# MONETARY POLICY

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# Topics to be covered

- Inflation-Unemployment Trade-off?
  - Phillips curve theory and empirics
  - The Lucas critique
  - Expectations augmented Phillips curve

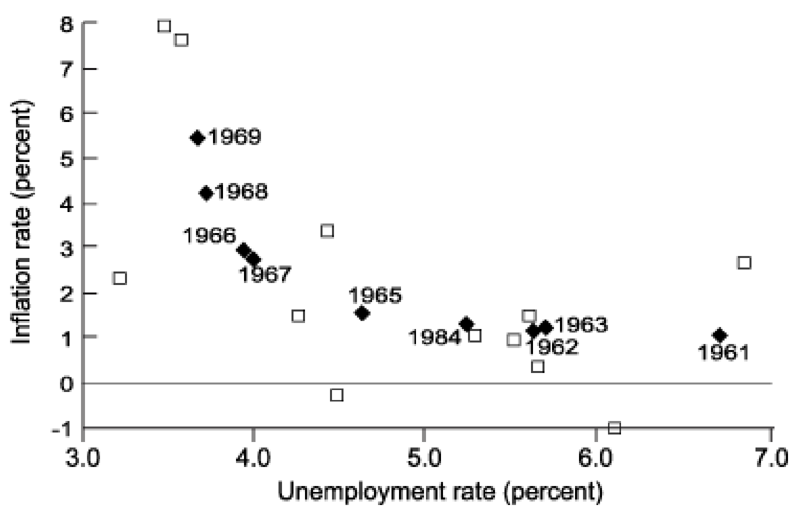
- Monetary Policy
  - Overview of “The Science of Monetary Policy”
  - Framework for analysis of monetary policy
  - Optimal monetary policy without commitment
  - Credibility and the gains from commitment
  - Monetary transmission mechanisms

# Inflation–Unemployment Trade-off?

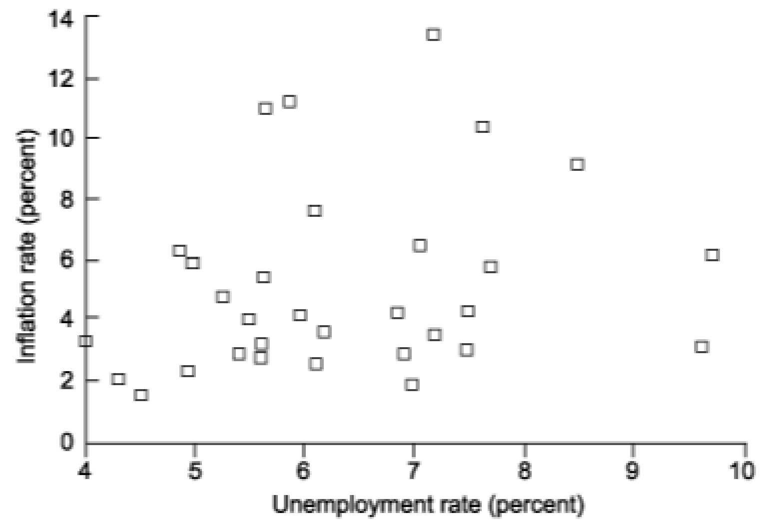
- Phillips analyzed ninety-seven years of British data and found that, historically, unemployment tend to be low in years when nominal wages grew rapidly and high in years when nominal wages grew slowly.
  - So Phillips original work: link between unemployment and growth rate of wages rather than inflation.
- In the 1950 and 1960 studies on different countries and time periods, in many cases, found a negative relationship between inflation and unemployment.

# Inflation–Unemployment Trade-off?

*Inflation versus Unemployment in the United States, 1948-1969*




*Inflation versus Unemployment in the United States since 1970*



# Inflation–Unemployment Trade-off?

- In the 1960's US data exhibited falling unemployment and rising inflation.
- All these findings created a false perception that it was possible to systemically reduce unemployment if some inflation was tolerated.
- In the mid 1970's there was high unemployment and also high inflation (stagflation), which created a puzzle for the Phillips curve relation.

# Inflation–Unemployment Trade-off?

a) Why there was a relationship ($\pi$,$u$) in pre 70's?

b) Why it vanished after 1970?

c) Does Phillips curve actually provide a menu of choices from which policy makers can choose?

# The Lucas Critique

- Forecasting the effects of policy changes has often been done using models estimated with historical data.
- Robert Lucas pointed out that such predictions would not be valid if the policy change alters expectations in a way that changes the fundamental relationships between variables.

# An Example of The Lucas Critique

- Prediction (based on past experience):
  An increase in the money growth rate will reduce unemployment.

- The Lucas critique points out that increasing the money growth rate may raise expected inflation, in which case unemployment would not necessarily fall.

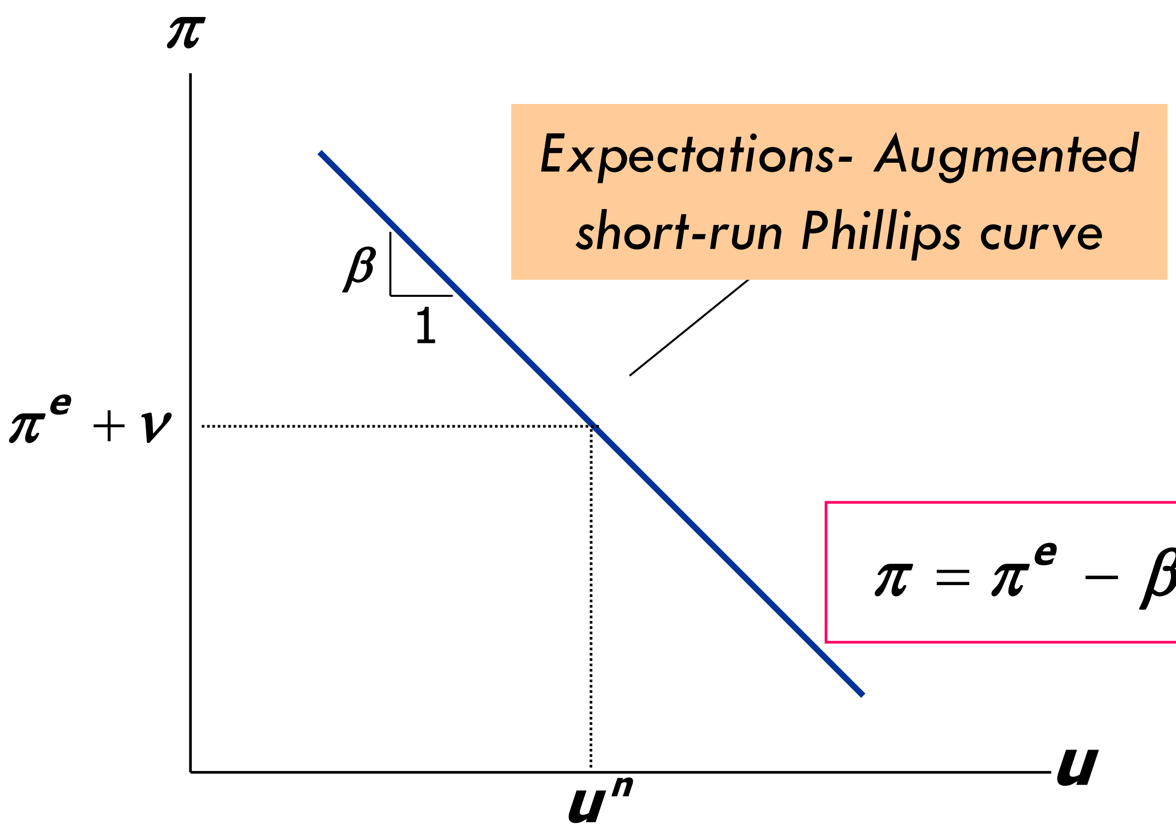
# Expectations-Augmented Phillips Curve

- Friedman and Phelps argued – purely on the basis of economic theory – that there should not be a stable negative relationship between inflation and unemployment.
- Instead, a negative relationship should exist between unanticipated inflation and cyclical unemployment.

$$\pi - \pi^e = -h\,(u - u^n) + v$$

  - If change in $M^s$ = expected change in $M^s$ → no effect on output and only change in prices.
  - If change in $M^s$ > expected change in $M^s$ → there could be a temporary effect on output.

# Graphing the Phillips Curve




$$\pi = \pi^e - \beta(u - u^n) + v$$

# Shifting the Phillips Curve

- The relationship illustrated by the expectations-augmented Phillips curve depends on the expected rate of inflation ($\pi^e$) and the natural rate of unemployment ($u^n$).
- A supply shock (v) is likely to affect both $\pi^e$ and $u^n$.
- A negative supply shock that increases $\pi^e$ or/and $u^n$ should shift the Phillips curve up and to the right.
  - Overall, the Phillips curve should be particularly unstable during periods of supply shocks.

# The Science of Monetary Policy by Clarida, Gali and Gertler (1999)

- Objective:
  - Review the recent literature on monetary policy analysis
  - Emphasize implications for policy-making in practice.

- Approach:
  - Exposit the monetary policy design problem within a simple baseline theoretical model, and then consider the implications of adding various real world complications.
  - Concentrate on results that are reasonably robust across commonly accepted macroeconomic frameworks.
  - Compare how the predictions from theory square with policy making in practice.

# Overview of the Model

- Relatively simple model with loss function for monetary authority.
- Monetary instrument is the short-term interest rate.
- Policy design: how should short-term interest rate adjust to current state of the economy?
- Complication: Private sector behavior depends on expected future course of monetary policy.
- Big issue: Is monetary policy credible? Look at a model with and without commitment.

# Optimal Policy Without Commitment

- Optimal policy involves inflation targeting in the sense of a gradual adjustment to the optimal inflation rate.
- Nominal interest rate should adjust more than one-for-one with inflation.
- Offset demand shocks, accommodate supply shocks.

# Benefits of Commitment

- Central bank target for real output exceeds the natural rate. This leads to inflation bias without commitment.
- Even if target is the natural rate, there can be gains from commitment if current price setting depends on future expectations.

# Framework for Analysis of Monetary Policy

- Model structure:
  - IS curve
  - Phillips curve
  - Policy objective

- Model can be derived from a dynamic general equilibrium framework with money and nominal price rigidities:
  - Real money balances in the utility function.
  - Monopolistic competition
  - Staggered pricing
  - Simplification: Consumption goods only. No capital goods.

# The IS Curve

- Denote the natural level of output with $z_t$ :

$$z_t = z_{t-1} + \varepsilon_t$$

where $\varepsilon_t$ is a mean zero iid shock to the change in $z$.

- The output gap, $x_t$, is defined as output, $y_t$, relative to the natural rate :

$$x_t = y_t - z_t$$

- IS curve relates current output to the current real interest rate

$i_t - E_t\{\pi_{t+1}\}$ and future output.

$$y_t = -\varphi[i_t - E_t\{\pi_{t+1}\}] + E_t\{y_{t+1}\} + g_t$$

where $g_t$ is a demand shock.

- Since $E_t\{z_{t+1}\} = z_t$ the IS curve can be written as :

$$x_t = -\varphi[i_t - E_t\{\pi_{t+1}\}] + E_t\{x_{t+1}\} + g_t$$

# Phillips Curve

- The Phillips Curve relates current inflation to the current output gap, expected future inflation, and shock to the price - setting $u_t$ :

$$\pi_t = \lambda x_t + \beta E_t\{\pi_{t+1}\} + u_t$$

- Solving this equation forward implies that current inflation depends on the PDV of expected future output gaps and shocks to inflation :

$$\pi_t = E_t\left\{\sum_{i=0}^{\infty} \beta^i \left[\lambda x_{t+i} + u_{t+i}\right]\right\}$$

- Intuitively : when output is above the natural rate, $x_t > 0$, and real marginal cost of production is high. Firms will tend to increase their prices in response. Because firms cannot adjust prices immediately, they must take into account future as well as current movements in the output gap when deciding how much to change prices today. Thus the inflation rate is forward looking.

# The LM Curve

- In logs, money demand satisfies an equation of the form :

$$m_t - p_t = \kappa y_t - \eta i_t + \nu_t$$

- With the nominal interest rate, $i_t$, as the instrument of monetary policy, we can ignore the LM curve.

- The reason is that money supply is not exogenous anymore, but it is a function of the nominal interest rate.

# The Policy Objective

- The policy objective is to minimize the deviation between the output gap and the target gap $k$, and the deviation of inflation from its target $\pi^*$

$$\min \frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[ \alpha \left( x_{t+i} - k \right)^2 + \left( \pi_{t+i} - \pi^* \right)^2 \right] \right\}$$

- The coefficient $\alpha$ measures the monetary authority's preference for output gap stability relative to inflation stability.
- We will start by assuming that the desired output gap is zero: $k = 0$. We will consider what happens if $k > 0$ later (we are below the steady-state state level of output as there is a markup)
- Without loss of generality we also assume $\pi^* = 0$ to simplify algebra.

# The model compactly

- IS:

$$x_t = -\varphi\left[i_t - E_t\left\{\pi_{t+1}\right\}\right] + E_t\left\{x_{t+1}\right\} + g_t$$

- AS:

$$\pi_t = \lambda x_t + \beta E_t\left\{\pi_{t+1}\right\} + u_t$$

where $g_t$ and $u_t$ are disturbances terms that obey, respectively:

$$g_t = \mu g_{t-1} + \hat{g}_t$$

$$u_t = \rho u_{t-1} + \hat{u}_t$$

for $0 \leq \mu \leq 1, 0 \leq \rho \leq 1$. Both $\hat{g}_t$ and $\hat{u}_t$ are i.i.d random variables with zero mean and variances $\sigma_{\mathrm{g}}^2$ and $\sigma_{\mathrm{u}}^2$, respectively.

- Policy objective:

$$\min \frac{1}{2} E_t\left\{\sum_{i=0}^{\infty} \beta^i\left[\alpha\left(x_{t+i}\right)^2 + \left(\pi_{t+i}\right)^2\right]\right\}$$

# The Policy Problem and Discretion versus Rules

- The policy problem is to choose a time path for the instrument $i_t$ to engineer time paths of the target variables $x_t$ and $\pi_t$ that minimize:

$$\min \frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[ \alpha \left( x_{t+i} \right)^2 + \left( \pi_{t+i} \right)^2 \right] \right\}$$

subject to

- IS:

$$x_t = -\varphi \left[ i_t - E_t \left\{ \pi_{t+1} \right\} \right] + E_t \left\{ x_{t+1} \right\} + g_t$$

- AS:

$$\pi_t = \lambda x_t + \beta E_t \left\{ \pi_{t+1} \right\} + u_t$$

# The Policy Problem and Discretion versus Rules

- Current policy affects behavior, but also expectations of future policy.

- Iterating the IS and AS curves forward:

$$x_t = E_t\left\{\sum_{i=0}^{\infty}\left[-\varphi\left[i_{t+i} - E_t\{\pi_{t+1+i}\}\right] + g_{t+i}\right]\right\}$$

$$\pi_t = E_t\left\{\sum_{i=0}^{\infty}\beta^i\left[\lambda x_{t+i} + u_{t+i}\right]\right\}$$

- Since a central bank can affect behavior by influencing expectations of future policy, there may be gains from credible commitments.

# Optimal Monetary Policy without Commitment

- Mechanically:
  - The central bank computes an optimal rule for $i_t$ taking the private sectors expectations of the future as given.
  - Given the optimal feedback rule, the private sector makes a rational forecast of the future.
- Key implications of no commitment
  - Future inflation and output cannot be influenced by current actions.
  - Central bank cannot directly manipulate expectations.

# Implied Policy Problem without Commitment

- Stage 1. Each period, choose $x_t$ and $\pi_t$ to minimize:

$$\min \frac{1}{2}\left[\alpha x_t^2 + \pi_t^2\right] + F_t$$

subject to

$$\pi_t = \lambda x_t + f_t$$

taking as given $F_t$ and $f_t$, where

$$F_t \equiv \frac{1}{2} E_t \left\{ \sum_{i=1}^{\infty} \beta^i \left[ \alpha \left( x_{t+i} \right)^2 + \left( \pi_{t+i} \right)^2 \right] \right\} \text{ and } f_t \equiv \beta E_t \left\{ \pi_{t+1} \right\} + u_t$$

- Stage 2. Given $x_t^*$ and $\pi_t^*$, pick $i_t$ to satisfy

$$x_t^* = -\varphi\left[i_t - E_t\left\{\pi_{t+1}^*\right\}\right] + E_t\left\{x_{t+1}^*\right\} + g_t$$

# Central Bank's Optimality Condition:

$$L = -\tfrac{1}{2}\left[\alpha x_t^2 + \pi_t^2\right] + F_t + \mu\left[\lambda x_t + f_t - \pi_t\right]$$

$$\tfrac{\partial L}{\partial x_t} = -\alpha x_t + \mu\lambda = 0 \quad , \quad \tfrac{\partial L}{\partial \pi_t} = -\pi_t - \mu = 0$$

$$x_t = -\frac{\lambda}{\alpha}\pi_t$$

This is a lean - against - the wind policy. If $\pi > 0$ (target level), raise interest rate to push down output below its natural rate.

◦ Aggressiveness of policy depends on $\frac{\lambda}{\alpha}$:

– $\lambda$ gain in reduced inflation per unit loss of output.

– $\alpha$ trade - off between $\pi$ and $x$ (low $\alpha$ means less weight on $x$)

# Solving the rest of the model

- To solve the model we need to find an expression for the engoneous variables $(\pi_t, x_t, i_t)$ as a function the parameters $(\varphi, \lambda, \beta, \alpha)$ and the shocks $(g_t, u_t)$.

- To get the solution first use the central bank's optimality condition : $x_t = -\frac{\lambda}{\alpha}\pi_t$ to replace $x_t$ in the Phillips curve and solve for $\pi_t$.

- Once you have a solution for $\pi_t$ substitute back in the optimality condition to get a solution for $x_t$.

Finally, plug the solutions for $\pi_t$ and $x_t$ into the IS curve to solve for $i_t$.

# Solving for $\pi_t^*$

- So first use the central bank's optimality condition : $x_t = -\frac{\lambda}{\alpha}\pi_t$

to replace $x_t$ in the Phillips curve and solve for $\pi_t^*$.

$$\pi_t = \lambda x_t + \beta E_t\{\pi_{t+1}\} + u_t \quad \Rightarrow \quad \pi_t = -\frac{\lambda^2}{\alpha}\pi_t + \beta E_t\{\pi_{t+1}\} + u_t$$

$$\Rightarrow \left[1 + \frac{\lambda^2}{\alpha}\right]\pi_t = \beta E_t\{\pi_{t+1}\} + u_t \quad \Rightarrow \quad \pi_t = \frac{\alpha}{\alpha+\lambda^2}\left[\beta E_t\{\pi_{t+1}\} + u_t\right]$$

- Solving this equation forward we get :

$$\pi_t = \frac{\alpha}{\alpha+\lambda^2} E_t\left\{\sum_{i=0}^{\infty}\left(\frac{\alpha\beta}{\alpha+\lambda^2}\right)^i u_{t+i}\right\} \quad \Rightarrow \quad \pi_t = \frac{\alpha}{\alpha+\lambda^2} E_t\left\{\sum_{i=0}^{\infty}\left(\frac{\alpha\beta\rho}{\alpha+\lambda^2}\right)^i u_t\right\}$$

$$\Rightarrow \pi_t = \frac{\alpha}{\alpha+\lambda^2} u_t \sum_{i=0}^{\infty}\left(\frac{\alpha\beta\rho}{\alpha+\lambda^2}\right)^i \qquad \Rightarrow \quad \pi_t = \frac{\alpha}{\alpha+\lambda^2} u_t \frac{1}{1-\left(\frac{\alpha\beta\rho}{\alpha+\lambda^2}\right)}$$

$$\pi_t^* = \alpha \frac{1}{\lambda^2 + \alpha(1-\beta\rho)} u_t = \alpha q u_t$$

# Solving for $x_t^*$

- Now that we have a solution for $\pi_t = \alpha q u_t$, we just need to substitute it in the central bank's optimality condition : $x_t = -\frac{\lambda}{\alpha}\pi_t$ to get

$$x_t^* = \frac{-\lambda}{\lambda^2 + \alpha(1-\beta\rho)} u_t = -\lambda q u_t$$

while

$$\pi_t^* = \alpha \frac{1}{\lambda^2 + \alpha(1-\beta\rho)} u_t = \alpha q u_t$$

- Notice that supply side shocks $u_t$ causes recession and inflation.

# Solving $i_t^*$

- To achieve these optimal levels $\pi_t^* = \alpha q u_t$ and $x_t^* = -\lambda q u_t$ we pick $i_t$ to satisy :

$$x_t^* = -\varphi\left[i_t - E_t\pi_{t+1}^*\right] + E_t x_{t+1}^* + g_t$$

$$\Rightarrow \quad i_t = E_t\pi_{t+1}^* + \tfrac{1}{\varphi}\left[E_t x_{t+1}^* - x_t^*\right] + \tfrac{1}{\varphi} g_t$$

using $x_t^* = -\frac{\lambda}{\alpha}\pi_t^*$ and $E_t\pi_{t+1} = \rho\pi_t = \rho\alpha q u_t$

$$\Rightarrow \quad i_t = E_t\pi_{t+1}^* + \tfrac{1}{\varphi}\left[E_t\left\{-\tfrac{\lambda}{\alpha}\pi_{t+1}^*\right\} + \tfrac{\lambda}{\alpha}\pi_t^*\right] + \tfrac{1}{\varphi} g_t$$

$$\Rightarrow \quad i_t = E_t\pi_{t+1}^* + \tfrac{1}{\varphi}\left[E_t\left\{-\tfrac{\lambda}{\alpha}\pi_{t+1}^*\right\} + \tfrac{\lambda}{\alpha\rho} E_t\left\{\pi_{t+1}^*\right\}\right] + \tfrac{1}{\varphi} g_t$$

$$\Rightarrow \quad i_t = \left[1 + \frac{\lambda}{\alpha\rho\varphi} - \frac{\lambda}{\alpha\varphi}\right] E_t\pi_{t+1}^* + \tfrac{1}{\varphi} g_t$$

$$\Rightarrow \quad i_t^* = \left[1 + \frac{(1-\varphi)\lambda}{\alpha\rho\varphi}\right] E_t\pi_{t+1}^* + \tfrac{1}{\varphi} g_t$$

# Result 1: Short-run trade-off for supply shocks

- Result 1: To the extent cost push inflation is present, there exists a short-run trade-off between inflation and output variability.

$$\sigma_x = \frac{-\lambda}{\lambda^2+\alpha(1-\beta\rho)}\sigma_u = -\lambda q \sigma_u$$

while

$$\sigma_\pi = \alpha\frac{1}{\lambda^2+\alpha(1-\beta\rho)}\sigma_u = \alpha q \sigma_u$$

- To see trade-off look at policy frontier as we vary the weight on output: $\alpha$.

  As $\alpha \to 0$ $\quad \sigma_x \to \frac{\sigma_u}{\lambda}$, $\quad \sigma_\pi \to 0$

  As $\alpha \to \infty$ $\quad \sigma_x \to 0$, $\quad \sigma_\pi \to \frac{\sigma_u}{(1-\beta\rho)}$

- We reduce inflation volatily but increase output volatility, and viceversa.

# Result 2: Inflation targeting

- Result 2 : The optimal policy incorporates flexible inflation targeting in the sense that inflation converges to its target over time (speed depends on $\alpha$).

$$\lim_{s\to\infty} E_t\left\{\pi_{t+s}\right\} = \lim_{s\to\infty} \alpha q \rho^s u_t = 0$$

- To reduce inflation in response to $u_t$ we need to contract aggregate demand. Because of the trade - off, we do this slowly.
- Extreme inflation targeting (i.e. $\pi_t = 0$ always) occurs if :

  $-\alpha = 0$

  $-u_t = 0$

# Result 3: Monetary Policy

- Result 3 : Under the optimal policy, in response to a rise in expected inflation, nominal interest rates should rise sufficiently to increase real interest rates.

$$i_t = \left[1 + \tfrac{(1-\varphi)\lambda}{\alpha\rho\varphi}\right] E_t \pi^*_{t+1} + \tfrac{1}{\varphi} g_t$$

- Empirical application : Clarida, Gali and Gertler estimate policy reaction function : $i_t = \gamma_\pi E_t \pi^*_{t+1} + \tfrac{1}{\varphi} g_t$

– Pre - Volcker era : $\gamma_\pi < 1$

– Volcker and Greenspan : $\gamma_\pi > 1$

# Result 4: No trade-off for either demand shocks or shocks to potential output

- Result 4: The optimal policy calls for adjusting the interest rate to perfectly offset demand shocks, $g_t$, but accommodate shocks to potential output, $z_t$, by keeping the nominal rate constant.
  - A rise in $z_t$ causes $y_t$ to adjust one-for-one, implying no change in $x_t$ (think of this in terms of permanent income – 1% increase in $z_t$ causes a 1% increase in consumption demand).
  - Implication: no trade-off for either demand shocks or shocks to potential output.

# Credibility and the Gains from Commitment

- Two distinct strands of the literature:
  - Inflationary bias when central bank desires $y_t > z_t$ (i.e., $x_t > 0$). (Kydland and Prescott, Barro and Gordon, and thousands of subsequent papers.)
  - Credibility may improve the short-run output/inflation trade-off (emphasized in applied discussions of policy).

# Inflationary Bias without Commitment

- Assume $\beta = 1$ in Phillips curve for simplicity : $\pi_t = \lambda x_t + E_t\{\pi_{t+1}\}$.

- Now assume that $k > 0$, remember that we are below the steady-state level of output as there is a markup.

- Continue to assume $\pi^* = 0$.

- Then Central bank preferences are give by :

$$\min \frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[ \alpha \left( x_{t+i} - k \right)^2 + \left( \pi_{t+i} \right)^2 \right] \right\}$$

# Optimal Condition Without Commitment

$$L = \frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[ \alpha \left( x_{t+i} - k \right)^2 + \left( \pi_{t+i} \right)^2 \right] \right\} + \mu \left[ E_t \left\{ \sum_{i=0}^{\infty} \lambda x_{t+i} \right\} - \pi_t \right]$$

$$\tfrac{\partial L}{\partial x_t} = \alpha \left( x_t - k \right) + \mu\lambda = 0 \qquad \tfrac{\partial L}{\partial \pi_t} = \pi_t - \mu = 0$$

$$x_t^k = -\tfrac{\lambda}{\alpha} \pi_t^k + k$$

- Behavior of $x_t^k$ and $\pi_t^k$ :

$$x_t^k = x_t$$

$$\pi_t^k = \pi_t + \tfrac{\alpha}{\lambda} k$$

where $x_t$ and $\pi_t$ are the equilibrium values of the target variables for the baseline case with $k = 0$.

- Implications : no ability to influence the output gap and inflation bias.

# Result 5: Inflationary Bias
# Result 6: Central Banker Appointment

- Result 5: If the monetary authority could commit to targeting $x_t = 0$, rather than $x_t = k$, there would be no inflationary bias. Without commitment, if the central bank desires to push output above potential (i.e., $k>0$), then we are at a sub-optimal equilibrium with inflation persistently above target, and no gain in output.

- Result 6: Appointing an independent central bank chairman who assigns a higher relative cost to inflation than society as a whole ($\alpha^{Central\ Banker} < \alpha^{society}$), reduces the inefficient inflationary bias that is obtained under discretion when $k>0$.

# Improving the Short-Run Output/Inflation Trade-off

- Another potential gain from commitment, even with $k=0$, is that we can improve the short - run output/inflation trade - off.
- To see this, suppose that the monetary authority can commit to the following policy rule :

$$x_t^c = -\omega u_t$$

- From the Phillips curve we know that inflation follows

$$\pi_t^c = \lambda x_t^c + \beta E_t\left\{\pi_{t+1}^c\right\} + u_t = E_t\left\{\sum_{i=0}^{\infty}\beta^i\left[\lambda x_{t+i}^c + u_{t+i}\right]\right\} = E_t\left\{\sum_{i=0}^{\infty}\beta^i\left[-\lambda\omega u_{t+i} + u_{t+i}\right]\right\}$$

$$= E_t\left\{\sum_{i=0}^{\infty}\beta^i\left[1-\lambda\omega\right]\rho^i u_t\right\} = u_t\left[1-\lambda\omega\right]\sum_{i=0}^{\infty}\left(\beta\rho\right)^i = \tfrac{1-\lambda\omega}{1-\beta\rho}u_t = \tfrac{-\lambda\omega}{1-\beta\rho}u_t + \tfrac{1}{1-\beta\rho}u_t$$

$$= \tfrac{\lambda}{1-\beta\rho}x_t^c + \tfrac{1}{1-\beta\rho}u_t$$

- Since $\frac{\lambda}{1-\beta\rho} > \lambda$, commitment improves the short - run output/inflation tradeoff.

# Should policy be conducted by rule or by discretion?

- *Policy conducted by rule:*
  Policymakers announce in advance how policy will respond in various situations, and commit themselves to following through.

- *Policy conducted by discretion:*
  As events occur and circumstances change, policymakers use their judgment and apply whatever policies seem appropriate at the time.

# Arguments for rules

**1. Distrust of policymakers and the political process**

- misinformed politicians
- politicians' interests sometimes not the same as the interests of society

**2. The time inconsistency of discretionary policy**

- def: A scenario in which policymakers have an incentive to renege on a previously announced policy once others have acted on that announcement.
- Destroys policymakers' credibility, thereby reducing effectiveness of their policies.

# Examples of time inconsistency

1. To encourage investment, government announces it will not tax income from capital.

   But once the factories are built, government reneges in order to raise more tax revenue.

2. To reduce expected inflation, the central bank announces it will tighten monetary policy.

   But faced with high unemployment, the central bank may be tempted to cut interest rates.

# Traditional Interest Rate Mechanism

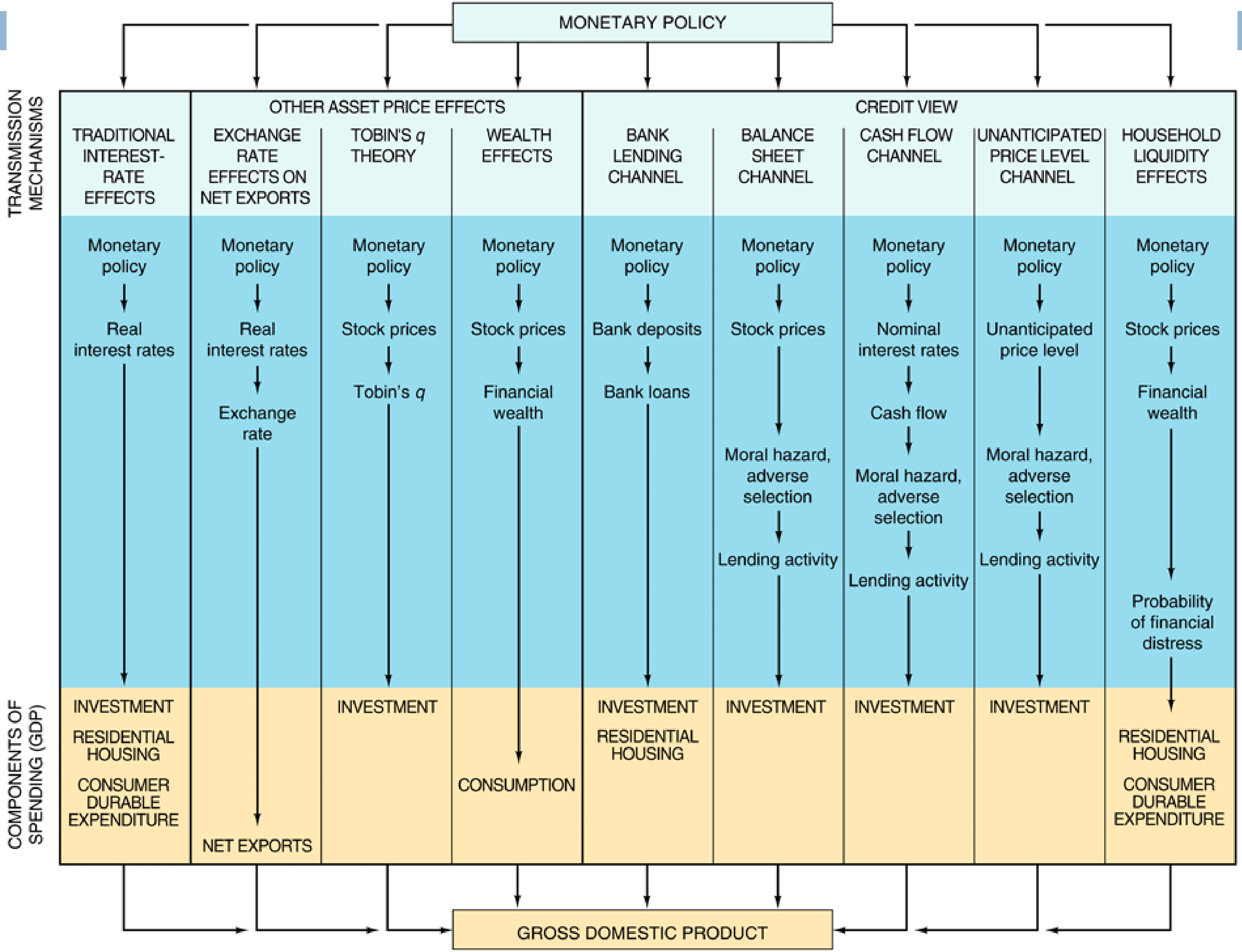
- Traditional interest rate effects

• Expansionary monetary policy $\Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$

• Emphasis on real interest rate: Expansionary monetary policy

$$\Rightarrow P^e \uparrow \Rightarrow \pi^e \uparrow \Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

# The Link Between Monetary Policy and GDP: Monetary Transmission Mechanisms



# Asset Price Effects

- Traditional interest rate effects
  - Expansionary monetary policy $\Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$
  - Emphasis on real interest rate: Expansionary monetary policy

$$\Rightarrow P^e \uparrow \Rightarrow \pi^e \uparrow \Rightarrow i_r \downarrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$$

- Exchange rate effects on net exports
  - Expansionary monetary policy $\Rightarrow i_r \downarrow \Rightarrow E \downarrow \Rightarrow NX \uparrow \Rightarrow Y \uparrow$

# Asset Price Effects

- Tobin's q theory
  - Expansionary monetary policy $\Rightarrow P_s \uparrow \Rightarrow q \uparrow \Rightarrow I \uparrow \Rightarrow Y \uparrow$

- Wealth effects
  - Expansionary monetary policy

$$\Rightarrow P_s \uparrow \Rightarrow wealth \uparrow \Rightarrow \; consumption \uparrow \Rightarrow Y \uparrow$$

# Credit View

- **Bank lending channel**

$$\text{Expansionary monetary policy} \rightarrow \text{bank deposits} \uparrow \rightarrow$$
$$\rightarrow \text{bank loans} \uparrow \rightarrow I \uparrow \rightarrow Y \uparrow$$

- **Balance sheet channel**

$$\text{Expansionary monetary policy} \rightarrow P_s \uparrow \rightarrow \text{net worth} \uparrow \rightarrow$$
$$\rightarrow \text{adverse selection} \downarrow, \text{moral hazard} \downarrow \rightarrow \text{lending} \uparrow \rightarrow$$
$$\rightarrow I \uparrow \rightarrow Y \uparrow$$

# Credit View

- Cash flow channel

Expansionary monetary policy $\rightarrow i \downarrow \rightarrow$ cash flow $\uparrow \rightarrow$ adverse selection $\downarrow$, moral hazard $\downarrow \rightarrow$ lending $\uparrow \rightarrow I \uparrow \rightarrow Y \uparrow$

- Unanticipated price level channel

Expansionary monetary policy $\rightarrow$ unanticipated $P \uparrow \rightarrow$ real net worth $\uparrow \rightarrow$

$\rightarrow$ adverse selection $\downarrow$, moral hazard $\downarrow \rightarrow$ lending $\uparrow \rightarrow I \uparrow \rightarrow Y \uparrow$

- Household liquidity effects

Expansionary monetary policy $\rightarrow P_s \uparrow \rightarrow$ value of financial assets $\uparrow \rightarrow$ likelihood of financial distress $\downarrow \rightarrow$ consumer durable and housing expenditure$\uparrow$ $\rightarrow Y \uparrow$

# Lessons for Monetary Policy

1. It is dangerous always to associate the easing or the tightening of monetary policy with a fall or a rise in short-term nominal interest rates

2. Other asset prices besides those on short-term debt instruments contain important information about the stance of monetary policy because they are important elements in various monetary policy transmission mechanisms

# Lessons for Monetary Policy

3. Monetary policy can be highly effective in reviving a weak economy even if short-term interest rates are already near zero

4. Avoiding unanticipated fluctuations in the price level is an important objective of monetary policy, thus providing a rationale for price stability as the primary long-run goal for monetary policy