More on Credit Policy Analysis 20A

This Appendix takes a closer look at credit policy analysis by investigating some alternative approaches and by examining the effect of cash discounts and the possibility of non-payment.

Two Alternative Approaches

From our chapter discussion, we know how to analyze the NPV of a proposed credit policy switch. Now we discuss two alternative approaches: the "one-shot" approach and the accounts receivable approach. These are very common means of analysis; our goal is to show that these two and our NPV approach are all the same. Afterward, we use whichever of the three is most convenient.

The One-Shot Approach If the switch is not made, Locust would have a net cash flow this month of $(P - v)Q = \$29 \times 100 = \$2{,}900$. If the switch is made, Locust would invest $vQ' = \$20 \times 110 = \$2{,}200$ this month and receive $PQ' = \$49 \times 110 = \$5{,}390$ next month. Suppose we ignore all other months and cash flows and view this as a one-shot investment. Is Locust better off with $2,900 in cash this month, or should Locust invest the $2,200 to get $5,390 next month?

The present value of the $5,390 to be received next month is $5,390/1.02 = $5,284.31; the cost is $2,200, so the net benefit is $5,284.31 – 2,200 = $3,084.31. If we compare this to the net cash flow of $2,900 under the current policy, Locust should switch. The NPV is $3,084.31 – 2,900 = $184.31.

In effect, Locust can repeat this one-shot investment every month and thereby generate an NPV of $184.31 every month (including the current one). The PV of this series of NPVs is:

$$\text{Present value} = \$184.31 + \$184.31/.02 = \$9{,}400$$

This PV is the same as our previous answer.

The Accounts Receivable Approach Our second approach is the one that is most commonly discussed and is very useful. By extending credit, the firm increases its cash flow through increased gross profits. However, the firm must increase its investment in receivables and bear the carrying cost of doing so. The accounts receivable approach focusses on the expense of the incremental investment in receivables compared to the increased gross profit.

As we have seen, the monthly benefit from extending credit is given by the gross profit per unit $(P - v)$ multiplied by the increase in quantity sold $(Q' - Q)$. For Locust, this benefit was $(\$49 - 20) \times (110 - 100) = \$290$ per month.

If Locust makes the switch, receivables rise from zero (since there are no credit sales) to PQ', so Locust must invest in receivables. The necessary investment has two components: The first part is what Locust would have collected under the old policy (PQ). Locust must carry this amount in receivables each month because collections are delayed by 30 days.

The second part is related to the increase in receivables that results from the increase in sales. Since unit sales increase from Q to Q', Locust must produce this quantity today even though it won't collect for 30 days. The actual cost to Locust of producing the extra quantity is equal to v per unit, so the investment necessary to provide the extra quantity sold is $v(Q' - Q)$.

In sum, if Locust switches, its investment in receivables is equal to the $P \times Q$ in revenues that are given up plus an additional $v(Q' - Q)$ in production costs:

$$\text{Incremental investment in receivables} = PQ + v(Q' - Q)$$

The required return on this investment (the carrying cost of the receivables) is R per month; so, for Locust, the accounts receivable carrying cost is:

$$\begin{aligned}\text{Carrying cost} &= [PQ + v(Q' - Q)] \times R \\ &= [\$4{,}900 + 200] \times .02 \\ &= \$102 \text{ per month}\end{aligned}$$

Since the monthly benefit is $290 and the cost per month is only $102, the net benefit per month is $290 – 102 = $188 per month. Locust earns this $188 every month, so the PV of the switch is:

$$\begin{aligned}\text{Present value} &= \$188/.02\\ &= \$9{,}400\end{aligned}$$

Again, this is the same figure we previously calculated.

One of the advantages of looking at the accounts receivable approach is that it helps us interpret our earlier NPV calculation. As we have seen, the investment in receivables necessary to make the switch is $PQ + v(Q' - Q)$. If you look back at our original NPV calculation, this is precisely what we had as the cost to Locust of making the switch. Our earlier NPV calculation thus amounts to a comparison of the incremental investment in receivables to the PV of the increased future cash flows.

There is one final thing to notice. The increase in accounts receivable is PQ', and this amount corresponds to the amount of receivables shown on the balance sheet. However, the incremental investment in receivables is $PQ + v(Q' - Q)$. It is straightforward to verify that this second quantity is smaller by $(P - v)(Q' - Q)$. This difference is the gross profit on the new sales, which Locust does not actually have to put up to switch credit policies.

Put another way, whenever we extend credit to a new customer who would not otherwise pay cash, all we risk is our cost, not the full sales price. This is the same issue we discussed in Section 20.5.

Example 20A.1 **Extra Credit**

Looking back at Locust Software, determine the NPV of the switch if the quantity sold is projected to increase by only 5 units instead of 10. What will be the investment in receivables? What is the carrying cost? What is the monthly net benefit from switching?

If the switch is made, Locust gives up $P \times Q$ = $4,900 today. An extra five units have to be produced at a cost of $20 each, so the cost of switching is $4,900 + (5 × $20) = $5,000. The benefit of selling the extra five units each month is 5 × ($49 – 20) = $145. The NPV of the switch is – $5,000 + $145/.02 = $2,250, so it's still profitable.

The $5,000 cost of switching can be interpreted as the investment in receivables. At 2 percent per month, the carrying cost is .02 × $5,000 = $100. Since the benefit each month is $145, the net benefit from switching is $45 per month ($145 – $100). Notice that the PV of $45 per month forever at 2 percent is $45/.02 = $2,250 as we calculated.

Discounts and Default Risk

We now look at cash discounts, default risk, and the relationship between the two. To get started, we define the following:

π = Percentage of credit sales that go uncollected
d = Percentage discount allowed for cash customers
P' = Credit price (the no-discount price)

The cash price (P) is equal to the credit price (P') multiplied by $(1 - d)$: $P = P'(1 - d)$ or, equivalently, $P' = P/(1 - d)$.

The situation at Locust is now a little bit more complicated. If a switch is made from the current policy of no credit, the benefit to the switch comes from both the higher price (P') and, potentially, the increased quantity sold (Q').

Furthermore, in our previous case, it was reasonable to assume that all customers took the credit since it was free. Now, not all customers take the credit because a discount is offered. In addition, of the customers who do take the credit offered, a certain percentage (π) do not pay.

To simplify the following discussion, we assume the quantity sold (Q) is not affected by the switch. This assumption isn't crucial, but it does cut down on the work (see Problem 25 at the end of the chap-

ter). We also assume that all customers take the credit terms. This assumption also isn't crucial. It actually doesn't matter what percentage of our customers take the offered credit.[18]

NPV of the Credit Decision Currently Locust sells Q units at a price of P = \$49. Locust is considering a new policy that involves 30 days' credit and an increase in price to P' = \$50 on credit sales. The cash price remains at \$49, so Locust is effectively allowing a discount of (\$50 – \$49)/\$50 = 2% for cash.

What is the NPV to Locust of extending credit? To answer, note that Locust is already receiving $(P - v)Q$ every month. With the new, higher price, this rises to $(P' - v)Q$ assuming that everybody pays. However, since π percent of sales would not be collected, Locust collects only on $(1 - \pi) \times P'Q$; so net receipts are $[(1 - \pi) P' - v] \times Q$.

The net effect of the switch for Locust is thus the difference between the cash flows under the new policy and the old policy:

$$\text{Net incremental cash flow} = [(1 - \pi)P' - v] \times Q - (P - v) \times Q$$

Since $P = P' \times (1 - d)$, this simplifies to:[19]

$$\text{Net incremental cash flow} = P'Q \times (d - \pi) \qquad \textbf{[20A.1]}$$

If Locust does make the switch, the cost of the investment in receivables is just $P \times Q$ since $Q = Q'$. The NPV of the switch is thus:

$$\text{NPV} = -PQ + P'Q \times (d - \pi)/R \qquad \textbf{[20A.2]}$$

For example, suppose that, based on industry experience, the percentage of deadbeats (π) is 1 percent. What is the NPV of changing credit terms for Locust? We can plug in the relevant numbers as follows:

$$\begin{aligned}\text{NPV} &= -PQ + P'Q \times (d - \pi)/R \\ &= -\$49 \times 100 + \$50 \times 100 \times (.02 - .01)/.02 \\ &= -\$2{,}400\end{aligned}$$

Since the NPV of the change is negative, Locust shouldn't switch.

In our expression for NPV, the key elements are the cash discount percentage (d) and the default rate (π). One thing we see immediately: If the percentage of sales that goes uncollected exceeds the discount percentage, $d - \pi$ is negative. Obviously, the NPV of the switch would be negative as well. More generally, our result tells us that the decision to grant credit here is a trade-off between getting a higher price, thereby increasing sales, and not collecting on some fraction of those sales.

With this in mind, $P'Q \times (d - \pi)$ is the increase in sales less the portion of the increase that won't be collected. This increase is the incremental cash inflow from the switch in credit policy. If d is 5 percent and π is 2 percent, for example, loosely speaking, revenues are increasing by 5 percent because of the higher price, but collections rise by only 3 percent since the default rate is 2 percent. Unless $d > \pi$, we actually have a decrease in cash inflows from the switch.

A Break-Even Application Since the discount percentage (d) is controlled by the firm, the key unknown is the default rate (π). What is the break-even default rate for Locust Software?

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[18] The reason is that all customers are offered the same terms. If the NPV of offering credit is \$100, assuming that all customers switch, it is \$50 if only 50 percent of our customers switch. The hidden assumption is that the default rate is a constant percentage of credit sales.

[19] To see this, note that the net incremental cash flow is:

$$\begin{aligned}\text{Cash flow} &= [(1 - \pi) \times P' - v] \times Q - (P - v) \times Q \\ &= [(1 - \pi) \times P' - P] \times Q\end{aligned}$$

Since $P = P' \times (1 - d)$, this can be written as:

$$\begin{aligned}\text{Net incremental cash flow} &= [(1 - \pi) \times P' - (1 - d) \times P'] \times Q \\ &= P' \times Q \times (d - \pi)\end{aligned}$$

We can answer by finding the default rate that makes the NPV equal to zero.

$$\text{NPV} = 0 = -PQ + P'Q \times (d - \pi)/R$$

Rearranging things a bit:

$$PR = P'(d - \pi)$$
$$\pi = d - R \times (1 - d)$$

For Locust, the break-even default rate works out to be:

$$\pi = .02 - .02 \times (.98)$$
$$= .0004$$
$$= .04\%$$

This is quite small because the implicit interest rate Locust is charging its credit customers (2 percent discount interest per month, or about .02/.98 = 2.0408%) is only slightly greater than the required return of 2 percent per month. As a result, there's not much room for defaults if the switch is going to make sense.

Concept Questions

1. What is the incremental investment that a firm must make in receivables if credit is extended?
2. Describe the trade-off between the default rate and the cash discount.

Appendix Review and Self-Test Problems

20A.1 Credit Policy Rework Chapter Review and Self-Test Problem 20.1 using the one-shot and accounts receivable approaches. As before, the required return is 2.0 percent per period, and there will be no defaults. The basic information is:

	Current Policy	New Policy
Price per unit	$ 175	$ 175
Cost per unit	$ 130	$ 130
Sales per period in units	1,000	1,100

20A.2 Discounts and Default Risk The De Long Corporation is considering a change in credit policy. The current policy is cash only, and sales per period are 2,000 units at a price of $110. If credit is offered, the new price will be $120 per unit and the credit will be extended for one period. Unit sales are not expected to change, and all customers are expected to take the credit. De Long anticipates that 4 percent of its customers will default. If the required return is 2 percent per period, is the change a good idea? What if only half the customers take the offered credit?

Answers to Appendix Review and Self-Test Problems

20A.1 As we saw earlier, if the switch is made, an extra 100 units per period will be sold at a gross profit of $175 – 130 = $45 each. The total benefit is thus $45 × 100 = $4,500 per period. At 2.0 percent per period forever, the PV is $4,500/.02 = $225,000.

The cost of the switch is equal to this period's revenue of $175 × 1,000 units = $175,000 plus the cost of producing the extra 100 units, 100 × $130 = $13,000. The total cost is thus $188,000, and the NPV is $225,000 – 188,000 = $37,000. The switch should be made.

For the accounts receivable approach, we interpret the $188,000 cost as the investment in receivables. At 2.0 percent per period, the carrying cost is $188,000 × .02 = $3,760 per period. The benefit per period we calculated as $4,500; so the net gain per period is $4,500 – 3,760 = $740. At 2.0 percent per period, the PV of this is $740/.02 = $37,000.

Finally, for the one-shot approach, if credit is not granted, the firm will generate ($175 – 130) – 1,000 = $45,000 this period. If credit is extended, the firm will invest $130 × 1,100 = $143,000 today and receive $175 × 1,100 = $192,500 in one period. The NPV of this second

option is \$192,500/1.02 – 143,000 = \$45,725.49. The firm is \$45,725.49 – 45,000 = \$725.49 better off today and in each future period because of granting credit. The PV of this stream is \$725.49 + 725.49/.02 = \$37,000 (allowing for a rounding error).

20A.2 The costs per period are the same whether or not credit is offered; so we can ignore the production costs. The firm currently has sales of, and collects, \$110 × 2,000 = \$220,000 per period. If credit is offered, sales will rise to \$120 × 2,000 = \$240,000.

Defaults will be 4 percent of sales, so the cash inflow under the new policy will be .96 × \$240,000 = \$230,400. This amounts to an extra \$10,400 every period. At 2 percent per period, the PV is \$10,400/.02 = \$520,000. If the switch is made, De Long will give up this month's revenues of \$220,000; so the NPV of the switch is \$300,000. If only half of the customers take the credit, then the NPV is half as large: \$150,000. So, regardless of what percentage of customers take the credit, the NPV is positive. Thus, the change is a good idea.

Appendix Questions and Problems

Basic (Questions 1–5)

1. **Evaluating Credit Policy** Notel Six is in the process of considering a change in its terms of sale. The current policy is cash only; the new policy will involve one period's credit. Sales are 40,000 units per period at a price of \$450 per unit. If credit is offered, the new price will be \$475. Unit sales are not expected to change, and all customers are expected to take the credit. Notel estimates that 7 percent of credit sales will be uncollectible. If the required return is 3 percent per period, is the change a good idea?

2. **Credit Policy Evaluation** The Jusdoit Company sells 1,500 pairs of running shoes per month at a cash price of \$75.95 per pair. The firm is considering a new policy that involves 45 days' credit and an increase in price to \$78.30 per pair on credit sales. The cash price will remain at \$75.95, and the new policy is not expected to affect the quantity sold. The discount period will be 15 days. The required return is 1 percent per month.
   a. How would the new credit terms be quoted?
   b. What is the investment in receivables required under the new policy?
   c. Explain why the variable cost of manufacturing the shoes is not relevant here.
   d. If the default rate is anticipated to be 10 percent, should the switch be made? What is the break-even credit price? The break-even cash discount?

3. **Credit Analysis** Silicon Wafers, Inc. (SWI), is debating whether or not to extend credit to a particular customer. SWI's products, primarily used in the manufacture of semiconductors, currently sell for \$2,250 per unit. The variable cost is \$1,600 per unit. The order under consideration is for 15 units today; payment is promised in 30 days.
   a. If there is a 20 percent chance of default, should SWI fill the order? The required return is 2 percent per month. This is a one-time sale, and the customer will not buy if credit is not extended.
   b. What is the break-even probability in part (*a*)?
   c. This part is a little harder. In general terms, how do you think your answer to part (*a*) will be affected if the customer will purchase the merchandise for cash if the credit is refused? The cash price is \$2,000 per unit.

4. **Credit Analysis** Consider the following information on two alternative credit strategies:

	Refuse Credit	Grant Credit
Price per unit	\$ 36	\$ 39
Cost per unit	\$ 17	\$ 21
Quantity sold per quarter	3,300	3,500
Probability of payment	1.0	.90

The higher cost per unit reflects the expense associated with credit orders, and the higher price per unit reflects the existence of a cash discount. The credit period will be 90 days, and the cost of debt is .75 percent per month.
   a. Based on this information, should credit be granted?
   b. In part (*a*), what does the credit price per unit have to be to break even?

Basic ***(continued)***

c. In part (*a*), suppose we can obtain a credit report for $2 per customer. Assuming that each customer buys one unit and that the credit report correctly identifies all customers who will not pay, should credit be extended?

5. **NPV of Credit Policy Switch** Suppose a corporation currently sells Q units per month for a cash-only price of P. Under a new credit policy that allows one month's credit, the quantity sold will be Q' and the price per unit will be P'. Defaults will be π percent of credit sales. The variable cost is v per unit and is not expected to change. The percentage of customers who will take the credit is α, and the required return is R per month. What is the NPV of the decision to switch? Interpret the various parts of your answer.