

Chapters 13-15 Detailed Solutions / 第 13-15 章详细解答

Macroeconomics Review

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Chapter 13. Exchange Rates, Business Cycles, and Macroeconomic Policy in the Open Economy

第 13 章开放经济中的汇率、商业周期与宏观政策

Review Questions / 复习题

13.RQ1. Define nominal exchange rate and real exchange rate. How are changes in the real exchange rate and the nominal exchange rate related?

中文解答：名义汇率 nominal exchange rate 是两种货币之间的相对价格。例如若用“外国货币/本国货币”表示，记为 E ，则 E 上升表示 1 单位本币能换到更多外币，本币名义升值。真实汇率 real exchange rate 是两国商品篮子的相对价格，常写成

$$e = \frac{EP}{P^*},$$

其中 P 是本国价格水平， P^* 是外国价格水平。若 e 表示“1 单位本国商品能换多少外国商品”，则 e 上升叫真实升值 real appreciation，本国商品相对变贵，净出口通常下降； e 下降叫真实贬值 real depreciation，本国商品相对变便宜，净出口通常上升。

变化关系为

$$\frac{\Delta e}{e} \approx \frac{\Delta E}{E} + \pi - \pi^*,$$

其中 π 是本国通胀率， π^* 是外国通胀率。因此，真实汇率变化不仅取决于名义汇率变化，还取决于两国通胀差。若本国通胀高于外国，即使名义汇率不变，本国也会真实升值。

English solution: The nominal exchange rate is the relative price of two currencies. The real exchange rate is the relative price of the two countries' goods baskets. With the convention $e = EP/P^*$, the percentage change in the real exchange rate is approximately the percentage change in the nominal exchange rate plus domestic inflation minus foreign inflation. Thus nominal appreciation, higher domestic inflation, or lower foreign inflation tends to cause real appreciation.

13.RQ2. What are the two main types of exchange-rate systems? Which system determines the values of major currencies?

中文解答：两类主要汇率制度是：

1. **浮动汇率制 flexible/floating exchange rate system:** 汇率主要由外汇市场供求决定，中央银行不承诺维持固定价格。
2. **固定汇率制 fixed exchange rate system:** 中央银行承诺把本币与某种外币、黄金或一篮子货币维持在固定比价附近，并通过买卖外汇储备调节货币供给。

当代美元、日元、欧元等主要货币之间大体属于浮动汇率制度，不过现实中中央银行可能进行干预，所以更准确说是 managed float，即有管理的浮动。

English solution: The two main systems are floating exchange rates and fixed exchange rates. The dollar, yen, and euro are mainly determined by flexible exchange rates, though central banks may occasionally intervene, so in practice the system is often described as a managed float.

13.RQ3. Define purchasing power parity, or PPP. Does PPP work well empirically?

中文解答: 购买力平价 purchasing power parity, PPP 认为同一种商品篮子在不同国家用同一种货币计价后应当价格相同。其绝对形式是

$$E = \frac{P^*}{P} \quad \text{或等价地} \quad EP = P^*.$$

相对 PPP 认为名义汇率的变动应反映两国通胀差:

$$\frac{\Delta E}{E} \approx \pi^* - \pi.$$

经验上, PPP 在长期和高通胀国家之间较有解释力, 但短期表现并不好。原因包括: 运输成本、关税与贸易壁垒、不可贸易品、商品篮子不同、市场不完全竞争、价格黏性以及资本流动导致的金融市场冲击。考试中要记住: PPP 是长期锚 long-run anchor, 不是短期汇率预测公式。

English solution: PPP says that the same basket of goods should cost the same across countries once prices are expressed in a common currency. It works better as a long-run tendency, especially for high-inflation countries, but it performs poorly in the short run because of transportation costs, trade barriers, nontraded goods, different consumption baskets, sticky prices, and financial shocks.

13.RQ4. What is the J curve? What explains the behavior of net exports represented by the J curve?

中文解答: J 曲线描述真实贬值之后净出口 NX 的动态路径: 先下降, 后上升, 形状像字母 J。核心机制是“价格先变, 数量后变”。

真实贬值后, 进口商品用本国商品计价变贵。短期内进口、出口数量因合同、习惯和生产调整滞后而变化不大, 于是进口支出价值上升, 净出口可能先恶化。较长期中, 居民和企业开始用本国产品替代进口品, 外国人也购买更多本国产品, 出口数量上升、进口数量下降, 净出口改善。

English solution: The J curve is the path of net exports after a real depreciation: net exports may initially fall and then rise. The reason is that prices adjust faster than quantities. In the short run import quantities are sticky, so the value of imports rises. In the longer run trade volumes respond, raising exports and lowering imports.

13.RQ5. For a given real exchange rate, how are net exports affected by domestic income, foreign income, and the domestic real interest rate?

中文解答: 在给定真实汇率 e 下:

- 本国收入 Y 上升, 本国居民购买更多商品, 其中一部分是进口品, 所以进口增加, NX 下降。
- 外国收入 Y^* 上升, 外国居民购买更多本国出口品, 所以出口增加, NX 上升。
- 本国真实利率 r 上升会吸引资本流入, 使本币升值, 真实汇率 e 上升。本国商品变贵, 出口下降、进口上升, 因此 NX 下降。

可以概括为

$$NX = NX(e, Y, Y^*), \quad NX_e < 0, \quad NX_Y < 0, \quad NX_{Y^*} > 0.$$

English solution: Holding the real exchange rate fixed, higher domestic income raises imports and lowers net exports, while higher foreign income raises exports and raises net exports. A higher domestic real interest rate attracts capital inflows, appreciates the real exchange rate, and tends to reduce net exports.

13.RQ6. Why do foreigners demand dollars and why do U.S. residents supply dollars in the foreign exchange market?

中文解答: 外国人需求美元, 是因为他们要购买美国商品、服务或资产。例如购买美国债券、股票、房地产, 或进口美国飞机、软件服务等, 都需要美元。美国居民供给美元, 是因为他们要购买外国商品、服务或资产, 例如进口日本汽车、去欧洲旅游、购买外国股票或债券。

美元需求增加的例子:

1. 美国资产收益率上升, 外国投资者更想买美国资产;
2. 外国收入上升, 外国对美国出口品需求增加。

美元供给增加的例子:

1. 美国收入上升, 美国进口需求增加;
2. 外国资产收益率上升, 美国居民增加海外投资。

English solution: Foreigners demand dollars to buy U.S. goods, services, or assets. U.S. residents supply dollars to buy foreign goods, services, or assets. Dollar demand rises, for example, when U.S. interest rates rise or foreign income increases. Dollar supply rises when U.S. income raises imports or when foreign assets become more attractive.

13.RQ7. How does the open-economy IS-LM model differ from the closed-economy IS-LM model? How can a recession be transmitted internationally?

中文解答: 封闭经济中产品市场均衡是

$$Y = C + I + G.$$

开放经济中加入净出口:

$$Y = C + I + G + NX(e, Y, Y^*).$$

而且利率会通过资本流动影响汇率，汇率再影响净出口。因此开放经济 IS 曲线不仅受消费、投资、政府购买影响，还受真实汇率和外国收入影响。

一国衰退向外传导的机制是：本国收入下降 $\Rightarrow$ 进口减少 $\Rightarrow$ 外国出口减少 $\Rightarrow$ 外国总需求下降 $\Rightarrow$ 外国收入和就业下降。若该国货币政策收缩导致利率上升，还可能造成资本流动与汇率变化，使贸易伙伴的真实汇率、净出口和产出受到进一步冲击。

English solution: The open-economy IS-LM model adds net exports and the exchange-rate channel. A recession in one country lowers its imports, which lowers other countries' exports and shifts their IS curves left. Interest-rate and exchange-rate movements can further transmit the shock through capital flows and relative prices.

13.RQ8. How are net exports affected by expansionary fiscal and monetary policy? What is ambiguous?

中文解答：扩张性财政政策提高 G 或降低 T ，使 IS 右移，收入和利率倾向上升。收入上升会增加进口，使 NX 下降；利率上升导致本币升值，也使 NX 下降。因此一般结论是：扩张性财政政策倾向于降低净出口，即产生贸易收支恶化或 twin deficits。

扩张性货币政策使 LM 右移，利率下降，货币贬值，出口增加、进口减少， NX 倾向上升。但同时收入上升会增加进口，使 NX 下降。因此货币政策对净出口的总效应存在潜在歧义：汇率效应提高 NX ，收入效应降低 NX 。通常在开放经济模型中，贬值效应较强时 NX 上升。

English solution: Expansionary fiscal policy tends to reduce net exports because it raises income and often raises the interest rate, appreciating the currency. Expansionary monetary policy tends to raise net exports through depreciation, but the induced income expansion raises imports. Thus the net effect of monetary policy on net exports can be ambiguous.

13.RQ9. What effects does expansionary monetary policy have on the nominal exchange rate in the short and long run?

中文解答：短期价格黏性下，扩张性货币政策增加货币供给，使利率下降，资本流出，本币名义贬值。若汇率用外币/本币表示，则 E 下降；若用本币/外币表示，则汇率上升。

长期中，货币中性成立，实际变量回到由真实因素决定的水平，价格水平按货币供给比例上升。根据 PPP，长期名义汇率主要反映相对价格水平，因此本国货币会长期贬值，幅度大体与本国价格水平相对上升一致。短期可能出现 overshooting，即汇率先过度贬值，随后随价格调整部分回升。

English solution: In the short run, monetary expansion lowers the interest rate and depreciates the nominal exchange rate. In the long run, prices rise and real variables return to fundamentals, so the currency remains depreciated in proportion to the higher domestic price level. With sticky prices, exchange-rate overshooting may occur.

13.RQ10. What is the fundamental value of a currency? What is an overvalued currency? Why is it a problem and what can be done?

中文解答：货币的 fundamental value 是在给定宏观基本面，如货币供给、价格水平、实际产出、国际价格和资本流动条件下，与长期均衡或购买力平价相一致的汇率。若固定汇率高于基本价值，即政府把本币定得过贵，就称本币被高估 overvalued。

本币高估的问题是：本国商品相对过贵，出口受损、进口过多，国际收支出现压力；市场参与者预期贬值，可能引发投机攻击；中央银行必须卖出外汇储备、买入本币来维持汇率，储备会不断流失。

应对方式包括：紧缩货币政策、降低国内价格水平、提高利率、获得国际贷款、实行资本管制，或直接 devalue/abandon the peg，即贬值或放弃固定汇率。

English solution: The fundamental value is the exchange rate consistent with long-run macroeconomic fundamentals. A currency is overvalued when its official fixed value is above that fundamental value. This hurts exports, encourages imports, creates reserve losses, and invites speculative attacks. The country can tighten monetary policy, obtain reserves, impose controls, devalue, or abandon the peg.

13.RQ11. Why is money supply limited under a fixed exchange-rate system? How can policy coordination help?

中文解答：固定汇率下，中央银行必须随时按固定价格买卖外汇。如果它扩张货币供给，国内利率下降，本币面临贬值压力。为了维持固定汇率，央行必须卖出外汇储备、买入本币，这会收回基础货币，抵消原来的货币扩张。因此固定汇率制度会约束独立货币政策，这就是 impossible trinity 的一个表现：资本自由流动、固定汇率和独立货币政策不能三者兼得。

政策协调可以缓解约束。例如多个国家同时扩张货币或同时调整固定平价，汇率压力会减少；一国有国际收支压力时，其他国家提供外汇支持或共同调整利率，也能提高政策空间。

English solution: Under a fixed exchange rate, monetary expansion creates depreciation pressure and reserve losses, forcing the central bank to reverse the expansion. Coordination helps because countries can adjust policies together, provide reserve support, or realign parities, reducing pressure on any single currency.

13.RQ12. Compare flexible rates, fixed rates, and a currency union.

中文解答：浮动汇率优点是保留货币政策独立性，并让汇率吸收外部冲击；缺点是汇率波动可能增加贸易和投资不确定性。固定汇率优点是降低汇率风险、帮助控制通胀预期；缺点是丧失货币政策独立性，并可能遭受投机攻击。货币联盟 currency union 彻底消除成员之间汇率风险和兑换成本，促进市场整合；但成员国放弃本国货币政策，面对非对称冲击时调整困难，必须依靠工资价格弹性、劳动力流动或财政转移机制。

English solution: Flexible rates preserve monetary independence but create exchange-rate volatility. Fixed rates reduce exchange-rate uncertainty and may import credibility, but they restrict monetary policy and invite crises. A currency union eliminates internal exchange-rate risk,

but members lose national monetary policy and need other adjustment mechanisms for asymmetric shocks.

Numerical Problems / 数值题

13.NP1. West Bubble and East Bubble soap bars

中文解答：设名义汇率 E 为“guilders per florin”。East Bubble 的 deluxe soap bar 价格是 100 florins，换成本国 West 货币为 $100E$ guilders。West Bubble 的 ordinary soap bar 价格是 5 guilders。因此 1 个 deluxe soap bar 相当于

$$\frac{100E}{5} = 20E$$

个 ordinary soap bars。题目给真实汇率为 2 ordinary soap bars per deluxe soap bar，所以

$$20E = 2 \Rightarrow E = 0.1.$$

即 1 florin = 0.1 guilder，或 1 guilder = 10 florins。

第二年 West 通胀 10%，ordinary soap 价格变为 5.5 guilders；East 通胀 20%，deluxe soap 价格变为 120 florins。真实汇率仍为 2，所以

$$\frac{120E'}{5.5} = 2 \Rightarrow E' = \frac{11}{120} \approx 0.0917.$$

以 guilders per florin 表示， E 从 0.1 降到 0.0917，florin 贬值、guilder 升值。等价地，florins per guilder 从 10 上升到 10.91，说明 guilder 名义升值。

English solution: Let E be guilders per florin. The real exchange rate is $(100E)/5 = 20E$ ordinary bars per deluxe bar. Since this equals 2, $E = 0.1$. After inflation, $(120E')/5.5 = 2$, so $E' = 0.0917$. Thus the florin depreciates relative to the guilder; the guilder appreciates.

13.NP2. Japan cameras and Saudi oil: J-curve calculation

中文解答：真实汇率是“每台相机可换多少桶油”。所以把进口的油换算成相机数量时，要用“油桶数/真实汇率”。

初始：

$$\text{imports in cameras} = \frac{64}{4} = 16, \quad NX = 40 - 16 = 24 \text{ cameras.}$$

短期真实汇率降到 3，出口 42 台，进口 60 桶：

$$\text{imports in cameras} = \frac{60}{3} = 20, \quad NX = 42 - 20 = 22.$$

净出口从 24 下降到 22，短期恶化。

长期出口 45 台，进口 54 桶：

$$\text{imports in cameras} = \frac{54}{3} = 18, \quad NX = 45 - 18 = 27.$$

长期净出口改善到 27。

这正是 J 曲线：贬值后短期因进口价格效应， NX 先恶化；长期因出口量上升、进口量下降， NX 改善。

English solution: Convert oil imports into cameras by dividing barrels by barrels per camera. Initially $NX = 40 - 64/4 = 24$. In the short run, $NX = 42 - 60/3 = 22$, so net exports worsen. In the longer run, $NX = 45 - 54/3 = 27$, so net exports improve. This is the J curve.

13.NP3. Classical open economy

Given:

$$C^d = 300 + 0.5Y - 200r, \quad I^d = 200 - 300r, \quad G = 100,$$

$$NX = 150 - 0.1Y - 0.5e, \quad e = 20 + 600r.$$

中文解答：先代入真实汇率：

$$NX = 150 - 0.1Y - 0.5(20 + 600r) = 140 - 0.1Y - 300r.$$

产品市场均衡：

$$Y = C + I + G + NX = 740 + 0.4Y - 800r.$$

(a) $\bar{Y} = 900$:

$$900 = 740 + 0.4(900) - 800r = 1100 - 800r \Rightarrow r = 0.25.$$

$$e = 20 + 600(0.25) = 170.$$

$$C = 300 + 450 - 50 = 700, \quad I = 200 - 75 = 125, \quad NX = 140 - 90 - 75 = -25.$$

(b) $\bar{Y} = 940$:

$$940 = 740 + 0.4(940) - 800r = 1116 - 800r \Rightarrow r = 0.22.$$

$$e = 152, \quad C = 300 + 470 - 44 = 726, \quad I = 200 - 66 = 134, \quad NX = 140 - 94 - 66 = -20.$$

(c) $\bar{Y} = 940, G = 132$: 常数项从 740 变为 772, 所以

$$940 = 772 + 0.4(940) - 800r = 1148 - 800r \Rightarrow r = 0.26.$$

$$e = 176, \quad C = 300 + 470 - 52 = 718, \quad I = 200 - 78 = 122, \quad NX = 140 - 94 - 78 = -32.$$

English solution: Substitute $e = 20 + 600r$ into NX , giving $NX = 140 - 0.1Y - 300r$. Goods-market equilibrium becomes $Y = 740 + 0.4Y - 800r$, with the constant changing to 772 when $G = 132$. The results are:

Case	r	e	C	I	NX
(a) $Y = 900, G = 100$	0.25	170	700	125	-25
(b) $Y = 940, G = 100$	0.22	152	726	134	-20
(c) $Y = 940, G = 132$	0.26	176	718	122	-32

13.NP4. Keynesian open economy

Given:

$$\begin{aligned}C &= 200 + 0.6(Y - T) - 200r, & T &= 20 + 0.2Y, & I &= 300 - 300r, \\G &= 152, & NX &= 150 - 0.08Y - 500r, & L &= 0.5Y - 200r, & M &= 924, & \bar{Y} &= 1000.\end{aligned}$$

中文解答：先化简消费函数：

$$\begin{aligned}T &= 20 + 0.2Y \Rightarrow Y - T = 0.8Y - 20, \\C &= 200 + 0.6(0.8Y - 20) - 200r = 188 + 0.48Y - 200r.\end{aligned}$$

(a) 长期一般均衡 $Y = \bar{Y} = 1000$ 。产品市场：

$$Y = C + I + G + NX = 790 + 0.4Y - 1000r.$$

代入 $Y = 1000$ ：

$$\begin{aligned}1000 &= 1190 - 1000r \Rightarrow r = 0.19. \\C &= 630, & I &= 243, & NX &= -25.\end{aligned}$$

货币市场：

$$\frac{M}{P} = L = 0.5(1000) - 200(0.19) = 462, \quad P = \frac{924}{462} = 2.$$

(b) G 从 152 增至 214。短期价格固定在 $P = 2$ ，所以实际货币供给仍为 462。新 IS：

$$Y = 852 + 0.4Y - 1000r.$$

LM：

$$0.5Y - 200r = 462.$$

解得

$$r = 0.24, \quad Y = 1020.$$

于是

$$C = 629.6, \quad I = 228, \quad NX = -51.6, \quad P_{SR} = 2.$$

长期 $Y = 1000$ ：

$$\begin{aligned}1000 &= 852 + 400 - 1000r \Rightarrow r = 0.252. \\C &= 617.6, & I &= 224.4, & NX &= -56, & L &= 449.6, & P &= \frac{924}{449.6} \approx 2.055.\end{aligned}$$

(c) 若 $G = 152$ 不变，但 NX 在任意 Y, r 下增加 62，则 $NX = 212 - 0.08Y - 500r$ 。这使 IS 的常数项同样从 790 变为 852，所以对 Y, r, P 的影响与 (b) 相同。短期：

$$Y = 1020, \quad r = 0.24, \quad C = 629.6, \quad I = 228, \quad NX = 212 - 81.6 - 120 = 10.4, \quad P = 2.$$

长期：

$$Y = 1000, \quad r = 0.252, \quad C = 617.6, \quad I = 224.4, \quad NX = 212 - 80 - 126 = 6, \quad P \approx 2.055.$$

比较：财政扩张和净出口外生增加对总需求、产出、利率、价格的总量效应相同，但支出构成不同。财政扩张挤出 NX ，外需冲击则直接提高 NX 。

English solution: First simplify consumption to $C = 188 + 0.48Y - 200r$. In the initial long-run equilibrium, $Y = 1000$, $r = 0.19$, $C = 630$, $I = 243$, $NX = -25$, and $P = 2$. When G rises by 62, the short-run equilibrium with fixed $P = 2$ is $Y = 1020$, $r = 0.24$. In the long run, $Y = 1000$, $r = 0.252$, and $P \approx 2.055$. A 62-unit autonomous increase in net exports shifts IS by the same amount, so aggregate effects are the same, but the composition differs.

13.NP5. Fundamental value under a fixed exchange rate

中文解答：由 AS 得 $Y = 1000$ 。AD 为

$$Y = 400 + 50\frac{M}{P}, \quad M = 48.$$

所以

$$1000 = 400 + 50\frac{48}{P} = 400 + \frac{2400}{P} \Rightarrow P = 4.$$

真实汇率是 5 wedges of cheese per bottle of wine。设名义汇率 E 为 crowns per franc。国内一瓶酒价格为 4 francs，即 $4E$ crowns；外国一块奶酪价格为 20 crowns。因此

$$\frac{4E}{20} = 5 \Rightarrow E = 25 \text{ crowns per franc.}$$

这就是基本价值。

若政府固定在 50 crowns per franc，高于基本价值 25，本币 franc 被高估。央行为维持 50 必须卖出外汇储备、买入 franc，官方储备会减少。

若希望基本价值也等于 50，则在 $e = 5$ 、 $P^* = 20$ 下

$$\frac{EP}{P^*} = 5 \Rightarrow \frac{50P}{20} = 5 \Rightarrow P = 2.$$

在 $Y = 1000$ 的 AD 中，

$$1000 = 400 + 50\frac{M}{2} \Rightarrow M = 24.$$

所以货币供给要从 48 缩减到 24。

English solution: The price level is $P = 4$. If E is crowns per franc, the real exchange rate is $(EP)/P^* = (4E)/20$. Setting this equal to 5 gives $E = 25$. A fixed rate of 50 crowns per franc overvalues the franc and causes reserve losses. To make 50 the fundamental rate, the domestic price level must be $P = 2$, which requires $M = 24$.

13.NP6. Appendix 13.B using Numerical Problem 4

中文解答：由 13.NP4 的化简式：

$$C = 188 + 0.48Y - 200r, \quad I = 300 - 300r, \quad NX = 150 - 0.08Y - 500r.$$

(a) 开放经济 IS:

$$Y = C + I + G + NX = 790 + 0.4Y - 1000r.$$

所以

$$0.6Y = 790 - 1000r, \quad Y = 1316.67 - 1666.67r.$$

(b) LM:

$$\frac{M}{P} = 0.5Y - 200r.$$

因 $M = 924$,

$$Y = 2\frac{924}{P} + 400r = \frac{1848}{P} + 400r.$$

(c) 一般均衡: $Y = 1000$ 。由 IS 得 $r = 0.19$; 由 LM 得 $924/P = 462$, 所以 $P = 2$ 。

(d) AD 曲线由 IS 与 LM 联立。由 IS:

$$r = 0.79 - 0.0006Y.$$

代入 LM:

$$\frac{924}{P} = 0.5Y - 200(0.79 - 0.0006Y) = 0.62Y - 158.$$

因此

$$Y = \frac{924/P + 158}{0.62}.$$

若净出口在任意 Y, r 下增加 62, IS 变为

$$Y = 852 + 0.4Y - 1000r, \quad r = 0.852 - 0.0006Y.$$

新 AD 为

$$\frac{924}{P} = 0.62Y - 170.4, \quad Y = \frac{924/P + 170.4}{0.62}.$$

因此 AD 右移。每个价格水平下产出提高

$$\frac{170.4 - 158}{0.62} = 20.$$

(e) 若价格固定在 (c) 的 $P = 2$, 则

$$Y = \frac{462 + 170.4}{0.62} = 1020, \quad r = 0.24.$$

这与 13.NP4(c) 的短期结果一致, 因为水平 SRAS 使价格不动, 需求冲击全部反映为产出变化。

English solution: The open-economy IS curve is $Y = 1316.67 - 1666.67r$. The LM curve is $Y = 1848/P + 400r$. General equilibrium is $Y = 1000, r = 0.19, P = 2$. The AD curve is $Y = (924/P + 158)/0.62$. A 62-unit increase in autonomous net exports shifts AD right by 20 units of output at every price level. With fixed $P = 2$, output rises to 1020 and $r = 0.24$.

Analytical Problems / 分析题

13.AP1. Import restrictions during a recession

中文解答： (a) 在凯恩斯开放经济 IS-LM 模型中，进口限制会在给定汇率下减少进口、提高 NX ，使 IS 曲线右移。若经济本来处于衰退，短期价格黏性下，这会提高产出和就业，并可能提高利率。利率上升会吸引资本流入，使本币真实升值，从而部分抵消净出口改善。

(b) 对外国而言，本国进口限制意味着外国出口减少，外国 IS 左移，外国产出和就业下降。若外国报复，也限制来自本国的进口，那么本国出口下降，最初的扩张效应会被削弱甚至反转。两国都采取保护主义时，贸易量下降，双方总福利通常受损。

(c) 若本国已经处于充分就业，基本古典模型下产出和就业由供给决定，进口限制不能提高总产出。它只会改变支出构成和相对价格：真实汇率可能升值，抵消直接的进口限制效应；实际利率也可能上升以使商品市场重新均衡。结论是保护主义不是提高充分就业产出的有效方法。

English solution: Import restrictions shift the domestic IS curve right by raising net exports at a given exchange rate, so in a recession they can raise output and employment in the short run. Foreign countries lose exports, so their IS curves shift left. Retaliation reduces domestic exports and can make both countries worse off. At full employment in the classical model, output and employment do not rise; the real exchange rate and interest rate adjust instead.

13.AP2. U.S. investment attractiveness in the early 1980s

中文解答： 更有利的税法降低本国资本使用成本，使本国期望投资 I^d 上升。LDC 债务危机降低外国预期资本边际产出，使外国投资需求下降。若本国当前产出和劳动供给不变，本国储蓄大体不变，而投资需求上升，所以

$$NX = S^d - I^d$$

下降。本国需要从国外吸收资金，即资本流入增加。资本流入推高本币需求，使本币真实升值；真实升值又降低出口、提高进口，所以本国净出口下降。

金融流动方面，本国出现资本账户流入，对应经常账户恶化；外国资金流出，对应外国经常账户改善。世界真实利率的方向取决于本国投资上升和外国投资下降哪个更强，但本国真实汇率升值和净出口下降是题目强调的核心结论。

English solution: Lower user cost of capital raises domestic desired investment, while the LDC debt crisis lowers foreign desired investment. With domestic saving unchanged, $NX = S - I$ falls. The country receives capital inflows, its real exchange rate appreciates, and net exports decline. The current account deteriorates while the capital account improves.

13.AP3. West Bubble monetary contraction and East Bubble

中文解答： (a) West Bubble 紧缩货币使 West 利率上升、产出下降。West 收入下降会减少其从 East 的进口，因此 East 出口下降、IS 左移。与此同时 West 利率上升吸引资本流向 West，East 货币相对 West 贬值。若 East 价格短期不变，名义贬值也是真实贬值。真实贬值会部分刺激 East 净出口，但通常不能完全抵消外国需求下降。

(b) East 的名义汇率短期贬值。长期中价格调整后，真实汇率回到由基本面决定的水平；若 West 货币供给永久减少，West 长期价格水平较低，West 货币长期更强，因此 East 货币相对 West 也会有名义贬值压力。

(c) 若 East 对 West 固定汇率，并希望维持基本价值，East 必须跟随 West 紧缩货币：卖出外汇储备、买入本币，减少本国基础货币。这样 East 的 LM 左移，短期产出下降更明显；由于汇率不能贬值，净出口不能通过价格竞争力改善来缓冲冲击。

(d) 若 East 不调整政策却坚持固定汇率，市场会认为 East 货币被高估并攻击固定汇率。央行储备流失，最终可能被迫贬值、放弃固定汇率、实行资本管制、请求国际援助，或改行紧缩政策。

English solution: West's monetary tightening raises West's interest rate and lowers West's income. East loses export demand and faces depreciation pressure. Under floating rates, East's depreciation partly offsets the demand loss. Under a fixed rate, East must contract its own money supply to defend the peg, causing a larger short-run output loss. If it refuses to adjust, reserve losses and a currency crisis may follow.

13.AP4. Beneficial temporary supply shock and net exports

中文解答： (a) 若有利供给冲击使充分就业产出暂时增加 100，而居民不增加期望支出，则期望储蓄上升。因为

$$NX = S^d - I^d,$$

投资不变而储蓄上升，所以均衡净出口上升。另一方面收入上升会增加进口，使给定真实汇率下的 NX 下降；为了使实际 NX 上升，真实汇率必须贬值，以刺激出口、抑制进口。

(b) 若居民把额外收入全部或大部分花掉，其中一部分花在进口品上，则储蓄不一定上升。此时 $S - I$ 变化较小，而进口需求增加使 NX 曲线下降。真实汇率需要贬值来抵消进口增加；净出口可能变化不大，甚至下降，取决于支出中进口品比例和储蓄反应。

(c) 如果收入增加是暂时的，消费平滑理论认为居民不会把全部临时收入都花掉，而会增加储蓄。因此 (a) 更可能发生。这支持“临时有利供给冲击提高储蓄并改善经常账户/净出口”的模型预测。

English solution: If a temporary supply shock raises full-employment output but desired spending does not rise, desired saving increases and $NX = S - I$ rises. The real exchange rate must depreciate enough to generate the higher net exports. If residents spend the extra income, especially on imports, net exports improve less or may not improve. For a temporary shock, consumption smoothing makes case (a) more likely.

Chapter 14. Monetary Policy and the Federal Reserve System

第 14 章货币政策与美联储体系

Review Questions / 复习题

14.RQ1. Define monetary base. What is its relation to money supply in an all-currency economy?

中文解答：货币基础 monetary base, high-powered money 是中央银行直接发行并控制的货币，包括公众持有的通货 C 和商业银行准备金 R ：

$$H = C + R.$$

在 all-currency economy 中，所有货币都以现金形式持有，没有存款和银行准备金，因此

$$M = C = H.$$

货币乘数等于 1，央行每增加 1 单位基础货币，货币供给也增加 1 单位。

English solution: The monetary base is currency held by the public plus bank reserves, $H = C + R$. In an all-currency economy there are no deposits or reserves, so $M = H$ and the money multiplier is 1.

14.RQ2. Define money multiplier. Compare 100 percent reserve banking and fractional reserve banking.

中文解答：货币乘数 money multiplier 是货币供给 M 与货币基础 H 的比率：

$$m = \frac{M}{H}.$$

若公众的通货-存款比率为 $c = C/D$ ，银行准备金-存款比率为 $res = R/D$ ，则

$$M = C + D = (c + 1)D, \quad H = C + R = (c + res)D,$$

所以

$$m = \frac{1 + c}{c + res}.$$

100% 准备金制度下 $res = 1$ 。若所有货币都以存款形式持有，即 $c = 0$ ，则

$$m = \frac{1}{1} = 1.$$

部分准备金制度下 $0 < res < 1$ ，若 $c = 0$ ，则

$$m = \frac{1}{res} > 1.$$

原因是银行只保留部分存款为准备金，其余贷出；贷款又形成新存款，产生多倍存款创造。

English solution: The money multiplier is $m = M/H$. With currency-deposit ratio c and reserve-deposit ratio res , $m = (1 + c)/(c + res)$. Under 100 percent reserves and all deposits, $m = 1$. Under fractional reserves, $m = 1/res > 1$ because lending creates additional deposits.

14.RQ3. How can the public and banks affect the money multiplier? Does this mean the central bank cannot control money?

中文解答: 公众通过改变 $c = C/D$ 影响乘数。若公众更偏好现金, c 上升, 银行体系可用于创造存款的基础减少, 通常 m 下降。银行通过改变 $res = R/D$ 影响乘数。若银行持有更多超额准备金, res 上升, 贷款和存款创造减少, m 下降。

这不意味着央行完全不能控制货币供给。央行能控制基础货币 H , 并能通过准备金要求、贴现率、准备金利率等影响 res 。但由于 c 和超额准备金行为会波动, 央行对 M 的控制并非机械精确, 而是带有不确定性。

English solution: The public affects the multiplier through the currency-deposit ratio; banks affect it through the reserve-deposit ratio. A higher currency ratio or reserve ratio lowers the multiplier. The central bank still controls the monetary base and can influence reserve behavior, but control of the money supply is imperfect because the multiplier varies.

14.RQ4. What is the effect of an open-market purchase of U.S. Treasury securities?

中文解答: 公开市场买入 open-market purchase 是央行从公众或银行购买国债, 并支付准备金或现金。央行资产增加国债, 负债增加基础货币。因此货币基础 H 增加。货币供给 $M = mH$ 通常按乘数扩大, 增加幅度为

$$\Delta M = m\Delta H$$

若乘数稳定。若银行持有大量超额准备金或公众增加现金持有, 乘数效应会较弱。

English solution: An open-market purchase raises the monetary base because the Fed pays with reserves or currency. The money supply usually rises by the multiplier times the increase in the base, though the effect is smaller if banks hold excess reserves or the public holds more currency.

14.RQ5. Who determines monetary policy in the United States? What role does the President play?

中文解答: 美国货币政策主要由 Federal Reserve System 决定, 尤其是 Federal Open Market Committee, FOMC。FOMC 决定公开市场操作和联邦基金利率目标。美联储理事会还影响准备金要求、贴现率和准备金利率等工具。

总统不能直接命令美联储改变货币政策。总统的影响主要是任命美联储理事和主席, 并通过财政政策、公开言论和政治环境间接影响政策。美联储具有制度独立性, 目的是提高货币政策反通胀信誉并减少短期政治周期干扰。

English solution: U.S. monetary policy is determined mainly by the Federal Reserve, especially the FOMC. The President influences policy indirectly by appointing members of the Board of Governors and the Fed Chair, but does not directly set monetary policy.

14.RQ6. Besides open-market operations, what other tools does the Fed have?

中文解答：除公开市场操作外，美联储还有：

1. **贴现贷款与贴现率 discount lending and discount rate:** 降低贴现率鼓励银行向 Fed 借款，增加准备金和货币供给；提高贴现率则相反。
2. **法定准备金率 reserve requirements:** 降低准备金率提高货币乘数，增加货币供给；提高准备金率降低乘数。
3. **准备金利率 interest on reserves:** 提高准备金利率使银行更愿意持有准备金、少放贷，降低乘数；降低准备金利率鼓励放贷。
4. **非常规工具**，如量化宽松 QE、前瞻指引 forward guidance、资产购买等，影响长期利率和金融条件。

English solution: Other tools include discount lending, reserve requirements, interest on reserves, and unconventional policies such as quantitative easing and forward guidance. These tools affect reserves, the money multiplier, and broader financial conditions.

14.RQ7. What are intermediate targets? How do they differ from policy goals?

中文解答：政策目标 goals 是最终想实现的宏观结果，例如低通胀、高就业、稳定产出和金融稳定。中介目标 intermediate targets 是央行可以较快观察并影响、且与最终目标相关的变量，用来指导短期操作。

美联储使用过的两类主要中介目标是：

1. 货币总量目标 monetary aggregates, 例如 $M1$ 、 $M2$ 增长率；
2. 利率目标 interest-rate targets, 例如联邦基金利率。

区别是：中介目标不是最终目的，而是达到最终目标的操作性桥梁。

English solution: Final goals include low inflation, high employment, and stable output. Intermediate targets are variables the central bank can influence more directly and that are linked to the final goals. The Fed has used monetary aggregates and interest rates as principal intermediate targets.

14.RQ8. What are the three channels of monetary policy?

中文解答：三个常见渠道是：

1. **利率渠道 interest-rate channel:** 扩张性货币政策降低实际利率，刺激投资和耐用品消费，增加总需求。
2. **汇率渠道 exchange-rate channel:** 利率下降导致资本流出和本币贬值，净出口增加。
3. **资产价格/信用渠道 asset-price and credit channel:** 货币宽松推高股票、债券和房地产价格，改善资产负债表，降低外部融资溢价，使消费和投资增加。信用渠道还包括银行贷款渠道和资产负债表渠道。

English solution: Monetary policy works through interest rates, exchange rates, and asset-price/credit channels. Lower rates stimulate investment; depreciation raises net exports; higher asset prices

and easier credit strengthen spending.

14.RQ9. Monetarist and modern arguments for rules rather than discretion

中文解答：货币主义者的回应是：虽然 discretion 似乎能灵活应对新信息，但现实中的政策存在信息滞后、识别滞后、执行滞后和效果滞后。央行试图微调经济，可能反而制造货币增长和通胀波动。因此货币主义者主张稳定的货币增长规则。

更现代的规则论证强调 time inconsistency 和 credibility。即使央行事前承诺低通胀，事后也有制造意外通胀、短期降低失业的诱因。理性公众预期到这一点，会形成更高通胀预期，结果是高通胀而没有更低失业。规则、独立央行和明确目标可以提高可信度，降低通胀偏差。

English solution: Monetarists argue that discretion is dangerous because of long and variable lags and imperfect information, so attempts to fine-tune the economy may destabilize it. The modern argument is time inconsistency: discretionary central banks may be tempted to create surprise inflation, so credible rules can reduce inflation bias.

14.RQ10. Have money-growth targets improved credibility? What else can improve credibility?

中文解答：货币增长目标在某些时期有帮助，但总体并没有显著、稳定地改善央行信誉。原因是货币需求不稳定，金融创新改变 $M1$ 、 $M2$ 与收入、通胀之间的关系，使货币总量目标难以执行和解释。

提高央行信誉的其他方式包括：赋予央行独立性；明确低通胀目标或 inflation targeting；任命反通胀声誉强的央行官员；提高政策透明度；建立财政纪律，避免财政赤字货币化；加入固定汇率制度或货币联盟以输入外部信誉。

English solution: Money-growth targets have not consistently improved credibility because money demand and the relation between monetary aggregates and inflation became unstable. Credibility can also be improved by central bank independence, inflation targeting, transparent communication, conservative central bankers, fiscal discipline, and sometimes fixed exchange-rate commitments.

Numerical Problems / 数值题

14.NP1. Multiple expansion of deposits and loans

中文解答：题目给货币基础 $H = 1,000,000$ ，公众始终一半持有现金、一半持有存款，所以

$$c = \frac{C}{D} = 1.$$

银行准备金率为

$$res = \frac{R}{D} = 0.2.$$

货币乘数：

$$m = \frac{1 + c}{c + res} = \frac{2}{1.2} = \frac{5}{3}.$$

最终货币供给：

$$M = mH = \frac{5}{3}(1,000,000) = 1,666,666.67.$$

最终公众一半现金一半存款：

$$C = D = 833,333.33.$$

最终准备金：

$$R = 0.2D = 166,666.67,$$

最终银行贷款：

$$Loans = D - R = 666,666.67.$$

过程表如下：

Stage	D	R	$Loans$	C
After first deposits	500,000	500,000	0	500,000
After 1st loans/redeposits	700,000	300,000	400,000	700,000
After 2nd loans/redeposits	780,000	220,000	560,000	780,000
Final	833,333.33	166,666.67	666,666.67	833,333.33

中央银行最终资产为 coconuts 1,000,000；负债为公众现金 833,333.33 与银行准备金 166,666.67，总计基础货币 1,000,000。银行体系资产为准备金 166,666.67 和贷款 666,666.67；负债为存款 833,333.33。公众资产为现金和存款合计 1,666,666.67，同时有银行贷款负债 666,666.67。

English solution: Here $c = 1$, $res = 0.2$, so $m = (1 + c)/(c + res) = 5/3$. Final money supply is 1.667 million florins. Final currency and deposits are each 833,333.33, reserves are 166,666.67, and bank loans are 666,666.67. The balance-sheet process is shown in the table above.

14.NP2. Money multiplier calculations

中文解答： (a) $M = 6,000,000$ ，公众现金 $C = 2,000,000$ ，所以

$$D = M - C = 4,000,000.$$

准备金率 $res = 0.25$ ，所以

$$R = 0.25D = 1,000,000.$$

货币基础：

$$H = C + R = 3,000,000.$$

货币乘数：

$$m = \frac{M}{H} = 2.$$

(b) 银行准备金包括库存现金和在央行存款：

$$R = 1,000,000 + 4,000,000 = 5,000,000.$$

基础货币 $H = 10,000,000 = C + R$, 所以

$$C = 5,000,000.$$

存款 $D = 20,000,000$, 因此

$$M = C + D = 25,000,000, \quad m = \frac{25}{10} = 2.5.$$

English solution: In part (a), deposits are 4 million, reserves 1 million, base 3 million, multiplier 2. In part (b), reserves are 5 million, currency is 5 million, money supply is 25 million, and the multiplier is 2.5.

14.NP3. Interest-sensitive reserve ratio and LM slope

中文解答: 已知

$$res = 0.4 - 2r, \quad c = 0.4, \quad H = 60, \quad P = 1, \quad L = 0.5Y - 10i, \quad i = r.$$

货币乘数为

$$m = \frac{1 + c}{c + res} = \frac{1.4}{0.4 + res}.$$

(a) 若 $r = i = 0.10$,

$$res = 0.4 - 0.2 = 0.2, \quad m = \frac{1.4}{0.6} = 2.3333.$$

$$M = mH = 2.3333(60) = 140.$$

资产市场出清:

$$M/P = L \Rightarrow 140 = 0.5Y - 10(0.10) = 0.5Y - 1,$$

$$Y = 282.$$

(b) 若 $r = i = 0.05$,

$$res = 0.4 - 0.1 = 0.3, \quad m = \frac{1.4}{0.7} = 2, \quad M = 120.$$

$$120 = 0.5Y - 0.5 \Rightarrow Y = 241.$$

(c) 若准备金率固定为 (a) 的 0.2, 且 $r = i = 0.05$, 则

$$m = 2.3333, \quad M = 140.$$

$$140 = 0.5Y - 0.5 \Rightarrow Y = 281.$$

(d) 当 res 随 r 上升而下降时, 利率上升不仅降低货币需求, 还提高货币乘数和货币供给。于是给定利率变化会对应更大的收入变化, LM 曲线在 (Y, r) 图中更平坦。经济含义是: 高利率鼓励银行少持准备金、多贷款, 从供给侧放大货币扩张效应。

English solution: At $r = 0.10$, $res = 0.2$, $m = 2.333$, $M = 140$, and $Y = 282$. At $r = 0.05$, $res = 0.3$, $m = 2$, $M = 120$, and $Y = 241$. If res is fixed at 0.2, then at $r = 0.05$, $Y = 281$. The LM curve is flatter when the reserve ratio falls with the interest rate because higher rates raise money supply as well as reduce money demand.

14.NP4. Sequential game

中文解答：收益表为： $(A, a) = (2, 2)$, $(A, b) = (5, 0)$, $(B, a) = (0, 5)$, $(B, b) = (3, 3)$ 。

(a) 若 Player I 先行动, Player II 观察后行动。若 I 选 A, II 在 a 得 2、b 得 0, 所以选 a; 若 I 选 B, II 在 a 得 5、b 得 3, 所以也选 a。I 预期到这一点, 会比较 A 得 2、B 得 0, 因此选 A。结果是 (A, a) , 收益 $(2, 2)$ 。若 II 先行动, I 对 a 会选 A, 对 b 也会选 A, 所以 II 选 a, 结果仍为 (A, a) 。

(b) 若 II 能在 I 行动前作出 legally binding announcement。若承诺 a, I 选 A, II 得 2; 若承诺 b, I 选 A, II 得 0。所以 II 承诺 a, 结果仍为 (A, a) 。

(c) 若 II 能作出有约束力的 contingent threat/promise, 即说明 I 选 A 时自己做什么、I 选 B 时自己做什么。比较四种策略:

II strategy	I's best response	Outcome/payoff
(a after A, a after B)	A	$(A, a) : (2, 2)$
(a after A, b after B)	B	$(B, b) : (3, 3)$
(b after A, a after B)	A	$(A, b) : (5, 0)$
(b after A, b after B)	A	$(A, b) : (5, 0)$

II 会选择“若 A 则 a, 若 B 则 b”, 诱导 I 选 B, 结果 (B, b) , 收益 $(3, 3)$ 。这使 II 从 2 变为 3, I 也从 2 变为 3, 所以 I 没有变差, 反而更好。关键是: 承诺能力能改变动态博弈中的可信性。

English solution: Backward induction gives (A, a) when either player moves first without contingent commitment. A simple binding announcement by II also gives (A, a) . With binding contingent commitments, II chooses the strategy a after A, b after B, inducing I to choose B. The outcome is (B, b) , payoffs $(3, 3)$, making both players better off.

Analytical Problems / 分析题

14.AP1. Effects on U.S. money supply

中文解答：(a) 银行增加超额准备金, res 上升, 货币乘数下降, 货币供给下降。

(b) 人们为圣诞购物从银行账户取现金, C/D 上升。基础货币不一定变化, 但存款创造能力下降, 乘数下降, 货币供给通常下降。

(c) 美联储向公众出售黄金, 公众用现金或存款支付, 基础货币减少, 货币供给下降。

(d) Fed 开始对银行准备金支付利息, 银行更愿意持有准备金, res 上升, 乘数下降, 货币供给下降, 除非 Fed 通过增加基础货币抵消。

(e) ATM 使存款更方便, 相对现金需求下降, C/D 下降, 乘数上升, 货币供给上升。

(f) 政府向 Fed 出售新债券，并把收入支付给雇员。Fed 购买债券增加基础货币；当政府支出进入公众账户后，货币供给上升。

(g) Fed 在东京以 yen 出售政府证券。若 Fed 只是收到并持有 yen，而没有换成美元资产或从美国银行体系吸收美元准备金，则美国美元基础货币基本不变，美元货币供给基本不变。

English solution: The money supply falls when excess reserves rise, when the public shifts from deposits to currency, when the Fed sells gold for dollars, or when interest on reserves raises desired reserves. It rises when ATMs lower the currency-deposit ratio or when the Fed monetizes government bonds and the government spends the proceeds. A sale of securities for yen does not directly change the U.S. dollar monetary base unless it is converted into a dollar transaction.

14.AP2. Taylor rule under different shocks

中文解答： Taylor rule 的基本思想是：通胀高于目标或产出高于潜在水平时提高利率；通胀低于目标或产出低于潜在水平时降低利率。

(a) 货币需求增加会在货币供给不变时推高利率、压低产出。Taylor rule 会降低政策利率或增加货币供给来抵消，因此稳定。

(b) 临时政府购买增加是总需求正冲击，使产出和通胀上升。Taylor rule 紧缩，抵消过热，因此稳定。

(c) 不利供给冲击使产出下降但通胀上升。规则若因通胀上升而紧缩，会进一步压低产出；若因产出下降而宽松，又会加剧通胀。因此对供给冲击存在权衡，不能同时稳定产出和通胀，效果可能有歧义。

(d) 消费者信心下降使总需求下降、产出和通胀下降。Taylor rule 降息，稳定。

(e) 出口需求增加使总需求上升、产出和通胀上升。Taylor rule 加息，稳定。

English solution: A Taylor rule stabilizes money-demand shocks and aggregate-demand shocks by adjusting interest rates in the opposite direction of output and inflation movements. It is ambiguous for adverse supply shocks because inflation rises while output falls, creating a tradeoff.

14.AP3. Fed-firm game when the Fed does not value unemployment below natural

中文解答： 原始时间不一致模型中，Fed 可能想制造意外通胀，把失业率暂时压到自然率以下；企业预期到这一点，会提高工资和价格预期，结果形成高通胀均衡。现在假设 Fed 对 $u < \bar{u}$ 没有正效用，甚至把 $u \neq \bar{u}$ 都看作坏事：若 $u = \bar{u}$ 得 0，若 u 高于或低于 $\bar{u}$ 都得 -1。

这样 Fed 不再有制造意外通胀的诱因。若企业预期低通胀，Fed 选择低货币增长可以实现自然失业率且低通胀；选择高货币增长会使失业率低于自然率，反而给 Fed 带来损失。因此低通胀承诺变得可信。博弈结果从“通胀偏差”转向低通胀、自然失业率均衡。

若在某些节点 Fed 对两种行动无差异，题目规定 Fed 选择让企业更好的行动，这进一步支持低通胀、可信规则的结果。

English solution: If the Fed no longer values unemployment below the natural rate, it has no incentive to create surprise inflation. Low inflation becomes credible: when firms expect low inflation, the Fed validates it rather than inflating. The inflation-bias outcome disappears and the economy can reach low inflation with unemployment at the natural rate.

14.AP4. Hostage-taking policy and monetary rules

中文解答：“不与劫持者谈判”的政策类似货币政策规则：政府事前承诺放弃某些短期 discretionary response，以改变私人部门的预期和激励。如果劫持者相信政府绝不让步，劫持的预期收益下降，劫持事件可能减少。

但问题在于可信度和成本。事后面对真实人质，政府有强烈诱因破例谈判；如果公众预期政府会破例，规则就失去威慑力。此外，严格规则可能在个案中造成巨大人道成本。货币政策规则也类似：能提高信誉、降低通胀偏差，但可能牺牲面对特殊冲击时的灵活性。

English solution: A no-negotiation policy is analogous to a monetary rule because it tries to change expectations by limiting future discretion. It can reduce hostage-taking only if credible. The disadvantage is the same as with policy rules: strict commitment may be costly when exceptional circumstances arise.

Chapter 15. Government Spending and Its Financing

第 15 章政府支出及其融资

Review Questions / 复习题

15.RQ1. Major components of government outlays and revenues

中文解答：政府支出 outlays 主要包括：政府购买 goods and services，例如国防、教育、基础设施和公共服务；转移支付 transfer payments，例如养老金、医疗、失业保险和福利；债务利息 interest payments；以及中央对地方的 grants-in-aid。

政府收入 revenues 主要包括：个人所得税、社会保险税 payroll/social insurance taxes、公司所得税、消费税/关税，以及各种收费。

联邦政府支出中转移支付、国防和利息占比较大；收入主要来自个人所得税和社会保险税。州和地方政府支出中教育、警察、消防、道路等公共服务占比较大；收入更多来自销售税、财产税以及联邦补助。

English solution: Government outlays include purchases, transfers, grants, and interest payments. Revenues include individual income taxes, payroll taxes, corporate taxes, excise taxes, and fees. The federal government relies heavily on income and payroll taxes and spends heavily on transfers, defense, and interest. State and local governments rely more on sales/property taxes and grants and spend more on education and local services.

15.RQ2. Overall deficit vs primary deficit

中文解答：总赤字 overall deficit 是政府总支出减总收入，其中包括债务利息：

$$\text{overall deficit} = G + TR + INT - T.$$

初级赤字 primary deficit 不包括债务利息：

$$\text{primary deficit} = G + TR - T.$$

需要两个概念，是因为总赤字反映债务实际增加额，而初级赤字反映当前财政政策本身是否收支平衡。若一个国家总赤字很高，可能并不是当前支出过高，而是过去债务积累导致利息负担高。

English solution: The overall deficit includes interest payments; the primary deficit excludes them. The overall deficit measures the increase in debt, while the primary deficit measures the fiscal stance excluding the burden of past debt.

15.RQ3. Relation between debt and deficit; debt-GDP ratio

中文解答：政府债务是过去赤字的累积。近似地：

$$B_{t+1} = B_t + \text{deficit}_t.$$

债务-GDP 比率 $b = B/Y$ 的变化取决于：初级赤字率、真实利率、真实 GDP 增长率以及初始债务比率。近似公式是

$$\Delta b \approx \frac{\text{primary deficit}}{Y} + (r - g)b.$$

若 $r > g$ ，已有债务会相对于 GDP 自动扩大；若 $g > r$ ，经济增长会帮助稀释债务。

English solution: Debt is the accumulation of past deficits. The debt-GDP ratio rises with primary deficits and when the real interest rate exceeds the real growth rate. The approximate formula is $\Delta b \approx pd/Y + (r - g)b$.

15.RQ4. Three main macroeconomic channels of fiscal policy

中文解答：财政政策影响宏观经济主要有三条渠道：

1. **总需求渠道 aggregate demand:** 政府购买增加或减税会提高需求，短期提高产出和就业。
2. **供给/激励渠道 supply-side incentives:** 税率和转移支付影响劳动供给、储蓄和投资激励。
3. **储蓄和资本形成渠道 saving and capital accumulation:** 赤字可能降低国民储蓄、挤出投资，提高未来税负，影响长期资本存量和产出。

English solution: Fiscal policy affects the macroeconomy through aggregate demand, incentives for labor/saving/investment, and national saving/capital accumulation.

15.RQ5. Automatic stabilizer

中文解答：自动稳定器 automatic stabilizer 是不需要新的立法、会随经济周期自动改变财政收支的制度。例子：累进所得税、失业保险、福利转移支付。经济衰退时，税收自动下降、转移支付自动上升，支撑可支配收入；经济繁荣时相反。

优点是速度快、无需政治程序、能够及时对冲总需求波动。相比临时财政刺激，自动稳定器较少受到识别滞后、立法滞后和执行滞后的影响。

English solution: Automatic stabilizers are tax and spending rules that automatically offset business cycles, such as progressive income taxes and unemployment benefits. They are useful because they act quickly without new legislation.

15.RQ6. Average vs marginal tax rate

中文解答：平均税率 average tax rate 是总税额除以总收入；边际税率 marginal tax rate 是额外赚 1 元收入需要缴纳的税率。

例子：收入 100，税 20，则平均税率为 20%。若再赚 1 元，其中 30% 要缴税，则边际税率为 30%。在税前真实工资不变时，平均税率更直接影响一个人感觉自己“富不富”，因为它影响总可支配收入；边际税率更直接影响额外工作一小时的回报，因为它决定额外工资中能留下多少。

English solution: The average tax rate is total taxes divided by total income. The marginal tax rate is the tax rate on an extra unit of income. Average taxes affect overall after-tax income; marginal taxes affect the reward to working an additional hour.

15.RQ7. Why keep tax rates roughly constant over time?

中文解答：税率扭曲劳动、储蓄和投资决策，而且扭曲成本通常随税率以凸函数方式上升。简单说，50% 税率造成的扭曲通常不只是 25% 的两倍，而是超过两倍。因此在给定长期财政收入需求下，平滑税率 tax smoothing 比在高税率和低税率之间剧烈波动更有效率。

English solution: Because the distortionary cost of taxation rises more than proportionally with the tax rate, it is more efficient to smooth tax rates over time than to alternate between very high and very low rates.

15.RQ8. Is government debt a burden on future generations? Relation to Ricardian equivalence

中文解答：政府债务可能通过几种方式成为未来负担：未来需要加税还本付息；赤字降低国民储蓄并挤出资本形成，使未来工资和产出下降；若债务引发危机或通胀融资，未来宏观稳定受损。

Ricardian equivalence 认为，如果家庭完全理性、寿命无限或关心后代、资本市场完美、税收不扭曲，那么政府债务不是真实负担：今天减税发债只意味着未来加税，家庭会增加储蓄来抵消政府负储蓄。但若这些条件不成立，债务就可能真实影响消费、储蓄和代际福利。

English solution: Debt burdens future generations if it requires future taxes, crowds out capital, or creates crisis/inflation risk. Ricardian equivalence says debt is not a burden under strong assumptions because households save for future taxes. When those assumptions fail, debt can be a real burden.

15.RQ9. Four reasons Ricardian equivalence may not hold exactly

中文解答：四个常见原因：

1. 有些家庭 liquidity constrained, 不能按未来税负自由借贷；
2. 人们寿命有限，未必完全关心后代；
3. 未来税收是扭曲性的，会改变劳动和投资激励；
4. 不确定性和短视行为使家庭不完全理解或不完全抵消政府债务。

还可以补充：人口增长导致未来纳税人与当前受益人不是同一群体；政府支出本身可能改变资源配置。

English solution: Ricardian equivalence can fail because of borrowing constraints, finite horizons, distortionary taxes, uncertainty, myopia, population turnover, and changes in government spending.

15.RQ10. Inflation tax / seignorage

中文解答: 通胀税 inflation tax 或铸币税 seignorage 是政府通过创造货币来获得实际资源的方式。若实际货币余额为 M/P , 通胀率为 π , 则稳态中真实铸币税近似为

$$S = \pi \frac{M}{P}.$$

持有不付息货币的人因通胀导致实际购买力下降, 他们就是通胀税承担者。

政府不能无限提高通胀税收入。因为通胀越高, 人们越不愿持有货币, M/P 会下降。铸币税 $S = \pi L(i, Y)$ 类似 Laffer curve: 低通胀时提高 π 增加收入; 高通胀时货币需求大幅下降, 收入反而减少。

English solution: Seignorage is revenue from money creation. In steady state, real seignorage is approximately $\pi M/P$. Holders of non-interest-bearing money pay the inflation tax. Revenue cannot rise forever with inflation because high inflation reduces real money demand.

Numerical Problems / 数值题

15.NP1. Central, provincial, and combined deficits

中文解答: 使用定义:

$$\text{overall deficit} = \text{noninterest outlays} + \text{net interest payments} - \text{revenues},$$

$$\text{primary deficit} = \text{noninterest outlays} - \text{revenues excluding interest receipts}.$$

中央政府: 非利息支出为 $\text{purchases } 200 + \text{transfers } 100 + \text{grants } 100 = 400$ 。税收为 450。中央债务 1000, 利率 10%, 利息支付 100; 从私人部门收利息 10, 净利息支付 90。因此

$$\text{central overall} = 400 + 90 - 450 = 40,$$

$$\text{central primary} = 400 - 450 = -50.$$

省政府: 非利息支出为 $150 + 50 = 200$ 。收入包括本级税收 100 和中央补助 100。省级债务为 0; 从私人部门收利息 10, 并持有中央债务 200, 收到中央利息 20。因此省政府总体赤字为

$$\text{provincial overall} = 200 - (100 + 100) - 10 - 20 = -30.$$

其初级赤字按非利息收支为

$$\text{provincial primary} = 200 - (100 + 100) = 0.$$

合并政府: 中央对省的 grants 和中央债务利息属于政府内部交易, 要抵消。对公众债务为 $1000 - 200 = 800$, 利息支付 80; 对私人部门利息收入共 20。非利息支出为 $\text{purchases } 350 + \text{transfers } 150 = 500$; 税收 550。

$$\text{combined overall} = 500 + 80 - 550 - 20 = 10,$$

$$\text{combined primary} = 500 - 550 = -50.$$

Key result / 结论: 中央 overall 40、primary -50; 省政府 overall -30、primary 0; 合并 overall 10、primary -50。

English solution: Central government: noninterest outlays are 400, taxes 450, net interest 90, so overall deficit is 40 and primary deficit is -50. Provincial government has overall deficit -30 and primary deficit 0. Consolidating governments cancels intergovernmental grants and interest; combined overall deficit is 10 and combined primary deficit is -50.

15.NP2. One-time transfer bailout

中文解答: 转移支付当年增加 1 billion, 税收不变, 所以当年初级赤字和总体赤字都增加 1 billion。

下一年不再有转移支付, 但政府债务比原来多 1 billion。利率 10%, 所以利息支付增加

$$0.10 \times 1 = 0.1 \text{ billion.}$$

因此下一年总体赤字增加 0.1 billion, 初级赤字不变。

再下一年, 如果上一年的利息也靠发债支付, 则债务额外增加到 $1 + 0.1 = 1.1$ billion, 利息增加

$$0.10 \times 1.1 = 0.11 \text{ billion.}$$

所以总体赤字增加 0.11 billion, 初级赤字仍不变。

English solution: In the transfer year, both the overall and primary deficits rise by \$1 billion. In the next year, only interest on the extra debt is added: \$0.1 billion to the overall deficit, zero to the primary deficit. In the following year, if interest is debt-financed, the extra debt is \$1.1 billion, so the overall deficit rises by \$0.11 billion and the primary deficit remains unchanged.

15.NP3. Actual and full-employment deficits

中文解答: 税收、转移、政府购买和利息分别为:

$$T = 1000 + 0.1Y, \quad TR = 800 - 0.05Y, \quad G = 1800, \quad INT = 100.$$

赤字函数:

$$DEF = G + TR + INT - T = 1800 + (800 - 0.05Y) + 100 - (1000 + 0.1Y) = 1700 - 0.15Y.$$

充分就业产出 $Y^* = 10000$, 所以充分就业赤字:

$$DEF^* = 1700 - 0.15(10000) = 200.$$

(a) $Y = 12000$:

$$DEF = 1700 - 1800 = -100.$$

实际为盈余 100，充分就业赤字为 200。

(b) $Y = 10000$:

$$DEF = 200.$$

实际赤字与充分就业赤字相同。

(c) $Y = 8000$:

$$DEF = 1700 - 1200 = 500.$$

实际赤字 500，充分就业赤字 200。

关系：实际赤字随经济周期变化；衰退时税收下降、转移上升，实际赤字大于充分就业赤字。繁荣时相反。

English solution: The deficit function is $DEF = 1700 - 0.15Y$. The full-employment deficit at $Y = 10000$ is 200. At $Y = 12000$, the actual deficit is -100; at $Y = 10000$, it is 200; at $Y = 8000$, it is 500. The actual deficit is cyclical, while the full-employment deficit removes the output-gap effect.

15.NP4. Average and marginal tax rates

中文解答：原税法：8000 以下免税，8000 到 20000 税率 25%，20000 以上税率 30%。

收入 16000:

$$Tax = 0.25(16000 - 8000) = 2000, \quad ATR = \frac{2000}{16000} = 12.5\%, \quad MTR = 25\%.$$

收入 30000:

$$Tax = 0.25(12000) + 0.30(10000) = 3000 + 3000 = 6000, \\ ATR = \frac{6000}{30000} = 20\%, \quad MTR = 30\%.$$

新税法：6000 以下免税，6000 到 20000 税率 20%，20000 以上仍为 30%。

收入 16000:

$$Tax = 0.20(16000 - 6000) = 2000, \quad ATR = 12.5\%, \quad MTR = 20\%.$$

收入 30000:

$$Tax = 0.20(14000) + 0.30(10000) = 2800 + 3000 = 5800, \\ ATR = \frac{5800}{30000} = 19.33\%, \quad MTR = 30\%.$$

对 16000 收入者：平均税率不变，但边际税率从 25% 降至 20%，额外工作回报提高，劳动供给倾向增加。对 30000 收入者：平均税率略降，边际税率不变；替代效应不变，收入效应可能使其稍微增加闲暇，劳动供给变化不确定。

English solution: Under the old law, the \$16,000 earner pays \$2,000, so ATR is 12.5 percent and MTR is 25 percent. The \$30,000 earner pays \$6,000, so ATR is 20 percent and MTR is 30 percent. Under the new law, the \$16,000 earner still pays \$2,000 but MTR falls to 20 percent; the \$30,000 earner pays \$5,800, so ATR is 19.33 percent and MTR remains 30 percent.

15.NP5. Wage tax, labor supply, and distortion

中文解答：工人每天闲暇价值为 90 goods。企业劳动需求满足

$$w = MPN = 250 - N.$$

(a) 无税时，工人要求实际工资等于闲暇价值：

$$w = 90.$$

所以

$$250 - N = 90 \Rightarrow N = 160.$$

产出：

$$Y = 250(160) - 0.5(160)^2 = 40000 - 12800 = 27200.$$

(b) 工资税 25%。工人关心税后工资：

$$(1 - 0.25)w = 90 \Rightarrow w = 120.$$

$$250 - N = 120 \Rightarrow N = 130.$$

$$Y = 250(130) - 0.5(130)^2 = 32500 - 8450 = 24050.$$

相对无税损失产出：

$$27200 - 24050 = 3150.$$

(c) 工资税 50%。

$$0.5w = 90 \Rightarrow w = 180.$$

$$250 - N = 180 \Rightarrow N = 70.$$

$$Y = 250(70) - 0.5(70)^2 = 17500 - 2450 = 15050.$$

损失产出：

$$27200 - 15050 = 12150.$$

50% 税率造成的损失是 25% 税率损失的

$$\frac{12150}{3150} \approx 3.86$$

倍，不是两倍。这说明税收扭曲随税率上升而非线性增加，因此支持 tax smoothing。

English solution: With no tax, $w = 90$, so $N = 160$ and $Y = 27200$. With a 25 percent wage tax, $0.75w = 90$, so $w = 120$, $N = 130$, $Y = 24050$, and lost output is 3150. With a 50 percent tax, $w = 180$, $N = 70$, $Y = 15050$, and lost output is 12150. The distortion rises more than proportionally with the tax rate.

15.NP6. Largest deficit without increasing debt-GDP ratio

中文解答：债务-GDP 比率不变要求名义债务增长率等于名义 GDP 增长率。因此最大名义赤字为

$$DEF_{max} = g_N B.$$

(a) 名义 GDP 增长率 10%，债务 1000：

$$DEF_{max} = 0.10(1000) = 100.$$

(b) 实际 GDP 不变，通胀 5%，所以名义 GDP 增长率 5%。初始名义 GDP 为 10000，债务-GDP 比率 0.6，因此

$$B = 0.6(10000) = 6000.$$

$$DEF_{max} = 0.05(6000) = 300.$$

English solution: To keep the debt-GDP ratio constant, debt may grow at the nominal GDP growth rate. Thus the maximum deficit is $g_N B$. Part (a): 100. Part (b): debt is 6000 and nominal growth is 5 percent, so the maximum deficit is 300.

15.NP7. Rolling over debt with new bonds

中文解答：初始名义 GDP 为 1 billion，债务为 100 million，所以初始债务-GDP 比率是

$$b_0 = 0.1.$$

若初级赤字永远为 0，利息靠发新债支付，则

$$B_t = (1+i)^t B_0, \quad Y_t = (1+g)^t Y_0,$$

$$b_t = b_0 \left(\frac{1+i}{1+g} \right)^t.$$

(a) $i = 7\%$, $g = 5\%$:

$$b_t = 0.1 \left(\frac{1.07}{1.05} \right)^t.$$

$$b_1 = 0.1019, \quad b_2 = 0.1038, \quad b_5 \approx 0.1099, \quad b_{10} \approx 0.1208.$$

由于 $i > g$ ，债务比率会持续上升。若公众在债务-GDP 比率超过 1 时拒绝购买新债，则解

$$0.1 \left(\frac{1.07}{1.05} \right)^t = 1$$

得 $t \approx 122$ 年。因此最终会触及该上限，政府不能永远不还；终究需要初级盈余、违约、通胀融资或债务重组。

(b) 若 $g = 8\%$, $i = 7\%$:

$$b_t = 0.1 \left(\frac{1.07}{1.08} \right)^t.$$

$$b_1 \approx 0.0991, \quad b_2 \approx 0.0982, \quad b_5 \approx 0.0955, \quad b_{10} \approx 0.0911.$$

因为 $g > i$, 债务-GDP 比率下降, 不会达到 1。政府可以在债务比率意义上长期滚动债务。

English solution: With zero primary deficit, $b_t = b_0[(1+i)/(1+g)]^t$. If $i = 7\%$ and $g = 5\%$, the ratio rises from 0.1 to about 0.1208 after 10 years and eventually exceeds any finite ceiling. If $g = 8\%$, the ratio falls and the government can roll over debt without increasing the debt burden relative to GDP.

15.NP8. Seignorage revenue

中文解答: 货币需求为

$$L = 0.2Y - 500i, \quad Y = 1000.$$

由 Fisher 关系 $i = r + \pi$ 。当 $r = 0.04$ 时:

$$L = 200 - 500(0.04 + \pi) = 180 - 500\pi.$$

稳态真实铸币税收入为

$$S = \pi L = \pi(180 - 500\pi).$$

通胀率为 0、0.02、0.04、0.06、0.30 时:

π	0	0.02	0.04	0.06	0.30
L	180	170	160	150	30
S	0	3.4	6.4	9.0	9.0

最大化:

$$S = 180\pi - 500\pi^2, \quad \frac{dS}{d\pi} = 180 - 1000\pi = 0.$$

所以

$$\pi^* = 0.18, \quad S_{max} = 0.18(180 - 90) = 16.2.$$

若 $r = 0.08$:

$$L = 200 - 500(0.08 + \pi) = 160 - 500\pi, \quad S = 160\pi - 500\pi^2.$$

π	0	0.02	0.04	0.06	0.30
L	160	150	140	130	10
S	0	3.0	5.6	7.8	3.0

最大化:

$$160 - 1000\pi = 0 \Rightarrow \pi^* = 0.16, \quad S_{max} = 0.16(80) = 12.8.$$

English solution: With $r = 0.04$, money demand is $L = 180 - 500\pi$, so seignorage is $S = \pi(180 - 500\pi)$, maximized at $\pi = 0.18$ with revenue 16.2. With $r = 0.08$, $L = 160 - 500\pi$, so the maximum is at $\pi = 0.16$ with revenue 12.8.

15.NP9. Inflation tax with currency, reserves, and deposits

中文解答：初始数据：公众现金 $C = 200$ ，银行准备金 $R = 50$ ，货币基础 $H = 250$ ，存款 $D = 600$ ，货币供给 $M = 800$ 。货币基础、货币供给和通胀都以 10% 增长。

(a) 政府通过创造基础货币获得的名义铸币税为

$$\Delta H = 0.10(250) = 25.$$

(b) 若存款和准备金都不付息，且银行把非准备金存款按市场利率贷出。公众持有现金和存款，共 $M = 800$ ，通胀税为

$$0.10(800) = 80.$$

银行持有准备金 50，会因通胀损失 $0.10(50) = 5$ ，但银行也有不付息存款负债 600，通胀降低其实际负债，给银行带来 $0.10(600) = 60$ 的收益。因此银行净支付的通胀税是

$$5 - 60 = -55.$$

公众支付 80，银行支付 -55，合计

$$80 - 55 = 25,$$

正好等于政府铸币税收入。

(c) 若存款支付市场利率，存款人得到通胀补偿，不再通过存款承担通胀税。通胀税由持有不付息基础货币者承担：公众现金持有者支付

$$0.10(200) = 20,$$

银行因持有准备金支付

$$0.10(50) = 5.$$

总计仍为 25。

English solution: Nominal seignorage is $0.10 \times 250 = 25$. If deposits and reserves pay no interest, the public pays an inflation tax of $0.10 \times 800 = 80$, while banks pay $0.10(50) - 0.10(600) = -55$; the net is 25. If deposits pay market interest, depositors are compensated, so the inflation tax is paid by currency holders (20) and banks holding reserves (5).

Analytical Problems / 分析题

15.AP1. Grants-in-aid from the Federal government

中文解答：联邦补助州和地方政府的原因包括：联邦税基更广，筹资能力更强；某些地方公共品有跨地区外部性；贫困地区自身税基不足，需要均等化转移；联邦政府也可借补助实现全国性最低标准。

优点：促进地区间公平，帮助财政能力弱的地方提供公共服务，内部化跨州外部性，并在衰退时提供稳定支持。缺点：削弱地方财政责任，产生 moral hazard 和 flypaper effect；地方可能为拿补助而过度支出；联邦附加条件可能扭曲地方偏好。

English solution: Grants-in-aid exist because the federal government has a broader tax base, can redistribute across regions, and can internalize spillovers. Advantages are equalization and national standards. Disadvantages include weaker local accountability, moral hazard, and distorted spending incentives.

15.AP2. Federal budget in 1979, 1992, 2000, and 2004

中文解答：这题需要查 Economic Report of the President 或 OMB Historical Tables。以下给出按 GDP 比例的近似答案，重点是解释方向而不是记小数。

Fiscal year	Receipts/GDP	Outlays/GDP	Surplus or deficit/GDP	Sign
1979	18.5%	20.1%	-1.6%	deficit
1992	17.5%	22.1%	-4.5%	deficit
2000	20.0%	17.7%	+2.3%	surplus
2004	16.1%	19.6%	-3.5%	deficit

主要收入构成：个人所得税、社会保险税、公司税。1979 到 1992 赤字扩大，既有收入占 GDP 下降，也有支出占 GDP 上升，尤其是医疗、转移支付和净利息负担上升。1992 到 2000 赤字转为盈余，主要因为收入占 GDP 明显上升、支出占 GDP 下降；强劲经济、资本利得、较高个人所得税收入和支出控制都重要。2000 到 2004 从盈余转为大赤字，既有收入大幅下降，也有支出上升；收入下降与经济衰退、税收削减、资本利得收入下降有关，支出上升与国防、安全、医疗和其他项目有关。

English solution: Using budget data as shares of GDP, 1979 had a moderate deficit, 1992 a large deficit, 2000 a surplus, and 2004 a large deficit again. The 1979-1992 deterioration came from both higher outlays and lower receipts. The 1992-2000 improvement came from rising receipts and falling outlays as shares of GDP. The 2000-2004 deterioration came from a sharp fall in receipts and an increase in outlays.

15.AP3. Transfer program and incentives

中文解答：方案规定：若收入低于 10000，政府补足到 10000。假设一个人劳动收入从 0 增加到 1、2、…、9999，政府补助会等额减少。因此在 10000 以下，每多赚 1 美元，补助少 1 美元，实际可支配收入不变。等价于 100% 边际税率：

$$\text{disposable income} = \text{earnings} + \text{benefit} = 10000.$$

这会严重削弱低工资人群工作激励。

更好的方案可以是 negative income tax 或 EITC 式工资补贴：保证最低收入，但补助按低于 100% 的比例逐步退出，例如每多赚 1 美元只减少 0.3 或 0.5 美元补助。缺点是财政成本更高，可能让部分非贫困者也得到补贴，且 phase-out 区间仍存在较高边际税率和复杂性。

English solution: A guaranteed income that is reduced dollar-for-dollar imposes a 100 percent marginal tax rate below \$10,000, eliminating the reward to work. A better design is a negative

income tax or earned-income tax credit with a gradual phaseout. The disadvantage is higher fiscal cost and remaining phaseout disincentives.

15.AP4. Debt-GDP dynamics

中文解答：名义赤字等于初级赤字加名义利息：

$$DEF = PD + iB.$$

债务演化：

$$B_{t+1} = B_t + PD_t + iB_t.$$

设 $b = B/Y$ ，名义 GDP 增长率为 g_N 。精确形式近似为

$$\Delta b \approx \frac{PD}{Y} + (i - g_N)b.$$

而名义增长率近似为

$$g_N \approx g + \pi,$$

名义利率 $i \approx r + \pi$ ，所以

$$i - g_N \approx r - g.$$

因此

$$\Delta b \approx \frac{PD}{Y} + (r - g)b.$$

(b) 若初级赤字为 0：

$$\Delta b \approx (r - g)b.$$

这说明债务比率变化等于债务-GDP 比率乘以真实利率超过真实增长率的部分。若 $r > g$ ，即使没有初级赤字，债务比率也会上升；若 $r < g$ ，债务比率会下降。

English solution: Since the nominal deficit is the primary deficit plus nominal interest, debt evolves as $B_{t+1} = B_t + PD + iB_t$. Dividing by GDP gives approximately $\Delta b = PD/Y + (i - g_N)b$. Since $i - g_N \approx r - g$, $\Delta b \approx PD/Y + (r - g)b$. With zero primary deficit, the debt-GDP ratio changes by $(r - g)b$.

15.AP5. Balanced-budget amendment

中文解答：平衡预算修正案要求每年支出等于收入。优点是限制长期赤字和债务积累，降低利息负担，提高财政纪律，减少把成本转嫁给未来纳税人的可能。

但缺点很重要：

(a) **自动稳定器：**衰退时税收下降、转移支付上升，预算自然恶化。若必须平衡预算，政府反而要在衰退中加税或削支，形成 procyclical policy，加重衰退。

(b) **税收平滑**：政府无法把临时冲击、战争或衰退成本分摊到多年，只能当年大幅调税。由于税收扭曲成本随税率非线性上升，这会降低效率。

(c) **资本投资**：基础设施、教育、科研等项目收益跨多年。若不允许借债融资，政府可能低估长期项目价值，导致公共投资不足。

因此，如果没有修正案时联邦政府会运行大赤字，修正案确实能约束财政失控；但它也可能牺牲稳定化政策、税收平滑和长期公共投资。更合理的规则通常是 *cyclically adjusted balance* 或 *golden rule*，即经周期调整平衡，允许为公共投资借债。

English solution: A balanced-budget amendment can impose fiscal discipline, but it weakens automatic stabilizers, prevents tax smoothing, and discourages debt-financed capital investment. It may reduce chronic deficits, but a rigid annual rule can make fiscal policy procyclical and inefficient. A cyclically adjusted rule or a golden rule for investment is often more sensible.