Business Cycles

Part 4: The New Keynesian Model
Lecture 8: The Effect of Shocks in New Keynesian Model

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Outline

Part 1: Introduction

Part 2: Microeconomic Foundations

Part 3: The Real Business Cycle Model

Part 4: The New Keynesian Model

- Lecture 7: Deriving the New Keynesian Model
- Lecture 8: The Effects of Shocks in the New Keynesian Model

Part 5: Financial Crises

Learning Objective of Todays Lecture

1. Understanding business cycle dynamics in the New Keynesian model.
2. Comparing dynamics in the New Keynesian and the neoclassical model.
3. Understanding the transition from the short- to the medium-run, i.e. the connetion between the New Keynesian and the neoclassical model.

Literature

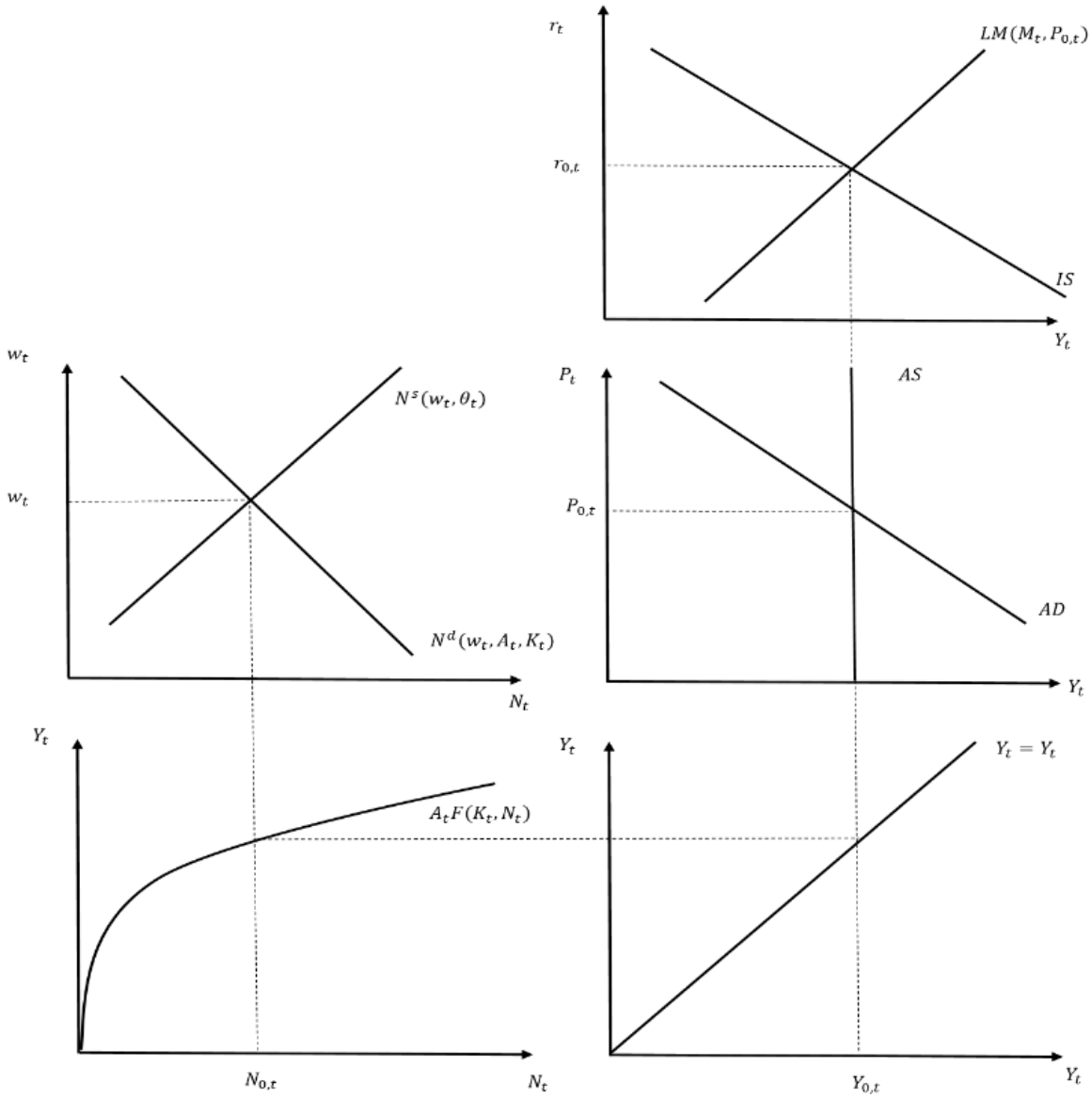
Required reading:

- Textbook chapter 26-27

Optional reading:

- -

Repetition: RBC IS-LM-AD-AS Equilibrium



$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$
$$N_t = N^s(w_t, \theta_t)$$
$$N_t = N^d(w_t, A_t, K_t)$$
$$I_t = I^d(r_t, A_{t+1}, K_t)$$
$$Y_t = A_t F(K_t, N_t)$$
$$Y_t = C_t + I_t + G_t$$
$$M_t = P_t M^d(i_t, Y_t)$$
$$r_t = i_t - \pi_t^e$$

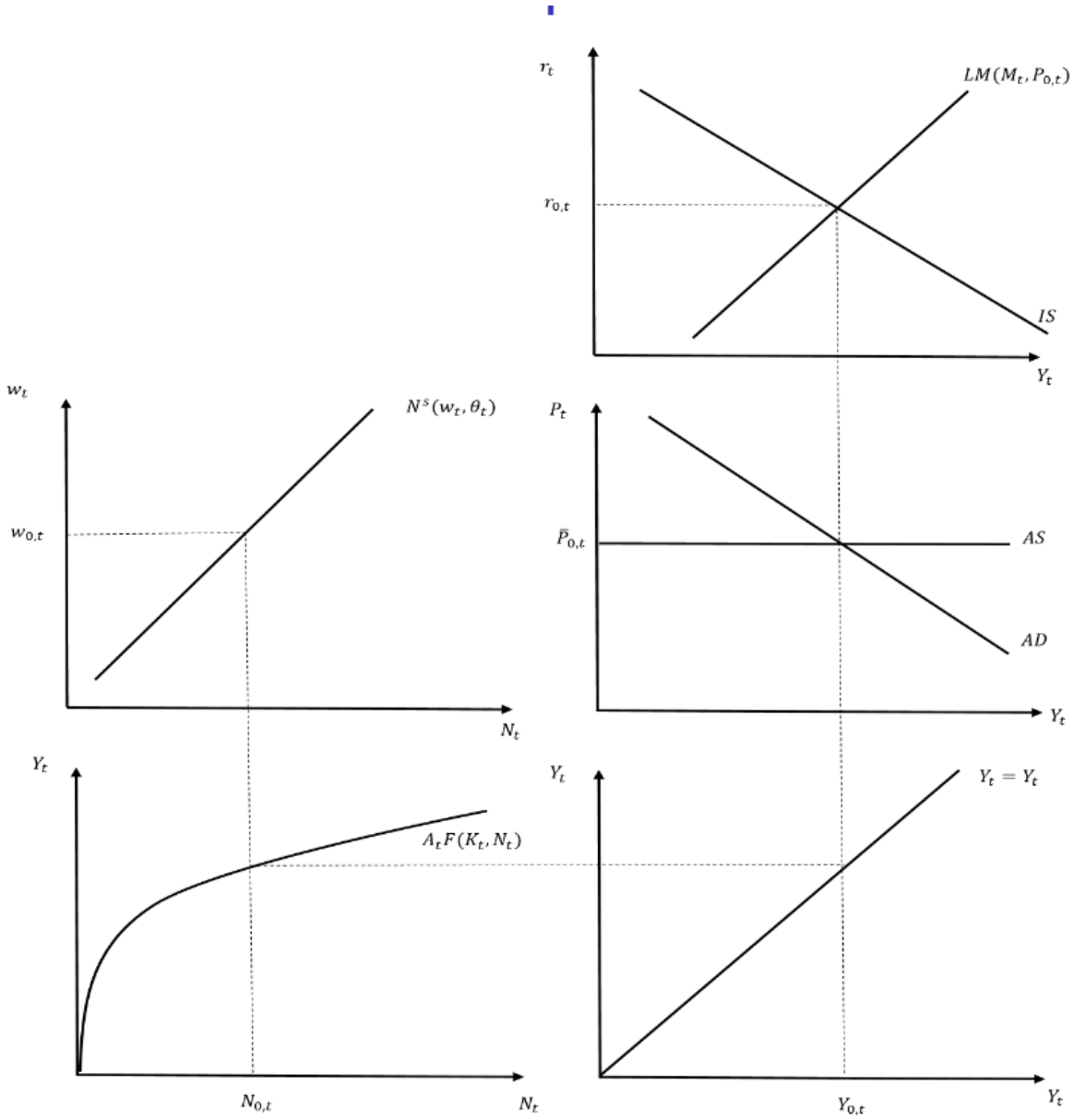
Output is determined by supply

AS-curve vertical

Intersection of AS and AD determines price level

Real interest rates adjusts to bring demand side in equilibrium

Repetition: New Keynesian IS-LM-AD-AS Equilibrium



$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$

$$N_t = N^s(w_t, \theta_t)$$

$$P_t = \bar{P}_t$$

$$I_t = I^d(r_t, A_{t+1}, K_t)$$

$$Y_t = A_t F(K_t, N_t)$$

$$Y_t = C_t + I_t + G_t$$

$$M_t = P_t M^d(i_t, Y_t)$$

$$r_t = i_t - \pi_t^e$$

Prices exogenous

AS-curve horizontal

Intersection of AS and AD determines output

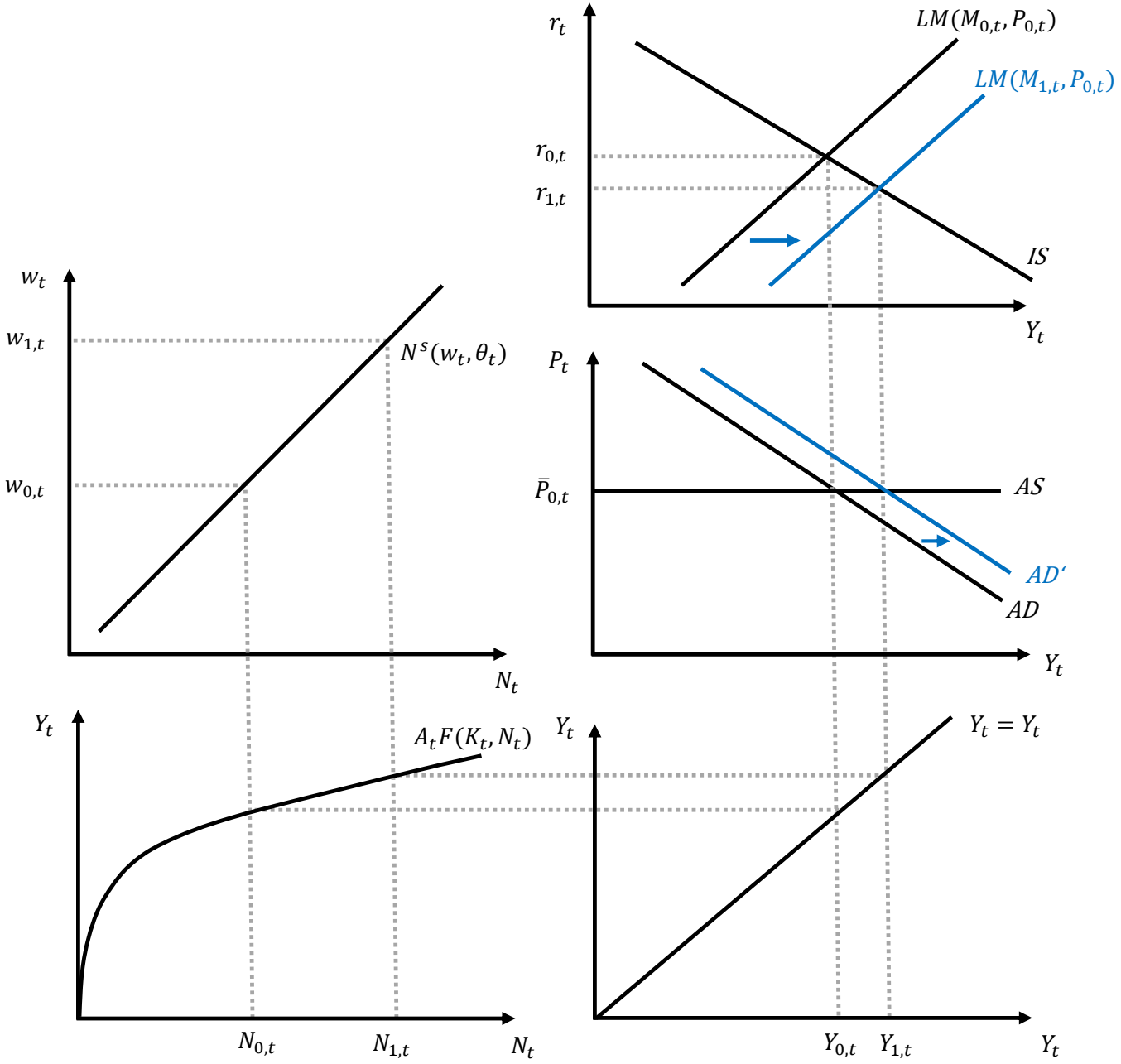
Labor is determined after output

Wage adjusts accordingly

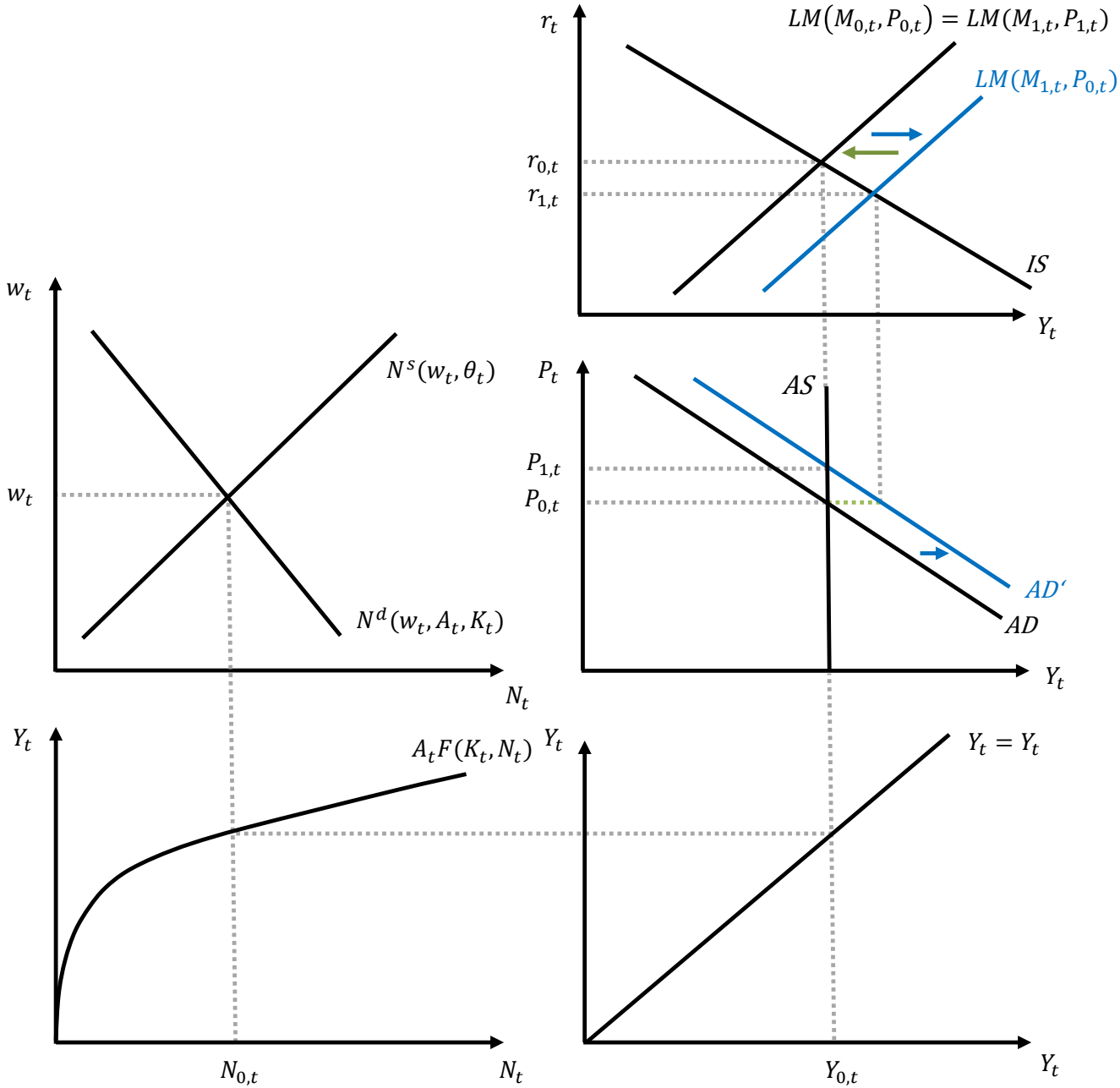
Increase in M_t

- Whereas in the neoclassical model Y_t is supply determined, in the New Keynesian model output is demand determined
- First, figure out what Y_t is, and then figure out what N_t must be to support that
- An increase in M_t shifts the LM curve to the right, and hence the AD curve to the right as well
- With a horizontal (as opposed to vertical) AS curve, this results in a higher Y_t and lower r_t
- The lower r_t stimulates I_t; lower r_t plus higher Y_t means C_t is higher
- To support higher Y_t, N_t must rise
- To induce workers to work more, w_t must rise

Increase in M_t: Graphically in the New Keynesian Model



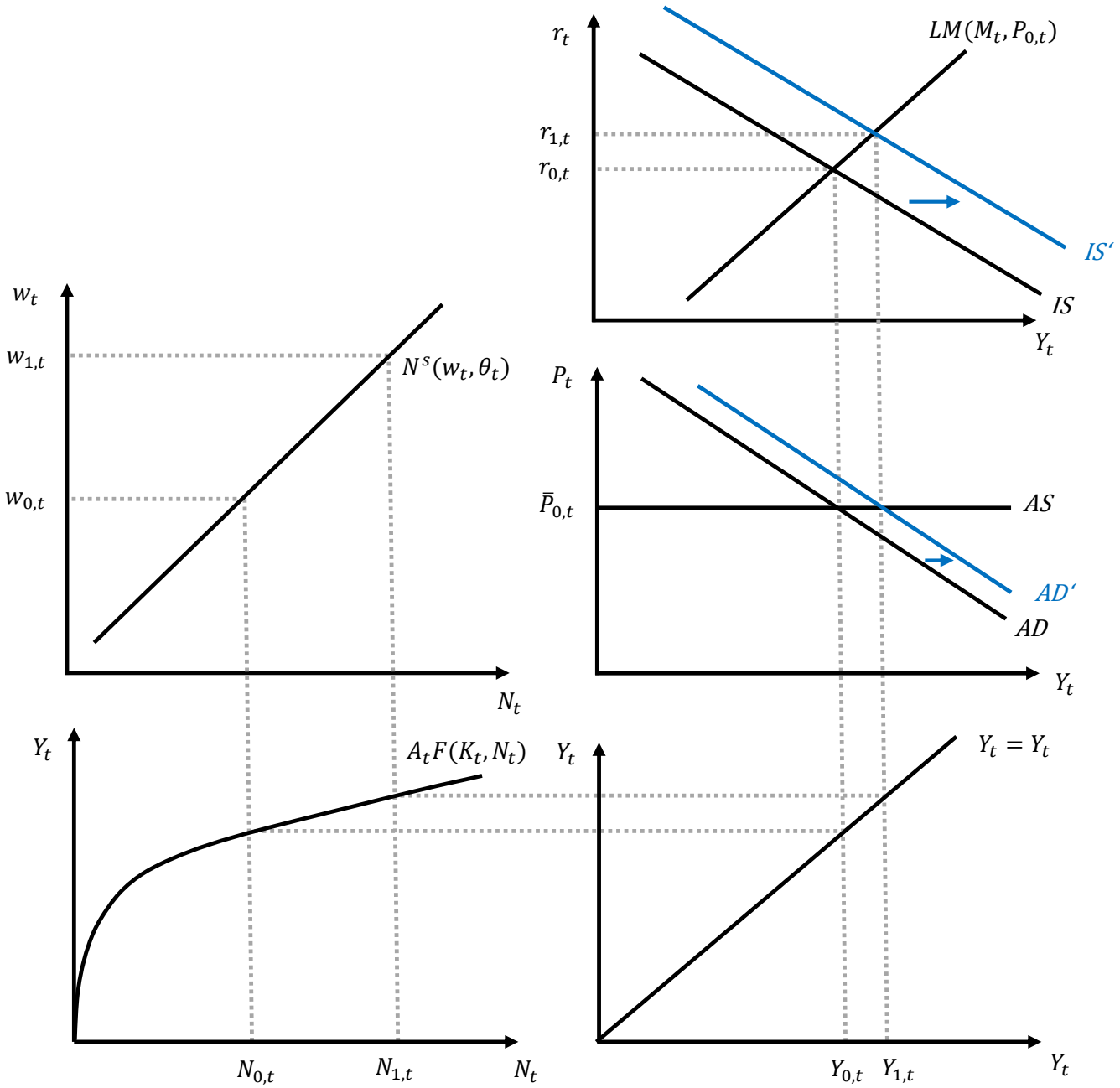
Increase in M_t: Graphically in the Neoclassical Model



IS Shock

- Increase in A_{t+1}, G_t, or decrease in G_{t+1}: shifts IS curve to the right
- Results in AD curve shifting to the right, which means higher Y_t
  - This effect is independent of the source of the shift.
  - To understand how consumption and investment react, the source of the shift is important.
- Higher Y_t means that N_t must rise
- Again, compare results to neoclassical model

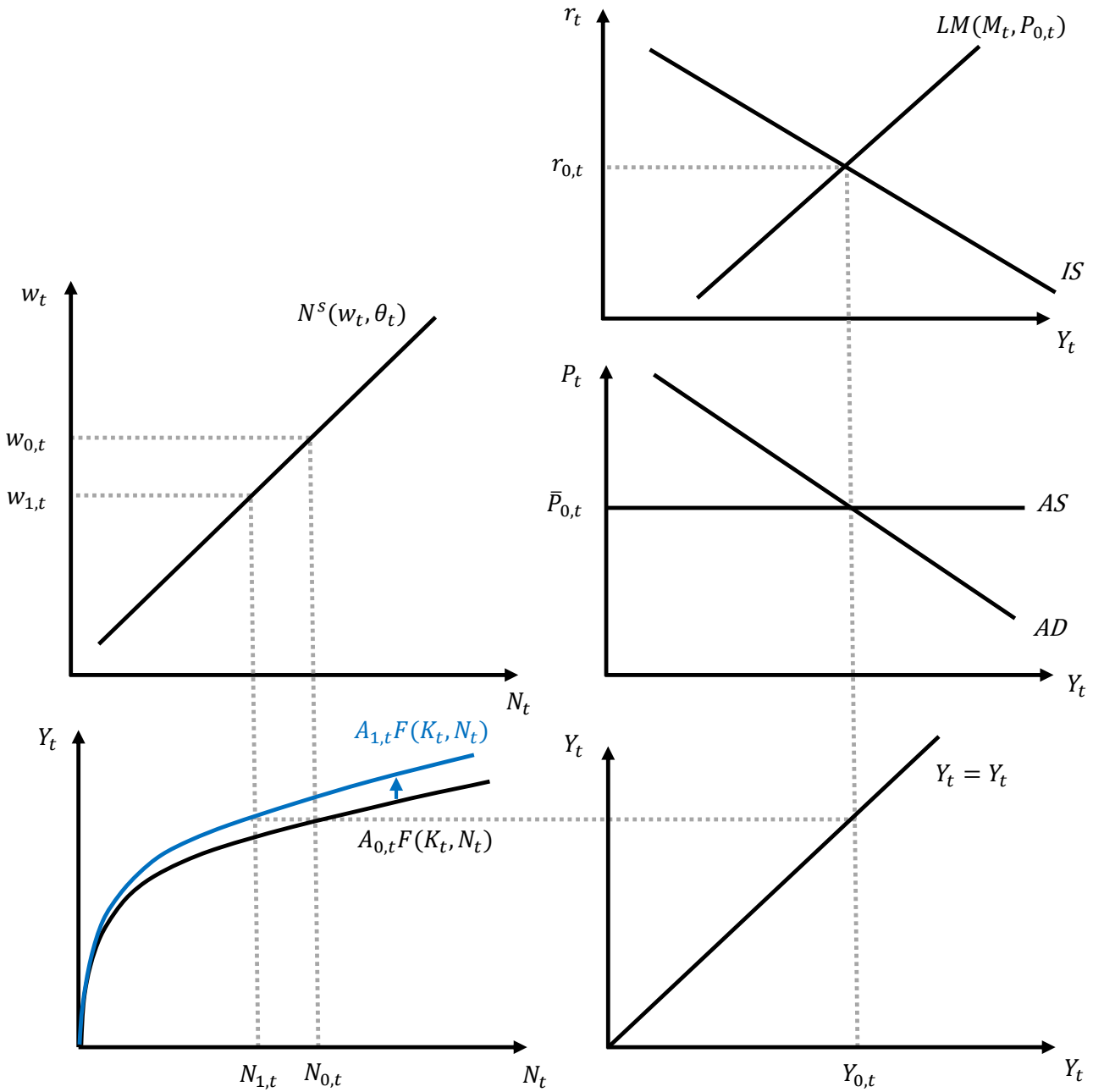
New Keynesian Model: IS Shock



Increase in A_t

- Since $\bar{P}_t$ doesn't change, in the sticky price model an increase in A_t has no effect on Y_t
- Mechanically, this means that N_t must fall

Increase in A_t: Graphically



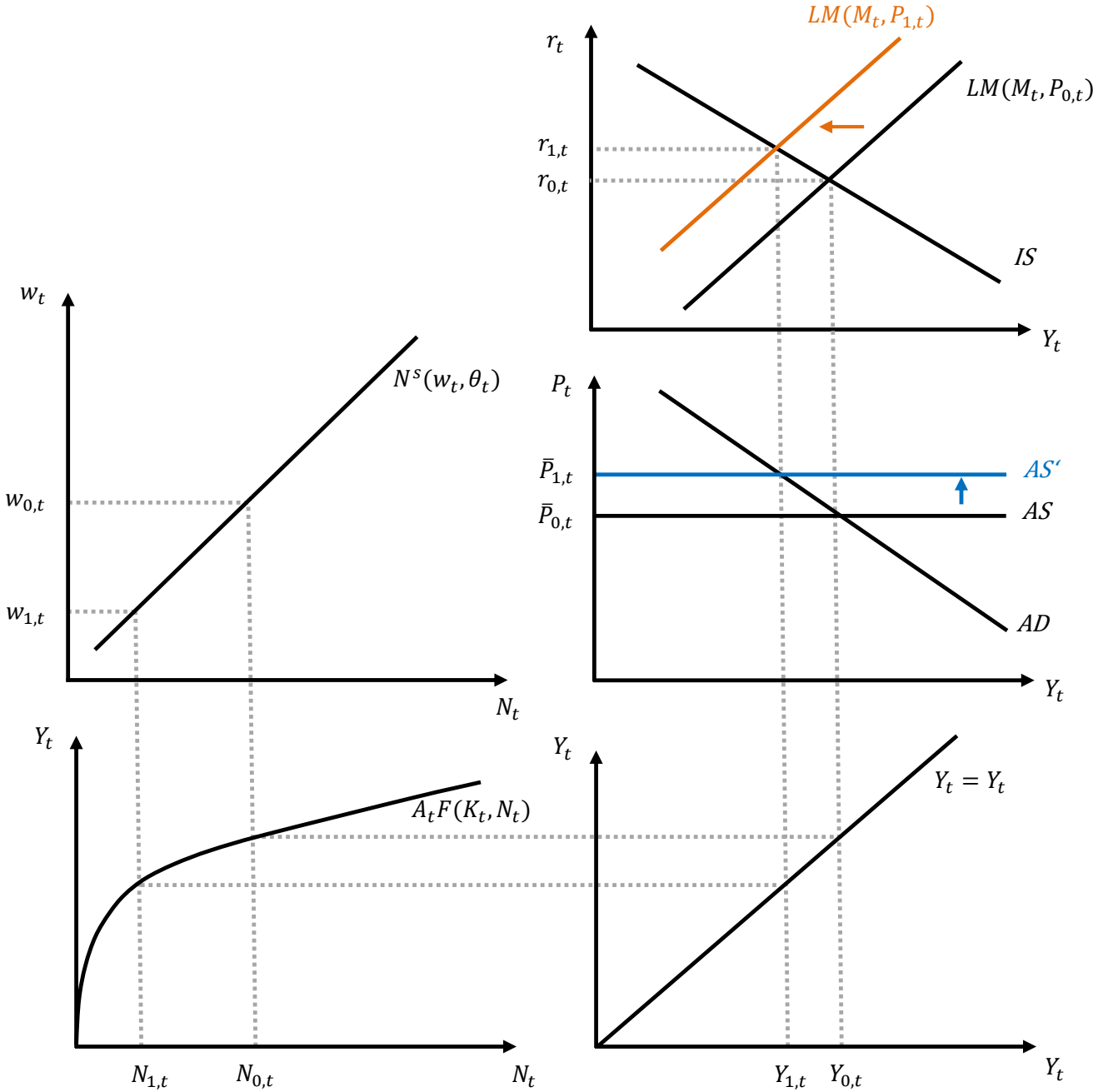
Comparing Neoclassical and New Keynesian Models

- Useful rule of thumb: demand shocks have bigger effects in New Keynesian model and supply shocks smaller effects relative to neoclassical model
- For productivity shock in particular, it is "contractionary" in sense of lowering hours worked
- Some empirical debate on this:
  - Gali (1999) and Basu, Fernald, and Kimball (2006): positive productivity shock lowers hours in the short run (i.e. the New Keynesian model) and raises hours in the medium run (i.e. the neoclassical model)
  - Nevertheless, there is some debate about these empirical findings

Increase in $\bar{P}_t$

- This is the only exogenous variable which will shift the AS curve in the sticky price model
- Real world interpretation: increase in prices of intermediate inputs (e.g. price of oil)
- Results in AS shifting up, Y_t falling, and P_t rising. Sometimes called “stagflation” – prices (inflation) rising and output (employment) declining.

Graphical Effects: Increase in $\bar{P}_t$



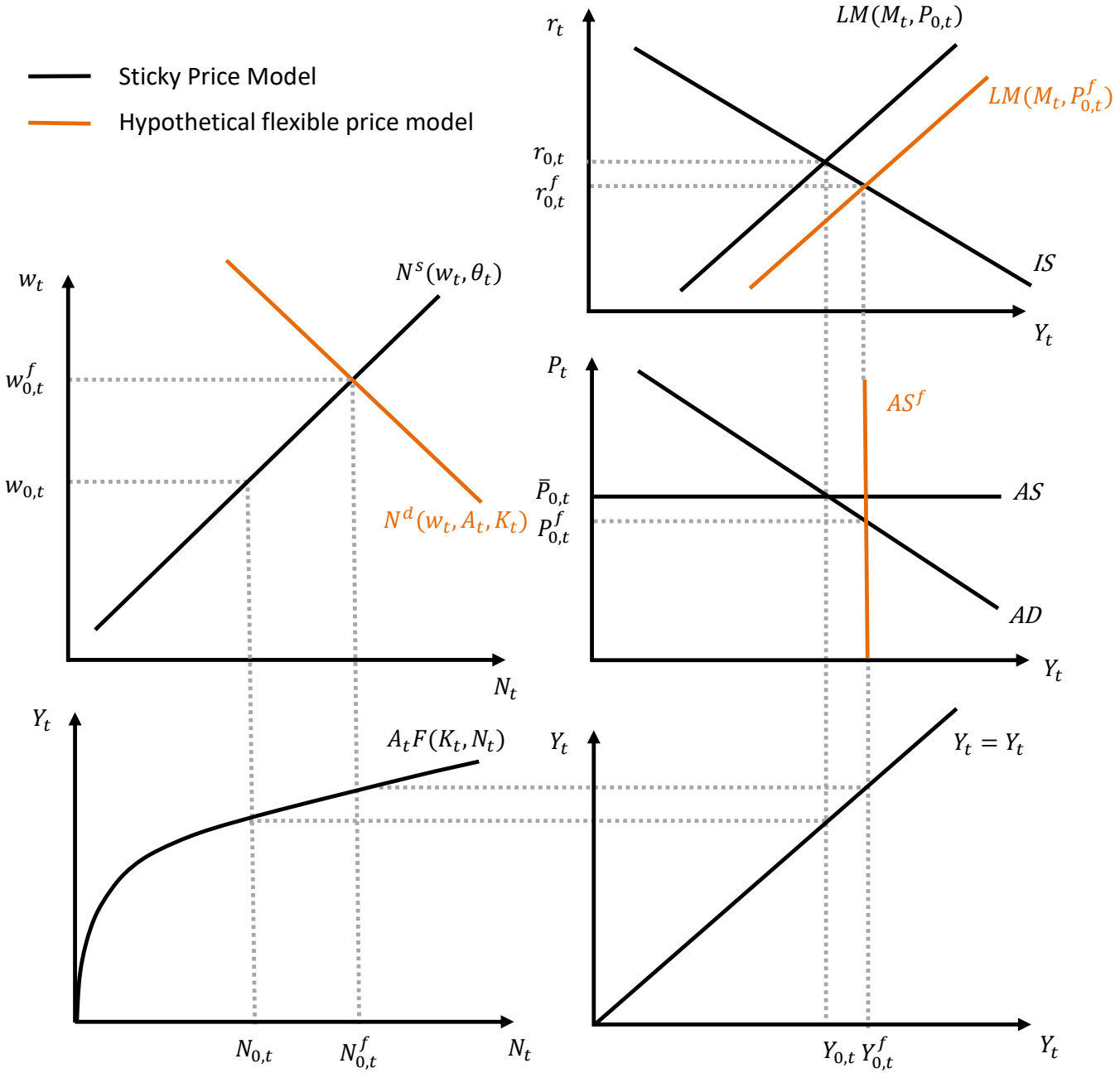
Summarizing Qualitative Effects in the Sticky Price Model

	Exogenous Shock				
Variable	$\uparrow M_t$	$\uparrow$ IS curve	$\uparrow A_t$	$\uparrow \theta_t$	$\uparrow \bar{P}_t$
Y_t	+	+	0	0	-
N_t	+	+	-	0	-
w_t	+	+	-	+	-
r_t	-	+	0	0	+
i_t	-	+	0	0	+
P_t	0	0	0	0	+

Dynamics

- The New Keynesian model is a special case of the neoclassical model – we simply swap labor demand with a fixed nominal price
- Call Y_t^f the "flexible price" level of output – the level of output which would emerge in the neoclassical model
- If the firm could adjust price, it would do so that it is on its labor demand curve, which would entail $Y_t = Y_t^f$
- Refer to $Y_t - Y_t^f$ as the output gap – the gap between actual output and what it would be in the absence of price stickiness
- To see this graphically, draw in a hypothetical AS curve for the neoclassical model – call this AS^f

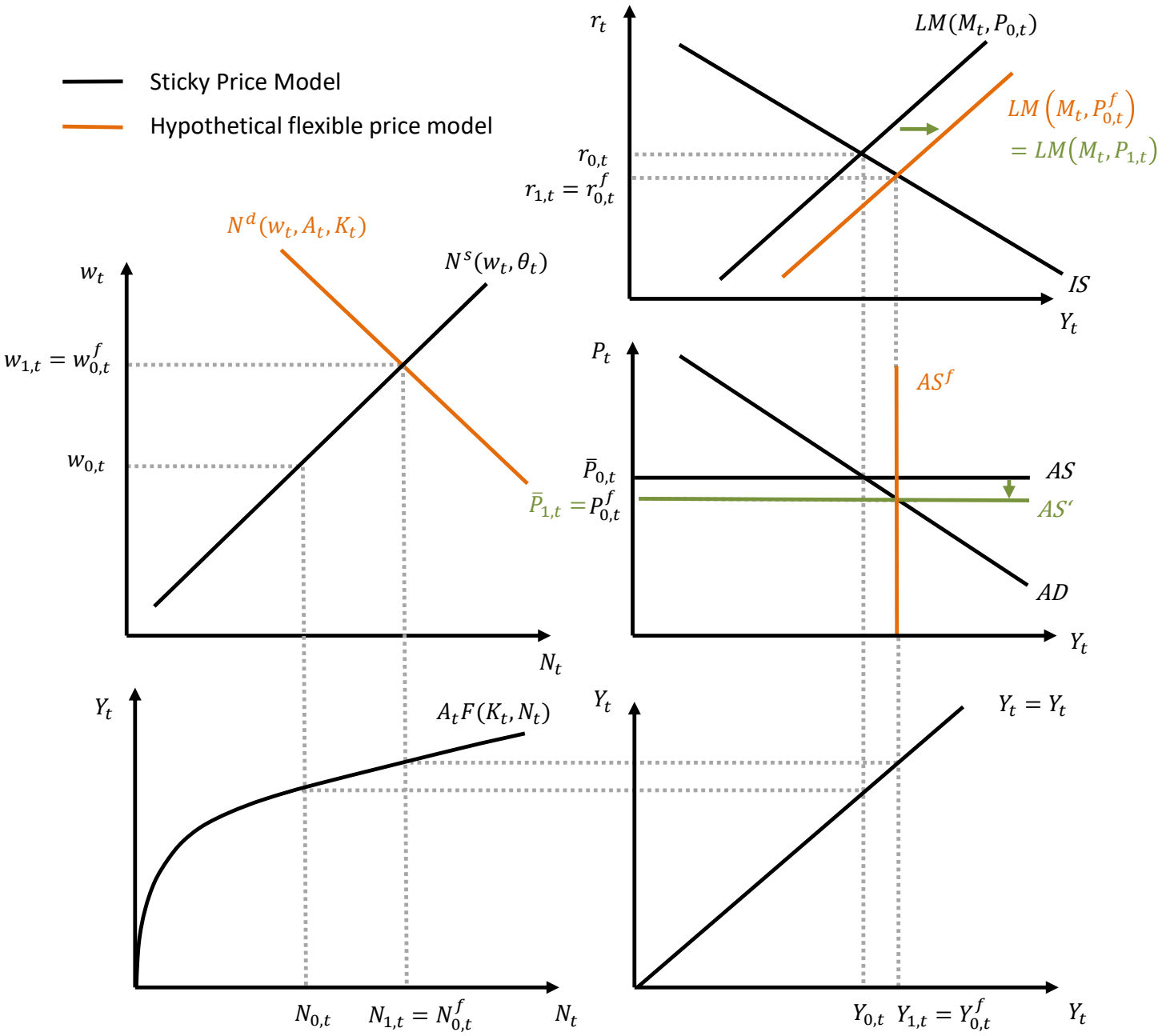
A Negative Output Gap



Transition from Short Run to Medium Run

- If the firm is producing less than it would like, it will face pressure to lower its price
- Hence, as we transition from short run (price fixed) to medium run (price flexible), the firm will lower its price, $\bar{P}_t$
- This will cause the AS curve to shift down, and output to rise
- This pressure will persist until “the gap is closed”

Closing the Gap



Dynamic Response to Shocks

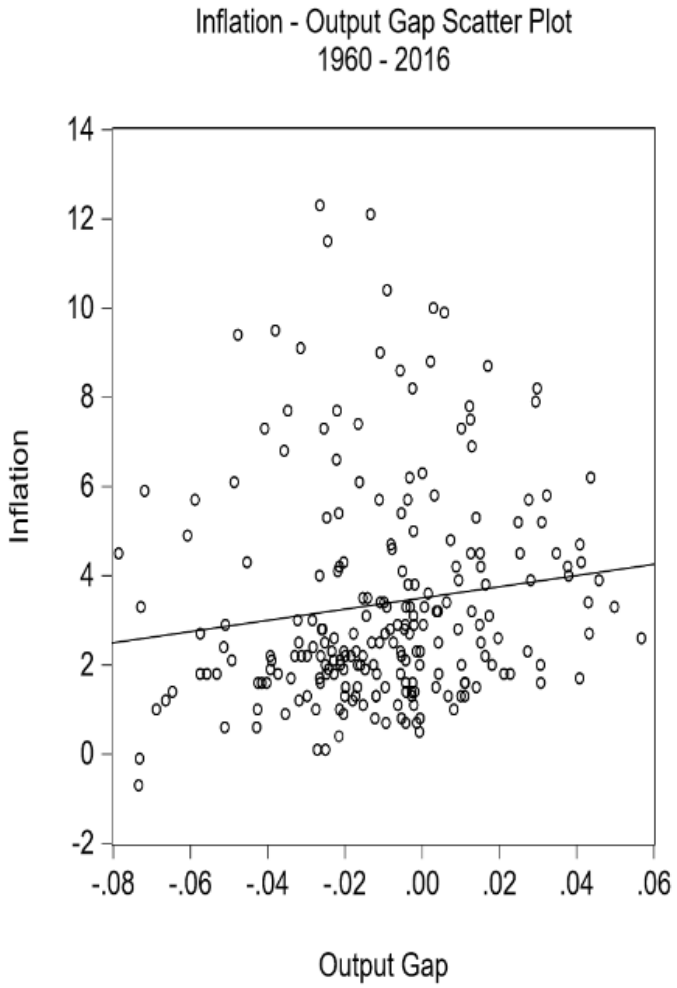
- Can use this approach to think about effects of shocks in both short run and medium run.
- In the short run, AS curve is fixed, and we determine endogenous variables with that fixed AS curve.
- In the medium run, the AS curve adjusts to "close the gap." Can graphically do this by thinking about a hypothetical vertical "medium run" AS curve (AS^f).

Phillips Curve

- This analysis suggests that there ought to exist a positive relationship between the output gap, $Y_t - Y_t^f$, and the inflation rate, π_t (the change in prices)
- Positive output gaps put upward pressure on prices, and negative gaps downward pressure on prices
- The Phillips Curve formalizes this idea:

$$\pi_t = \gamma\left(Y_t - Y_t^f\right), \qquad \gamma > 0$$

Empirical Relationship Between Inflation and the Output Gap



- Masks sub-sample differences
- Ambiguity about how to measure Y_t^f empirically

Summary

- In contrast to the Neoclassical model, demand shocks affect output in New Keynesian models. Also, real variables are simultaneously determined with nominal variables so a change in the money supply has real effects.
- The AS curve is flat in the sticky price economy meaning output is effectively determined by aggregate demand. Consequently, changes in productivity have no effect on output. Increases in the money supply level, decreases in the exogenous price level, and anything that shifts the IS curve to the right increases aggregate demand and therefore output.
- Although supply shocks do not affect the equilibrium level of output, they do affect the labor market. After a positive TFP shock, the same amount of output can be produced with fewer inputs so labor and the real wage decrease.
- In the sticky price model a suboptimal equilibrium is one in which firms would like to change prices but are unable to. As prices become flexible over a longer time horizon, firms will adjust prices bringing the equilibrium closer to the Neoclassical model. For instance, if output is lower than its flexible level, firms have an incentive to reduce prices which shifts the economy closer to the Neoclassical equilibrium. The intuition runs in the reverse direction if output is greater than its flexible price level.