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Macroeconomia 1

AT2.3: Extension of WS-PS model

2025-2026

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Theory 2.3

Class outline:

- Taxation in the WS-PS model
- Imported inputs
- Module review and model summary

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Aula Teórica 2.3

Bibliografia:

- The CORE Team. (2023). *The Economy 2.0: Macroeconomics* (módulos 2.7-2.13)

Taxation in the WS-PS model

Taxes: what they are and how they are classified

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Taxes are **mandatory financial contributions** paid to the state by individuals and firms, without a direct quid pro quo (which distinguishes them from fees). They are intended to **finance public expenditure** and the pursuit of economic and social objectives, to **redistribute income**, and/or to **encourage or discourage certain behaviors**.

They can be divided **into direct taxes**, which are levied on income or wealth (such as personal or corporate income taxes, IRS and IRC), and **indirect taxes**, which are levied on consumption and transactions (such as the value-added tax, VAT).

Taxes can also be **classified according to their progressivity**: they are **progressive** when the tax rate **increases with the tax base** (income or wealth), **proportional** when the rate **is constant**, and **regressive** when the relative tax burden is **lower for a higher tax base** (income or wealth).

Taxation in Portugal

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Direct Taxes

On income:

- IRS – Personal Income Tax
- IRC – Corporate Income Tax:

i. Municipal surtax
ii. State surtax

On wealth:

- IMI – Municipal Property Tax
- AIMI – Additional IMI
- IMT – Municipal Tax on Onerous Transfers of Property
- IUC – Single Circulation Tax (formerly the "car tax")

Other:

- Stamp Duty (on financial transactions, credit, insurance, gratuitous transfers, etc.)

Indirect Taxes

General consumption tax:

- VAT – Value Added Tax

Excise taxes on consumption:

- ISP – Tax on Petroleum and Energy Products
- IABA – Tax on Alcohol and Alcoholic Beverages
- Tobacco TaxTax on Energy Products and Electricity

Other specific indirect taxes:

- ISV – Vehicle Tax (on first registration)
- Gambling Tax

Taxation in the WS-PS model

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In our analysis of the impact of taxes within the WS–PS model, we will consider two types of taxes:

- taxes on consumption
- taxes on labour.

Consumption tax: we assume **a tax rate t_v**, such that the **price** paid by the consumer, P^c, is **increased by that proportion**:

$$P^c = P \cdot (1 + t_v)$$

Labour tax: we assume **a tax rate t^d**, such that the **total cost of labor** for the employer, W^{gross}, differs from the amount received by the worker by that proportion:

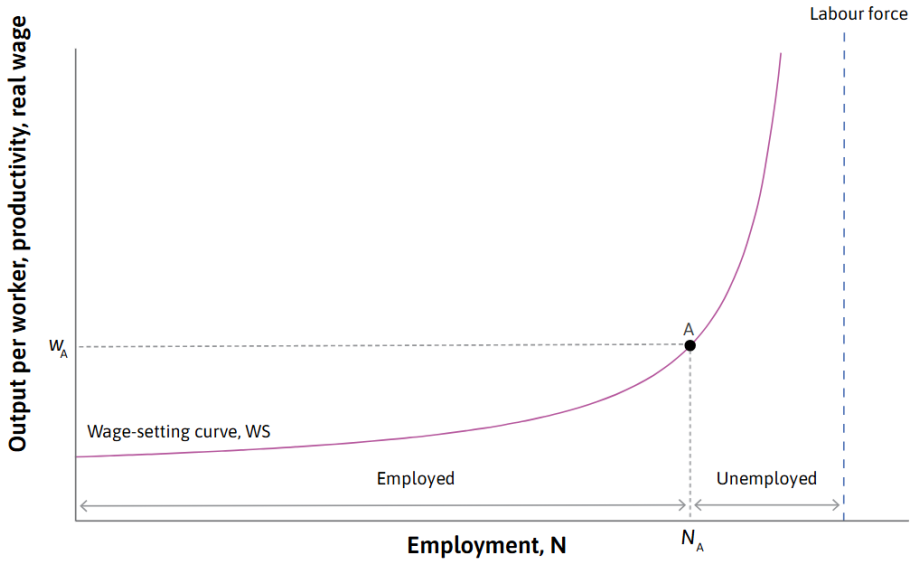
$$W^{gross} = W \cdot (1 + t^d)$$

Taxation in the WS-PS model

New version of the model:

- the real wage w still represents the real purchasing power of the nominal wage W received by workers.
- **New price level actually paid** (P^c instead of the previous P).
- We now have **$w = W / P^c$**.

As long as w is defined in this way, **the WS curve**—which indicates the wage level required to recruit and motivate workers for each level of employment—**remains as before**:



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By contrast, the **PS curve** will change. Recall that its original expression was:

$$W/P = (1 - \sigma)\,\lambda$$

In this expression, the relationship between **the price of the product** (as faced by firms) and **the wage cost** (as faced by firms) is a **function of firms' market power**, as expressed by the markup and the markdown (jointly captured in the term **1 – σ**).

To write this expression (with wage costs and prices as faced by firms) in our new notation, we must instead have:

$$W^{gross}/P = (1 - \sigma)\,\lambda$$

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And if we now want to write it in terms of **wages as faced by workers** (**W** instead of $\mathbf{W^{gross}}$) and **prices as faced by consumers** ($\mathbf{P^c}$ instead of **P**), so that it can be represented in the same graph as the **WS curve**, we obtain:

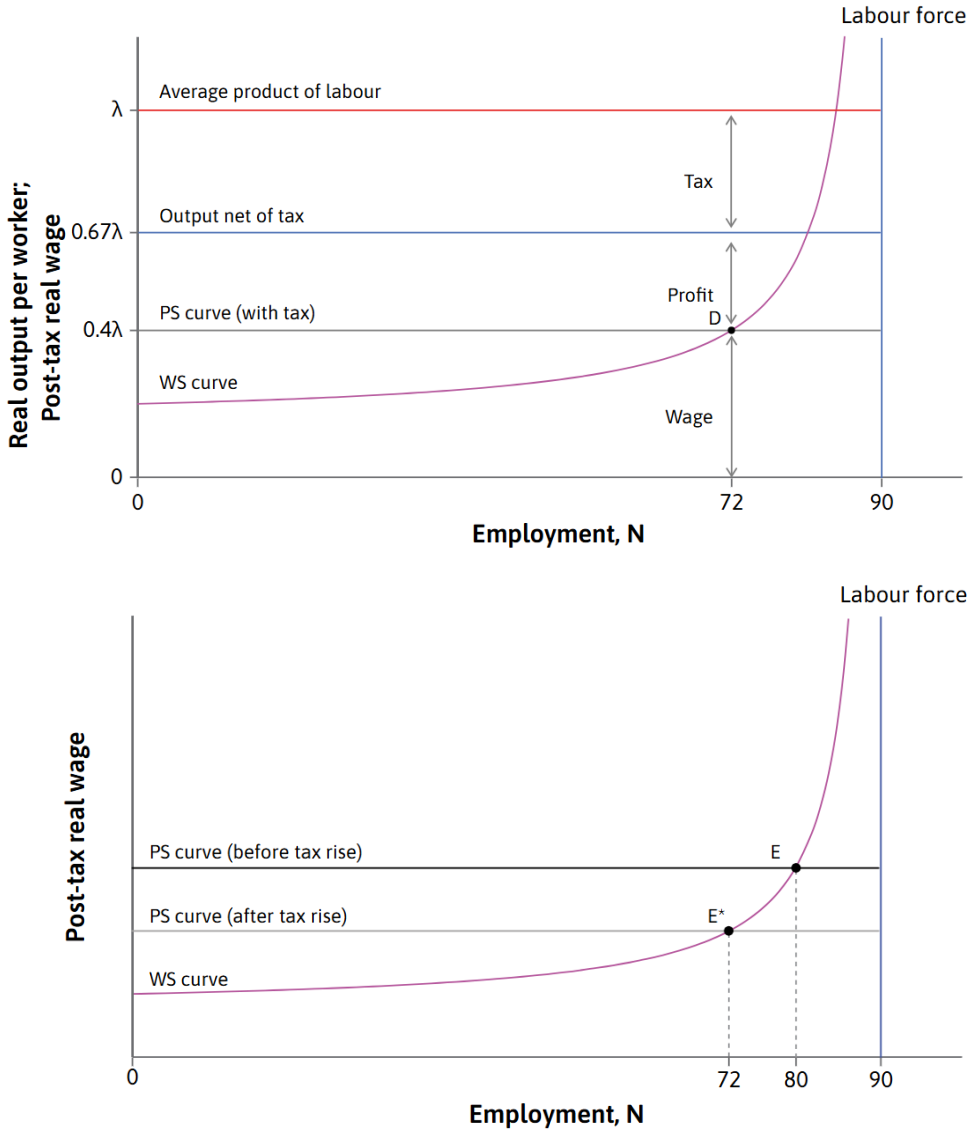
$$\frac{W^{gross}}{P} = (1-\sigma)\,\lambda$$
$$\Leftrightarrow\ W(1+t_d)/P = (1-\sigma)\,\lambda$$
$$\Leftrightarrow\ W(1+t_d)/[P^c/(1+t_v)] = (1-\sigma)\,\lambda$$
$$\Leftrightarrow\ W(1+t_d)(1+t_v)/P^c = (1-\sigma)\,\lambda$$
$$\Leftrightarrow\ W/P^c = \frac{(1-\sigma)\,\lambda}{(1+t_d)(1+t_v)}$$

The new **PS curve** is therefore a horizontal line drawn at a real wage level that is a proportion

$$\frac{1}{(1+t_d)(1+t_v)}$$

of its previous level.

Taxation in the WS-PS model



What happens is that **taxes** (on labour and on consumption) **reduce the share of total value available to be distributed** between employers and workers.

This reduction occurs in the proportion

$$\frac{1}{(1+t_d)(1+t_v)}.$$

The **distribution between wages and profits**, expressed by the term **σ**, remains unchanged. Graphically, we now have a **PS curve located lower** than before. In the new equilibrium, there is **lower employment** and a **lower real wage**.

Imported Inputs

Imported inputs

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Similarly, we can also use **the WS–PS model** to analyze what happens when we allow firms, in **addition to labor costs**, to **purchase imported inputs** (materials incorporated into production) from abroad, or **when the price of those inputs increases** (as in the recent inflationary crisis).

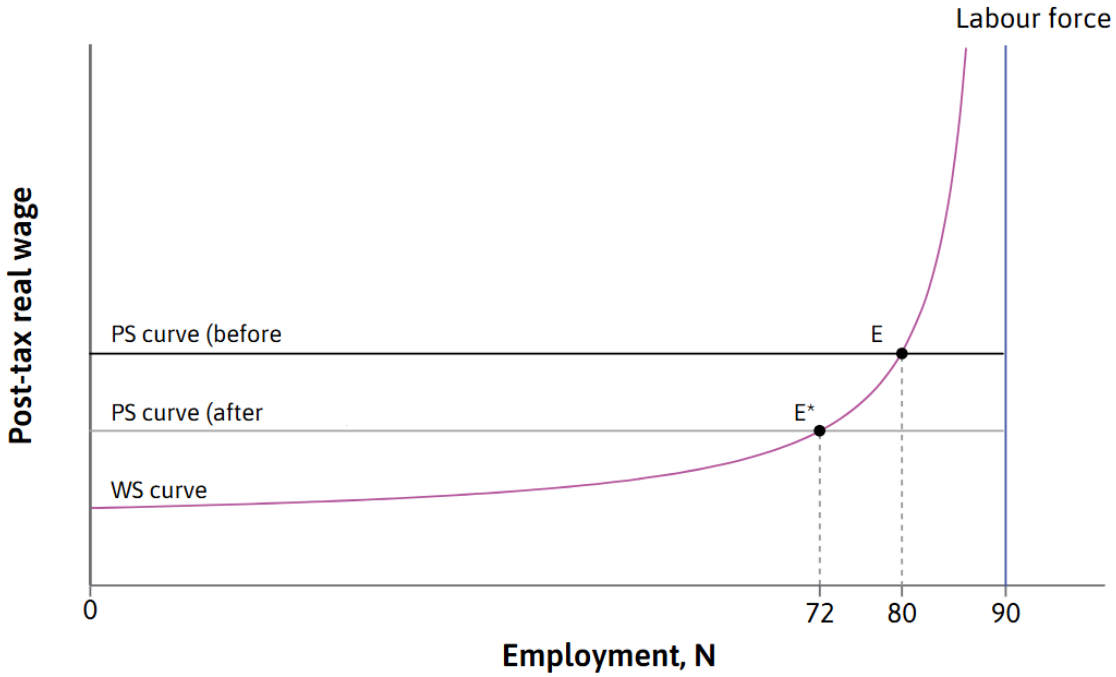
Recall that, by assumption, **firms set prices as a markup over costs**. If we now assume that firms' costs increase in the proportion (1 + ψ) due to the incorporation (or increase in the cost) of imported inputs,

then **the price of goods will increase by the same proportion (1 + ψ)**, and the real wage W / P will fall in the proportion 1 / (1 + ψ).

The **new PS curve becomes:**

$$W/P=(1-\sigma)\ \lambda 1+\psi \mathrm{W/P}=1+\psi(1-\sigma)\lambda$$

Imported inputs



Graphically, this once again corresponds to a **downward shift of the PS curve**

For each level of **output per worker λ**, the share available to be distributed between employers and workers decreases in the proportion $\frac{1}{(1+\psi)}$

Part of the value of production now goes to foreign suppliers.

In the new equilibrium E' ,**employment is lower and the real wage is lower**.

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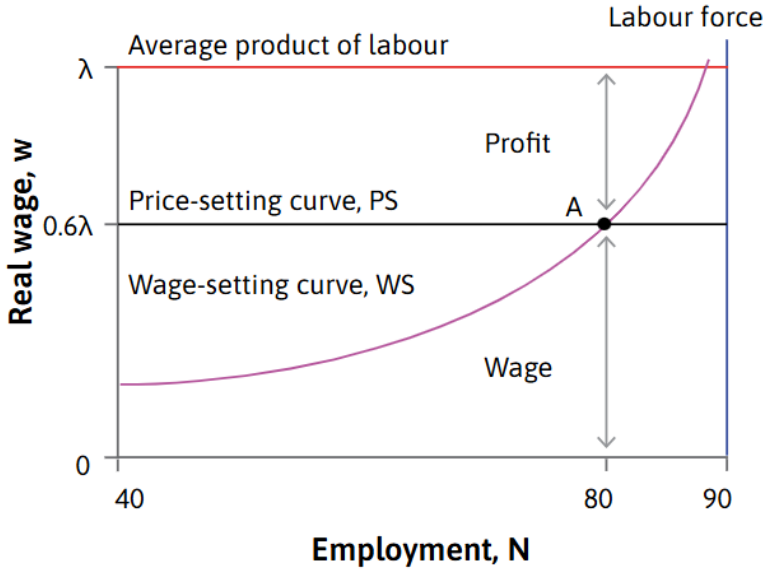
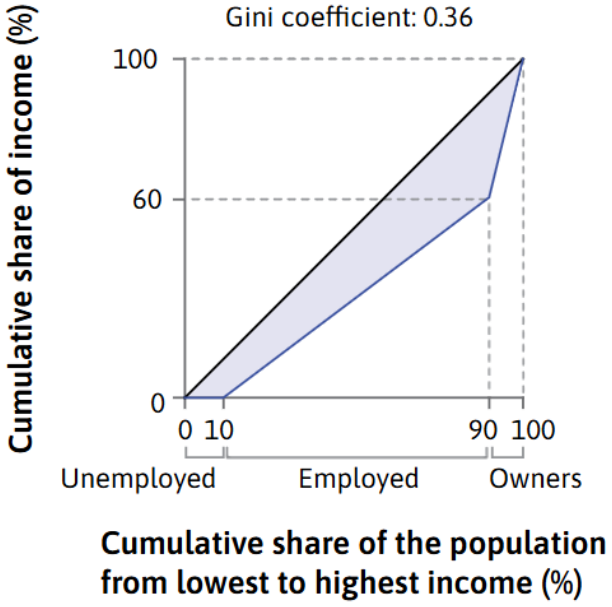
Model review and summary

Model review and summary

Module 2:

- Introducing the **issue of inequality** and some of the main **ways of measuring** and representing it (the **Lorenz curve** and the **Gini coefficient**).
- Lorenz curve with the WS–PS model in order to analyze the implications for inequality of the different equilibria in the WS–PS model.





Model review and summary

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Equipped with these tools, we were then able to **use the WS–PS model** to analyze the effects (on employment, wages, and inequality) of a **set of public policies** and other **important aspects of how economies function**:

- Changes in competition in the product market
- Education and vocational training
- Unemployment benefits
- Hiring subsidies
- Trade unions' actions
- Segmented labor markets
- Taxes
- Imported inputs

Model review and summary

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In each of these cases, **the analysis within the model requires making assumptions** about how each policy or factor affects the WS curve, the PS curve, or both.

From **these assumptions follow conclusions and predictions**—sometimes counterintuitive—that help us think about economic phenomena, policies, and their effects.

The **conclusions and predictions of models always depend on the assumptions made**.

Models may fail to account for certain fundamental aspects of reality and therefore predict incorrect equilibria. It may also happen that, **even when the predicted equilibria are correct**, economies **take a long time to reach** them.

As economists, we use models to help us think, **but we must always maintain a critical awareness of the distance between models and reality.**

Additional readings:

"2.9 Application: Did a decline in competition increase inequality in the US?". *In* The CORE Team. (2023). *The Economy 2.0: Macroeconomics* (módulo 2.9)

"2.10 Application: Employment security and labour market flexibility in Denmark". *In* The CORE Team. (2023). *The Economy 2.0: Macroeconomics* (módulo 2.10)

"2.11 Successes and failures: Germany and Spain". *In* The CORE Team. (2023). *The Economy 2.0: Macroeconomics* (módulo 2.11)