

What GDP growth?

Dependency of GDP growth rates on methods for price adjustment during times of high inflation

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- Deflators (like CPI) are composite indices and hence just represent growth rates
- Composite indices need two ingrediences
 - Growth rates of the prices we want to use for price adjustments
 - Weights for weighing growth rates together
- Weights should be representative for the periods of which we want to compare price changes. If we want to compare the GDP growth rates of year t to t-1 we consequently should use the weights of t or t-1, or both of them.
- As weights of period t are not available in real time, weights of t-1 are typically used as an approximation. This approximation is based on the assumptions that weights follow (only?) smooth trends.
- In times of crises, however, weights can change quickly from one period to another which makes price adjustment problematic.



- This presentation demonstrates on basis of Austrian GDP data how large the differences real GDP growth can be.
- The used crises scenario is not a hypothetical one but the last Covod-19 pandemic with its following high inflation period.



Figure 1: Sea freight costs





Figure 2: Global Supply Chain Pressure Index









The Laspeyres price index measuring the measuring **current year's quantities** at the **base year's prices**. This is equivalent to weighting price changes (called price relatives) by their component's share in the base year

$$I_{Las}^{p} = \frac{\sum p_{i}^{t} * q_{i}^{0}}{\sum p_{i}^{0} * q_{i}^{0}} = \sum w_{i}^{0} * \left(\frac{p_{i}^{t}}{p_{i}^{0}}\right)$$

with

$$w_i^0 = \frac{p_i^0 * q_i^0}{\sum p_i^0 * q_i^0}$$



The Paasche price index measuring the measuring **base year's quantities** at the **current year's prices**. This is equivalent to weighting price changes (called price relatives) by their component's share in the base year

$$I_{Paa}^{q} = \frac{\sum q_i^t * p_i^t}{\sum q_i^t * p_i^0} = \sum w_i^t * \left(\frac{p_i^t}{p_i^0}\right)$$

with

$$w_i^t = \frac{q_i^t * p_i^t}{\sum q_i^t * p_i^t}$$



As we want to measure GDP growth between two years, it is a good idea to take both of these years into account. We can take the weights of either year. As weights can change even between 2 years considerably, some authors recommend some averages of both years. Irving Fisher proposed to take the geometric average of both price indexes.

$$I_{Fish}^{p} = \sqrt{I_{Las}^{p} * I_{Paa}^{p}}.$$



The granularity of price adjustment is relevant

In order to provide meaningful results, price adjustment should be made at the most detailed level. Otherwise different weighting schemes enter the calculation

Gross domestic product at market prices	Total Construction (gross)		
Final consumption expenditure	Dwellings (gross)		
Household and NPISH final consumption expenditure	Other huildings and structures (gross)		
Final consumption expenditure of households	Other buildings and structures (gross)		
Final consumption expenditure of NPISH	Cultivated biological resources (gross)		
Final consumption expenditure of general government	Intellectual property products (gross)		
Individual consumption expenditure of general government	Changes in inventories and acquisitions less disposals of valuables ¹		
Collective consumption expenditure of general government	Exports of goods and services		
Gross capital formation	Exports of goods		
Gross fixed capital formation			
Machinery and equipment and weapons systems (gross)	Exports of services		
Other machinery and equipment and weapons systems (gross)	Imports of goods and services		
ICT equipment (gross)	Imports of goods		
Transport equipment (gross)	Imports of services		



Four different price indices applied

- Laspeyres price index with the previous year as base year, which is the EU standard as included in published data
- Paasche price index with the current year as the base period
- Fisher quantity index using the geometric average of the Laspeyres and the Paasche quantity index with previous and the current year as the bases
- Laspeyres price index with a fixed base year in 2019



	2020	2021	2022	2023	Cum. growth 2020/2023	2020/2023 Ø growth p.a.
Previous year base	-5.6%	+6.0%	+3.5%	+0.4%	+3.9%	+1.0%
Current year base	-5.2%	+8.9%	+3.6%	+1.0%	+8.0%	+1.9%
Fisher method	-5.4%	+7.4%	+3.5%	+0.7%	+6.0%	+1.5%
Fixed base 2019	-5.6%	+6.9%	+3.2%	+0.9%	+5.1%	+1.3%



Key findings

- annual growth rates vary widely
- but periods of expansion and contraction appear to be persistent across methods
- Medium term growth rate affected strongly with consequences for productivity measures
- Chain-linking freezes past growth rates what can distort the level of the timeseries
- The IMF's Quarterly National Accounts manual recommends the uses of a pre-crises bases year in times of strongly changing weight structure
- Here, the fixed-base-year approach delivers similar medium term growth results as the Fisher method, which is also recommended by the IMF. Both price adjustment methods could to be superior to the others during times of crisis and high inflation.



Thank you for your attention

