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2015/2016, week 5

## **Debt policies and monetary policies**

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Mankiw, Chapter 19, except for 19.2

Romer, Chapter 11.7, 11.8

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# Structure lecture

- ❑ Public debt
  - ❑ Facts and figures
  - ❑ The implicit debt due to population ageing
  - ❑ (Un-)stable and (un-)sustainable public debts
  - ❑ Economic effects of public debts and deficits
  - ❑ The political economy of public debt

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# Structure lecture

## □ Inflation

- Facts and figures; inflation and hyperinflation
- The theory of time-inconsistent monetary policies
- Empirical evidence
- Solutions to the time-inconsistency problem
  - Rules
  - Central banker independency

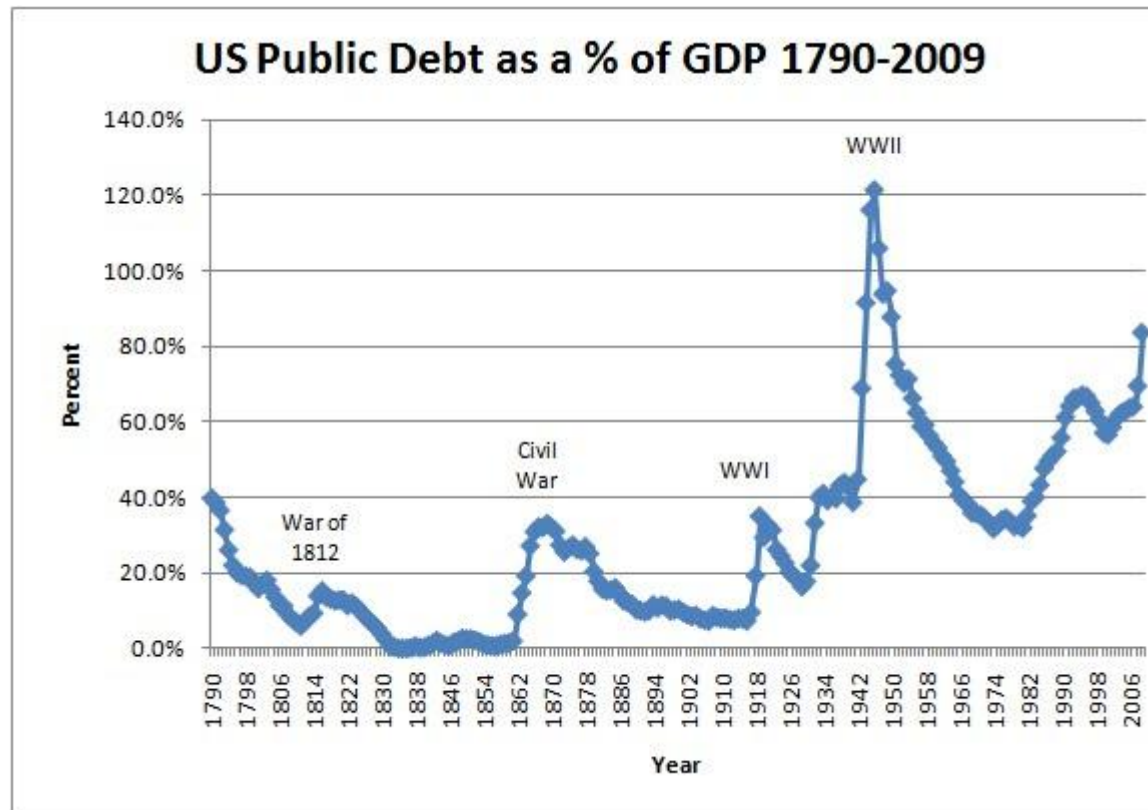
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# The public debt

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# Introduction

- History of public debt: US case



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# Introduction

- Public debt across countries (M, p. 543, 2011)

Public Debt of Countries Exceeding 0.5% of World,  
2012 estimate (CIA World Factbook 2013)

Country	Public Debt % of GDP
United States	73.60%
Japan	214.30%
China	31.70%
Germany	81.70%
Italy	114.60%
France	89.90%
United Kingdom	88.70%
Brazil	54.90%
Spain	85.30%
Canada	84.10%

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## Introduction

- Public debt across countries (M, p. 543, 2011)

Country	Public Debt % of GDP
India	51.90%
Mexico	35.40%
South Korea	33.70%
Turkey	40.40%
Netherlands	68.70%
Egypt	85.00%
Greece	161.30%
Belgium	99.60%
Singapore	111.40%
Taiwan	36.00%
Argentina	41.60%
Indonesia	24.80%
Portugal	119.70%

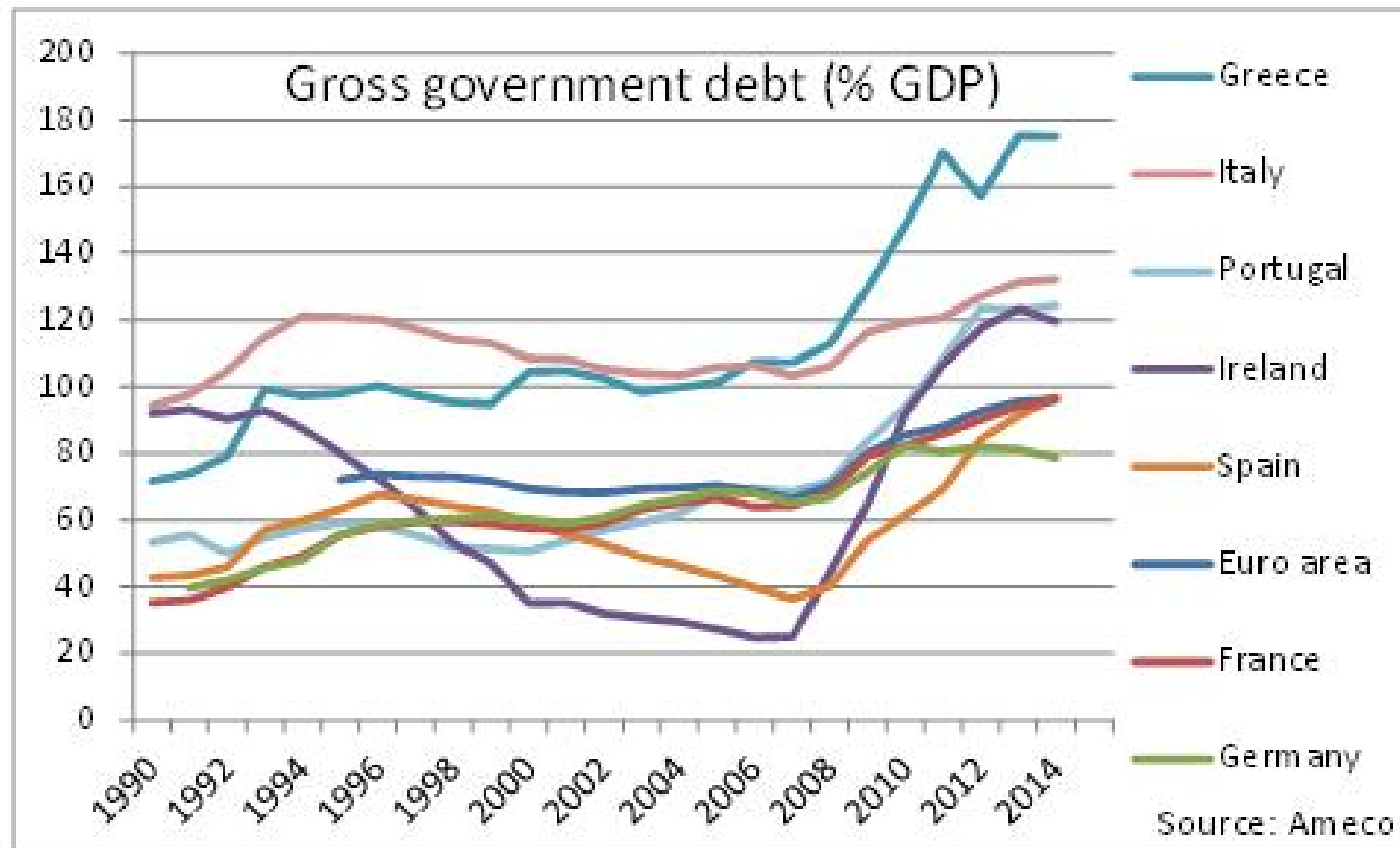
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## Downgrade of US government debt: facts

- ❑ Standard & Poor's downgraded US government debt in 2011
  - ❑ From AAA (highest category) to AA+
- ❑ The Netherlands: AA+ (AAA)



# Development public debt in eurozone countries since the financial crisis



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# Downgrade of US government debt

- How to interpret this result?
  - AAA: An obligor has EXTREMELY STRONG capacity to meet its financial commitments
  - AA+: An obligor has VERY STRONG capacity to meet its financial commitments. It differs from the highest rated obligors only in small degree

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# Population ageing

- ❑ Driving factors demographic and economic
- ❑ Demographic factors
  - ❑ Decrease in mortality rates (increasing life expectancy)
  - ❑ Decrease in fertility rates
- ❑ Economic factors
  - ❑ Share of health care spending in GDP increases over time
    - health care is a luxury good
- For more information on ageing and the economy, visit **[www.edwesterhout.nl](http://www.edwesterhout.nl)**

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# Hidden public debt

- ❑ For both reasons:
  - ❑ Primary public expenditure will increase more than revenues from taxes and social security contributions
  - ❑ Primary public deficits will increase
  - ❑ This implies a further increase of public debt
    - debt service → deficit → debt →
    - debt service → deficit → debt →
    - debt service, and so on

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## Important definitions

- Change in public debt equals sum of primary deficit and debt service
  - $\Delta D = G - T + iD_{-1}$
  - Primary deficit:  $G - T$
  - (Primary balance/surplus:  $T - G$ )
  - Debt service:  $iD_{-1}$
  - Total deficit:  $G - T + iD_{-1}$

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## Important definitions

- Assume  $Y$  (GDP),  $G$  and  $T$  grow at rate  $g$
- Change in public debt ratio equals sum of primary deficit ratio and growth-corrected debt service ratio

- $$\Delta\left(\frac{D}{Y}\right) \sim \left(\frac{G-T}{Y}\right) + (i - g) \left(\frac{D}{Y}\right)_{-1}$$

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## Important definitions

- The accumulation equation for the debt ratio is a first-order difference equation

- $$\left(\frac{D}{Y}\right)_t = (1 + i - g) \left(\frac{D}{Y}\right)_{t-1} + \left(\frac{G-T}{Y}\right)$$

- Equilibrium value of debt ratio

- $$\left(\frac{D}{Y}\right)^* = \left(\frac{T-G}{Y}\right) / (i - g)$$

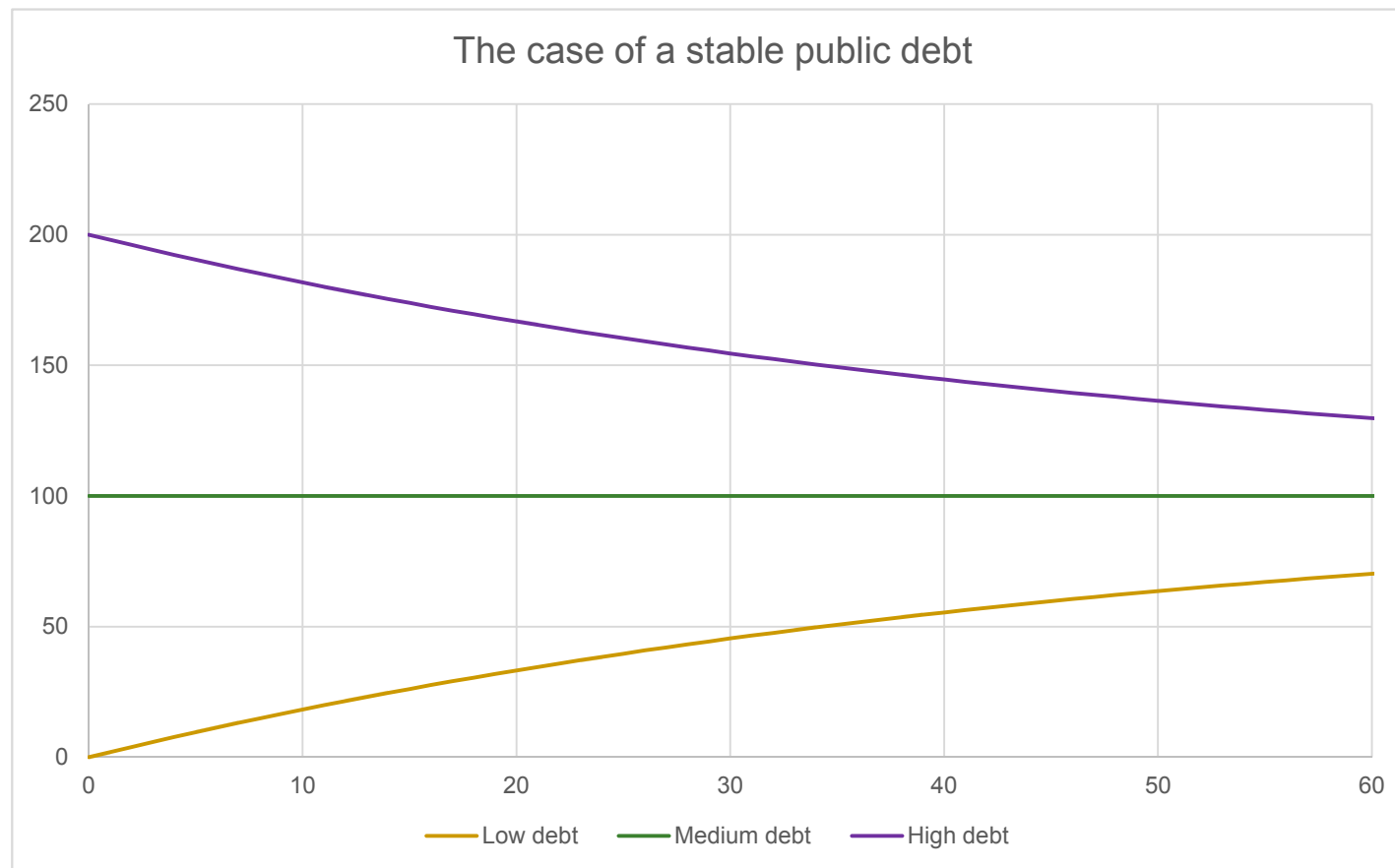
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## Important definitions

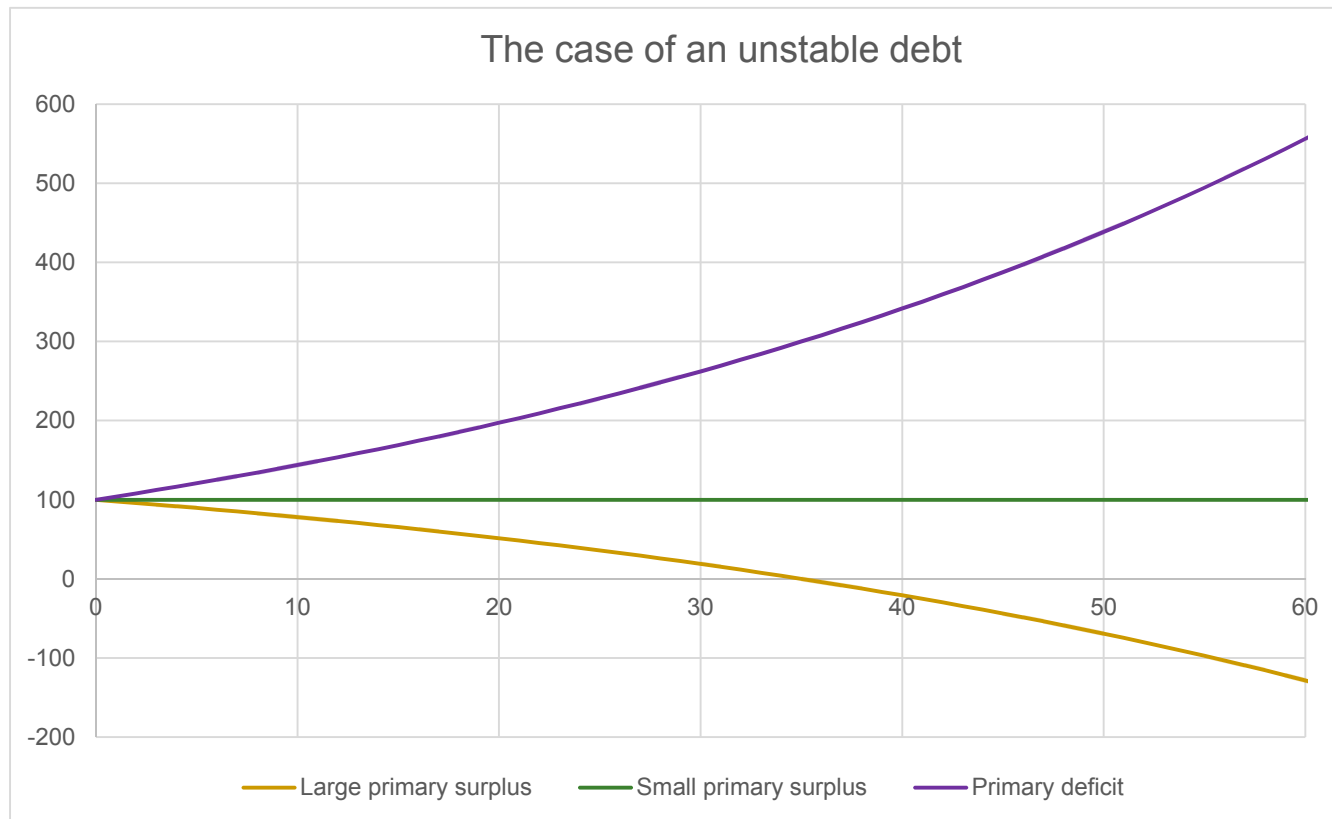
- If  $i < g$  ( $i > g$ ), the debt ratio is stable (unstable)
- If  $i > g$  and  $\left(\frac{D}{Y}\right)_0 = \left(\frac{T-G}{Y}\right) / (i - g)$ , the debt is sustainable
- If  $i > g$  and  $\left(\frac{D}{Y}\right)_0 > \left(\frac{T-G}{Y}\right) / (i - g)$ , the debt is unsustainable



# Stable public debt



# Unstable public debt



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## Important definitions

- For the case  $i > g$ ,  $\left(\frac{D}{Y}\right)_0 > \left(\frac{T-G}{Y}\right) / (i - g)$ , define  $s$ , the sustainability gap:
- $\left(\frac{D}{Y}\right)_0 = \left(\left(\frac{T-G}{Y}\right) + s\right) / (i - g)$ , or
- $s = \left(\frac{D}{Y}\right)_0 (i - g) - \left(\frac{T-G}{Y}\right)$

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# Effects of a larger public deficit

- Keynesian view: IS/LM model
  - Higher deficit shifts the IS curve → Output ↑, Interest rate ↑
  - Effect of higher public spending can exceed effect of lower taxes (difference between spending multiplier and tax multiplier) – the Haavelmo effect

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## Effects of a larger public deficit

- After some time, the Phillips curve will shift (see week 2's lecture)
  - In the end, output will have returned to its original value, whereas prices will have increased

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# Effects of a larger public deficit

- Mundell-Fleming model
  - Higher deficit shifts the  $IS^*$  curve → Exchange rate appreciates ( $e \uparrow$ ), output does not change, composition output does change

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# Effects of a larger public deficit

- ❑ If the deficit increase takes the form of a tax cut
- ❑ Supply-side economics:
  - ❑ Taxes distort economic decisions
  - ❑ Labour income tax can reduce labour supply
    - a consumption tax may have a similar effect
  - ❑ Ronald Reagan presidency

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## Supply-side economics

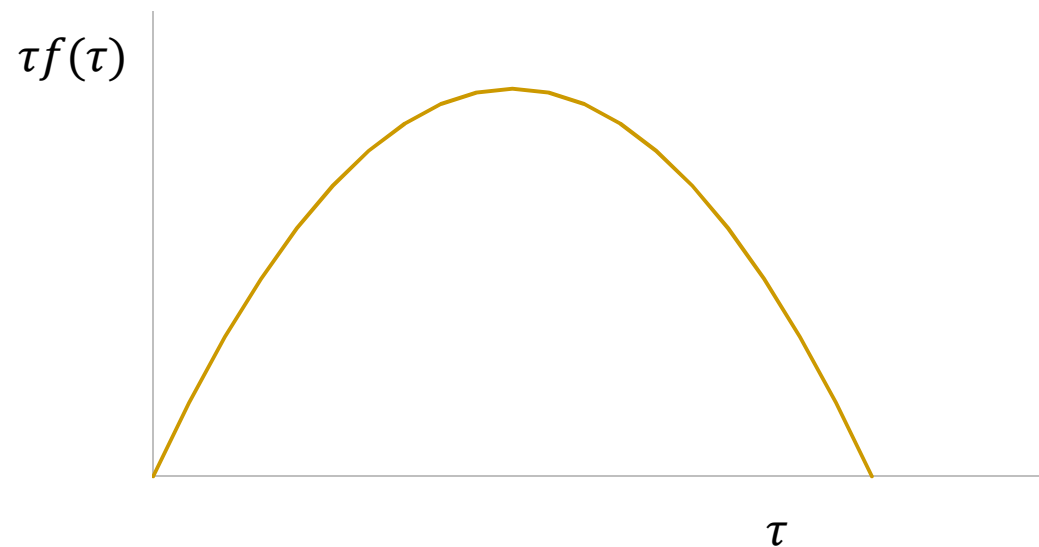
- ❑ Some argue that lower tax rates may increase tax revenues ('Reaganonomics')
- ❑ This requires that the economy is on the right-hand side of the Laffer curve
- ❑ Under the Reagan presidency, the public deficit increased



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# The Laffer curve

Tax revenues as a function of the tax rate



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## Ricardian equivalence

- ❑ Consumption based on lifetime income (lifecycle hypothesis)
- ❑ The effect of a tax cut today will be higher taxes in the future (unless government spending would be reduced)
- ❑ Hence, the household needs to save for the future tax rise
- ❑ The extra saving equals the amount of the tax cut

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## Ricardian equivalence

- Ricardian equivalence named after David Ricardo
- Concept of Ricardian equivalence revived after work by Robert Barro
- Implication is that a tax cut today will have no effect upon planned expenditure and thus output
- The tax multiplier, if Ricardian equivalence applies, is thus nil

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# Why Ricardian equivalence may fail to apply

- Myopia
  - People may be irrational
  
- Borrowing constraints
  
- Future generations
  - Bequests
  - Negative bequests not possible
  
- Heterogeneity
  - Tax rise may fall on other people's children
  - Tax rise may fall on firms

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# High public debt

- ❑ A high level of public debt
  - ❑ May fuel inflationary expectations
    - Nominal versus inflation-linked bonds
  - ❑ May raise the probability of default
    - Increase the risk premium in the interest rate
  - ❑ May lower investment and the rate of economic growth (see Reinhart and Rogoff, 2010)

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# The political economy of public debt

- Policymakers may produce public debt for none of the above reasons, but because they cannot resist the temptation to engage in high spending
- Idea popular under right-wing economists, like James Buchanan and Martin Feldstein
- Hence, the virtue of balanced-budget policies
  - They impose a cost upon too high (inefficient) public spending
- The case of the Netherlands:
  - It may be useful to have a constraint, not necessarily a balanced-budget constraint

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# The political economy of public debt

- Stabilization of the economy (business cycle)
  - Through automatic stabilizers
  - Discretionary policies
  
- Tax smoothing
  - Reduces the welfare loss of taxation
  - Budget deficits in case of war
  - What about population ageing?
  
- Intergenerational risk sharing

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# Price inflation

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## Price inflation: facts and figures

- Often low, but also quite often high or very high
- During the seventies, double-digit inflation rates in the industrialized world (Figure 11.6, p. 564)
- The Netherlands were no exception



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## Price inflation: facts and figures

- Hyperinflation (>40% a year) is more of a problem and is universal
- Reinhart and Rogoff (2009)
- Data on inflation in many countries in the world dating back to 1800

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## Price inflation: facts and figures

■ <u>Country</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>
■ Nigeria	22.6	9.4	72.9%	1995
■ Indonesia	18.6	9.6	939.8%	1966
■ Russia	35.7	26.4	13,534.7%	1923
■ Germany	9.7	4.3	2.22E10%	1923
■ Hungary	15.7	3.6	9.63E26%	1946
■ Argentina	24.6	15.5	3,079.5%	1989

- (1): Share of years in which inflation exceeded 20%
- (2): Share of years in which inflation exceeded 40%
- (3): Maximum annual inflation
- (4): Year of peak inflation

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## Why price inflation?

- The intriguing question is: why do countries produce so much inflation? Inflation is costly. What are the motives?
- Especially intriguing with the Phillips curve in mind:
  - It is vertical in the long run

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# The theory of time-inconsistent discretionary monetary policies

- Kydland and Prescott (1977): the inability of policymakers to commit themselves to a low-inflation policy produces sub-optimally high inflation
- Stylized model of time-inconsistent monetary policies
  - Assumes that, absent any surprise inflation, output is below the level that is socially optimal:  $y^n < y^*$
  - $y^n$  is log of structural output
  - $y^*$  is log of socially optimal level of output

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# The theory of time-inconsistent discretionary monetary policies

- Aggregate supply curve:
  - $y = y^n + b(\pi - \pi^e) \quad b > 0$
  - $y$  is the log of output
  - $y^n$  is log of structural output
  - $\pi$  is the rate of inflation
  - $\pi^e$  is the expected rate of inflation
- Interpretations:
  - Lucas supply curve
  - Nominal contracts

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# The theory of time-inconsistent discretionary monetary policies

- Social welfare loss function:

- $L = \frac{1}{2}(y - y^*)^2 + \frac{1}{2}a(\pi - \pi^*)^2 \quad a > 0$

- Inflation rather than money supply is considered an instrument of monetary policies

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## The case of discretion

- In the case of discretion, the central banker cannot commit himself to producing inflation as announced
- First step of the game
  - Central banker announces monetary policies; the public forms inflationary expectations
- Second step of the game
  - Given these expectations, the central banker minimizes the social welfare loss function
- We solve the model by backward induction



# Game between central banker and the public

## ■ Solution of the second step of the game

$$\square \frac{\partial L}{\partial \pi} = 0 \rightarrow [y^n + b(\pi - \pi^e) - y^*]b + a(\pi - \pi^*) = 0$$

$$\square \rightarrow (b^2 + a)\pi + b(y^n - y^*) - b^2\pi^e - a\pi^* = 0$$

$$\square \pi = \frac{b^2\pi^e + a\pi^* + b(y^* - y^n)}{a + b^2}$$

$$\square \frac{d\pi}{d\pi^e} = \frac{b^2}{a + b^2} < 1$$

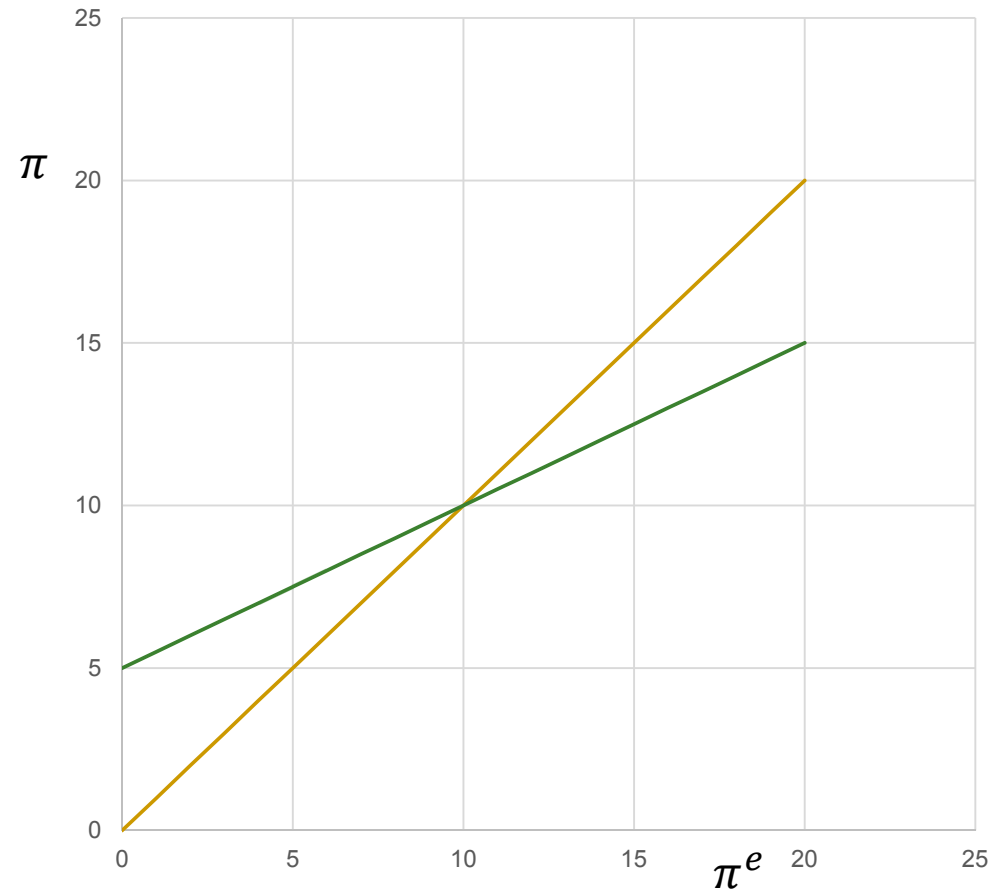
$$\square \text{Intercept } \frac{a\pi^* + b(y^* - y^n)}{a + b^2} > 0$$

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# Game between central banker and the public

- Solution of the first step of the game
  - $\pi^e = \pi \rightarrow \pi = \pi^e$
  - $\frac{d\pi}{d\pi^e} = 1$
  - Intercept 0

# The case of discretion



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## The case of rules

- In the case of rules, the central banker commits himself to producing inflation as announced
  - $\pi^e = \pi$
  - $\rightarrow y = y^n$  (aggregate supply curve)
  - $\rightarrow L = \frac{1}{2}(y^n - y^*)^2 + \frac{1}{2}a(\pi - \pi^*)^2$
- Result is that the inflation rate equals its target level and output equals structural output
  - $\pi = \pi^*$
  - $y = y^n$

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## Rules versus discretion

- $\pi = \pi^e = \pi^* + \frac{b}{a}(y^* - y^n)$
- $\pi > \pi^*$ : inflation is higher than socially optimal
- $y = y^n$ : output equals structural output
- This reminds us of the long-run Phillips curve:
  - No trade-off between output and inflation
- The cases of rules and discretion
  - Differ in terms of inflation
  - Share the result for output
  - Differ in the implied level of social welfare

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## Rules versus discretion

- The cases of rules and discretion
  - Differ in terms of inflation
  - Share the result for output
  - Differ in the implied level of social welfare
- Social welfare loss under rules
  - $L_{RULES} = \frac{1}{2}(y^* - y^n)^2$
- Social welfare loss under discretion
  - $L_{DISCRETION} = \frac{1}{2}\left(1 + \frac{b^2}{a}\right)(y^* - y^n)^2 > L_{RULES}$

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# The time-inconsistency of discretionary monetary policies

- ❑ Reason is the inability of the central banker to commit to a certain monetary policy
- ❑ After expectations have been formed, the central banker has an incentive to renege on its announcement
- ❑ The public anticipates this and sets expectations higher
- ❑ Ultimately, due to the inability to commit, the rate of inflation will be sub-optimally high
- ❑ Indeed, monetary policy that is optimal ex ante, will not be optimal ex post: the time inconsistency of optimal policies

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## Time-inconsistent policies

- Kydland and Prescott (1977) call their theory that of the time-inconsistency of optimal policies. Why?
- Policies that are ex ante optimal do not coincide with policies that are ex post optimal
  - Ex ante:  $\pi = \pi^*$
  - Ex post:  $\pi = \pi^* + \frac{b}{a}(y^* - y^n)$
- Another example is that of a capital tax
  - Investors will not be taxed
  - After entrepreneurs have invested, the government may break its promise and tax capital, which is a lumpsum (non-distortionary) tax
  - Entrepreneurs will anticipate this and will not invest



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# Solution to the time inconsistency problem

- Rules (rather than discretion)
  - Central banker cannot deviate from rule, even if this ex post suboptimal
  - Similar in case of a capital income tax: the tax cannot be raised ex post, even if this would be optimal ex post
  - Disadvantage of rules is loss of flexibility
- Delegation to a central banker who is more inflation-adverse than society
  - Requirement: the central banker has to be independent

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## Empirical evidence

- Researchers measure central banker independency by focussing on certain features of independency, like:
  - Rules for appointment and dismissal of the governor and the board of the central bank
  - Rules that establish the government's ability to control the central bank's decisions
  - The attendance of government representatives on the board of the central bank
- Some empirical evidence in support of theory
  - Alesina and Summers (1993), Grilli, Masciandaro and Tabellini (1991)
- The case of the ECB

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## Caveats

- The government may choose the level of central bank independency and the central banker's preferences simultaneously
  - High degree of independency may be correlated with central bankers who are not too much inflation-averse
- Central bank independency and inflation may both be related to a third variable, e.g. inflation preferences of society
- The empirical relationship is rejected for non-industrialized countries

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# Inflation-linked bonds

- ❑ Issued by the UK, the US, and some Eurozone countries
  - ❑ France, Italy, Germany, Spain
  - ❑ Not the Netherlands
  
- ❑ Inflation-linked bonds
  - ❑ Reduce inflation risk, for debt holders and debt issuers
  - ❑ Have lower interest rate than nominal bonds on account of inflation risk premium
  - ❑ Today's inflation