1. (a) An anticipated increase in the rate of return on currency will shift the line representing the rate of return on currency upward.

It causes a rise in $s^*$. This implies that there is an increase in the minimum purchase size for which fiat money offers a higher rate of return than deposits. In the aggregate, more individuals will use fiat money instead of deposits. In terms of our notation $Q_t$, outside money, will increase and $H_t$, inside money, will decrease. This causes a decrease in the deposit-to-currency ratio $H_t/Q_t$, and hence money multiplier, $(1 + H_t/Q_t)$. For a given fiat money stock, $M_t$, the total money stock, $(M1)_t$, will decline $[(M1)_t = (1 + H_t/Q_t) M_t ]$. Since $Q_t$ rises, equation $p_t = M_t/Q_t$ tells us that the price level declines. The decrease in $H_t$ means that banks have fewer deposits with which to buy capital. The decrease in intermediated capital will cause a decrease in output next period.
(b) An unanticipated permanent decrease in transaction costs from $\phi$ to $\phi'$ causes an increase in the rate of return on deposits (after transaction costs). It is represented by an upward shift in the curve that represents that rate of return.

The decrease in $\phi$ causes $s^*$ to decrease. This implies that there is a decrease in the minimum purchase size for which fiat money offers a lower rate of return than deposits. In the aggregate, more individuals will use deposits instead of currency. This should make intuitive sense since the transaction costs associated with deposits have reduced. The inside money, $H_t$, will increase and outside money, $Q_t$, will decrease. This causes an increase in the deposit-to-currency ratio, $(H_t/Q_t)$, and the money multiplier, $(1 + H_t/Q_t)$. For a given fiat money stock, $M_t$, the total money stock, $(M1)_t$, will rise. Since $Q_t$ falls, the price level goes up. The increase in $H_t$ means that banks have more deposits with which to buy capital. The increase in intermediated capital will cause an increase in output next period.

(c) There are two shocks in the economy: an unanticipated permanent decrease in the productivity of capital and a permanent increase in the stock of fiat money owned by the initial old. We will consider the effect from each shock separately, and then get the overall consequences by combining two results together.

An unanticipated permanent decrease in the productivity of capital as represented by $x$ decreases $x$ to $x'$. It is represented by a downward shift in the curve that represents the rate of return.
The decrease in $x$ causes a rise in $s^*$. This implies that there is an increase in the minimum purchase size for which fiat money offers a higher rate of return than deposits. In the aggregate, more individuals will use fiat money instead of deposits since the return on capital associated with deposits has reduced. Outside money, $Q_t$, will increase and inside money, $H_t$, will decrease. This causes a decrease in the deposit-to-currency ratio $H_t/Q_t$, and hence money multiplier, $(1 + H_t/Q_t)$. For a given fiat money stock, $M_t$, the total money stock, $(M1)_t$, will decline. Since $Q_t$ goes up, the price level goes down. The decrease in $H_t$ means that banks have fewer deposits with which to buy capital. The decrease in intermediated capital will cause a decrease in output next period.

A one-time increase in the fiat money stock, $M_0$, will remain fixed in the subsequent period. The rate of return on fiat money is still equal to 1. It does not alter the rate of return on deposits. There is no effect on $s^*$, $H_t$, or $Q_t$. Also, an increase in the fiat money stock will not cause an increase real output. Unlike the change in inside money, an increase in the monetary base does not represent an increase in real loans to fund capital investment and so will not have an effect on real out. However, the price level in all periods increases because of the increase in $M_t (p_t = M_t/Q_t)$. Moreover, equation $[(M1)_t = (1 + H_t/Q_t) M_t]$ indicates that the total money stock $(M1)_t$ increases.

The overall effect is that $s^*$ increases. The inside money, $H_t$, will decrease and outside money, $Q_t$, will increase. This causes a decrease in the deposit-to-currency ratio, $(H_t/Q_t)$. The decrease in $H_t$ means that banks have fewer deposits with which to buy capital. The decrease in intermediated capital will cause a decrease in output next period. The overall effects on the price level and the total money stock are ambiguous since the first shock causes both variables to fall while the second shock causes them to rise.
2. (a) The bank will determine its portfolio according to the relative sizes of the type 1 and type 2 populations. The bank will accept total of deposits of \( Ny = (900)(10) = 9000 \). Since two-thirds of the people are type 1 and will withdraw after one period, the bank will place two-thirds of deposits (6000) into storage. In the absence of a bank run, the bank will pay this amount out to type 1 depositors in the next period (at a rate of return of 1). One-third of deposits (3000) will be placed in capital. In the absence of a run, the bank will pay a total 3600 \([= 3000x = (3000)(1.2)]\) goods to type 2 people in two periods.

(b) If the bank were to liquidate all of its deposits that it placed into capital it would obtain 2700 \([= 3000(\theta u − k) = 3000(0.9)]\) goods. It also has 6000 goods in storage. This means that it can pay out at most 8700 goods in the period after the deposits are made. Since each person deposited 10 goods, only 870 \((= 8700/10)\) people can be paid off. Given that there are a total of 900 people, 30 people will never get repaid. The bank’s assets will have been exhausted.

(c) Yes. What if you are one of the thirty who receives nothing?

(d) Clearly, the 30 people who receive nothing are made much worse off by the run. If people arrive randomly at the bank, 20 of the people who receive nothing are type 1 and 10 are type 2. The remaining 290 type 2 people can place their early withdrawals (which were equal to 10 goods each) into storage and each consume 10 units in their third period of life. However, if the run had not occurred, each type 2 person would have received 12 \([= 10x = 10(1.2)]\) goods in the third period of life. All type 2 people (and some type 1 people) are made worse off by the run. However, once a run had begun, it was in the self interest of all type 2 people to try to retrieve their deposits. Waiting means getting nothing!

3. (a) We know that for this simple S&L, Assets = Deposits + Net worth, which implies that Net worth = Assets − Deposits = $1,000,000 − $1,200,000 = −$200,000. Your S&L is insolvent. Since net worth is negative, you have already lost all of your investment in the S&L.

(b) For simplicity, we will assume that the deposits do not pay interest. Abandoning this assumption will not affect the relative ranking of the projects.

**Project A:** If you undertake option A,

The S&L’s assets will be equal to \((1.07)(1,000,000) = 1,070,000\). Net worth will be \$1,070,000 − $1,200,000 = −$130,000.
Your net worth will still be negative.

**Project B:** Notice that if the project attains the bad outcome, you will not be any worse off. You have already lost your total investment in the S&L and cannot lose any more (your return will be zero).

If the project attains the good outcome, the S&L’s assets will be 
\[(1.21)(1,000,000) = 1,210,000.\]
Net worth will be 
\[1,210,000 - 1,200,000 = 10,000.\]

There is a 50% chance that you could gain $10,000, and 50% chance that you could get nothing. An expected return is 
\[
(0.5)(10,000) + (0.5)(0) = 5,000.
\]
This looks more appealing than option A.

**Project C:** As with option B, the bad outcome does not concern you.

If the project attains the good outcome, the S&L’s assets will be 
\[(2)(1,000,000) = 2,000,000.\]
Net worth will be 
\[2,000,000 - 1,200,000 = 800,000.\]

You have a (slim) chance of winning big. The expected return would be 
\[
(0.1)(800,000) + (0.9)(0) = 80,000.
\]
You prefer option C > B > A.

It is important to note that your objective does not consider the losses of the depositors (in the case of no deposit insurance) or the government (in the case of government-provided deposit insurance). An investment strategy that is good for you may not represent what is desirable for the economy as a whole.

(c) In this case, the S&L is borderline insolvent. Its net worth is zero. With regard to your decisions, this case is no different than the original case. You have lost all of your investment in the S&L. It was in your self interest to get out of the hole. You want to win big although you have a slim chance of winning. In this case, you will again choose option C.

However, if you work on the math, you will find that project B gives you the highest expected return. I will accept both answers.

(d) In this case, you stand to lose if the S&L experiences losses. The net worth of the S&L is 
\[2,000,000 - 1,200,000 = 800,000.\] You can lose up to $800,000.
**Project A:**

With option \( A \), the S&L’s assets will become \((1.07)(2,000,000) = 2,140,000\). Net worth will become \(2,140,000 - 1,200,000 = 940,000\). You have a 100% chance of gaining $140,000.

**Project B:** Now the bad outcomes matter to you because you have something to lose if the bad outcome occurs.

There is a 50% probability that net worth will become \((1.21)(2,000,000) - 1,200,000 = 2,420,000 - 1,200,000 = 1,220,000\) (you gain $420,000).

There is also a 50% probability that net worth will become \((1 - 0.21)(2,000,000) - 1,200,000 = 1,580,000 - 1,200,000 = 380,000\) (you lose $420,000).

The expected return to you is \((0.50)(420,000) + (0.50)(-420,000) = 0\).

You prefer option A.

**Project C:** Again the bad outcome matters to you.

There is a 10% probability that net worth will become \((2)(2,000,000) - 1,200,000 = 4,000,000 - 1,200,000 = 2,800,000\) (you gain $2,000,000).

There is a 90% probability that net worth becomes \(0 - 1,200,000 = -1,200,000\) (you lose $800,000, all of your investment).

The expected return to you is \((0.10)(2,000,000) + (0.90)(-800,000) = -520,000\).

Option C is the worst option of the three.

You prefer option A > B > C. Note that your ranking of the options changes dramatically when you have some of your own funds at risk.

(e) If you abscond with $100,000 you will lose all of your net worth. Therefore, only if net worth is less than $100,000 will the theft be worthwhile. We see that a situation where an intermediary is insolvent would make such an illegal activity more tempting. Of course, in the real world, the owner would have to consider any possible punishment or reputational damage. We are ignoring those considerations here.
(f) We have seen that an insolvent S&L has a strong incentive to take on risky assets. The owners have already lost their entire investment and cannot lose any more. They will pursue high-risk ventures (like option C) that have a slim chance of a big payoff. Unfortunately, such a venture also has a high probability of a big loss. When that bad outcome occurs, the government may very well have to pay off depositors. It would be in the government’s interest to close down the insolvent S&L before it gambles on the risky venture. In this way, the government lowers the amount that it has to pay off depositors. Part (f) gave an additional reason for the government to close down insolvent intermediaries. Insolvency may provide incentive for owners to pursue illegal activities like absconding with some of the intermediary’s assets. Such an action would increase the amount that the government has to pay out in deposit insurance.