RESOLVING NEW KEYNESIAN ANOMALIES WITH WEALTH IN THE UTILITY FUNCTION

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Paper available at https://www.pascalmichaillat.org/11.html

ANOMALIES IN NK MODEL AT ZLB

- collapse of output & inflation
- implausibly large effects of forward guidance
- implausibly large effects of government spending

EXISTING REMEDIES TO ZLB ANOMALIES

- Gabaix [2016]: bounded rationality
- Diba, Loisel [2017]: interest on bank reserves
- Cochrane [2018]: fiscal theory of price level
- Bilbiie [2018] & Acharya, Dogra [2018]: heterogeneous agents
- this paper: minimal deviation from textbook model
  - equilibrium remains 2-dimensional (Euler + Phillips)
  - same derivations
  - only one coefficient changes in equilibrium system (Euler)

WHY WOULD PEOPLE VALUE WEALTH IN ITSELF?

- Keynes [1919]: “The duty of saving became nine-tenths of virtue and the growth of the cake the object of true religion.... Saving was for old age or for your children; but this was only in theory—the virtue of the cake was that it was never to be consumed, neither by you nor by your children after you.”
- Irving Fisher [1930]: “A man may include in the benefits of his wealth...the social standing he thinks it gives him, or political power and influence, or the mere miserly sense of possession, or the satisfaction in the mere process of further accumulation.”

WHY WOULD PEOPLE VALUE WEALTH IN ITSELF?

- Camerer, Loewenstein, Prelec [2005]: "brain-scans conducted while people win or lose money suggest that money activates similar reward areas as do other primary reinforcers like food and drugs, which implies that money confers direct utility, rather than simply being valued only for what it can buy."
- evidence from economics, social psychology, sociology, social neuroscience: wealth is a marker of social status, and people value high social status

NK MODEL WITH WEALTH IN THE UTILITY

- self-employed household $j \in [0,1]$ maximizes utility

$$\int_0^\infty e^{-\delta t}\left[\ln\Big(c_j(t)\Big) + u\left(\frac{b_j(t)}{p(t)} - \frac{b(t)}{p(t)}\right) - \kappa h_j(t) - \frac{\gamma}{2}\pi_j(t)^2\right] dt$$

  - consumption index: $c_j(t) = \left[\int_0^1 c_{jk}(t)^{(\epsilon-1)/\epsilon}\, dk\right]^{\epsilon/(\epsilon-1)}$
  - aggregate wealth: $b(t) = \int_0^1 b_j(t)\, dj$
  - inflation: $\pi_j(t) = \dot{p}_j(t)/p_j(t)$

- subject to budget constraint:

$$\dot{b}_j(t) = i(t)b_j(t) + p_j(t)y_j(t) - \int_0^1 p_k(t)c_{jk}(t)\, dk$$

- to production function: $y_j(t) = ah_j(t)$
- to demand for good i: $y_j(t) = \left[p_j(t)/p(t)\right]^{-\epsilon} c(t)$

EQUILIBRIUM: EULER-PHILLIPS SYSTEM

- monetary policy: real rate $r(\pi) = i(\pi) - \pi$
- Phillips curve: standard

$$\dot{\pi} = \delta\pi - \frac{\epsilon\kappa}{\gamma a}\left(y - y^n\right) \quad \text{with} \quad y^n = \frac{\epsilon - 1}{\epsilon} \cdot \frac{a}{\kappa}$$

- Euler equation: "discounted"
  - $\dot{y}/y = r(\pi) + u'(0)y - \delta$
  - financial return on saving: $r(\pi)$
  - hedonic return on saving: $u'(0)y^n$ = MRS(wealth, consumption)
  - so $\dot{y}/y = r(\pi) - r^n + u'(0)(y - y^n)$ with $r^n = \delta - u'(0)y^n$

TWO MODELS

- NK: standard New Keynesian model

$$u'(0) = 0$$

- WUNK: wealth-in-the-utility New Keynesian model

$$u'(0) > \frac{\epsilon\kappa}{\delta\gamma a}$$

OUTPUT & INFLATION COLLAPSE

ZLB SCENARIO

ZLB

back to natural
steady state

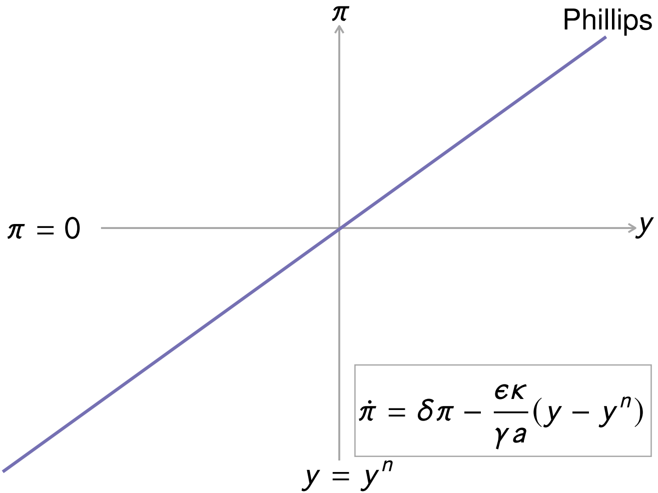
- $r^n < 0$
- $i(\pi) = 0$

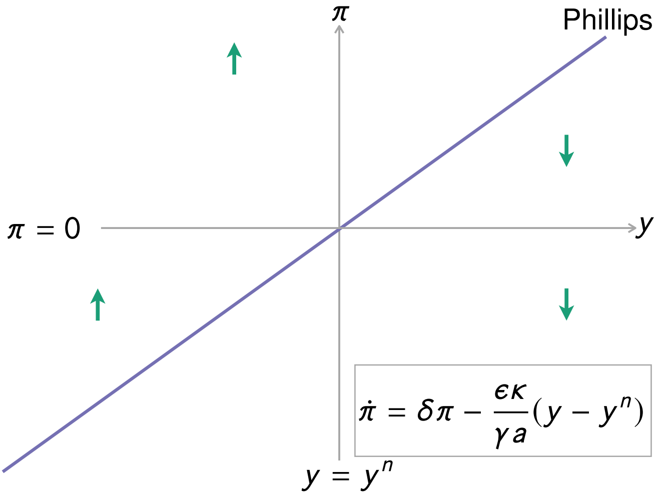
- $r^n > 0$
- $i(\pi) = r^n + \phi\pi$
  $\phi > 1$

$t = 0$

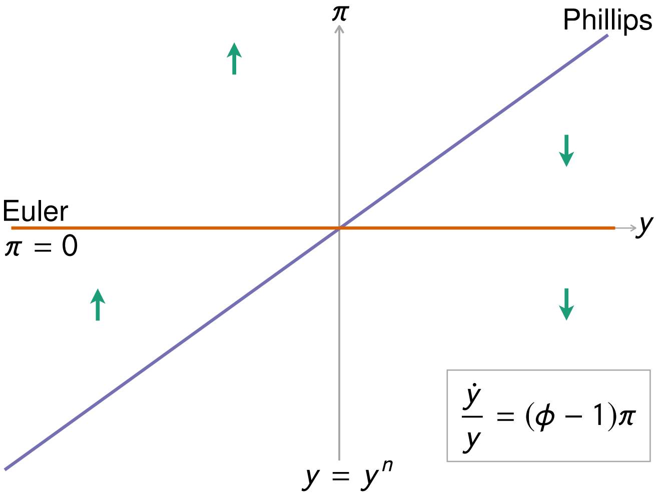
$t = \mathrm{T}$

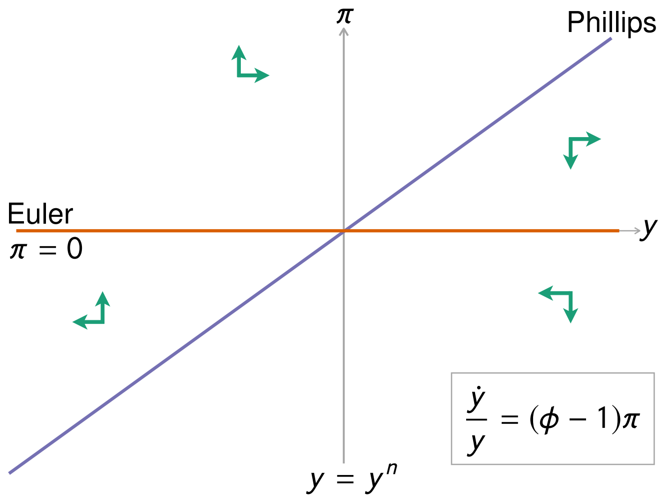
NK 〉 PHASE DIAGRAM IN NORMAL TIMES: SOURCE



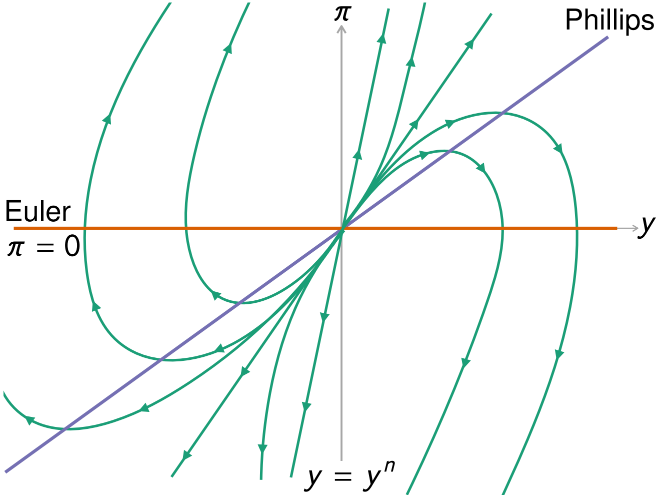

π
Phillips
$\pi = 0$
y
$y = y^n$
$\dot{\pi} = \delta\pi - \frac{\epsilon\kappa}{\gamma a}(y - y^n)$

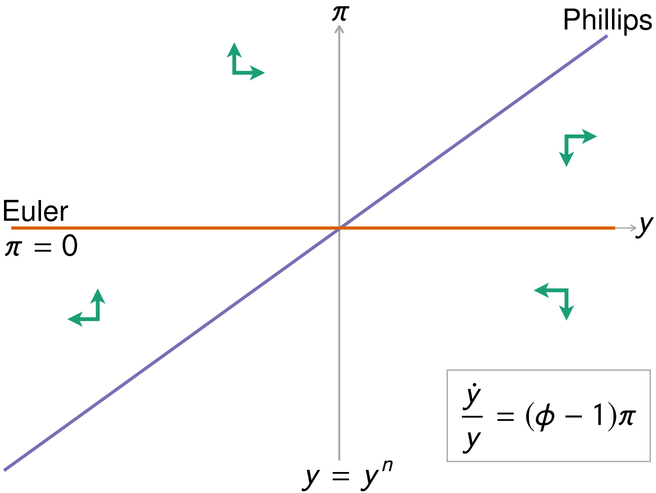
NK 〉 PHASE DIAGRAM IN NORMAL TIMES: SOURCE




π
Phillips
Euler
$\pi = 0$
y
$y = y^n$
$\frac{\dot{y}}{y} = (\phi - 1)\pi$

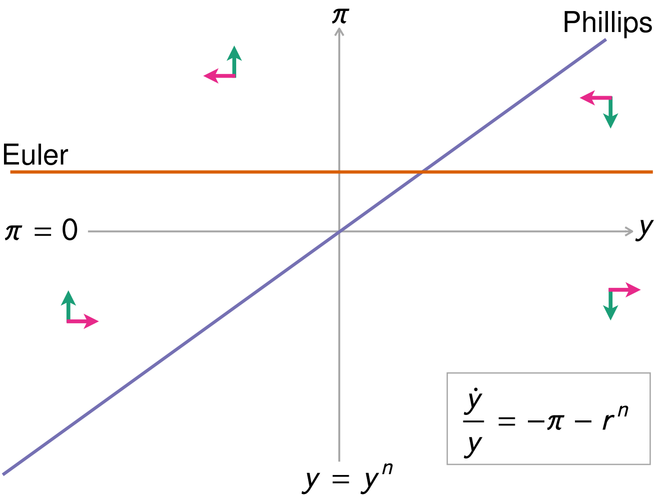
NK 〉 PHASE DIAGRAM IN NORMAL TIMES: SOURCE

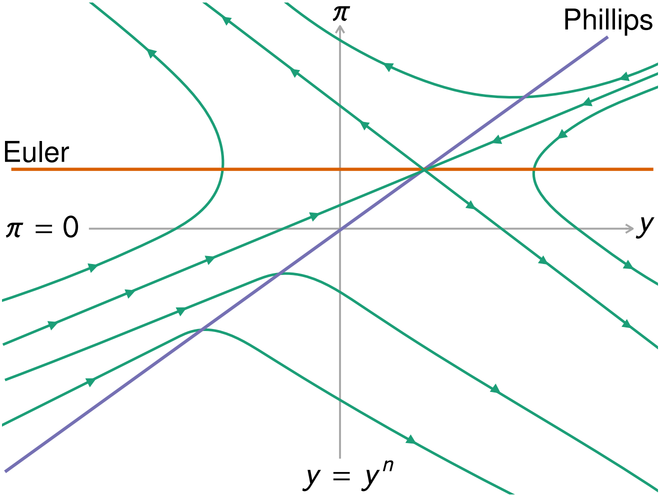




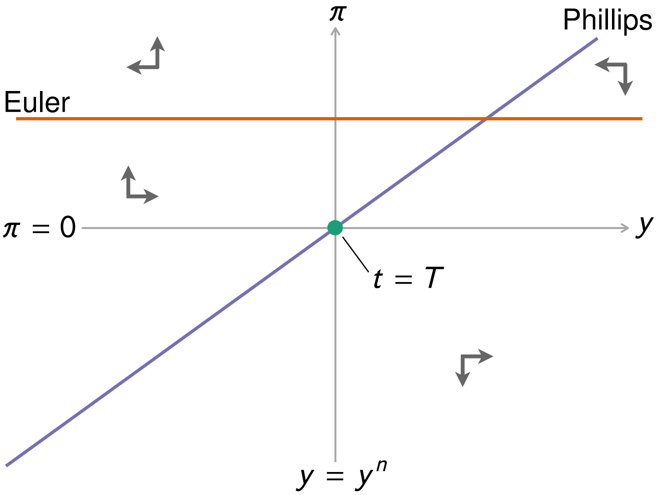
π
Phillips
Euler
$\pi = 0$
y
$y = y^n$
$\frac{\dot{y}}{y} = (\phi - 1)\pi$

NK ⟩ PHASE DIAGRAM AT ZLB: SADDLE

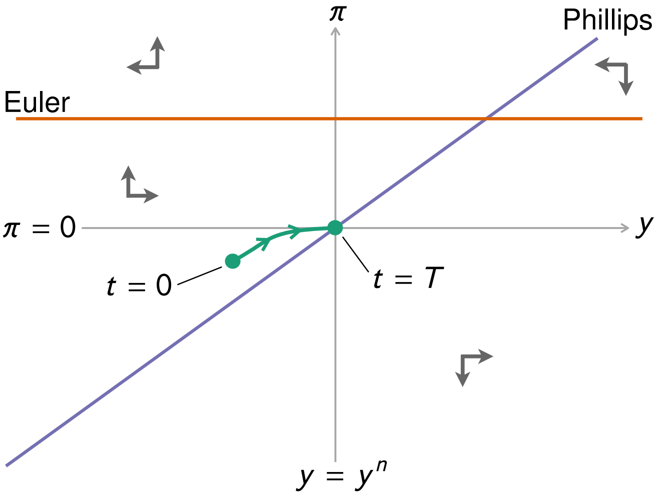




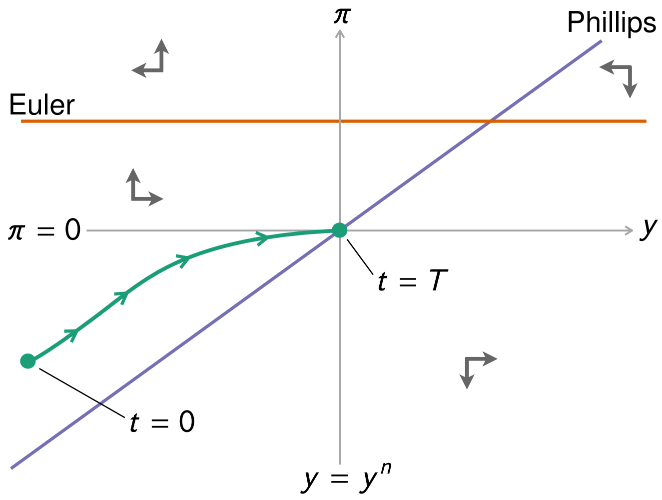
π
Phillips
Euler
$\pi = 0$
y
$y = y^n$

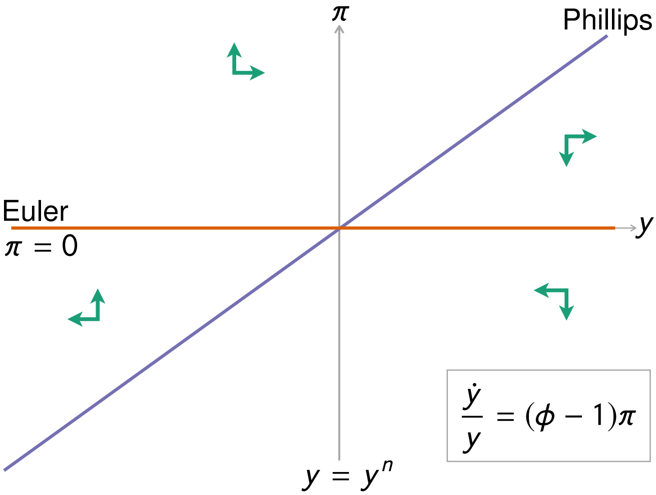


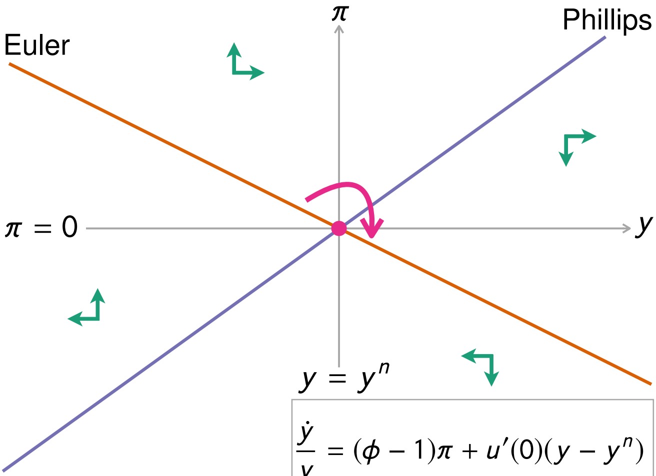
π
Phillips
Euler
$\pi = 0$
y
$t = T$
$y = y^n$


π
Phillips
Euler
π = 0
y
t = 0
t = T
y = y^n

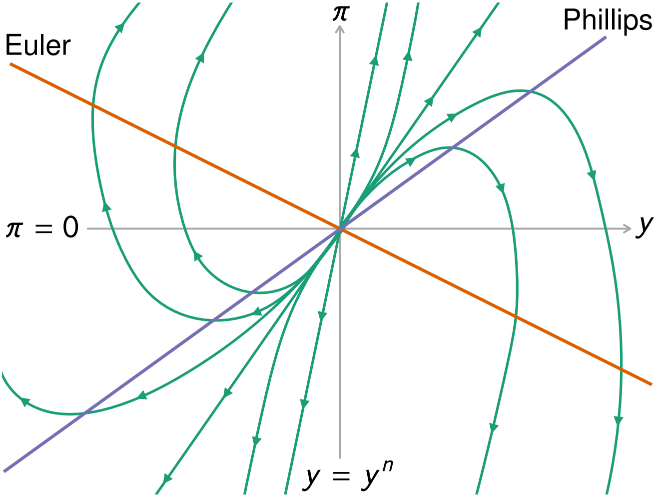
NK ⟩ LONGER ZLB: OUTPUT & INFLATION COLLAPSE



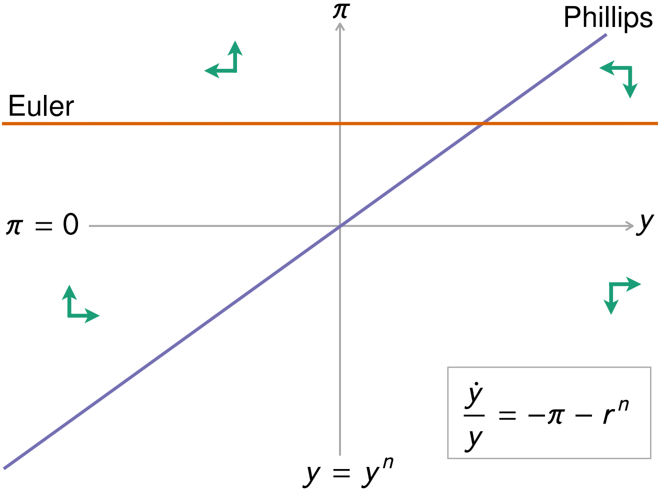

π
Phillips
Euler
$\pi = 0$
y
$y = y^n$
$\frac{\dot{y}}{y} = (\phi - 1)\pi$

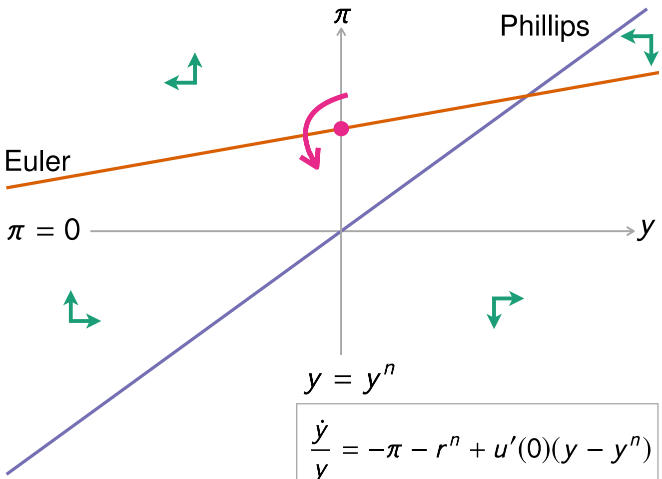


$$\boxed{\frac{\dot{y}}{y} = (\phi - 1)\pi + u'(0)(y - y^n)}$$

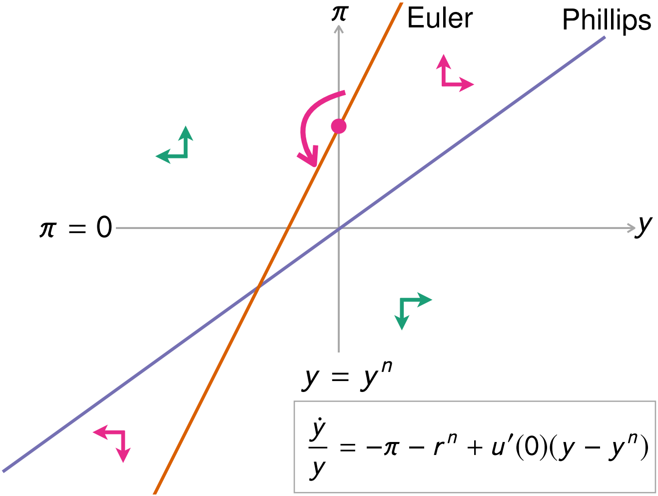


π
Phillips
Euler
$\pi = 0$
y
$y = y^n$

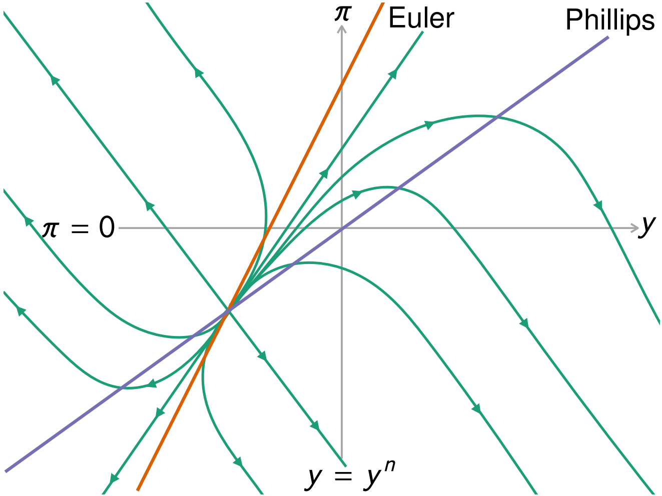

π
Phillips
Euler
$\pi = 0$
y
$y = y^n$
$\frac{\dot{y}}{y} = -\pi - r^n$

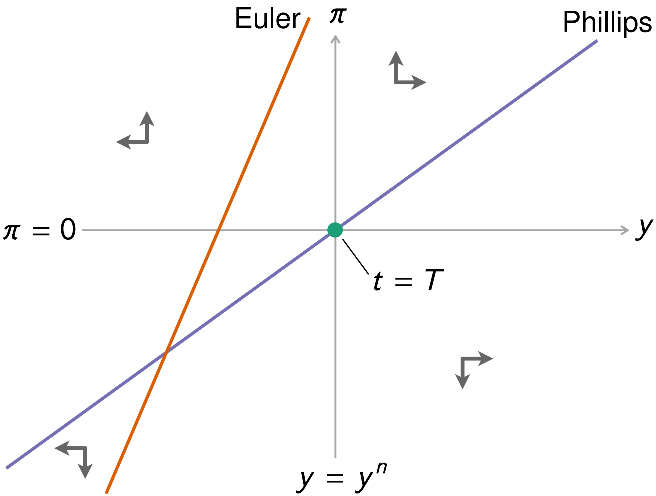


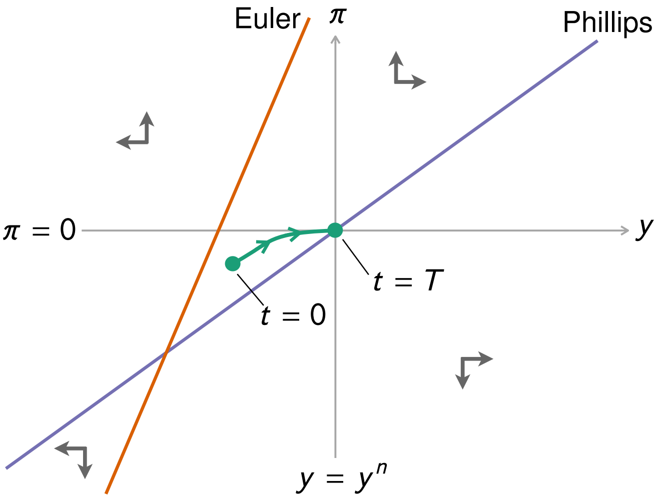
$$\frac{\dot{y}}{y} = -\pi - r^n + u'(0)(y - y^n)$$

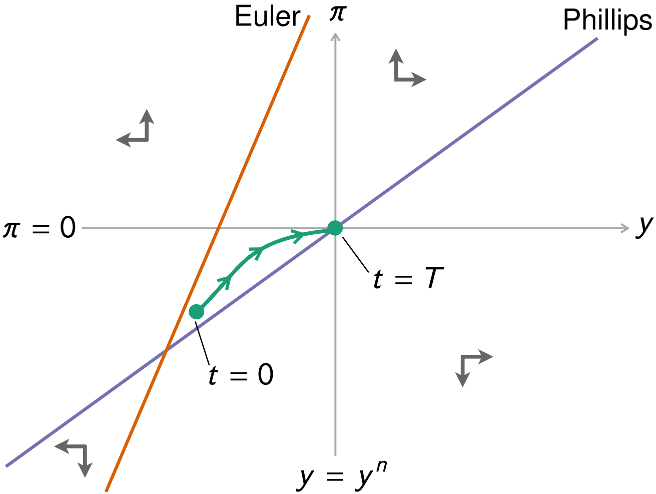


$$\frac{\dot{y}}{y} = -\pi - r^n + u'(0)(y - y^n)$$


π
Euler
Phillips
π = 0
y
y = y^n


Euler
π
Phillips
$\pi = 0$
y
$t = T$
$y = y^n$


Euler
π
Phillips
$\pi = 0$
y
$t = T$
$t = 0$
$y = y^n$



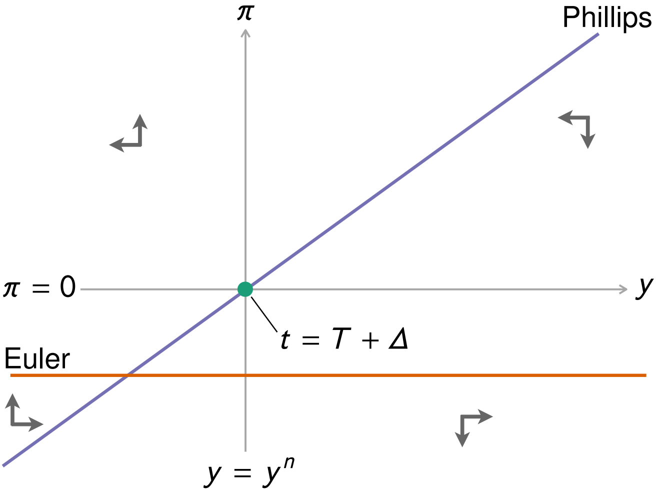
Euler
π
Phillips
$\pi = 0$
y
$t = T$
$t = 0$
$y = y^n$

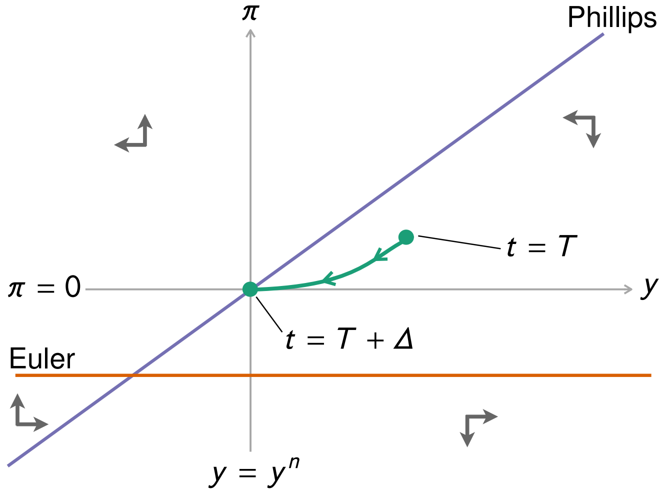
FORWARD GUIDANCE

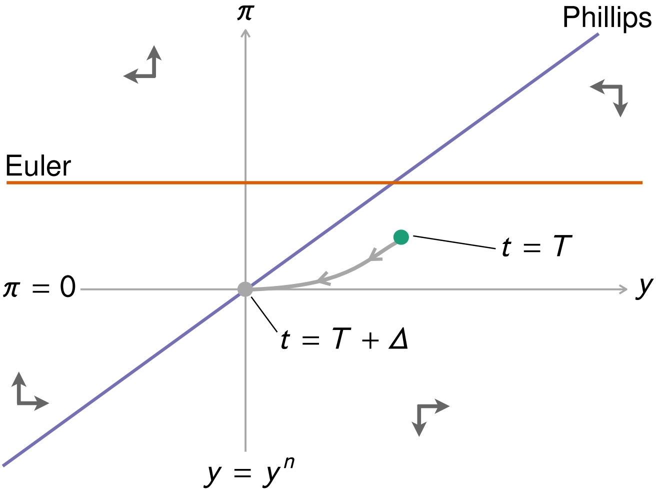
FORWARD-GUIDANCE SCENARIO

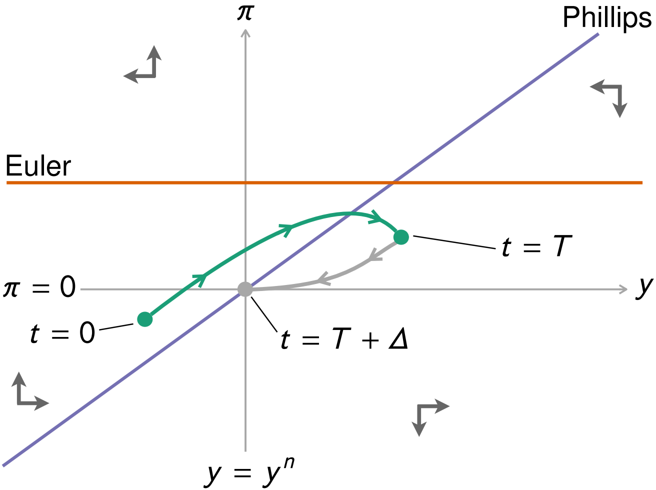
ZLB	forward guidance	back to natural steady state
• $r^n < 0$	• $r^n > 0$	• $r^n > 0$
• $i(\pi) = 0$	• $i(\pi) = 0$	• $i(\pi) = r^n + \phi\pi$ $\phi > 1$
$t = 0$	$t = \mathrm{T}$	$t = T + \Delta$

NK ⟩ ZLB EPISODE + **FORWARD GUIDANCE**

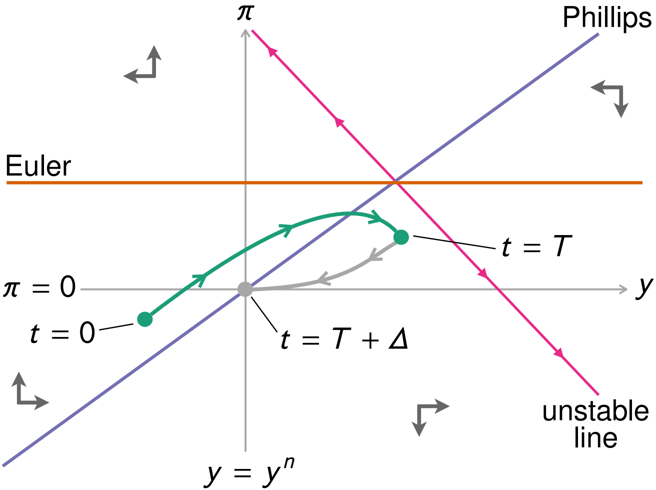


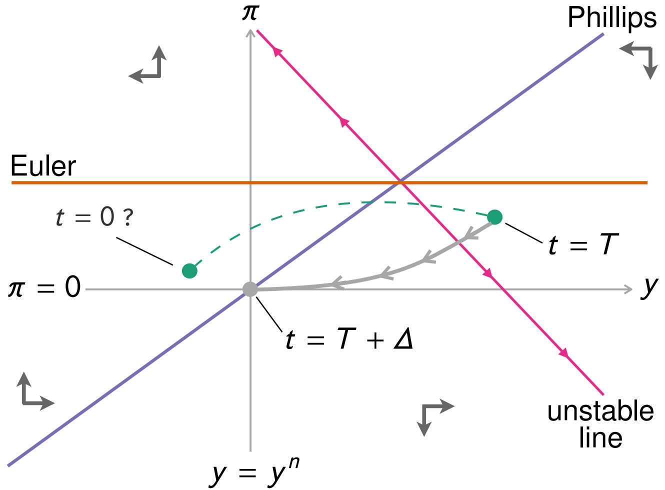

π
Phillips
$t = T$
$\pi = 0$
y
$t = T + \Delta$
Euler
$y = y^n$


π
Phillips
Euler
$t = T$
$\pi = 0$
y
$t = T + \Delta$
$y = y^n$


π
Phillips
Euler
$t = T$
$\pi = 0$
y
$t = 0$
$t = T + \Delta$
$y = y^n$

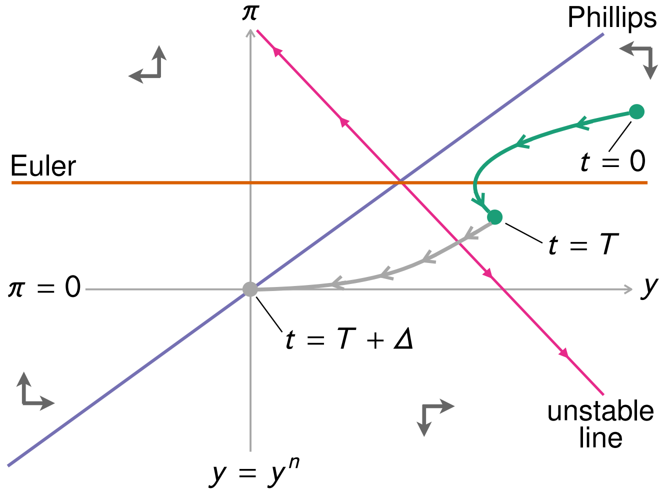
NK 〉 LONGER GUIDANCE: BOOM AT ZLB

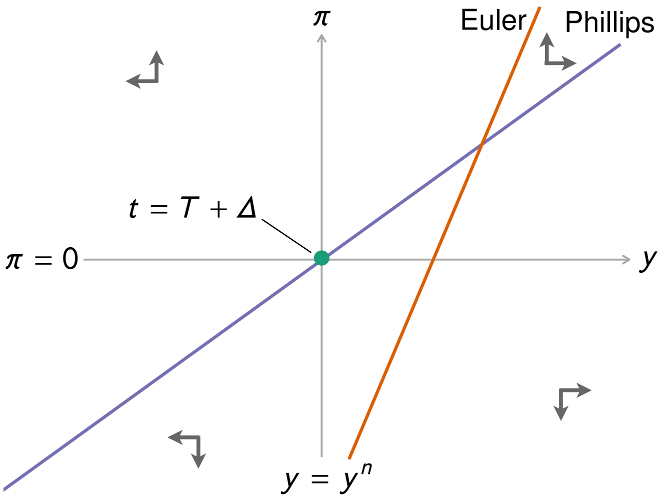


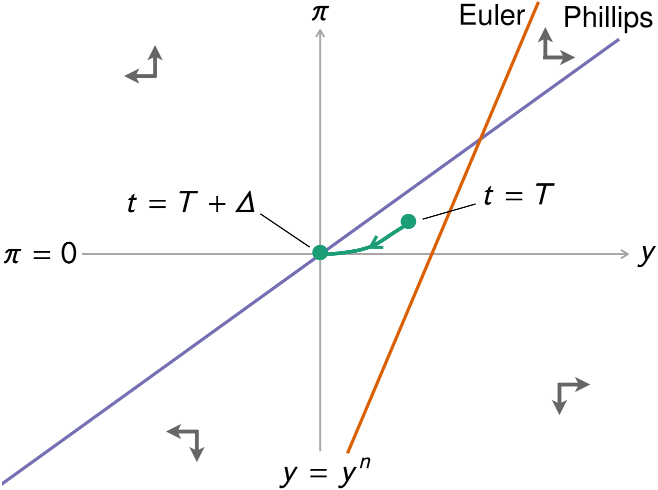


π
Phillips
Euler
t = 0 ?
t = T
π = 0
y
t = T + Δ
unstable
line
y = yⁿ

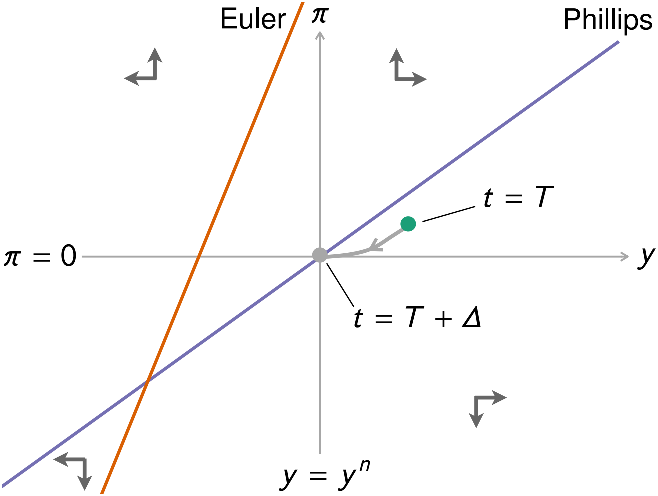
NK 〉 LONGER GUIDANCE: BOOM AT ZLB

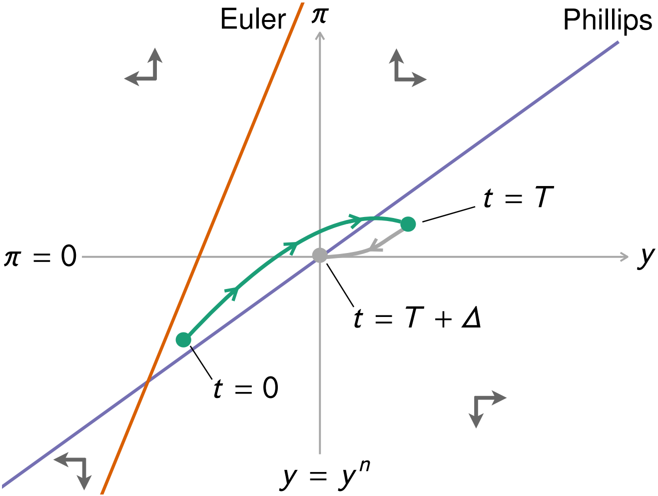


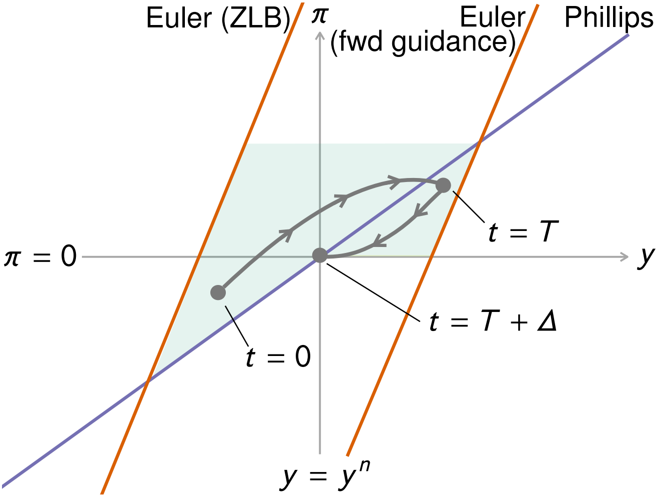

π
Euler
Phillips
t = T + Δ
π = 0
y
y = yⁿ



π
Euler
Phillips
$t = T + \Delta$
$t = T$
$\pi = 0$
y
$y = y^n$

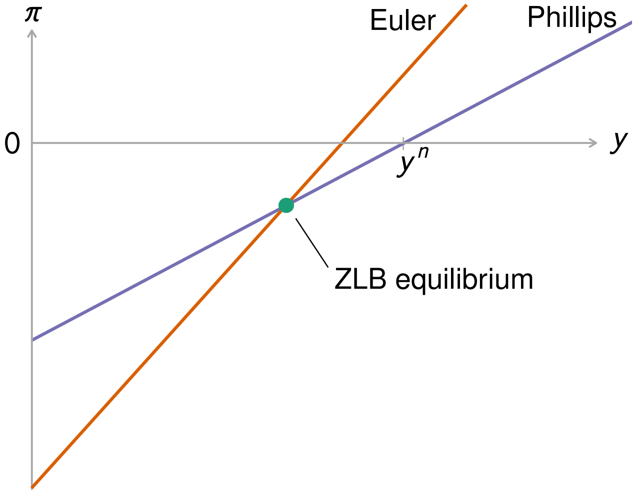

Euler
π
Phillips
$t = T$
$\pi = 0$
y
$t = T + \Delta$
$y = y^n$


Euler
π
Phillips
$t = T$
$\pi = 0$
y
$t = T + \Delta$
$t = 0$
$y = y^n$

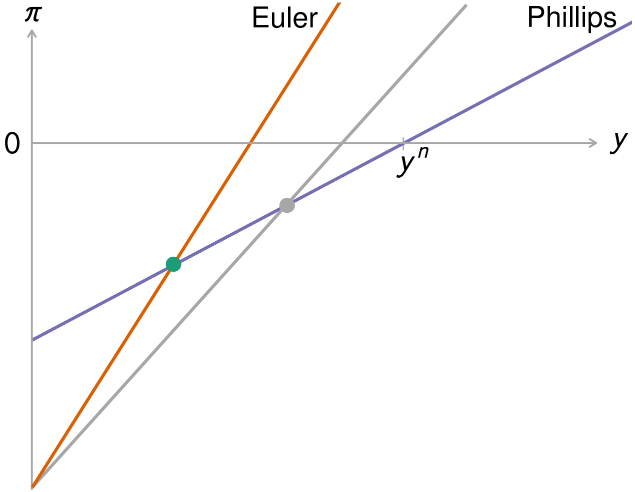

Euler (ZLB)
π
Euler
(fwd guidance)
Phillips
$\pi = 0$
y
$t = T$
$t = T + \Delta$
$t = 0$
$y = y^n$

OTHER ZLB PROPERTIES IN WUNK

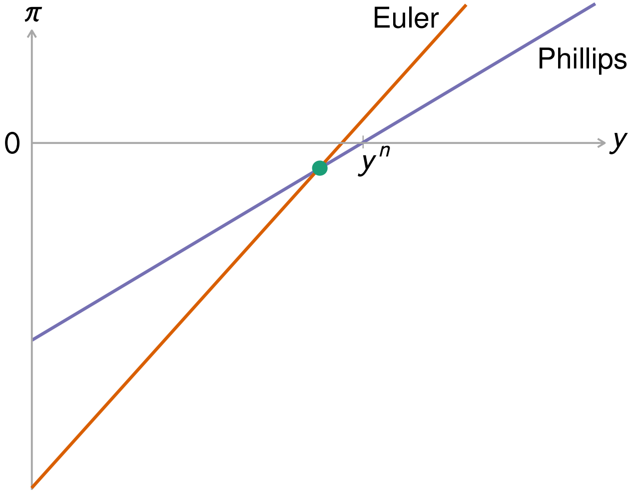
PARADOX OF THRIFT: HIGHER MU OF WEALTH



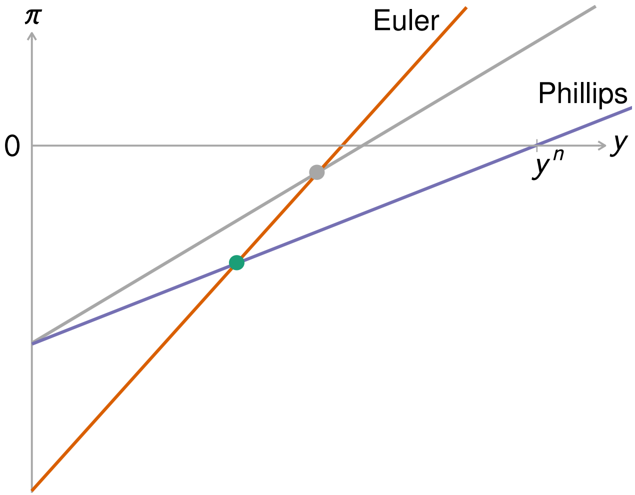
PARADOX OF THRIFT: HIGHER MU OF WEALTH



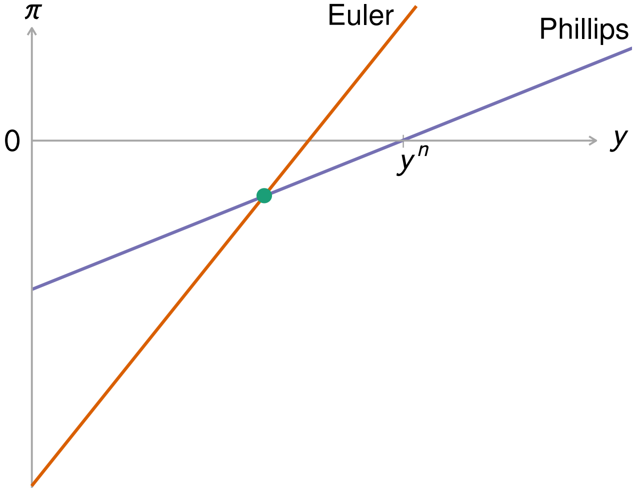
PARADOX OF TOIL: LOWER DISUTILITY OF LABOR



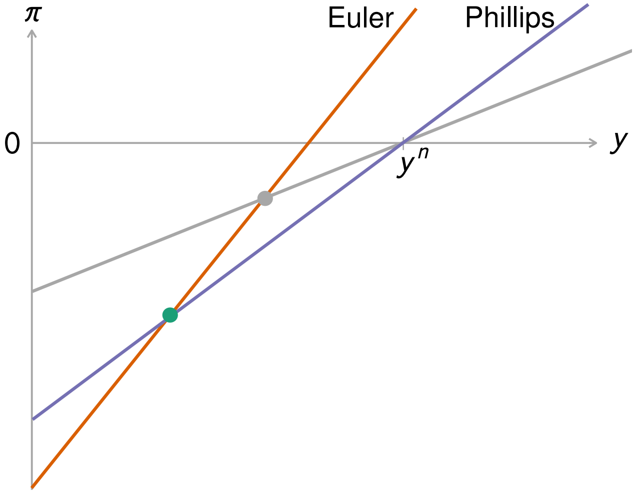
PARADOX OF TOIL: LOWER DISUTILITY OF LABOR



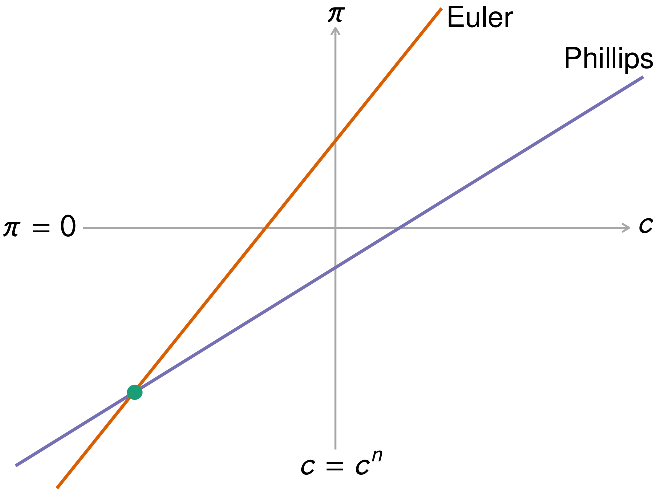
PARADOX OF FLEXIBILITY: LOWER ADJUSTMENT COST



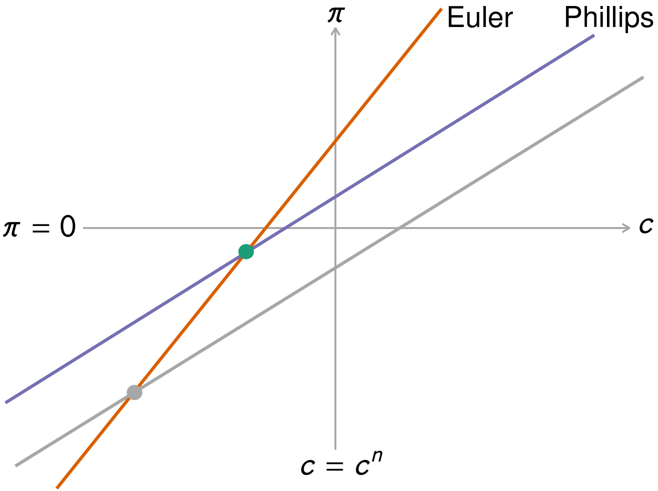
PARADOX OF FLEXIBILITY: LOWER ADJUSTMENT COST



ABOVE-ONE GOVERNMENT-SPENDING MULTIPLIER



ABOVE-ONE GOVERNMENT-SPENDING MULTIPLIER



ASSESSMENT OF WUNK ASSUMPTION

$$\delta - r^n > \frac{\lambda}{\delta}$$

- λ = output-gap coefficient in Phillips curve $\approx$ 6%
  - Mavroeidis, Plagborg-Moller, Stock [2014]
- δ = annual time discount rate $\approx$ 40%
  - Frederick, Loewenstein, O'Donoghue [2002]
  - Andersen, Harrison, Lau, Rutstrom [2014]
- r^n = natural rate of interest $\approx$ 2%
- WUNK assumption holds: $40\% - 2\% = 38\% > 15\% = 6\% \ / \ 40\%$
  - lowest acceptable household discount rate: 26%
  - lowest acceptable firm discount rate: 16%