



PYTHON PROJECT

Data analysis and employment policy guidance for 2024

You have been commissioned by the OECD in your capacity as econometrician to provide an informed diagnosis of the policy orientations to be pursued in terms of unemployment management in five member countries. The objective of this project is to provide indications on the right economic policy to be implemented for 2024.

The database you have covers 5 countries: France, Germany, Italy, the Netherlands and the United Kingdom. The variables to be analyzed are: the harmonised overall inflation rate (excluding volatile goods such as energy), the unemployment rate as a percentage and the working population estimated in million inhabitants. Finally, the data are observed for the year 2023 and forecasts have been made for 2024.

From these 30 observations, and following the lessons of the Phillips curve, you will draw up a detailed report of the cyclical situation in terms of inflation and unemployment for these 5 countries.

ADDITIONAL INFORMATION

In 1958, economist William Phillips empirically demonstrated the existence of an inverse relationship between the nominal wage growth rate and the unemployment rate. Two years later, Paul Samuelson and Robert Solow took up Phillips' work and proposed a new analysis: when unemployment is low, inflation rises. The intuitive mechanism is as follows: when the unemployment rate is low, the bargaining power held by workers is greater, wage bargaining is revised upwards. As the number of unemployed is low, companies agree to hire at higher wages without deteriorating the margin rate. In order to make up for this increase in wage costs, firms are increasing their selling prices. Even if the teaching of this relationship, nicknamed the "Phillips curve", has not been unanimously accepted by economists, a consensus has emerged that in the short term, countries can freely arbitrate between inflation and unemployment. This arbitration is the 5th fundamental economic principle of Gregory Mankiw.

$$\text{Inflation rate } (\Delta\pi) = \text{reservation wage } (Z) - \alpha * \text{unemployment rate } (\Delta u)$$

The above relation is a simplified version of the Phillips function. The reservation wage (Z) corresponds to the salary that an individual would receive if he did not work, which is mainly composed of unemployment benefits. The higher this wage, the better will be the purchasing power of unemployed individuals, which reciprocally increases the rate of inflation. The coefficient α measures the degree of rigidity in the labour market. We characterize market rigidity as a set of rules that prevent the natural functioning of the market. When the labour market is perfectly flexible, workers have no bargaining power and have no impact on equilibrium pay. Historically, Western countries have had more rigid markets due to the existence of a minimum wage. The weaker α , the more rigid the market will be and the higher the rate of inflation.

The following document presents the database on which you will base your expertise. Additional information is available in the "references" section. For your information, the data have been extracted from the OECD website except for the variable "active population" whose figures have been randomly selected.

Ensemble de données : Perspectives Economiques No 113 – juin 2023

		Variable	Inflation globale harmonisée		Taux de chômage		Population active	(en millions)
		Fréquence	Annuelle		Annuelle		Annuelle	Annuelle
		Temps	2023	2024	2023	2024	2023	2024
Pays	Unité							
1	Pourcentage, 2014	i	6,1	3,1	7,2	7,2	19,0	22,0
2	Pourcentage, 2015	i	6,3	3,0	2,9	2,8	32,0	31,0
3	Pourcentage, 2015	i	6,4	3,0	8,1	8,1	17,0	19,0
4	Pourcentage, 2015	i	3,2	2,2	3,7	4,0	16,0	16,0
5	Pourcentage, 2018	i	6,9	2,8	4,2	4,5	22,0	23,0

Données extraites le 20 Sep 2023 11:51 UTC (GMT), de OECD.Stat

lien internet : https://stats.oecd.org/viewhtml.aspx?datasetcode=EO113_INTERNET&lang=fr#

Indices des pays	
Pays	Numéro
France	1
Allemagne	2
Italie	3
Pays-Bas	4
Royaume-Uni	5

SECTION 1: ARRANGEMENT OF DATA

In this section, you need to organize the *Data set* to facilitate your diagnosis.

1. Create a dictionary that associates each key with the corresponding country. For example, the key "I" should be linked to the value "France". You will name this dictionary "Country".
2. Create for each country a list containing the inflation/unemployment pair only for the year 2023.
3. Program a function to calculate the number of unemployed (in millions) for each country only for 2023. Then add your result to the previous lists.

$$\text{Unemployment rate} = \frac{\text{chomeurs}}{\text{population active}} * 100 \rightarrow \text{unemployed} = \frac{\text{taux de chômage}}{100} * \text{population active}$$

SECTION 2: ESTIMATING THE PHILLIPS CURVE

In this section, you will estimate Phillips' relationship for the year 2024. The following questions therefore concern only this year. This section is the most technical from a mathematical point of view.

1. Using a function, calculate the average inflation rate and the average unemployment rate of all countries and then create a new list called "OECD" by adding the inflation/unemployment ratio obtained.
2. Regress the Phillips relation for any country "i". The formulas below allow you to calculate the 2 parameters of the Phillips function (see "additional information").

$$\alpha = \frac{\sum_i (\text{inflation}_i - \text{inflation moyenne})}{\sum_i (\text{chômage}_i - \text{chômage moyen})} \quad Z = \text{inflation moyenne} - \alpha * \text{chômage moyen}$$

Note. After calculation, you should find the following relationship: $\Delta\pi = 2.5 - 0.05*\Delta U$.
Nevertheless, the accuracy of your results has no impact on the future.

3. In the medium term, there is an unemployment rate that is described as natural (One) which is compatible with stable inflation (NAIRU, see "references" for more information). For example, in the United States, a natural unemployment rate of 6% keeps inflation stable. For each country, using a function, calculate the potential percentage point gap between the 2023 unemployment rate and the estimated natural unemployment rate of 5% *. The resulting gap corresponds to the "effort to be made" by countries to reduce unemployment to a minimum.
4. Add to the lists you created in Section I, the percentage "effort" to be made by countries in terms of reducing unemployment.

Note. You must therefore have 5 "country" lists, each containing the inflation rate, the unemployment rate, the number of unemployed and the percentage of effort. All these indicators relate to 2023.

* $Un = \frac{Z}{\alpha} = 5\%$ (après arrangement)

SECTION 3: ECONOMIC DIAGNOSIS AND POLICY ORIENTATION

In this final section, you will clearly mobilise the main results of this project and submit a report to the OECD Research Director in the form of a text document.

1. Create a program allowing the research officer, after entering the country key in the console, to display the "effort" to be provided if it is greater than 0 (this is not the case for example for the Netherlands which has an effort of -1 point). You must comply with the following rule:
 - In the case where the effort is less than 0, display: "the country [name of country] must conduct a restrictive fiscal policy because its unemployment rate is lower than the natural unemployment rate".
 - Otherwise, display: "the country [name of country] must pursue an expansionary fiscal policy because its unemployment rate is higher than the natural unemployment rate."
2. For each country, first calculate the estimated number of unemployed (in millions) for 2024 (use the formula in section 1). You can save your results in an auxiliary list if you wish. In a second step, multiply the result obtained by the "effort" in percentage in order to give the number of unemployed in 2024 if a cyclical policy is put in place. You will only do this for countries with a positive "effort" via a function you will create.

For example, in 2024, the France will have 1.58 million unemployed (for an estimated "effort" of 2.2 points (7.2-5). By implementing an expansionary fiscal policy, the number of fewer unemployed will be $34,760 (1.58 * 0.022) \cdot \frac{7.2}{100} * 22$)

3. Modify the program in question 1 to show the gain of the fiscal stimulus policy (i.e. the number of fewer unemployed) if the country has an "effort" greater than 0. For example, the sentence could be: "The country [name of country] must pursue an expansionary fiscal policy because its unemployment rate is higher than the natural unemployment rate. The number of unemployed should thus fall by [policy gain]."
4. Create a text file that you will name "conclusion_OECD" and note for each country, the fiscal policy to be conducted ("expansionary" or "restrictive") as well as the trade-off operated by the latter. If a country pursues an expansionary fiscal policy then it will give up on stabilizing inflation and if the country pursues a restrictive fiscal policy, then it will concede to a higher unemployment rate.

For example, France: "expansionary fiscal policy against inflation."
The Netherlands: "restrictive fiscal policy against unemployment".

Good luck!

REFERENCES

About the Phillips Curve: [Phillips Curve - Wikipedia \(wikipedia.org\)](https://en.wikipedia.org/wiki/Phillips_curve)

NAIRU Talk: [Unemployment rate not accelerating inflation - Wikipedia \(wikipedia.org\)](https://en.wikipedia.org/wiki/Unemployment_rate_not_accelerating_inflation)

About the data source: https://stats.oecd.org/viewhtml.aspx?datasetcode=EOI13_INTERNET&lang=fr#

About the database:

https://stats.oecd.org/DECDStat_Metadata/ShowMetadata.ashx?Dataset=EOI13_INTERNET&ShowOnWeb=true&Lang=fr