Macroeconomics

Week 10: Rampant Inflation vs. the Fear of Deflation

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Theoretical Review

Enhancing the Taylor Rule

- We introduced the Taylor Rule as:

$$r = \bar{r} + \lambda\pi, \quad \lambda > 0$$

- This rule just accounts for inflation stability, stabilizing **economic activity** only **indirectly**
- But **some Central Banks** (eg. Fed) have the **explicit duty** to stabilize economic activity
- So, the Taylor Rule above is not enough

The New Taylor Rule

- A Taylor Rule accounting for the two goals:

$$r = \bar{r} + 0.5\left(\pi - \pi^T\right) + 0.5\left(Y - Y^P\right)$$

with $\bar{r} = 2\%$, $\pi^T = 2\%$ and Y and Y^P measured in logs.

- Or, more generally:

$$r = \bar{r} + \lambda_\pi\left(\pi - \pi^T\right) + \lambda_Y\left(Y - Y^P\right)$$

The problem of Rules

- The previous MP rules **implicitly assume** that the Central Bank can **keep lowering the interest rate** forever
- But that is not true
  - **Nominal interest rates** must be **non-negative**
  - **Fisher's equation** always holds: $i = r + \pi \Rightarrow r = -\pi$, $i = 0$

What happens in the ZLB?

- **Fisher's equation** tells us that:

$$i = r + \pi \Leftrightarrow r = i - \pi$$

- For simplification, consider that the MP is: $r = \bar{r} + \lambda\pi$
- If $i = 0$:

$$0 - \pi = \bar{r} + \lambda\pi \Leftrightarrow \bar{r} = -(1 + \lambda)\pi$$

$$\Leftrightarrow \boxed{\pi_{ZLB} = -\frac{\bar{r}}{1 + \lambda}}$$

The ZLB and the MP Curve

- The MP Curve will have **two branches**:

$$\begin{cases} r = \bar{r} + \lambda\pi & , \pi \geq \pi_{ZL} \\ r = -\pi & , \pi < \pi_{ZL} \end{cases}$$

- This will generate two branches also on the **Aggregate Demand** (Do you remember how is it obtained?)

The ZLB and the AD Curve

- The **Aggregate Demand** will become:

$$\begin{cases} Y = m\overline{A} - m\phi(\bar{r} + \lambda\pi) & , \pi \geq \pi_{ZL} \\ Y = m\overline{A} + m\phi\pi & , \pi < \pi_{ZL} \end{cases}$$

- Notice that:

$$\frac{\partial Y}{\partial \pi} = m\phi > 0, \quad \pi < \pi_{ZL}$$

Exercises

Exercise 1. Inflation targeting

Eurozone inflation + Add to myFT

ECB changes inflation target, leaving extra room to keep rates low

First strategy review for nearly two decades amends key elements of monetary policy

The ECB also announced plans to tackle climate change risks by tilting its asset purchases and collateral rules away from heavy carbon-emitting companies © Michael Probst/AP

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On 8 July 2021, the European Central Bank (ECB) announced a revision of its monetary policy strategy for the first time since its creation in 1998. From the article above in the Financial Times, one can read:

Exercise 1. Inflation targeting

Eurozone inflation + Add to myFT

ECB changes inflation target, leaving extra room to keep rates low

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The ECB also announced plans to tackle climate change risks by tilting its asset purchases and collateral rules away from heavy carbon-emitting companies © Michael Probst/AP

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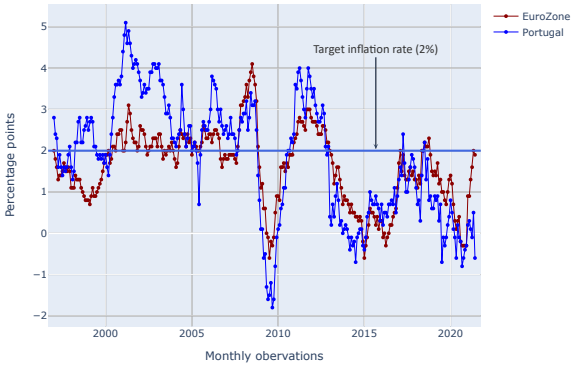
«The central bank said its new target of 2 per cent was symmetric, "meaning negative and positive deviations of inflation from the target are equally undesirable". The new target is a medium-term objective with flexibility to fluctuate in either direction in the short term [and] said it could tolerate temporary moves beyond that point, in a shift that gives policymakers flexibility to keep interest rates at historic lows for longer.»

Exercise 1. Inflation targeting

Fig 1. Inflation in the EuroZone and Portugal



a) *Figure 1 plots the data about inflation in the EuroZone (EZ) and Portugal since 1998. Why do you think the ECB stresses "the symmetric deviations of inflation from the target"?*

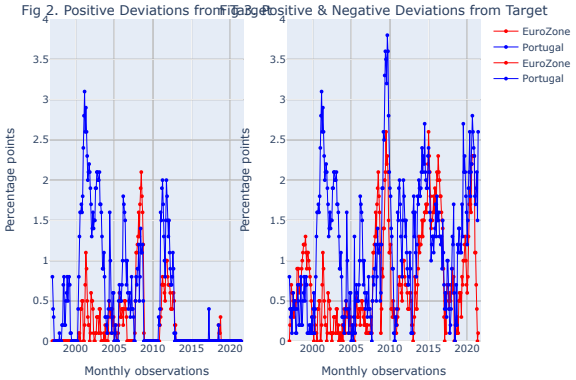
To clarify that it will stay equally reactive to positive and negative deviations.

Exercise 1. Inflation targeting

b) *Why do you think the article stresses "...in a shift that gives policymakers flexibility to keep interest rates at historic lows for longer"?*

- A **ceiling** value keeps **inflation rate too low**
- Low inflation may trigger **deflation expectations**
- A **target** value turns **negative deviations also undesirable**
- **Interest rates** may stay low for longer at the cost of **a temporary higher inflation**

Exercise 1. Inflation targeting



c) *For Portugal and the Eurozone, what is the mean for the inflation deviations from the target, according to the old strategy (we will call it "Loss1")? And according to the new strategy ("Loss2")?*

Exercise 1. Inflation targeting

The Loss function of the CB is quite different in both cases:

$$\text{Loss1} = \begin{cases} \pi - \pi^T & , \pi > \pi^T \\ 0 & , \pi \leq \pi^T \end{cases}$$

$$\text{Loss2} = |\pi - \pi^T| \quad , \forall \pi$$

Exercise 1. Inflation targeting

Loss to society	mean	min	median	max	std. dev.
Euro Zone (Ceiling)	0.1799	0.0	0.0	2.1	0.3579
Euro Zone (True target)	0.7568	0.0	0.6	2.6	0.6422
Portugal (Ceiling)	0.5081	0.0	0.0	3.1	0.7180
Portugal (True target)	1.2081	0.0	1.2	3.8	0.8148

Table 1: Descriptive statistics of two different loss functions of the Central Bank.

Exercise 2. The Taylor rule

We will use statistical data about the variables crucial for the analysis of the Taylor Rule: real GDP, Potential GDP, inflation rate, and the nominal interest rate (Federal Funds Rate). The data is in the file `Taylor.csv` *and can be found in the table below. We calculate and plot the Monetary Policy Rule for* ***three different scenarios****:*

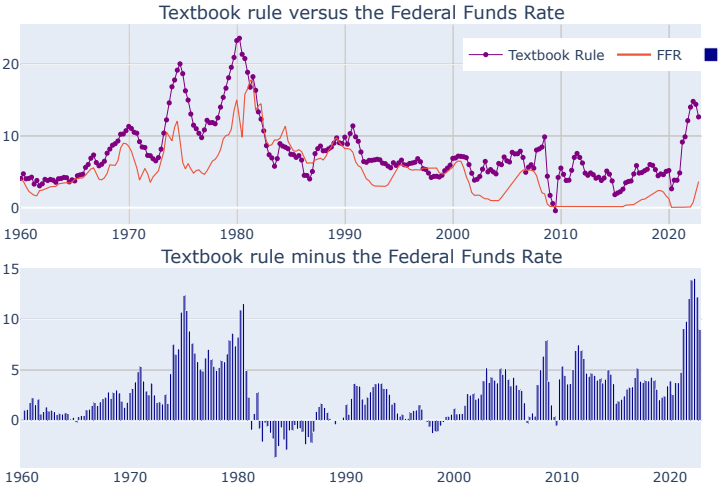
- *The MP rule, as considered in our textbook, with* $\lambda = 0.5$, $\bar{r} = 2\%$, *and* $\pi^T = 2\%$. *For the calculations, we use rates expressed by percentage points. This means that* $\bar{r} = 2$, *and* $\pi^T = 2$, *which makes the calculations easier to understand and corresponds to how FRED presents the data.*

Exercise 2. The Taylor rule

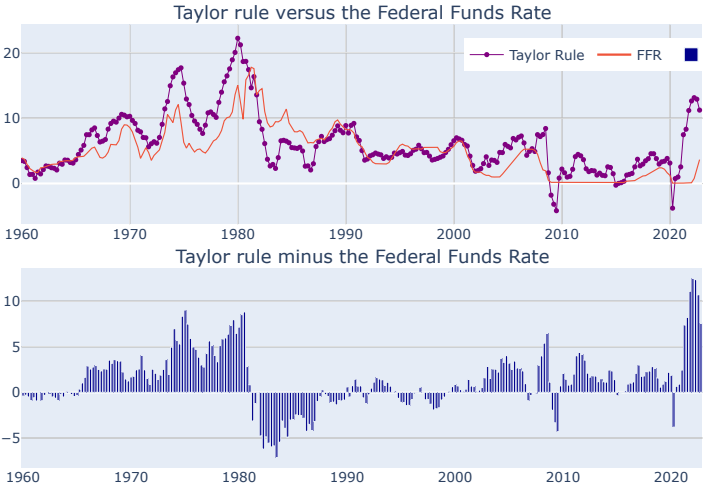
- *The original Taylor Rule with equal weights for the inflation gap and the output gap ($\lambda_\pi = \lambda_y = 0.5$).*
- *The (New) Taylor Rule with a higher weight for the output gap: $\lambda_\pi = 0.5$,and $\lambda_y = 1.0$.*

a) *Do you consider any of those three rules to explain well the Central Bank of the USA (Fed) decisions concerning the Fed Funds Rate?*

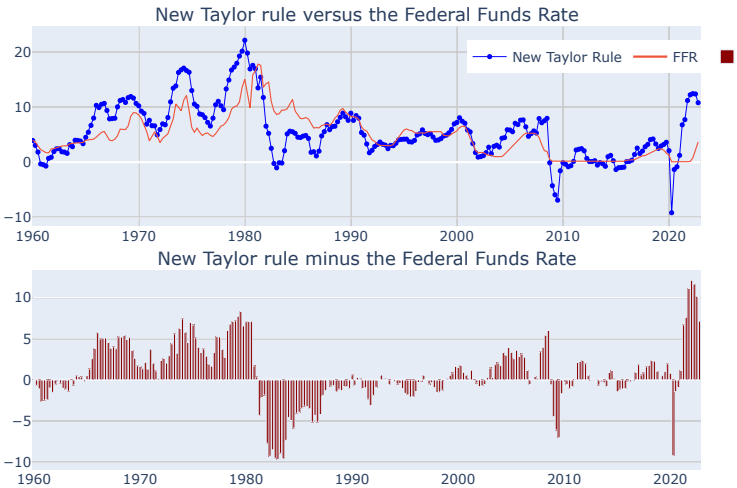
Exercise 2. The Taylor rule



Exercise 2. The Taylor rule



Exercise 2. The Taylor rule



Exercise 2. The Taylor rule

a) Do you consider any of those three rules to explain well the Central Bank of the USA (Fed) decisions concerning the Fed Funds Rate?

- **None** of the three rules is a **perfect fit**
- However, the **New Taylor Rule** seems better than the others

Exercise 2. The Taylor rule

b) *Can you provide clear evidence that having a Taylor Rule in autopilot may lead to extreme punishments for the economy?*

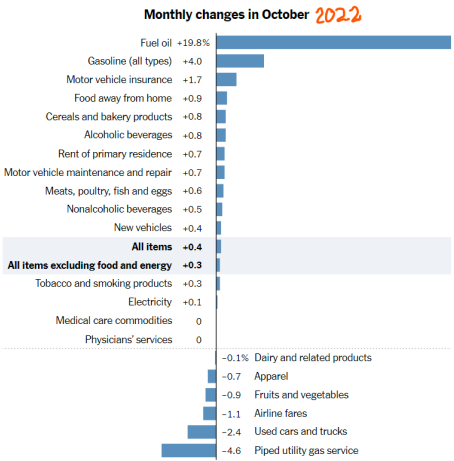
- There are **several periods** where **huge deviations** from a Taylor Rule occur
- **After 2008** crisis:
  - FFR set to zero in the summer 2008 to contain the recession
  - Under a Taylor Rule then (and today!) they would be around 7–9%
  - Rules are blind towards events like a Pandemic or two wars of unforeseen repercussions

Exercise 2. The Taylor rule

c) *Given the evidence in these three rules, are monetary policy rules useless?*

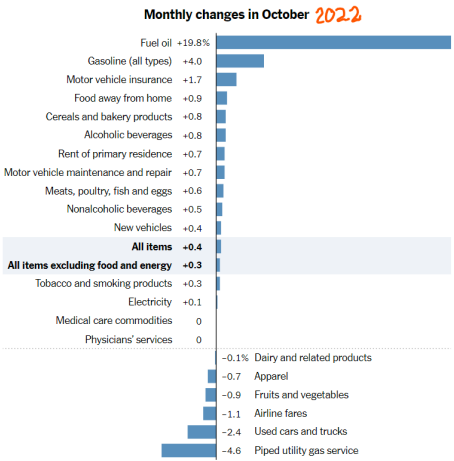
- **No.** But they are to be used wisely
- It is reasonable to have **targets for inflation** that determine **rules for interest rates**
- As it is necessary to have flexibility to **accommodate circumstances other** than those under which rules were adopted

Exercise 3. The trouble with inflation



The figure below shows the main contributors to inflation in October 2022 in the USA. The inflation rate for all items was 0.4% between September and October 2022. This monthly inflation rate would correspond to annual inflation of 4.9% if the same 0.4% were verified in all following months ($(1+0.004)^{11}-1=0.049$).

Exercise 3. The trouble with inflation

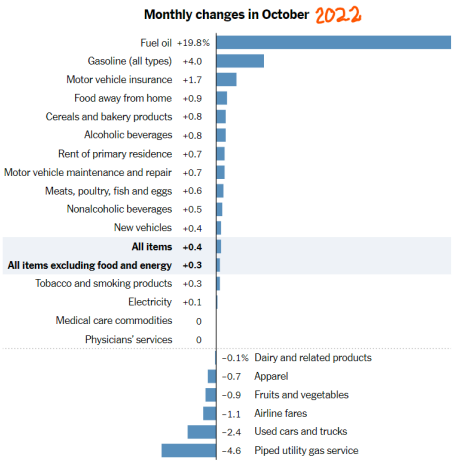


In September [the previous month], the monthly inflation rate between August and September 2022 was 0.6%, leading to an annual inflation rate of 7.44%.

a) *If this trend continues over time, what does it tell us about the behavior of inflation?*

That inflation was decreasing.

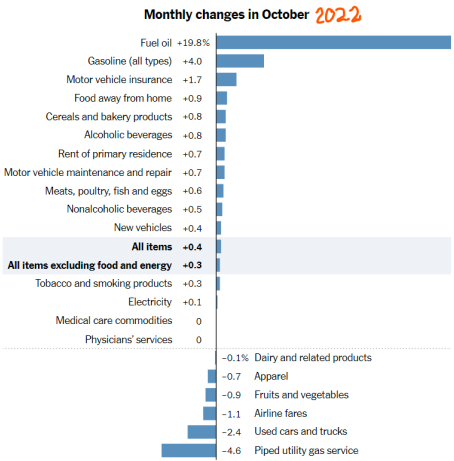
Exercise 3. The trouble with inflation



b) *Looking at the various items in the figure below, what items mainly contributed to the inflation rate in October 2022?*

- Mainly Fuel oil and Gasoline
- Transportation costs rise all over the world

Exercise 3. The trouble with inflation



c) *Can the Fed do anything to control the prices of those items most responsible for the October inflation?*

No. A Central Bank has no tools to respond to these sources of inflation.

Exercise 4. Inflation and the Scariest Opinion of 2022

In the Wall Street Journal, Sep. 7, 2022, Jason Furman — a Professor at Harvard University and a former Chair of the Council of Economic Advisers of President Barack Obama — published an Op-Ed. that ran with the title "Inflation and the Scariest Economics Paper of 2022". The scariest paper can be found here and was written by two IMF economists and Larry Ball from John Hopkins University.

Exercise 4. Inflation and the Scariest Opinion of 2022

The principal message from this paper was:

> *"To bring price increases down to 2%, we may need to tolerate unemployment of 6.5% for two years."*

Earlier, on June 20 of the same year, another highly respected economist, Larry Summers, made the same point even more forcefully in a speech in London:

> *"We need five years of unemployment above 5% to contain inflation — in other words, we need two years of 7.5% unemployment, or five years of 6% unemployment, or one year of 10% unemployment."*
>
> *— Bloomberg*

Exercise 4. Inflation and the Scariest Opinion of 2022

Considering the evolution of inflation and unemployment in the US economy that is depicted in the figure below, answer the following questions:

a) *why do you think economists and policymakers were so worried about inflation in the middle of 2022?*

- The inflation rate was at a **hike of 9%**
- The huge effects of the **Pandemic** were **still vanishing**
- Risk of **inflationary expectations** and loose of control (similar to what happened in the 1970's)

Exercise 4. Inflation and the Scariest Opinion of 2022

b) *Why did highly respected economists get it so wrong when prescribing a particular solution to the problem of inflation in the US?*

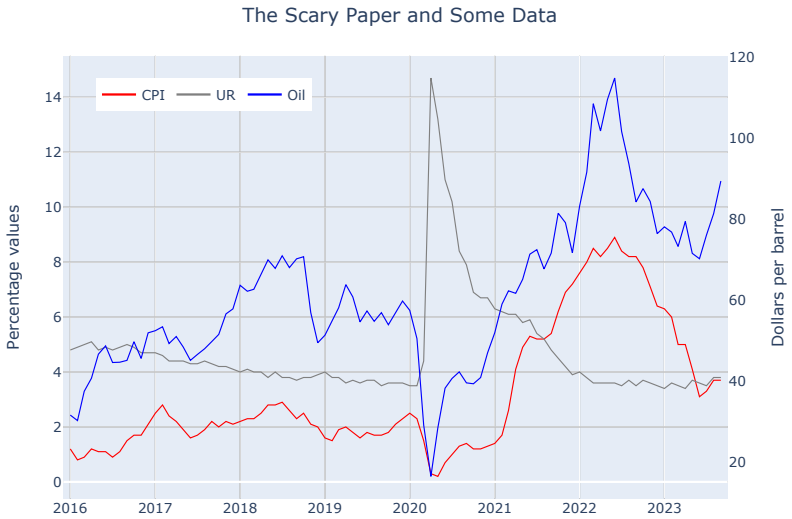
- They assumed that inflation came from a ***too hot*** **labor market**
- Fed was criticized for lasting too much to take action
- The Fed seems to have been correct: inflation and unemployment decreased systematically over the last year

Exercise 4. Inflation and the Scariest Opinion of 2022

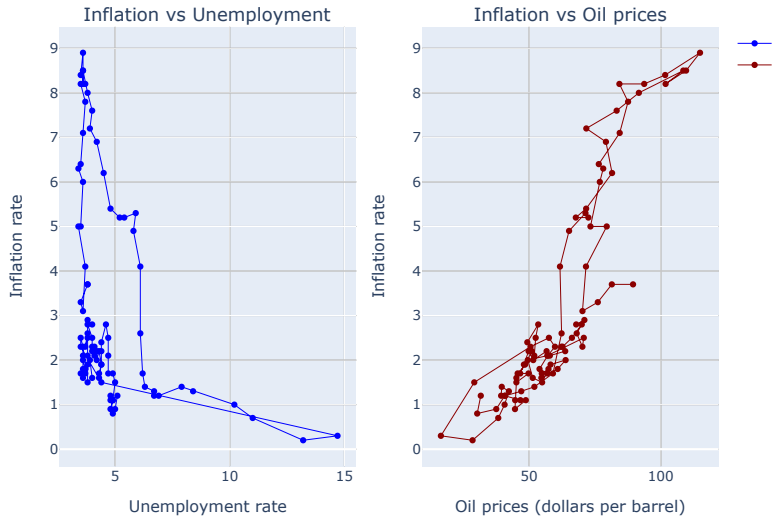
c) *hey based their prescriptions on one fundamental diagnosis: rampant inflation resulted from a too hot labor market. What alternative force may explain such explosive inflation if the labor market was not too hot?*

- The main source of inflation was the increase in **energy prices**
- In fact, when inflation set it, the unemployment rate was 14.7% (not exactly low)
- The next two plots support this idea

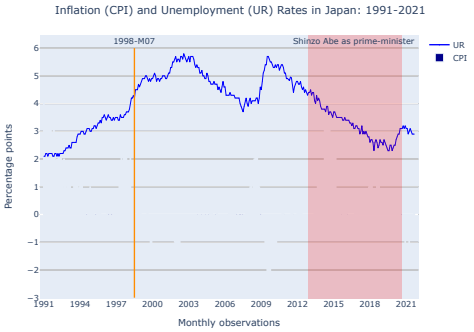
Exercise 4. Inflation and the Scariest Opinion of 2022



Exercise 4. Inflation and the Scariest Opinion of 2022

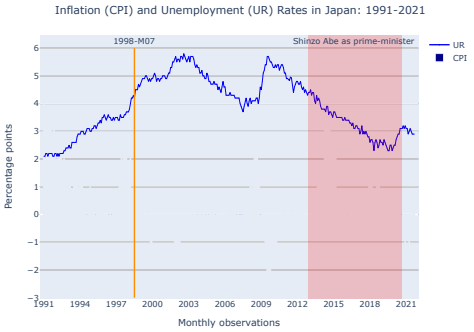


Exercise 5. Abenomics and Japanese deflation



In the following figure, we present Japan's inflation and unemployment evolution over the last four decades. Discounting the period of Abenomics — Shinzo Abe was the prime minister between 2013 and 2020 and was elected on the promise that he would take "all necessary and sufficient" measures to ensure the country would eradicate deflation — Japan was stuck in deflation since the summer of 1998.

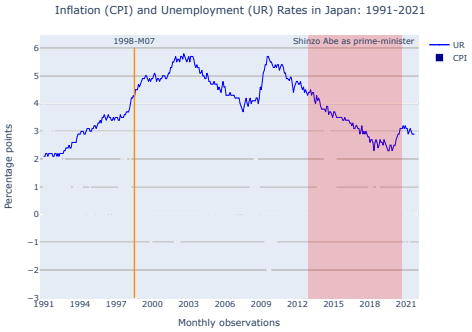
Exercise 5. Abenomics and Japanese deflation



a) *Considering its target inflation rate of 2%, how frequently did Japan reach such a target since 1998-M07?*

Almost never: Abe's period and between June and September 2008.

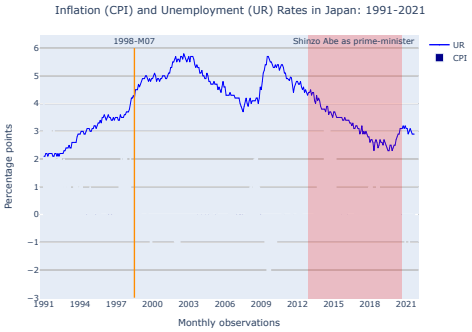
Exercise 5. Abenomics and Japanese deflation



b) *In normal conditions, if an economy suffers from very low inflation, it will experience high unemployment rates. This relationship is what the Phillips curve tells us. Can we observe this situation in Japan since 1998-M07?*

Not really. In Japan low unemployment coexisted with deflation.

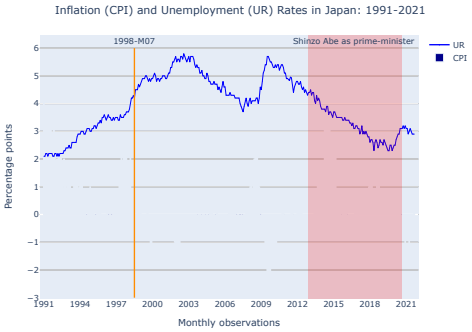
Exercise 5. Abenomics and Japanese deflation



c) *The unemployment rate in Japan is very low indeed. It is implausible that this rate can go lower than 2% or 3%. This information tells us something about Potential GDP. What is it?*

Since $U \approx U_n$, then $Y \approx Y^p$ (Okun's Law).

Exercise 5. Abenomics and Japanese deflation



d) *Someone asks you to create a slogan to describe the Japanese experience above. What would you propose?*

What about *Living at potential, addicted to deflation*?

Exercise 6. The Zero Lower Bound

Consider the four fundamental functions that allow us to analyze the entire functioning of the economy:

$$AD: \quad Y = m \cdot \overline{A} - m \cdot \phi \cdot (\overline{r} + \lambda\pi) \qquad MP: \quad r = \overline{r} + \lambda\pi$$

$$AS: \quad \pi = \pi^e + \gamma\left(Y - Y^P\right) + \rho \qquad \textit{Fisher Eq.}: \quad i = r + \pi$$

and the following information concerning exogenous variables and parameters:

$$\overline{A} = 7.6, \quad m = 2.0, \quad \phi = 0.2, \quad \overline{r} = 2.0,$$
$$\lambda = 0.5, \quad \pi^e = 2.0, \quad \gamma = 4.5, \quad Y^P = 14.0, \quad \rho = 0.$$

Exercise 6. The Zero Lower Bound

a) *Calculate the short-run equilibrium values for the inflation rate, the level of GDP, the real interest rate, and the nominal interest rate. The graphical representation of this equilibrium is displayed in Fig. 4 and 5.*

`NLSolve` or $\boldsymbol{Y} = \boldsymbol{A}^{-1} \times \boldsymbol{B}$, with:

$$\boldsymbol{A} \equiv \begin{bmatrix} 1 & m\phi\lambda & 0 & 0 \\ -\gamma & 1 & 0 & 0 \\ 0 & -\lambda & 1 & 0 \\ 0 & -1 & -1 & 1 \end{bmatrix} \qquad \boldsymbol{B} \equiv \begin{bmatrix} m\overline{A} - m\phi\overline{r} \\ \pi^e - \gamma Y^P + \rho \\ \overline{r} \\ 0 \end{bmatrix} \qquad \boldsymbol{Y} \equiv \begin{bmatrix} Y \\ \pi \\ r \\ i \end{bmatrix} = \begin{bmatrix} 14 \\ 2\% \\ 3\% \\ 5\% \end{bmatrix}$$

Exercise 6. The Zero Lower Bound

b) *Calculate the inflation rate value that corresponds to the ZLB (Zero Lower Bound).*

$$\pi_{ZLB} = -\frac{\bar{r}}{1+\lambda} = -\frac{2}{1+0.5} = -1.333$$

Exercise 6. The Zero Lower Bound

c) *In Fig. 6 and 7, we represent the equilibrium associated with the AS/AD curves graphically (including the part related to the ZLB), and we do the same for the MP curve. Is the equilibrium in the ZLB?*

$\pi = 2\% > 1.333\% = \pi_{ZLB}$. Then, we are above the ZLB.

Exercise 7. A negative demand shock

Consider the same values as in exercise 6. However, there is an external shock that affects the Autonomous Demand, which decreases $\overline{A}$ by \$0.2 trillion.

a) *The short-run equilibrium values for the inflation rate, the level of GDP, and the real interest rate are represented in Figs 8 and 9. What is the level of the nominal interest rate in this equilibrium?*

$$Y_2 = 13.7895 \neq Y^P, \quad \pi_2 = 1.05263\%, \quad r_2 = 2.5263\%, \quad i_2 = 3.5789\%.$$

Exercise 7. A negative demand shock

b) *Is the economy in a recession, or in an economic boom? Justify.*

At point 2, $Y_2 = 13.78 < 14 = Y^P$. Then, we are in a **recession**.

$$Y_2 = 13.7895 \neq Y^P, \quad \pi_2 = 1.05263\%, \quad r_2 = 2.5263\%, \quad i_2 = 3.5789\%.$$

Exercise 7. A negative demand shock

c) *If there is no other demand or supply shock what will happen to the economy over time?*

- Point 2 is **not a long-run equilibrium** since $Y_2 < Y^P$
- This will pull **down inflation**, triggering a gradual **shift of the AS curve to the right**
- The adjustment ends at point 3, **if the CB accepts this new inflation rate**
- Should the response of the CB be stronger in the first place, and the initial shock could have been neutralized

Exercise 7. A negative demand shock

d) *What will be the new value of the long-run equilibrium inflation rate? What about the real and nominal interest rates?*

The new long run equilibrium will be:

$$Y_3 = 14.0 = Y^P, \quad \pi_3 = 0.0\%, \quad r_3 = 2.0\%, \quad i_3 = 2.0\%.$$

Exercise 8. Stuck in deflation

Consider an economy that, for some reason, finds itself in an equilibrium inside the ZLB zone, as in point `1zl` in the figure below. Suppose there are no more shocks on the demand or supply sides.

a) *Is `1zl` an equilibrium point for this economy?*

Yes, it is, with:

$$Y_{1zl} = 13.4 \neq Y^P, \quad \pi_{1zl} = -3.6\%, \quad r_{1zl} = -3.6\%, \quad i_{1zl} = 0.0\%.$$

Exercise 8. Stuck in deflation

b) *Using the slider* `self_correction8` *and the figure below, show the long-term equilibrium in this economy.*

- At point `1zl` the economy is in a recession ($Y < Y^P$)
- This will pull **down inflation**, triggering a gradual **shift of the AS curve to the right**
- The adjustment ends at point `2zl` (where $Y = Y^P$)
- However, at point `2zl` inflation is still negative ($\pi = -2\%$)

Exercise 8. Stuck in deflation

c) *Can you propose one policy measure to help this economy escape the deflation trap at point* `2zl`*?*

- At point `2zl` the economy is in a **deflation trap** (a long run equilibrium with negativa inflation)
- Policy measures are not very effective to overcome the situation
- The best option, however, is a huge increase in public spending (G)

Exercise 9. Secular stagnation

Consider that initially, the economy is at point 1 in the figure below but suffers a huge negative external shock on aggregate demand: $\Delta\overline{A} = -0.5$ *trillion dollars. The impact of this shock can be seen in the movement of the economy to point 2 below. If the economy is at point 2, what will happen to it over time? Answer this question by manipulating the slider* `self_correction9` *below.*

Exercise 9. Secular stagnation

- At point 2 the economy is in a **recession**
- The AS curve self-correcting mechanism will force **inflation down until the kink** (no demand after that) — *secular stagnation*
- Just a **big positive shock on the demand** will bring the economy back to its potential

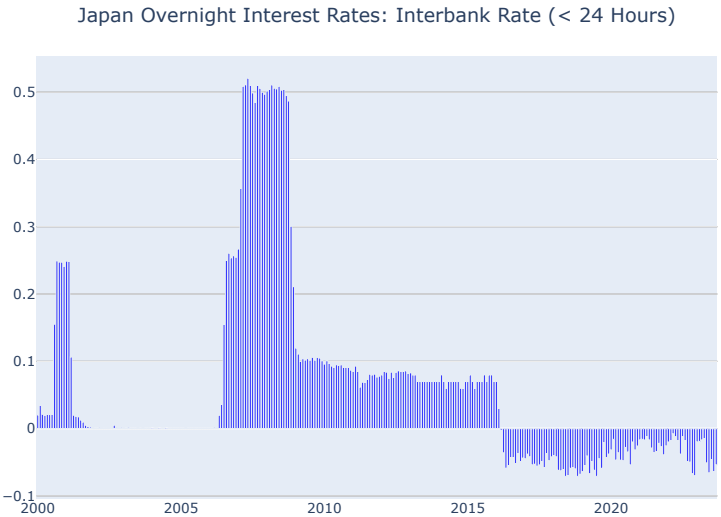
Exercise 10. Normalizing things in Japan?

Kazuo Ueda, the Governor of the Central Bank of Japan, in an recent interview with the Financial Times (November 9, here) said the following:

> *When we normalize short-term interest rates, we will have to be careful about what will happen to financial institutions, what will happen to borrowers of money in general, and what will happen to aggregate demand. It is going to be a serious challenge for us.*

Why do you think it is so difficult for the Bank of Japan to raise ("normalize") short-term interest rates, given that they are negative as we can observe in the figure below?

Exercise 10. Normalizing things in Japan?



Exercise 10. Normalizing things in Japan?

- Rising interest rate will **cool the aggregate demand**
- With a recession, **deflation may come back**
- Considering the long periods of deflation of the past in Japan, it seems sensible to wait before rising interest rates