Gross Domestic Product

Lecture 22: The Measurement of Total Production

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Recap: Aggregation ⏪

Last lecture we established **why** we aggregate:

✅ Individual transactions → economy-wide totals

✅ The circular flow: $Y = C + I + G + NX$

✅ Value-added approach avoids double-counting

✅ Three equivalent measurement approaches: **expenditure, income, production**

Today we go deep on the most important aggregate of all:

👉 **Gross Domestic Product (GDP)** — the economy's single most-watched number

Part I: What Exactly is GDP?

The Definition — Three Parts 📏

GROSS DOMESTIC PRODUCT (GDP)

is the **market value** 1️⃣ of **final goods and services** 2️⃣ **produced in a country** during a **given period of time** 3️⃣

Each word matters. Let us unpack all three parts carefully.

1️⃣ Market Value — Why Use Prices?

A modern economy produces **thousands** of different goods and services:

- Hotel nights 🏨
- Flights ✈️
- Restaurant meals 🍴
- Sunscreen ☀️
- Legal advice 💼

1️⃣ Market Value — Why Use Prices?

You cannot simply **add them up** in physical units. How many hotel nights equal one flight?

👉 We use **market prices** to convert everything to euros, making addition possible.

$$\text{GDP} = \sum_{n=1}^{N} P_n \times Q_n$$

💡 *Goods that aren't sold on markets (e.g. unpaid domestic work) are NOT included. Government services are included at cost.*

The “Motorália” Example 🏭

From the textbook — imagine a tiny economy producing only **engine filters** and **spark plugs**:

Good	Qty	Price	Value
Engine filters	4	€3.50	€14.00
Spark plugs	6	€5.00	€30.00
Shoes	3 pairs	€20.00	€60.00
GDP			**€104.00**

We cannot add “4 filters + 6 plugs + 3 shoes”. But we *can* add €14 + €30 + €60 = **€104**.

👉 Prices act as **weights** — more valuable goods count for more in GDP.

🤔 Quick check:

If instead the economy produced **3 filters, 3 plugs, and 4 pairs of shoes** (same prices):

$$(3 \times 3.50) + (3 \times 5.00) + (4 \times 20.00)$$

$$= 10.50 + 15.00 + 80.00 = \mathbf{€105.50}$$

GDP is *higher* — even though fewer filters and plugs were made — because **shoes are more valuable**.

2️⃣ Final Goods and Services — No Double Counting

FINAL GOODS AND SERVICES

are sold to **end users**. **Intermediate goods** are used as inputs in the production of other goods and are **not counted separately** in GDP.

2️⃣ Final Goods and Services — No Double Counting

The bread chain — tourism breakfast in Porto:

x: Wrong: €0.50 + €1.20 + €2.00 = €3.70 (triple-counts the wheat)

Stage	Revenue	Input cost	Value Added
Wheat farm	€0.50	€0.00	**€0.50**
Flour mill	€1.20	€0.50	**€0.70**
Bakery	€2.00	€1.20	**€0.80**
GDP contribution			**€2.00**

✔️ Right: €0.50 + €0.70 + €0.80 = **€2.00**

🏨 Tourism example:

A tour operator buys bus transport (€20/person) and packages it into a day trip sold for €80/person.

- Bus company value added: the fare they charged their suppliers (say €8 in fuel/maintenance) subtracted from €20 → **€12**
- Tour operator value added: €80 − €20 = **€60**
- Total GDP contribution: **€72**

👉 The €80 ticket price is **not** all GDP — it contains the bus company's contribution too.

3️⃣ Produced in a Country, in a Given Period

"In a country" = within **borders**, regardless of ownership

✔️ A German-owned hotel operating in Lisbon → counted in **Portugal's GDP**

❌ A Portuguese-owned hotel operating in London → counted in **UK's GDP**, not Portugal's

"During a given period" = only **current production** counts

✔️ A new apartment built in 2025 → counts in 2025 GDP

❌ A 20-year-old house sold in 2025 → **not** in 2025 GDP (it was counted when built)

✔️ BUT the estate agent's commission on that sale → **counted** (a new service)

TRICKY CASES:

❓ Stock market purchases? **No** — financial transactions, not production

❓ Government pensions? **No** — transfer payments, not new production

❓ Illegal activities? **No** (in standard accounts) — not market transactions

❓ Tourism spending by foreigners in Portugal? **Yes** — production of services within Portuguese borders → **export of services**

Part II: The Expenditure Approach

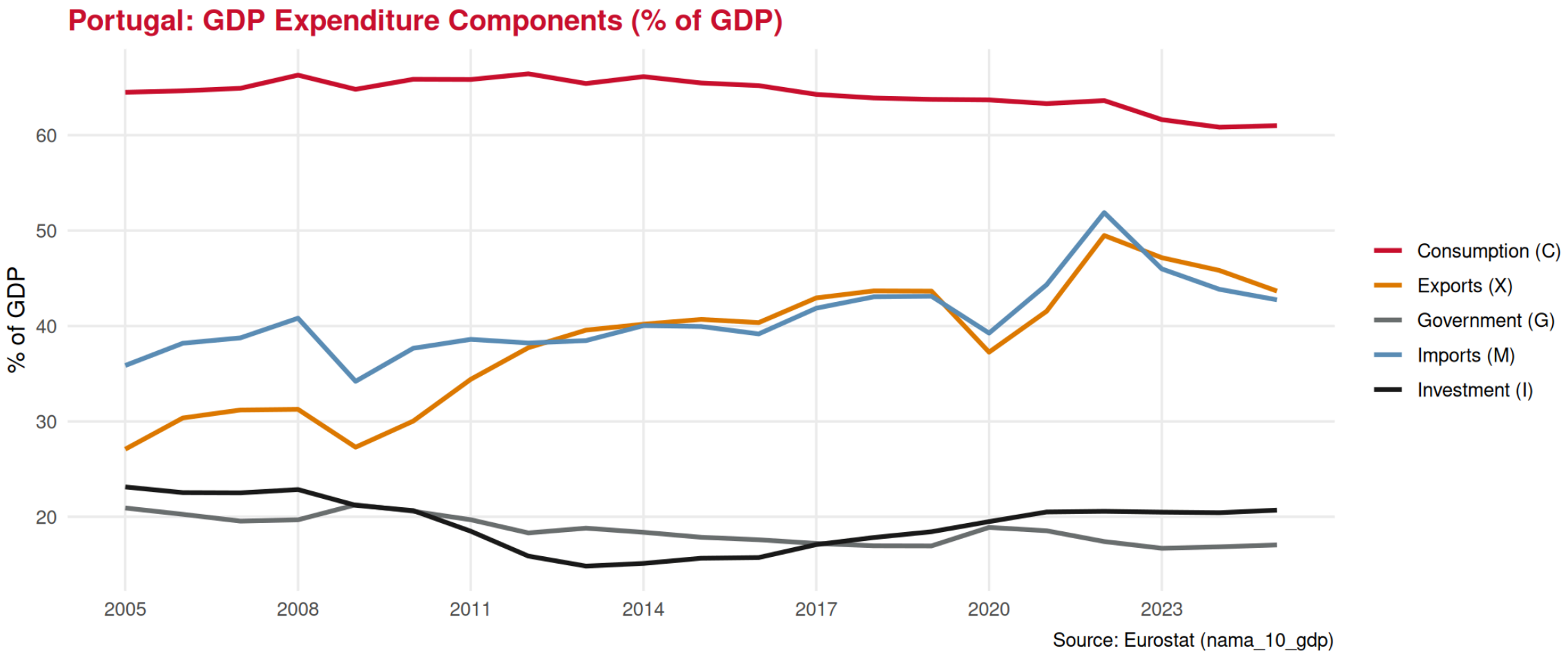
GDP = C + I + G + NX 📊

The **expenditure approach** adds up all spending on final goods and services:

Agent	Component	Symbol	Tourism example
Households	Consumption	**C**	Portuguese family's domestic holiday
Firms	Investment	**I**	Hotel building new pool
Government	Gov. expenditure	**G**	Airport expansion by the state
Rest of world	Net exports	**NX**	German tourist spending in Algarve

$$Y = C + I + G + NX$$

Portugal's GDP Components — A Look at the Data 🇵🇹



👉 Notice how **exports** have grown substantially — tourism plays a major role here.

A Worked Example: Portugal-Sized Economy 📝

Component	Sub-item	€bn
Consumption (C)		**395**
	Durable goods	100
	Non-durable goods	125
	Services	170
Investment (I)		**142**
	Business fixed capital	80
	Residential housing	40
	Inventory change	22
Government (G)		**178**
Net Exports (NX)		**58**
	Exports	95
	Imports	−37
GDP = C+I+G+NX		**773**

Using the structure from the textbook (Table 15), here is a hypothetical national accounts table:

💡 Key observations:

- **C** is always the largest component (~50% of GDP in most economies)
- **I** is the most *volatile* component — it collapses in recessions
- **G** is relatively stable (government keeps spending even in downturns)
- **NX** can be negative (trade deficit) or positive (surplus)

🏖️ Tourism in NX:

When a foreign tourist spends in Portugal, it counts as an **export of services** (increases X and therefore NX).

When a Portuguese resident holidays abroad, it counts as an **import of services** (increases M, reduces NX).

Part III: Nominal vs Real GDP

The Problem with Nominal GDP ⚠️

Nominal GDP is calculated using **current year prices**.

$$\text{Nominal GDP}_t = \sum_n P_{n,t} \times Q_{n,t}$$

The problem: Nominal GDP can rise even if **nothing more is produced** — simply because prices went up.

Example from the textbook — economy producing only pizzas and shorts:

Year	Q Pizza	P Pizza	Q Shorts	P Shorts	
2022	10	€10	15	€5	**(10×10)+(15×5) = €175**
2023	20	€12	30	€6	**(20×12)+(30×6) = €420**

Nominal GDP rose by a factor of **2.4**. But quantities only **doubled**. Why the discrepancy?

👉 **Prices also rose** — inflation inflated the nominal figure.

Real GDP — Stripping Out Inflation 🧹

REAL GDP

values quantities at **base year prices**, removing the effect of inflation:

$$\text{Real GDP}_t = \sum_n P_{n,\text{base}} \times Q_{n,t}$$

Continuing the example — base year = 2022:

$$\text{Real GDP}_{2023} = (20 \times \underbrace{€10}_{\text{2022 price}}) + (30 \times \underbrace{€5}_{\text{2022 price}}) = €200 + €150 = \mathbf{€350}$$

	Nominal GDP	Real GDP
2022	€175	€175 (base year: same)
2023	€420	€350
Change	**×2.4**	**×2.0** ✓

- ✔️ Real GDP correctly shows production **doubled** — matching the actual quantities.

The GDP Deflator 🔥

The gap between nominal and real GDP tells us about **inflation**.

$$\text{GDP Deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

$$\text{Inflation rate} \approx \frac{\text{Deflator}_t - \text{Deflator}_{t-1}}{\text{Deflator}_{t-1}} \times 100\%$$

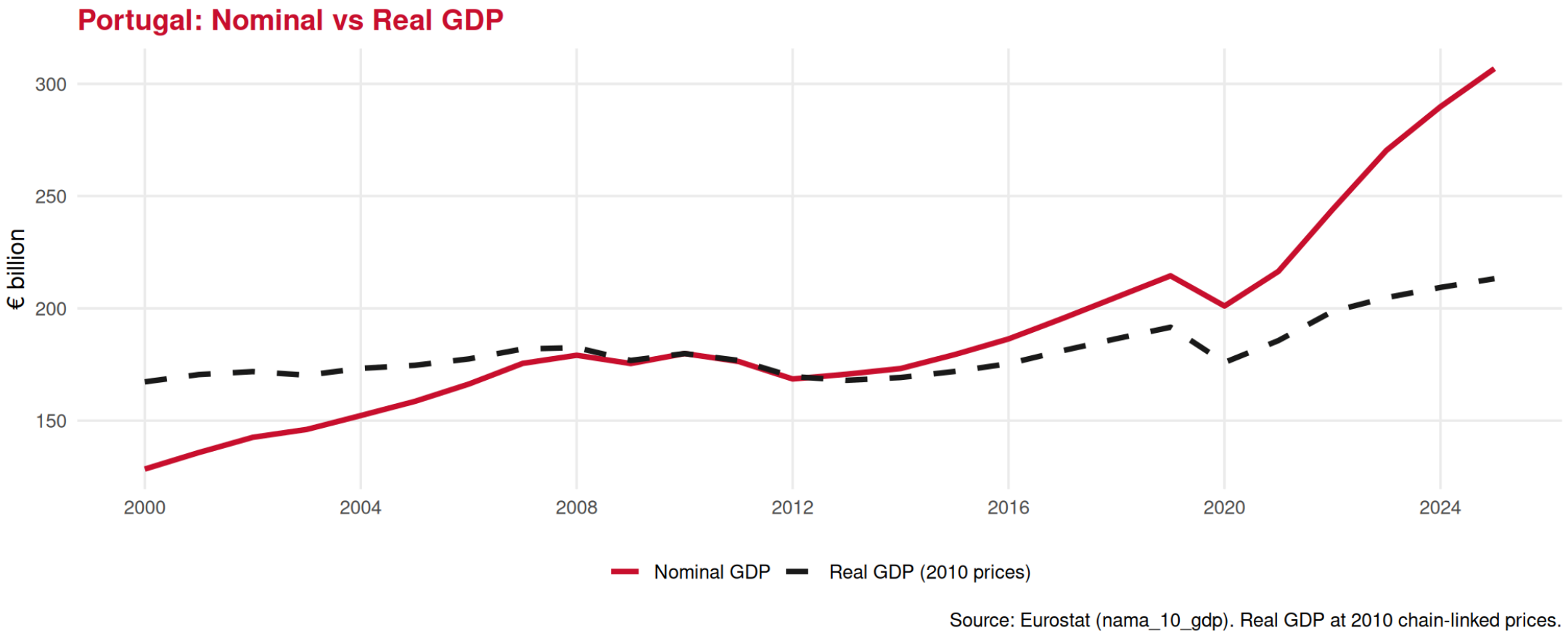
From our example:

$$\text{GDP Deflator}_{2023} = \frac{€420}{€350} \times 100 = \mathbf{120}$$

Prices rose by **20%** between 2022 and 2023.

💡 The GDP deflator is broader than the CPI (covers all goods in the economy, not just a consumer basket) — we will study the CPI in the inflation lecture.

Nominal vs Real GDP — Portugal 🇵🇹



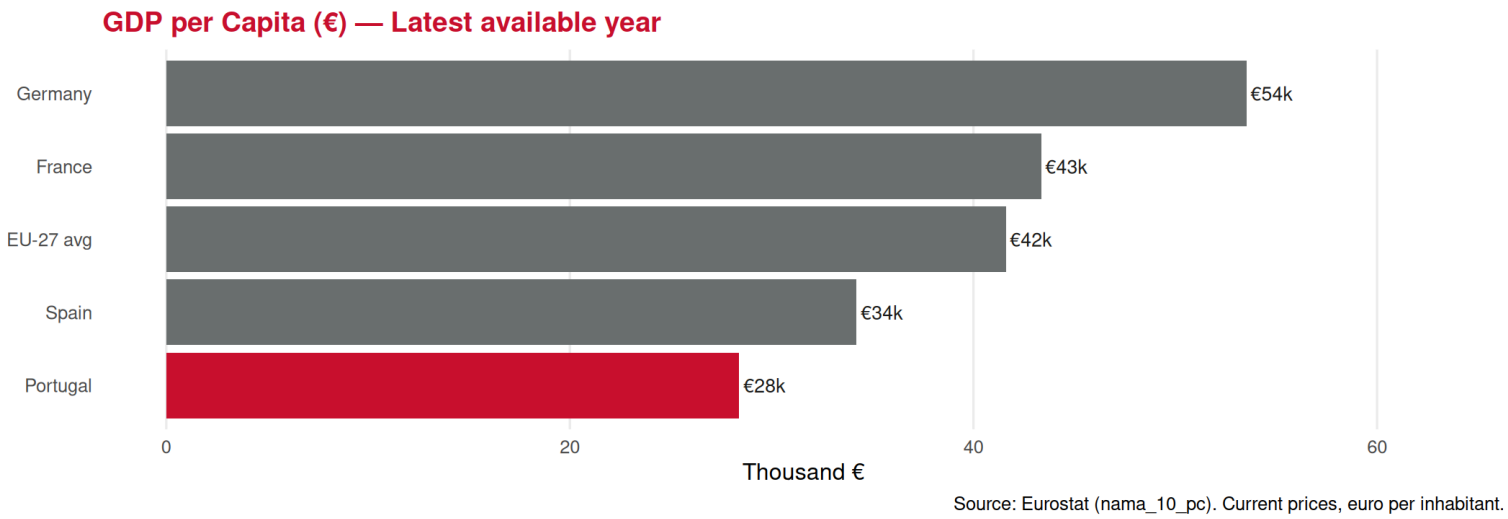
👉 The gap between the two lines = the **price level** rising over time. Always use **real GDP** for growth comparisons.

Part IV: GDP Per Capita and Its Limits

GDP Per Capita — Comparing Across Countries 🌐

A country with a larger population naturally has more GDP. To compare **living standards**, we use **GDP per capita**:

$$\text{GDP per capita} = \frac{\text{GDP}}{\text{Population}}$$



Source: Eurostat (nama_10_pc). Current prices, euro per inhabitant.

What GDP Does NOT Measure ❌

GDP is a powerful summary statistic — but it has important **limitations**:

❌ Inequality

GDP can grow while the bottom half of society gets poorer. A country with GDP/capita €30,000 might have most people earning far less.

❌ Unpaid work

Home cooking, childcare, volunteering — economically valuable, but **invisible** in GDP.

❌ Environmental degradation

Cutting down a forest raises GDP (timber production). Rebuilding it does too. The *loss* of the natural asset is not recorded.

❌ Quality of life

Health, safety, trust, leisure time — not captured by GDP.

❌ Informal economy

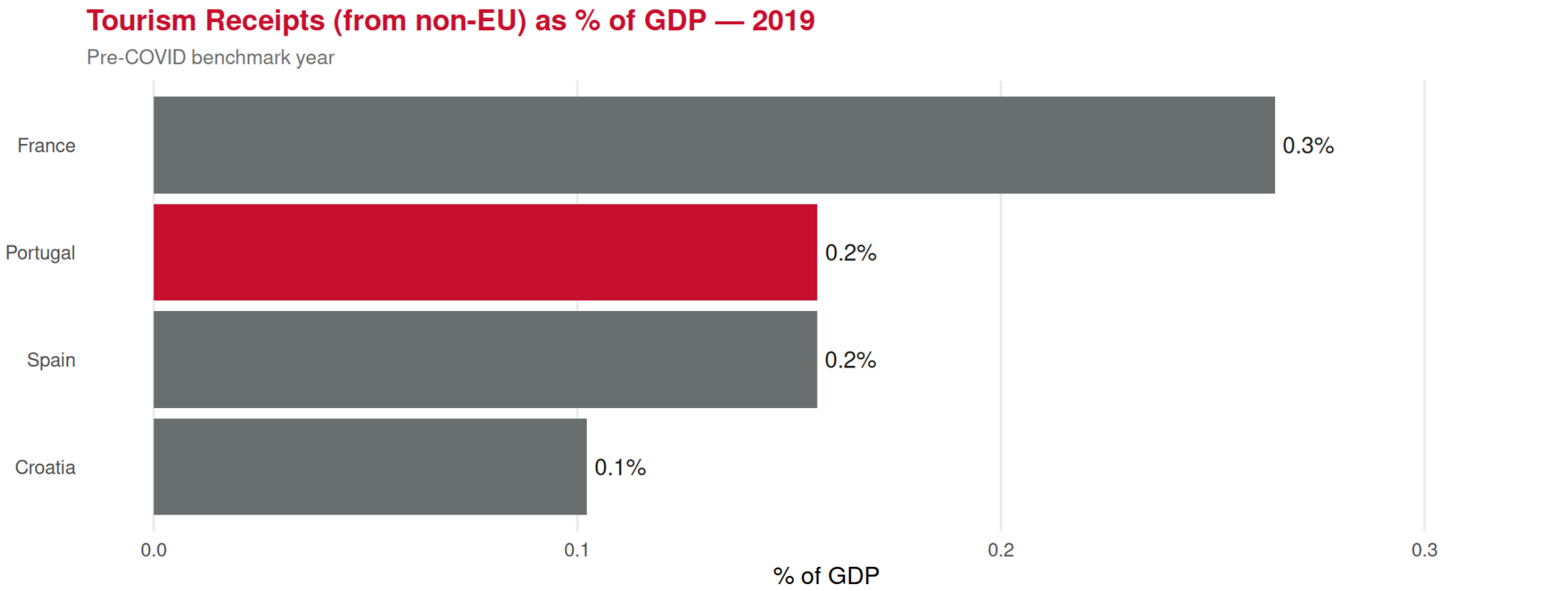
Cash transactions, barter, illegal activity — all absent.

🏖️ For tourism specifically:

A tourist's satisfaction with their experience, the quality of the landscape, or the cultural authenticity of a destination — none of these show up in GDP.

👉 Hence complementary measures: **Human Development Index (HDI)**, **Genuine Progress Indicator (GPI)**, **Tourism Satellite Accounts (TSA)**.

GDP and Tourism Receipts — How Big is the Sector?



Source: Eurostat (bop_its6_det, nama_10_gdp)

Exercises

📝 Exercise 1 — Multiple Choice

In 2022, a small economy produced 100 hotel nights at €80 each and 50 restaurant meals at €20 each. In 2023, it produced 120 hotel nights at €90 each and 60 meals at €25 each. Using 2022 as the base year, what is the real GDP growth rate from 2022 to 2023?

(A) 20%

(B) 25%

(C) 32%

(D) 20% in real terms and 32% in nominal terms — they are the same

Correct answer: (A)

Real GDP 2022 = (100×80) + (50×20) = €8,000 + €1,000 = **€9,000**

Real GDP 2023 (at 2022 prices) = (120×80) + (60×20) = €9,600 + €1,200 = **€10,800**

Growth = (10,800 − 9,000) / 9,000 = **20%**

Nominal GDP 2023 = (120×90) + (60×25) = €10,800 + €1,500 = **€12,300** → nominal growth ≈ 36.7%. Option D is wrong: they differ precisely because prices changed.

📝 Exercise 2 — Multiple Choice

Which of the following is the most accurate statement about GDP per capita as a measure of well-being?

(A) It is a perfect measure of living standards since it adjusts GDP for the size of the population

(B) It captures inequality within the country, making it a reliable welfare indicator

(C) It is a useful but incomplete measure — it misses inequality, unpaid work, environmental quality, and leisure

(D) It includes the value of informal tourism activities such as home-sharing between friends

Correct answer: (C)

GDP per capita is a useful starting point but misses inequality (the same average can hide vast differences), unpaid work, environmental costs, and quality of life. Options A and B overstate its power. Option D is incorrect — informal/non-market transactions are excluded from GDP.

📝 Exercise 3 — Open Question

The table below shows prices and quantities for a small tourism economy (Wakanda) that produces only two goods: hotel nights and guided tours.

Year	Q Hotels	P Hotels	Q Tours	P Tours
2022	500	€100	200	€50
2023	600	€115	250	€60

(a) Calculate **nominal GDP** for 2022 and 2023.

(b) Using 2022 as the base year, calculate **real GDP** for 2023.

(c) Calculate the **GDP deflator** for 2023 and interpret it.

(d) A tourism minister claims: *"Our economy grew by 38% last year."* Is this claim correct? What would be a more accurate statement?

Solution:

(a) Nominal GDP 2022 = (500×100) + (200×50) = €50,000 + €10,000 = **€60,000** Nominal GDP 2023 = (600×115) + (250×60) = €69,000 + €15,000 = **€84,000**

(b) Real GDP 2023 = (600×100) + (250×50) = €60,000 + €12,500 = **€72,500**

(c) GDP Deflator 2023 = (84,000 / 72,500) × 100 = **115.9** Interpretation: the price level rose by approximately **15.9%** between 2022 and 2023.

(d) The minister is citing **nominal** growth: (84,000 − 60,000)/60,000 = **40%** (even higher — the claim is already understated). The **real** growth rate is (72,500 − 60,000)/60,000 = **20.8%**. The correct statement is: *"Our economy's real output grew by approximately 21% — the rest of the nominal increase reflects inflation."*

Summary 📚

Today we covered:

✅ The **three-part definition** of GDP: market value / final goods / produced in a country

✅ The **value-added approach** — avoiding double counting

✅ What is and isn't included (transfer payments, financial transactions, used goods: **out**)

✅ The **expenditure approach**: $Y = C + I + G + NX$

✅ **Nominal vs Real GDP** — why we strip out inflation using base-year prices

✅ The **GDP deflator** as a measure of economy-wide price changes

✅ **GDP per capita** — useful but incomplete as a welfare measure

Next lecture (Lecture 23):

🔥 Inflation in depth — the CPI, how it is measured, consequences of high inflation, and implications for tourism

Thank You! 👋

Questions?

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Next class: Thursday, May 14th, 2026