

1.

- a) The government uses goods and services which are produced by the private sector. Therefore, the government share of use (consumption and investment) is larger than the share of production.
- b) A substantial share of government income (mainly tax revenue) is used for transfers such as pensions and social assistance. Therefore, the government share of income is larger than the government's share of use (consumption and investment).

2.

- a) Share of use: $\frac{100+12}{400} = 0.28$.
- b) Share of income: $\frac{180}{400} = 0.45$.
- c) Share of production: $\frac{40}{400} = 0.10$
- d) $\frac{100+12+80-180}{400} = 0.03$.
- e) $\frac{G+Tr-T+iD}{Y} = \frac{100+12+80-180+8}{400} = 0.05$.

3.

- a) Greece, Portugal, Spain, UK and USA.
- b) UK, US and Spain.
- c) Greece and Italy.
- d) For France we get

$$\Delta\left(\frac{D}{Y}\right) = \frac{G-T}{Y} + (r-g)\frac{D}{Y} = \frac{G-T+iD}{Y} - (\pi+g)\frac{D}{Y} = 0.071 - (0.008+0.014) \cdot 0.52 \approx 0.071 - 0.011 = 0.06$$

- e) Ireland, Greece, Spain, UK, Portugal and the US in that order.
- f) In terms of levels of debt, Greece and Italy had the biggest problems. The highest growth of the debt ratio occurred in Ireland, Greece, and Spain but also the UK, Portugal and the USA had rapidly rising debt ratios. Clearly, Greece had big problems both in terms of the level and the growth of debt and in fact they defaulted on part of their debt in 2012.

As concerns the others, it is hard to judge. The deficit in Ireland was enormous but hopefully temporary since it involved saving banks. Italy had a high debt level but it was not rising rapidly. Portugal and USA had rapidly rising debt starting from relatively high levels.

4.

$$a) \Delta\left(\frac{D}{Y}\right) = \frac{G-T}{Y} + (r-g)\frac{D}{Y} = 0.003 + (0.02 - 0.03) \cdot 1.00 = 0.003 - 0.01 = -0.007$$

$$b) \Delta\left(\frac{D}{Y}\right) = \frac{G-T}{Y} + (r-g)\frac{D}{Y} = 0.003 + (0.05 - 0) \cdot 1.00 = 0.003 + 0.05 = 0.053.$$

- c) In the first case the growth rate is higher than the interest rate, and since the primary deficit is close to zero, the debt ratio falls by 0.7 percent of GDP. In the second case the interest rate is higher and there is no growth. High interest payments add to the debt ratio and the debt ratio increases by 5.3 percent of GDP. We see that the interest rate and the growth rate have substantial effects on the change in the debt ratio for a given primary deficit.

$$5. \Delta\left(\frac{D}{Y}\right) = \frac{G-T+iD}{Y} - (\pi+g)\frac{D}{Y} = 0.05 - 0.10 \cdot 1.0 = -0.05$$

Although there is a substantial deficit the debt ratio falls because of high growth of nominal GDP.

6. Substituting into the goods market clearing condition we get

$$Y = a_0 + a_1(Y + Tr^0 - hY - T^0 - \tau Y) + b_0 - b_1i + G$$

$$Y + a_1(h + \tau - 1)Y = a_0 + a_1(Tr^0 - T^0) + b_0 - b_1i + G$$

$$Y = \frac{1}{1 + a_1(h + \tau - 1)} [a_0 + a_1(Tr^0 - T^0) + b_0 - b_1i + G]$$

$$\Delta Y = \frac{1}{1 + a_1(h + \tau - 1)} \Delta G$$

$$\Delta Y = -\frac{a_1}{1+a_1(h+\tau-1)}\Delta T^0$$

The multiplier is reduced because of the marginal tax. A fraction of an increase in income is paid in as taxes and not used for consumption. Also, the multiplier is reduced because transfers from the government fall when income increases. This means that the effect on consumption of a given increase in income is reduced.

A tax reduction of 1 million (reduction in T^0) has a smaller effect on aggregate demand than an increase in government consumption of one million because consumers do not spend the whole increase in disposable income, only the fraction a_1 .

7. We use the equation derived in exercise 6.

$$Y = \frac{1}{1+a_1(h+\tau-1)}[a_0 + a_1(Tr^0 - T^0) + b_0 - b_1i + G]$$

Suppose that taxes and the interest rate both change. Then we have:

$$\Delta Y = \frac{1}{1+a_1(1-h-\tau)}[-b_1\Delta i + \Delta G]$$

To keep production unchanged, the right hand has to be equal to zero. Therefore we must have that

$$-b_1\Delta i + \Delta G = 0 \quad \text{which implies} \quad \Delta i = \frac{1}{b_1}\Delta G.$$

This is how much the interest rate has to be raised in order to counteract the effect of increased government expenditure.

8. This is a discussion question.

9.

$$\text{a) } b = \frac{G + Tr - T + iD}{Y} = \frac{G + Tr^0 - hY - T^0 - \tau Y + iD}{Y} = (G + Tr^0 - T^0 + iD)Y^{-1} - h - \tau$$

$$\text{b) } \Delta b = -(G + Tr^0 - T^0 + iD)Y^{-2}\Delta Y = -(hY + \tau Y)Y^{-2}\Delta Y = -(h + \tau)\frac{\Delta Y}{Y}.$$

The deficit falls as a ratio of GDP because tax revenue increases and transfers fall when income increases.

- c) When GDP increases one percent the deficit decreases by 0.6 percent of GDP because taxes increase by 0.5 percent of GDP, transfers decrease by 0.1 percent of GDP and government consumption and investment are unchanged.