Aalto University
School of Business

# 31E2300
# MACROECONOMICS: POLICY

## THE THREE EQUATION MODEL IN ACTION

# ANOTHER EXAMPLE: POSITIVE PERMANENT AS SHOCK

Adjustment to a positive, permanent aggregate supply shock:

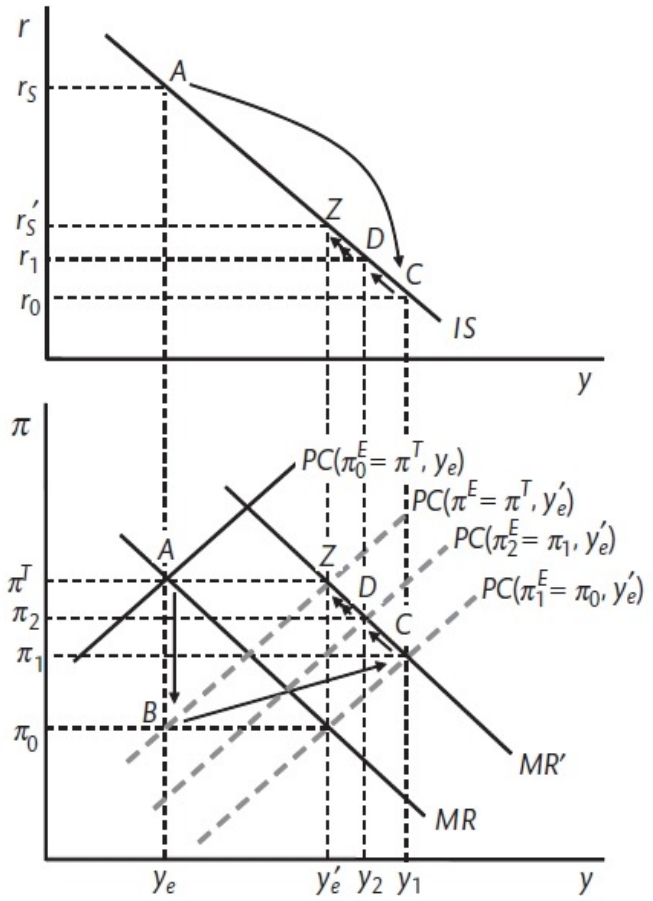



Figure 3.14 The adjustment of the economy to a positive permanent aggregate supply shock.

AS Shock: Shift in WS or PS Curves (see Ch.2)

Equilibrium output increases from $y_e$ to $y_e{}'$.

The PC Curve shifts down to $\mathrm{PC}\,(\pi_0^E = \pi^T, y_e{}')$ due to this change in $y_e$.

Current output does not change immediately (still at $y_e$), while inflation falls to $\pi_0$; Economy moves from A to B.

What do the **impulse response functions** look like?

# QUESTION

DOES IT MAKE SENSE TO TREAT COVID AS A NEGATIVE (TEMPORARY?) AS SHOCK AND, IF SO, WHAT WOULD THE 3-EQUATION MODEL PREDICT?

# ANOTHER EXAMPLE: THE DEFLATION TRAP

- Recall the Fisher equation from Ch. 1: $i = r + \pi^E$
- *The Zero Lower Bound (ZLB) on* $i$ *states that* $\min i = 0$ *, which implies that* $\min r \geq -\pi^E$.
- If expected inflation is -1%, the minimum *r* attainable is 1%.
- *KEY INSIGHT:* $r$ *cannot be reduced below 1% to achieve* $y_e$*, the ZLB is hit and the economy is stuck at a depressed level of output (*$y_0$*).*

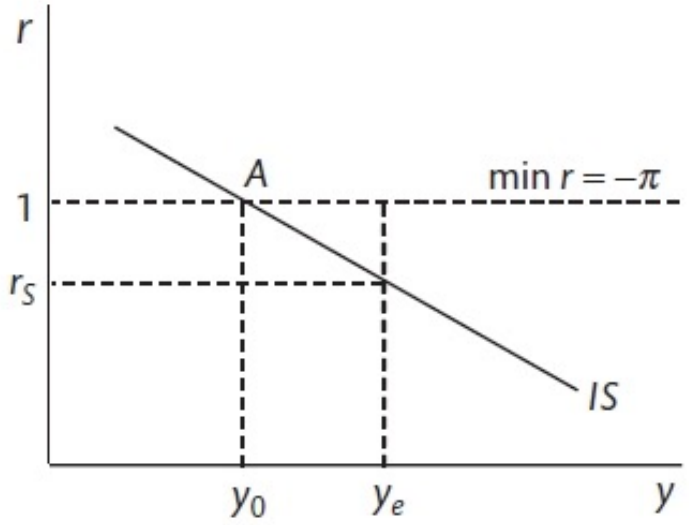



Figure 3.12 The zero lower bound on the nominal interest rate.

# THE DEFLATION TRAP IN THE 3-EQUATION MODEL (FOLLOWING PERMANENT NEGATIVE AD SHOCK)

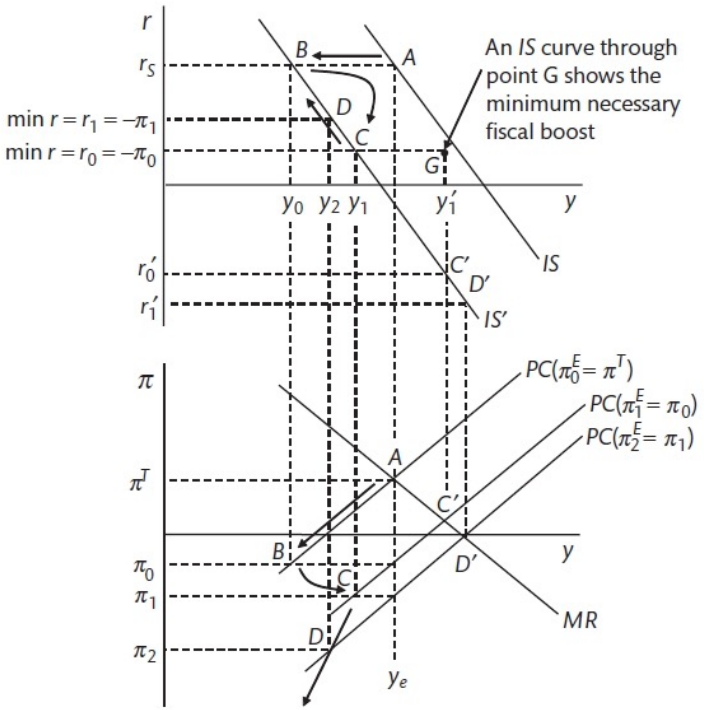



Figure 3.13 How a large negative permanent aggregate demand shock can lead to the economy entering a deflation trap.

**Period 0:**

- Large & permanent negative AD shock: The IS shifts to IS'.
- Inflation is now negative (Deflation), as the economy moves to point 'B'.
- Given the forecasted PC ($\pi_1^E = \pi_0$), the CB would like to choose optimal point $C'$ on the MR, which requires setting $r_0{}'$.
- However, $r_0{}'$ is below the minimum that can be achieved by setting a zero nominal int. rate, so the CB can only set the minimum $r_0 = -\pi_0$.

**Period 1:**

- The lower $r_0$ increases $y$, but $y$ is <u>still below equilibrium</u> at point C
- Thus, inflation falls further to $\pi_1$ and the CB forecasts the next period's PC to be PC ($\pi_2^E = \pi_1$)
- Given this PC, the ideal point for the CB is $D'$, which requires setting $r_1{}'$.
- However, the minimum attainable real int. rate is $r_1 = -\pi_1$.
- Thus the economy ends this period with lower inflation at $\pi_1$, lower output $y_1$, and a higher real int. rate $r_1 = -\pi_1$.

# THE DEFLATION TRAP IN THE 3-EQUATION MODEL (FOLLOWING PERMANENT NEGATIVE AD SHOCK)

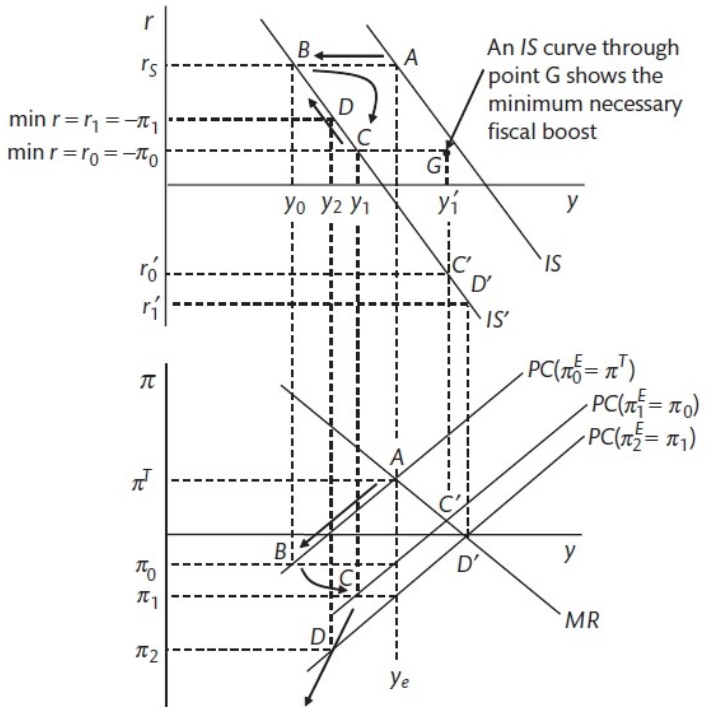



**Figure 3.13** How a large negative permanent aggregate demand shock can lead to the economy entering a deflation trap.

**Period 2 onwards:**

- The higher interest rate $r_1$ dampens demand, output and inflation both fall to $y_2$ and $\pi_2$ respectively (point 'D').
- The economy enters a Deflation Trap: In each future period, inflation falls further, causing $r$ to increase and output to fall continuously.
- Conventional (int. rate based) monetary policy is ineffective in reverting the economy back to its medium-run equilibrium.

# SOLUTIONS TO ZLB PROBLEMS

1. Shifting the IS rightwards (through point 'G') after the initial AD shock.
    - e.g. Increase in autonomous consumption or investment; Fiscal Policy.
    - CB can then achieve desired point $C'$ by setting $r_0$.

2. Creating more positive inflation expectations.
    - If inflation expectations are less negative ($\pi^E$ higher), then $\min r$ is lower and the PC curve shifts up.
    - Conventional MP now works to bring the economy back to equilibrium.

3. Unconventional Monetary Policy (Ch. 7)

# A WORD OR TWO ABOUT EXPECTATIONS

- Expectations are formed by households, firms and the state. Expectations influence consumption, investment, wage-setting and policy decisions.

- How is this reflected in 3-Equation Model?

  i. IS Curve

  *Tobin's Q: Firms and equity markets form expectations of future profits*

  *Permanent Income Hypothesis: Households form expectations over their future income.*

  ii. PC Curve

  *Wage setters form inflation expectations ($\pi_t^E$)*

  iii. MR Curve

  *Policy maker(s) forecast inflationary expectations, position of IS curve.*

# RISK VESUS UNCERTAINTY (VERSUS AMBIGUITY?)

- Expectations are a vital part of economic life, but are more complicated, many would now argue, than standard calculation of expected value.
- Risk is when *"well-behaved probabilities," objective or subjective, can be attached to the full set of future outcomes.* Economic models have this property, but does life?
- This doesnt mean such models are simple.

*e.g. The Bank of England Fan Chart*

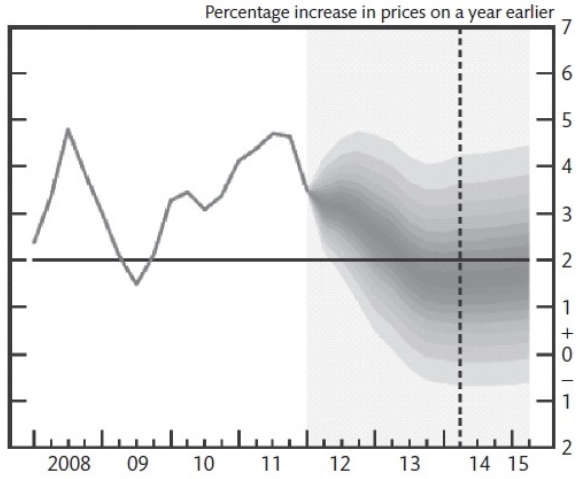
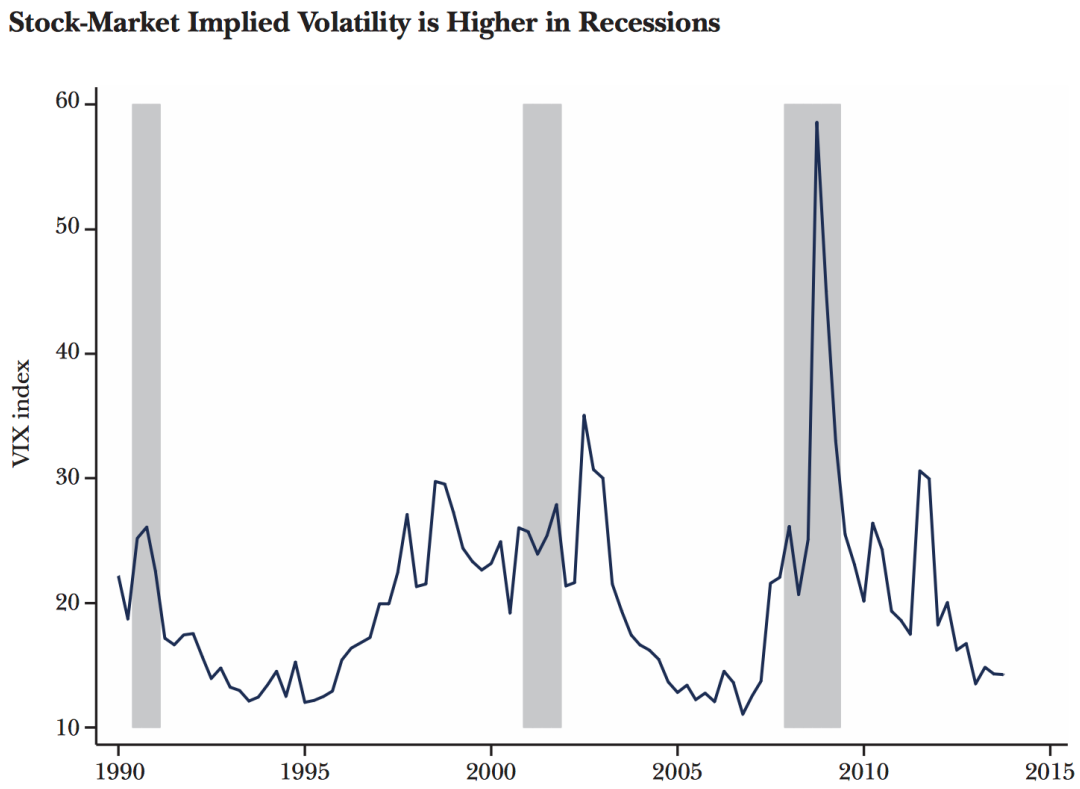



**Figure 4.1** Bank of England's CPI inflation projection based on market interest rate expectations and £325 billion asset purchases.

# RISK VESUS UNCERTAINTY (VERSUS AMBIGUITY?)

- According to Keynes and/or Hayek, an environment is uncertain if it is impossible to assign probabilities and/or the full set of outcomes isn't knowable.
- Experimentalists/behavioralists have attempted to capture this with the notion of "ambiguous" or "non-additive" probabilities. Review the Ellsberg Paradox. (It is now common to measure not just risk aversion but ambiguity aversion too.)
- How might uncertainty matter? We're reasonably confident, for example, that increased uncertainty is associated with stock market volatility.

# BLOOM (JEP, 2014)




The point is not that stock values are (just) lower in a recession but rather that the stock market is also more volatile.

What are the implications for, say, the q-theory of investment?

# INTRODUCING CENTRAL BANK CREDIBILITY

Anchoring Inflation Expectations:

- *Central bank communication* is used to keep inflation expectations ($\pi^E$) anchored at the inflation target ($\pi^T$ ).
- If the inflation target is perfectly credible and $\pi^E$ is anchored, then an inflation shock will only last for one period.
- There is costless disinflation (unemployment does not rise): The PC reverts back to the one indexed by $\pi^T$ in the next period.

Modelling CB credibility ($\chi$):

- PC: $\pi_t = [\chi\pi^T + (1-\chi)\pi_{t-1}] + \alpha(y_t - y_e)$ where $\pi_t^E = \chi\pi^T + (1-\chi)\pi_{t-1}$
- Expected Inflation is a weighted average of the inflation target and lagged inflation.

# Modelling:

CB Credibility ($\chi$) and the adjustment to an inflation shock:

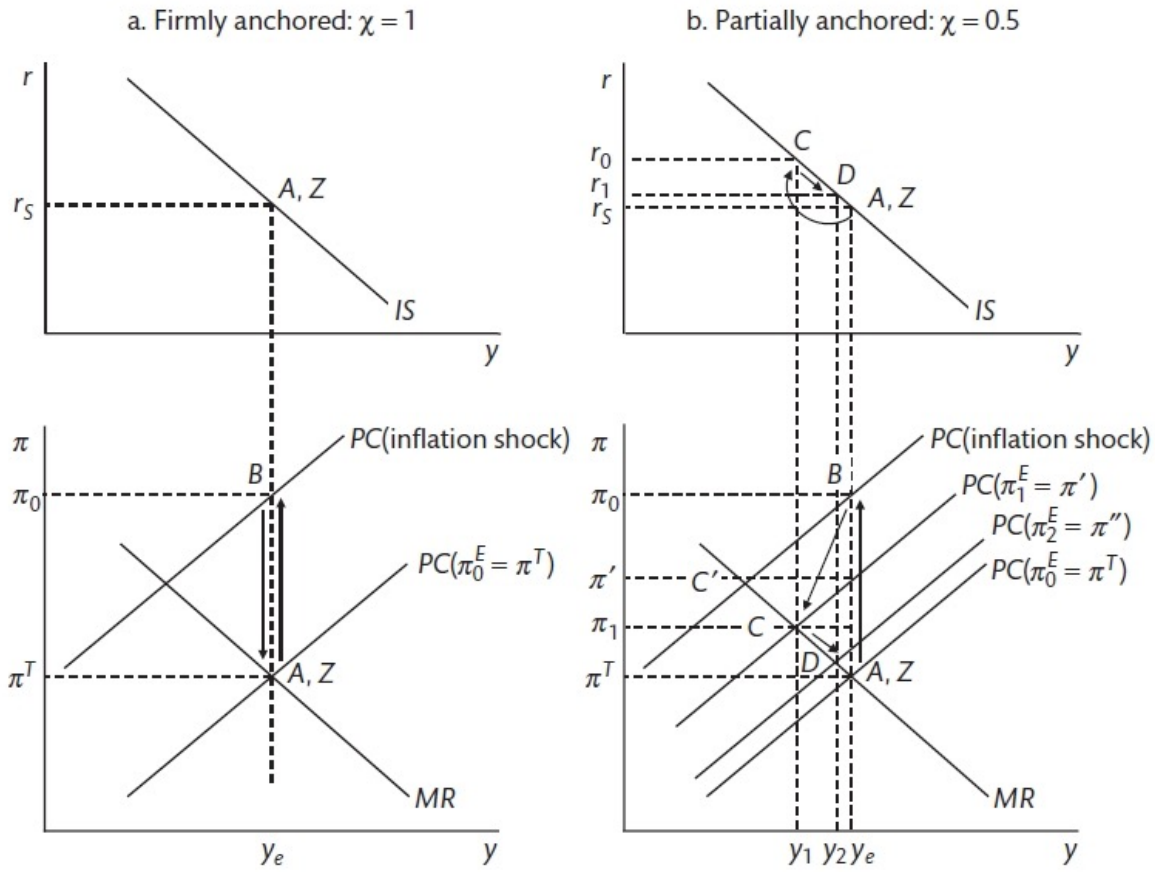



**Figure 4.6** Varying the level of central bank credibility, using the example of an inflation shock:
a. Firmly anchored: $\chi = 1$
b. Partially anchored: $\chi = 0.5$.

# Modelling:

CB Credibility ($\chi$) and the adjustment to an inflation shock :

$\chi = 0$ : Fully Backward-looking

- After a $\pi$ shock, CB needs to raise $r$ → some periods with $y_t < y_e$.

$\chi = 1$ : Firmly anchored at $\pi^T$

- Only 1 period effect of $\pi$ shock → PC reverts to PC ($\pi_0^E = \pi^T$) → CB does not need to change $r$ → $y_t = y_e$ (Disinflation is costless)

$\chi = 0.5$ : Partially anchored at $\pi^T$

- After a $\pi$ shock, CB needs to raise $r$, but to a lesser extent than $\chi = 0$ → fall in output is lower, adjustment to equilibrium quicker
- PC shifts down to PC ($\pi_0^E = \pi'$) instead, economy moves to point C