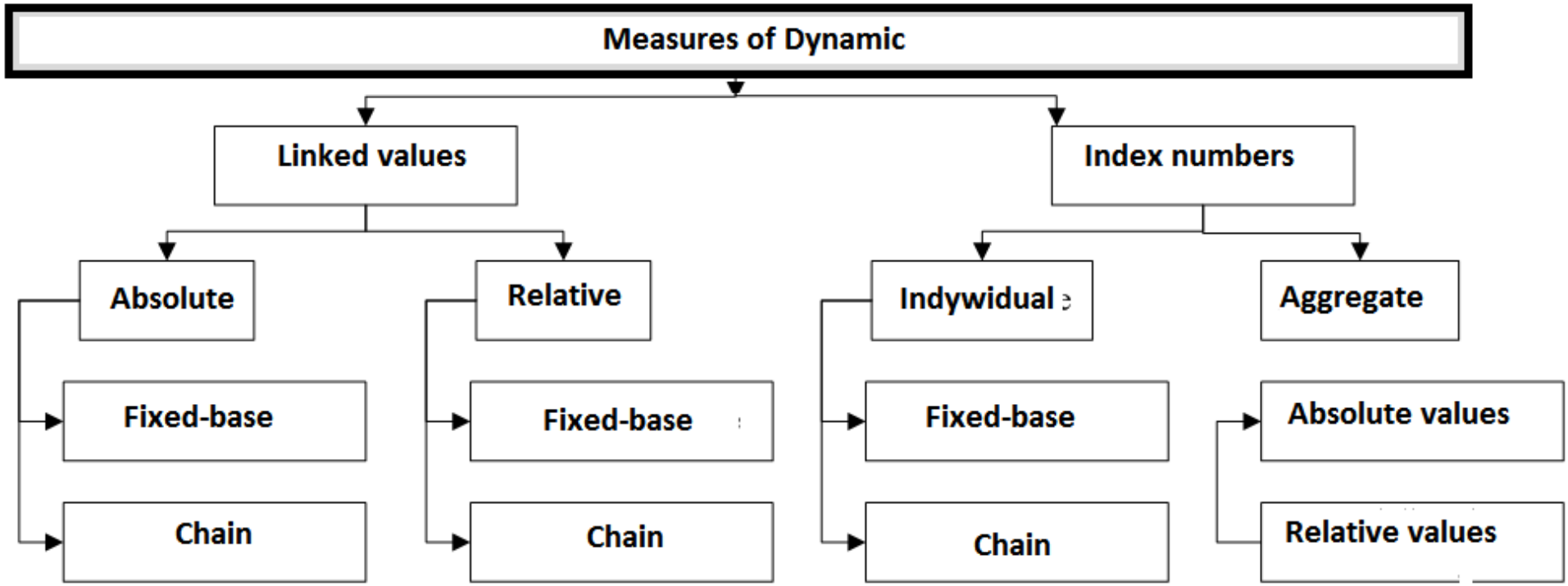
Index number- a ratio, expressed as a percentage, that relates to two or more time periods, one of which is designated as a base period.

The data to be compared may be prices, quantities, money values.

Index numbers measure the changes over time of particular time series data.

The basic function - describe the change in some variable over time, in as straightforward a manner as possible.

MEASURES OF DYNAMIC



LINKED VOLUMES

		Fixed-base	Chain
Linked volumes	Absolute	$\Delta x_{t/0} = x_t - x_0$	$\Delta x_{t/t-1} = x_t - x_{t-1}$
	Relative	$w_{t/0} = \frac{x_t - x_0}{x_0}$	$w_{t/t-1} = \frac{x_t - x_{t-1}}{x_{t-1}}$

SIMPLE INDEX NUMBERS

		Fixed-base	Chain
Indices	Indywidual	$i_{t/0} = \frac{x_t}{x_0} * 100$ $i_{t/0} = \frac{x_t}{x_0}$	$i_{t/t-1} = \frac{x_t}{x_{t-1}} * 100$ $i_{t/t-1} = \frac{x_t}{x_{t-1}}$

In comparison to base-period

$i_{t/0} = 1$ $i_{t/0} = 100$

$i_{t/0} < 1$ $i_{t/0} < 100$

$i_{t/0} > 1$ $i_{t/0} > 100$

Remain unchanged

Decrease

Increase

In comparison to previous-period

$i_{t/t-1} = 100$ $i_{t/t-1} = 1$

$i_{t/t-1} < 100$ $i_{t/t-1} < 1$

$i_{t/t-1} > 100$ $i_{t/t-1} > 1$

TASK. 1.

Construct the fixed-base index of average hourly earnings of private nonagricultural workers. Select 1960 as the base year.

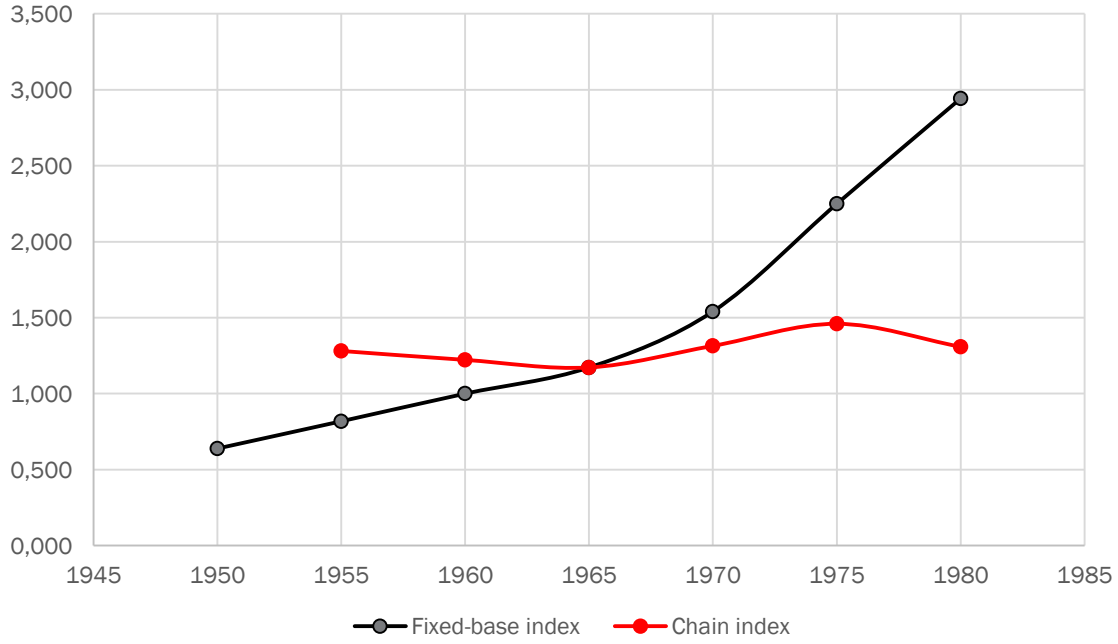
Construct the chain index of average hourly earnings of private nonagricultural workers.

The data are presented in the table.

Year	Average hourly earnings ($)
1950	1.335
1955	1.710
1960	2.090
1965	2.450
1970	3.220
1975	4.700
1980	6.150

TASK. 1.

Year	Average hourly earnings ($)	Fixed-base index	Chain index
1950	1,335	0,639	
1955	1,71	0,818	1,281
1960	2,09	1,000	1,222
1965	2,45	1,172	1,172
1970	3,22	1,541	1,314
1975	4,7	2,249	1,460
1980	6,15	2,943	1,309



AVERAGE CHANGES

Average absolute linked value

$$\Delta \bar{x} = \frac{1}{n} \sum_{i=1}^{n} \Delta x_t = \frac{x_n - x_0}{n}$$

Average growth rate

$$\bar{i} = \sqrt[n-1]{\frac{x_2}{x_1} * \frac{x_3}{x_2} * \frac{x_4}{x_3} * \ldots * \frac{x_n}{x_{n-1}}} * 100 = \sqrt[n-1]{\frac{x_n}{x_1}} * 100$$

Average rate of change

$$\overline{w} = \bar{i} - 100$$

IS IT POSSIBLE TO REBASE THE INDEX?

Fixed-base indices → Fixed-based indices with different base

Fixed-base indices → Chain indices

Chain indices → Fixed-base indices

SIMPLE AGGREGATE INDEX

$$I_1 = \left(\frac{\sum_{i=1}^{n} P_{1i}}{\sum_{i=1}^{n} P_{0i}} \right) * 100$$

I_1 - Index in the current year

P_{1i} - Current-year price of commodity *i*

P_{0i} - Base-year price of commodity *i*

TASK 2.

Construct a simple aggregate price index for meat, poultry and fish. Items are shown in table.

Item	June 1991	June 2002
Meats:		
Beef and Veal	$2.75	$3.02
Pork	$2.02	$2.21
Other meats	$2.17	$2.39
Poultry	$2.05	$2.21
Fish	$2.85	$3.20

$$I_1 = \left(\frac{\sum_{i=1}^{n} P_{1i}}{\sum_{i=1}^{n} P_{0i}} \right) * 100 = \frac{3.02 + 2.21 + 2.39 + 2.21 + 3.2}{2.75 + 2.02 + 2.17 + 2.05 + 2.85} * 100 = 110.1$$

WEIGHTED AGGREGATE INDEX

$$I_1 = \left(\frac{\sum_{i=1}^{n} P_{1i} * Q_{1i}}{\sum_{i=1}^{n} P_{0i} * Q_{0i}} \right) * 100$$

I_1 - Index in the current year

P_{1i} - Current-year price of commodity *i*

Q_{1i} - Current-year quantity of commodity *i* consumed (usualliy in decimal form)

P_{0i} - Base-year price of commodity *i*

Q_{0i} - Base-year quantity of commodity *i* consumed (usualliy in decimal form)

TASK 3.

Construct a weighted aggregate price index for meat, poultry and fish taking into account the consumption habits. Items are shown in table.

Item	June 1991			June 2002		
Meats:	Price	Quantity	Weightening	Price	Quantity	Weightening
Beef and Veal	$2.75	1	0.125	$3.02	1	0.125
Pork	$2.02	1	0.125	$2.21	1	0.125
Other meats	$2.17	1	0.125	$2.39	1	0.125
Poultry	$2.05	4	0.5	$2.21	4	0.5
Fish	$2.85	1	0.125	$3.20	1	0.125

$$I_1 = \left(\frac{\sum_{i=1}^{n} P_{1i} * Q_{1i}}{\sum_{i=1}^{n} P_{0i} * Q_{0i}} \right) * 100 = \frac{3.02 * (0.125) + 2.21 * (0.125) + 2.39 * (0.125) + 2.21 * (0.5) + 3.2 * (0.125)}{2.75 * (0.125) + 2.02 * (0.125) + 2.17 * (0.125) + 2.05 * (0.5) + 2.85 * (0.125)} * 100 =$$

$$= 109.3$$

LASPEYRES INDEX

$$L_1 = \left(\frac{\sum_{i=1}^{n} P_{1i} * Q_{0i}}{\sum_{i=1}^{n} P_{0i} * Q_{0i}} \right) * 100$$

I_1 - Index in the current year

P_{1i} - Current-year price of commodity *i*

P_{0i} - Base-year price of commodity *i*

Q_{0i} - Base-year quantity of commodity *i* consumed (usually expressed as a „weight", in decimal form)

- Special case of the weighted aggregate price index.
- The quantity consumed is held constant from the base year to all years of comparison.**The index without changes in consumption pattern!!!**

TASK 4.

A cake recipe calls for the following ingredients. Compute the Laspeyres index.

Ingredient	Price		Weightening	
	1980	1985	1980	1985
Butter	$1.27	$1.87	0.55	0.50
Sugar	$0.65	$0.95	0.10	0.15
Flour	$1.49	$1.89	0.25	0.20
Eggs	$0.52	$0.85	0.10	0.20

$$L_1 = \left(\frac{\sum_{i=1}^{n} P_{1i} * Q_{0i}}{\sum_{i=1}^{n} P_{0i} * Q_{0i}} \right) * 100 = \left(\frac{1.87 * 0.55 + 0.95 * 0.1 + 1.89 * 0.25 + 0.85 * 0.1}{1.27 * 0.55 + 0.65 * 0.1 + 1.49 * 0.25 + 0.52 * 0.1} \right) * 100 = 1.41\ \%$$

LASPEYRES INDEX - STEPS

Select the appropriate items for a basket

Select the appropriate weights

Select an appropriate items base period

CONSUMER PRICE INDEX

CPI

Consumer price inflation is the speed at which the prices of the goods and services bought by households rise or fall.

Consumer price inflation is estimated by using price indices.

A convenient way of thinking about the CPI

Imagine a very large 'shopping basket' full of goods and services on which people typically spend their money: from bread to ready-made meals, from the cost of a cinema seat to the price of a pint at the local pub, from a holiday in Spain to the cost of a bicycle.

The content of the basket is fixed for a period of 12 months, however, as the prices of individual products vary, so does the total cost of the basket. The CPI, as a measure of that total cost, only measures price changes. If people spend more because they buy more goods this is not reflected in the index. The quantities or 'weight' of the various items in the basket are chosen to reflect their importance in the typical household budget.

CONSUMER PRICE INDEX

CPI

Different basket in each country

A convenient way of thinking about the CPI

The CPI is compiled using around 700 separate representative items. Their movements are taken to represent the price changes for all goods and services covered by the index, including those for which prices are not specifically monitored.

There are, for example, several items in the basket covering purchases of bread - such as a large white sliced loaf and large wholemeal loaf - that are combined together to estimate the overall change in bread prices.

CPI in England- Structure and 2013 Weights

Divisions		Weight
01	Food and Non-Alcoholic Beverages	106
02	Alcoholic Beverages and Tobacco	44
03	Clothing and Footwear	68
04	Housing, Water, Electricity, Gas and Other Fuels	137
05	Furniture, Household Equipment and Maintenance	59
06	Health	25
07	Transport	148
08	Communications	31
09	Recreation and Culture	141
10	Education	21
11	Restaurants and Hotels	117
12	Miscellaneous Goods and Services	103

Groups and classes		Weight
01.1	**Food**	**93**
01.1.1	Bread and cereals	16
01.1.2	Meat	21
01.1.3	Fish	4
01.1.4	Milk, cheese and eggs	13
01.1.5	Oils and fats	2
01.1.6	Fruit	9
01.1.7	Vegetables including potatoes and tubers	14
01.1.8	Sugar, jam, syrups, chocolate and confectionery	11
01.1.9	Food products nec[1]	3
01.2	**Non-alcoholic beverages**	**13**
01.2.1	Coffee, tea and cocoa	3
01.2.2	Mineral waters, soft drinks and juices	10
02.1	**Alcoholic beverages**	**20**
02.1.1	Spirits	6
02.1.2	Wine	9
02.1.3	Beer	5
02.2	**Tobacco**	**24**
03.1	**Clothing**	**59**
03.1.2	Garments	54
03.1.3	Other clothing and clothing accessories	4
03.2	**Footwear including repairs**	**9**
04.1	**Actual rentals for housing**	**62**
04.3	**Regular maintenance and repair of the dwelling**	**16**
04.3.1	Materials for maintenance and repair	9
04.3.2	Services for maintenance and repair	7
04.4	**Water supply and misc. services for the dwelling**	**11**
04.4.1	Water supply	6
04.4.3	Sewerage collection	5
04.5	**Electricity, gas and other fuels**	**48**
04.5.1	Electricity	19
04.5.2	Gas	26
04.5.3	Liquid fuels	2
04.5.4	Solid fuels	1
05.1	**Furniture, furnishings and carpets**	**20**
05.1.1	Furniture and furnishings	16
05.1.2	Carpets and other floor coverings	4
05.2	**Household textiles**	**8**
05.3	**Household appliances, fitting and repairs**	**9**
05.3.1/2	Major appliances and small electric goods	8
05.3.3	Repair of household appliances	1
05.4	**Glassware, tableware and household utensils**	**5**
05.5	**Tools and equipment for house and garden**	**4**
05.6	**Goods and services for routine maintenance**	**13**
05.6.1	Non-durable household goods	5
05.6.2	Domestic services and household services	8
06.1	**Medical products, appliances and equipment**	**10**
06.1.1	Pharmaceutical products	6
06.1.2/3	Other medical and therapeutic	

CONSUMER PRICE INDEX

CPI

It is important that the index should be representative and kept up-to-date

The CPI measures price changes, not price levels. It is therefore expressed in terms of the comparison of prices relative to, e.g. 2005, when the index is given a value of 100.

A convenient way of thinking about the CPI

The index for January 2013 was 124.4 indicating that £124.40 would buy the same amount of goods and services as £100.00 would have in 2005.
This represents a rise in prices of 24.4 per cent between 2005 and January 2013.
The annual rate of inflation is simply the percentage change in the latest index compared to the value recorded twelve months previously.

PAASCHE INDEX

$$P_1 = \left(\frac{\sum_{i=1}^{n} P_{1i} * Q_{1i}}{\sum_{i=1}^{n} P_{0i} * Q_{1i}} \right) * 100$$

I_1 - Index in the current year

P_{1i} - Current-year price of commodity *i*

P_{0i} - Base-year price of commodity *i*

Q_{1i} - Current-year quantity of commodity *i* consumed (usualliy in decimal form)

TASK 5.

A cake recipe calls for the following ingredients. Compute the Paasche index.

Ingredient	Price		Weightening	
	1980	1985	1980	1985
Butter	$1.27	$1.87	0.55	0.50
Sugar	$0.65	$0.95	0.10	0.15
Flour	$1.49	$1.89	0.25	0.20
Eggs	$0.52	$0.85	0.10	0.15

$$P_1 = \left(\frac{\sum_{i=1}^{n} P_{1i} * Q_{1i}}{\sum_{i=1}^{n} P_{0i} * Q_{1i}} \right) * 100 = \left(\frac{1.87 * 0.5 + 0.95 * 0.15 + 1.89 * 0.2 + 0.85 * 0.15}{1.27 * 0.5 + 0.65 * 0.15 + 1.49 * 0.2 + 0.52 * 0.15} \right) * 100 = 1.43\ \%$$

COMPARISON

LASPEYRES

Holds consumption patterns constant from the base period to the current period

PAASCHE

Always uses current period weights

FISCHER'S INDEX

Fischer's index = $\sqrt{P_1 * L_1}$

TASK 6.

A cake recipe calls for the following ingredients. Compute the Fischer index.

Ingredient	Price		Weightening	
	1980	1985	1980	1985
Butter	$1.27	$1.87	0.55	0.50
Sugar	$0.65	$0.95	0.10	0.15
Flour	$1.49	$1.89	0.25	0.20
Eggs	$0.52	$0.85	0.10	0.15

$$\sqrt{P_1 * L_1} = \sqrt{1.41 * 1.43} = 1.42$$

Thank you for your attention