# 2015-2016 – Econ590
# Topics in Macroeconomics

# Lecture 1 : Business Cycle Models : The Current Consensus (Part C)

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# Disclaimer

*These are the slides we are using in class. They are not self-contained, do not always constitute original material and do contain some "cut and paste" pieces from various sources that we are not always explicitly referring to (not on purpose but because it takes time). Therefore, they are not intended to be used outside of the course or to be distributed. Thank you for signaling typos or mistakes at franck.portier@TSE-fr.eu.*

- We consider the cashless economy, and therefore abstract for optimal steady state inflation (the FRIEDMAN rule)
- We study optimal monetary policy in the business cycle

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.1. The First Best

- In the first best, the planner solves a static problem :

$$\begin{aligned} &\max_{C_t(i),N_t(i)} && U\left(C_t, N_t\right) \\ &\text{s.t.} && C_t(i) = A_t N_t(i)^{1-\alpha} \quad \forall i \in [0,1] \\ & && C_t = \left(\int_0^1 C_t(i)^{1-\frac{1}{\varepsilon}} di\right)^{\frac{\varepsilon}{\varepsilon-1}} \\ & && N_t = \int_0^1 N_t(i) di \end{aligned}$$

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.1. The First Best

- FOCs are :

$$\begin{aligned} C_t(i) &= C_t \quad \forall i \in [0,1] \\ N_t(i) &= N_t \quad \forall i \in [0,1] \\ -\frac{U_{Nt}}{U_{Ct}} &= \underbrace{(1-\alpha)A_t N_t^{-\alpha}}_{MPN_t} \end{aligned}$$

- It is optimal to produce and consume the same quantity of all the goods, and to worl equally in all firms.

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.2. Sources of inefficiencies

- 2 sources of inefficiencies in the decentralized equilibrium :
  - × market power on the good market
  - × sticky prices

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.2. Sources of inefficiencies : market power

- Assume prices are flexible
- Because of monopolistic competition, there is a markup of price over marginal cost :

$$P_t = \mathcal{M} \frac{W_t}{MPN_t}$$

- Therefore

$$-\frac{U_{Nt}}{U_{Ct}} = \frac{W_t}{P_t} = \frac{MPN_t}{\mathcal{M}} < MPN_t$$

- That distortion is not related to sticky prices, and can be eliminated with a pigouvian subsidy $\tau = \frac{1}{\varepsilon}$ on wages financed by lump-sum tax, so that

$$-\frac{U_{Nt}}{U_{Ct}} = \frac{W_t}{P_t} = \frac{MPN_t}{\mathcal{M}(1-\tau)}$$

with $\mathcal{M}(1-\tau) = 1$

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.2. Sources of inefficiencies : sticky prices

- Assume subsidy $\tau$ is implemented
- Because of sticky prices, the actual average markup will differ from $\mathcal{M}$
- Define average markup as

$$\mathcal{M}_t = \frac{P_t}{(1-\tau)(W_t/MPN_t} = \frac{P_t\mathcal{M}}{W_t/MPN_t}$$

- The labor market equilibrium condition writes

$$-\frac{U_{Nt}}{U_{Ct}} = \frac{W_t}{P_t} = MPN_t\frac{\mathcal{M}}{\mathcal{M}_t}$$

- Output and employment are therefore too high or too low

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.2. Sources of inefficiencies : sticky prices

- There is a second source of inefficiency relted to sticky prices
- Because of the Calvo lottery, there will be price dispersion : the relative price $P_t(i)/P_t(j)$ will typically not be equal to one.
- Therefore, $C_t(i) \neq C_t(j)$ and $N_t(i) \neq N_t(j)$

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.3. The Divine Coincidence

- What is therefore the optimal policy
- Assume again there is a pigouvian tax $\tau$
- Assume prices are initially equal : $P_0(i) = P_0(j)$
- Efficient allocation is attained by a policy that stabilizes marginal cost at the firm's desired level given initial prices
- If that policy is kept for ever, firm will never change their prices, markup will not fluctuate and there will be no price dispersion
- That policy will therefore implement :

$$\begin{aligned} \widetilde{y}_t &= 0 \\ \pi_t &= 0 \\ i_t &= r_t^n \end{aligned}$$

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.3. The Divine Coincidence

- Some remarks
  - × fully stabilizing output is not optimal
  - × price stability is optimal, although not valued *per se* by the Planner / the Central Bank
  - × *divine coincidence* : no trade-off between the stabilization of inflation and the stabilization of the welfare-relevant output gap
- The divine coincidence does not (strictly) hold when some other imperfections are added (like nominal wage stickiness)

# 5.5. Optimal Monetary Policy in The Business Cycle

## 5.5.4. Implementation of the optimal monetary policy

- interest rate rule :
  - $i_t = r_t^n$
  - but then indeterminacy of $\widetilde{y}$ and $\pi$
- interest rate rule with reaction :
  - $i_t = r_t^n + \phi_\pi \pi_t + \phi_y \widetilde{y}_t$
  - Determinacy if $\kappa(\phi_\pi - 1) + (1 - \beta)\phi_y > 0$
  - Monetary authorities response should be "strong enough"

# 6. Extensions / Refinements of the Consensus View

## 6.1. Impulse *versus* Propagation

- Propagation : shocks are given, but the way they impact the economy is enriched : more amplification, more persistence.
- Impulse : some new shocks are included in quantitative models.

# 6. Extensions / Refinements of the Consensus View

## 6.3. Propagation

- Adjustment costs : Cogley and Nason (1995), Christiano, Eichenbaum and Evans (2005)
- Intensive margin : Christiano and Eichenbaum (1992) for labor, Burnside and Eichembaum 96 for capital
- Labor market frictions : Merz (1995), Andolfatto (1996), Den Haan, Ramey and Watson (2000)
- Habit persistence & Catching up with the Joneses : Abel (1990), Lettau and Uhlig (2000), Boldrin, Christiano and Fisher (2001), Ravn, Schimdt-Grohé and Uribe (2006)
- Zero Lower Bound on $i$ : Benhabib, Schimdt-Grohé and Uribe (2001), Eggertsson and Woodford (2003)
- Credit frictions : Bernanke, Gertler and Gilchrist (1999), Kiyotaki and Moore (1997)

# 6. Extensions / Refinements of the Consensus View

## 6.4. Other Shocks

- Fiscal shocks : Baxter and King (1993), Christiano, Eichenbaum, and Rebelo (2011)
- Monetary shocks : Christiano, Eichenbaum and Evans (2005)
- Investment Specific Technology shocks : Greenwood, Hercowitz and Huffman (1988), Justiniano, Primiceri and Tambalotti (2010)
- News Shocks : Beaudry and Portier (2004, 2006), Jaimovich and Rebelo (2008), Schmidt-Grohé and Uribe (2012)
- Markup shocks : Smets and Wouters (2007), Christiano, Eichenbaum and Trabant (2015)
- Discount factors shocks : Smets and Wouters (2007), Christiano, Eichenbaum and Trabant (2015), Fisher (2015)