An Increase in Interest Rates in the q Model. Consider a perfectly competitive industry with costs of adjustment to capital that was in equilibrium with interest rate $\underline{r}$ leading up to period t, at which date the interest rate increases permanently to $\bar{r} > \underline{r}$.

1. Draw a diagram that shows how the $\Delta\lambda_{t+1} = 0$, $\Delta k_{t+1} = 0$ loci and the saddle path change in response to the increase in the interest rate. Is the new equilibrium level of the capital stock $\check{k}_{\text{post}}$ higher or lower than before? Why?

   Answer:

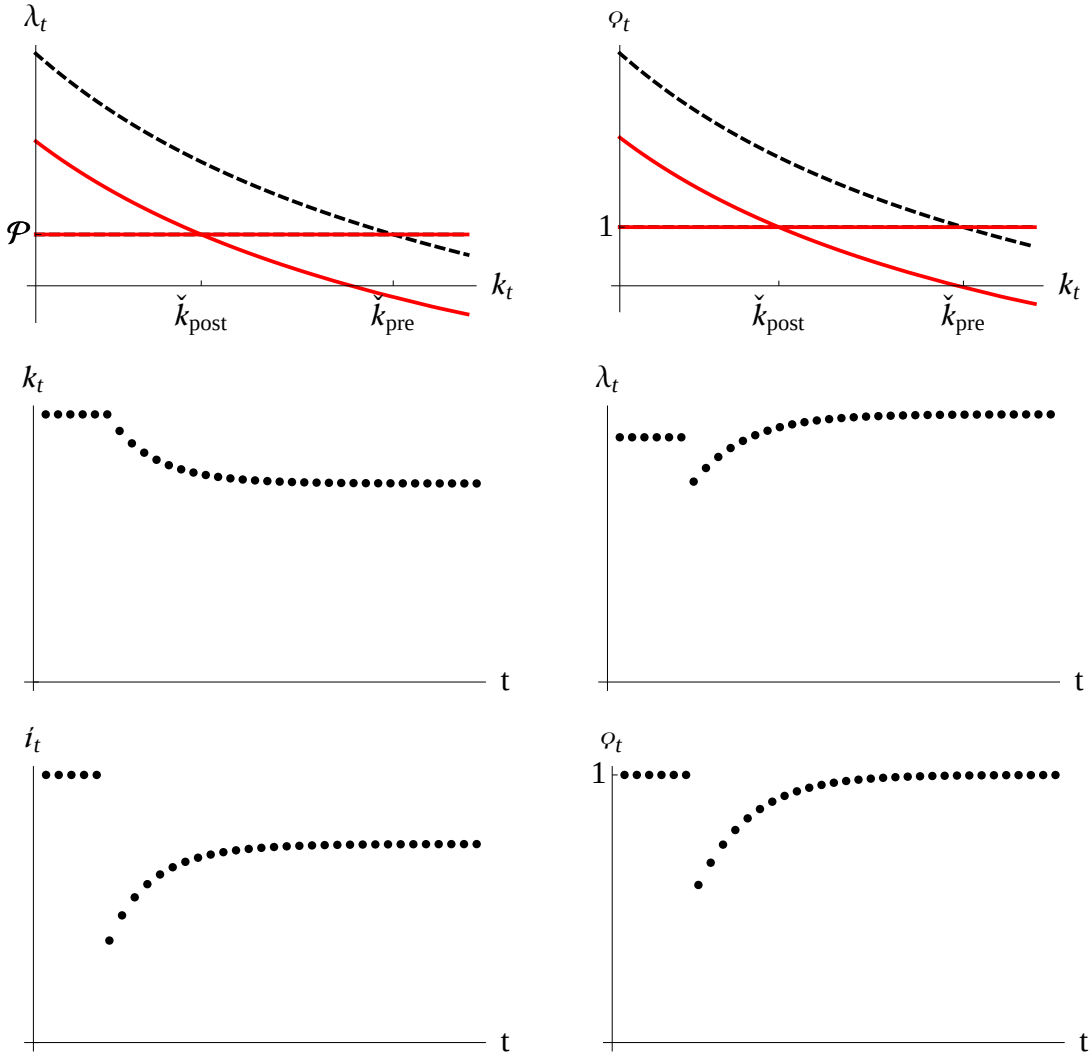

Figure 1 Increase in R: phase diagrams with saddle paths (dashed-black and continuous-red lines respectively pre and post the R change) and impulse response functions

Steady-state capital is lower (because with a higher interest rate, capital is more expensive).

2. Draw diagrams showing the time paths of share prices, investment, and the capital stock following the increase in the interest rate. Explain the time pattern of share prices over time; in particular, explain the relationship between any depicted movements in share prices, and the proposition that stock prices follow a random walk.

   Answer:

   The figures are plotted above. When interest rates rise, share prices fall; you can think of this as reflecting the fact that future earnings are being discounted at a higher interest rate (so it is kind of like a human wealth effect in the consumption model). Gradually over time share prices recover to the point where the value of a unit of capital inside the firm is equal to the original (unchanged) price of purchasing a unit of capital. Investment drops very sharply, then gradually recovers as the firm gradually accomplishes its goal of achieving a lower target capital.

   The proposition that share prices follow a random walk has little relevance except to the inital movement in λ that happens when interest rates change. That jump in share prices was assumed to reflect the fact that the change in interest rates was unanticipated, and so a resulting jump can be interpreted as a shock to expectations. The gradual movements in share prices thereafter are consistent with the need for capital gains or losses on share prices to counterbalance the dynamics of the cash flow of the firm's profits.

3. Suppose that, in response to the increase in interest rates, the government wanted to pursue a tax policy that would prevent any changes in the level of the capital stock. Describe the two options the government has, and explain how the two policies would differ or be similar with respect to their implications for dynamics of ϱ and λ.

   Answer:

   The government could either cut the corporate tax rate, or increase the investment tax credit. See qModel for detailed discussion of the consequences. Briefly, the key equilibrium equations that tell us what must happen are

   $$(\mathsf{r}+\delta)\lambda_t \approx \mathscr{T}\mathrm{f}^k(k_t) \tag{1}$$

   and

   $$\varrho = \lambda/\not{\zeta}. \tag{2}$$

   If the government wants to keep capital constant without changing the ITC, the equilibrium fact that $\varrho = 1$ tells us that the equilibrium value of λ must be unchanged. In this case (1) tells us that it will need to boost the portion of corporate earnings that are untaxed, $\mathscr{T}$, by an amount that exactly offsets on the LHS of the equation from a higher value of r.

On the other hand, if it wants to leave the corporate tax rate unchanged, then we know that in equilibrium $\lambda = \not{\zeta}$, so we can solve (1) for the value of

$$(\mathsf{r} + \delta)\not{\zeta} \quad \approx \quad \not{\pi}\mathrm{f}^k(\check{k}) \tag{3}$$

that counterbalances the higher r while keeping $\not{\pi}\mathrm{f}^k(\check{k})$ constant.