Chapter 19
Cash and Liquidity Management

Chapter Organization

- 19.1 Reasons for Holding Cash
- 19.2 Determining the Target Cash Balance
- 19.3 Understanding Float
- 19.4 Investing Idle Cash
- 19.5 Summary and Conclusions
- Appendix: Cash Management Models

T19.2 Key Issues: Cash and Liquidity Management

- Key issues:
  - What is the tradeoff between carrying a large versus a small cash balance?
  - What is the proper management of the cash balance?
  - How does cash management differ from liquidity management?
- Preliminaries: understanding float
  - Identifying the opportunity cost of float
  - Decreasing the collection float
  - Increasing disbursement float

T19.3 Reasons for Holding Cash

- Speculative Motive - the need to hold cash to take advantage of additional investment opportunities, such as bargain purchases.
- Precautionary Motive - the need to hold cash as a safety margin to act as a financial reserve.
- Transaction Motive - the need to hold cash to satisfy normal disbursement and collection activities associated with a firm's ongoing operations.
- Compensating Balance Requirements - cash balances kept at commercial banks to compensate for banking services the firm receives.

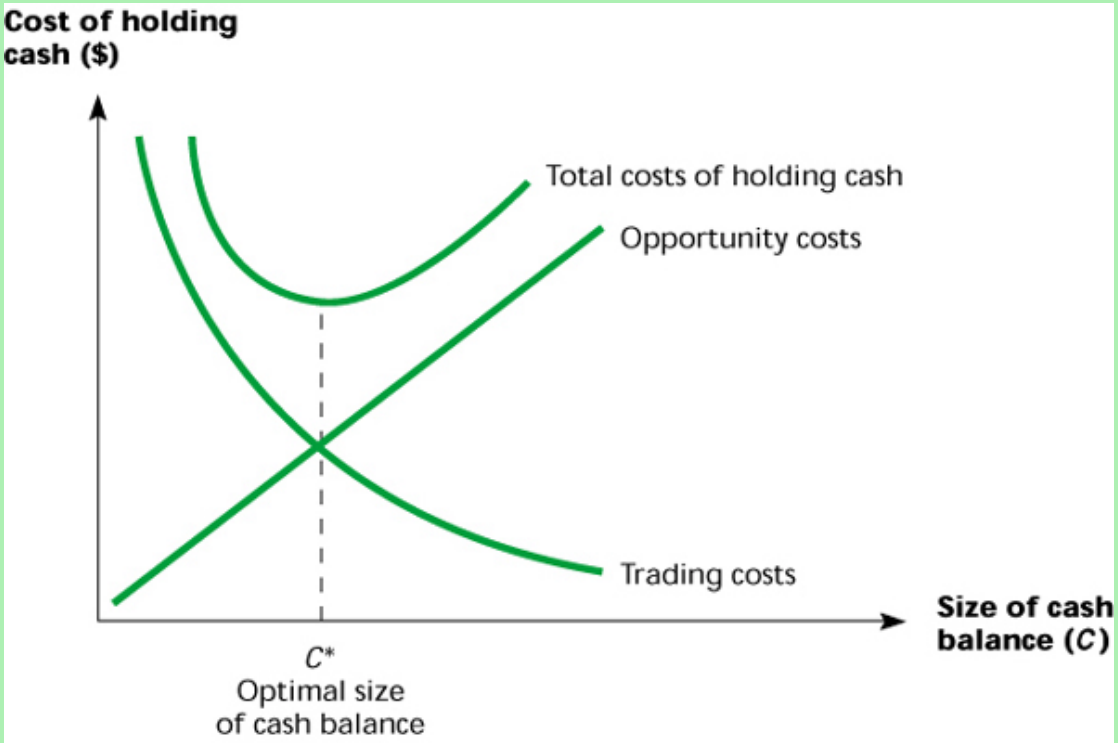
T19.4 Determining the Target Cash Balance

- Optimal choice of cash balance is a trade-off of
  - *Carrying costs: Opportunity costs of holding cash instead of some other income-producing asset.*

versus

  - *Shortage costs: Cost of not having cash available on-hand,or having to rapidly get the cash.*
- Other factors influencing the target cash balance
  - Ability to borrow rather than marketable securities
  - Scale economies in cash management - large firm advantage.

T19.4 Determining the Target Cash Balance (Figure 19.1)



Trading costs are increased when the firm must sell securities to establish a cash balance. Opportunity costs are increased when there is a cash balance because there is no return on cash.

T19.5 Understanding Float

- Preliminaries: what is float?

  The difference between book cash and bank cash, representing the net effect of checks in the process of clearing.

- Types of Float

  - Disbursement float

    The result of checks written; decreases book balance but does not immediately change available balance

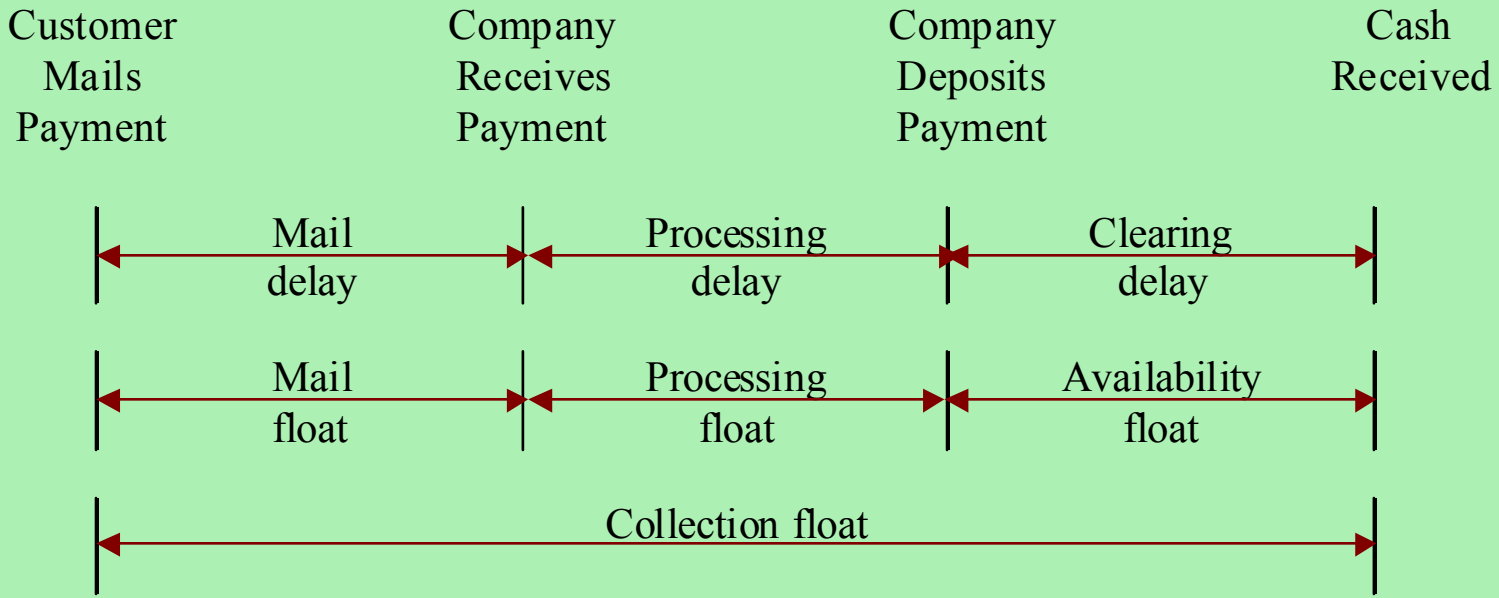
  - Collection float

    The result of checks received; increases book balance but does not immediately change available balance

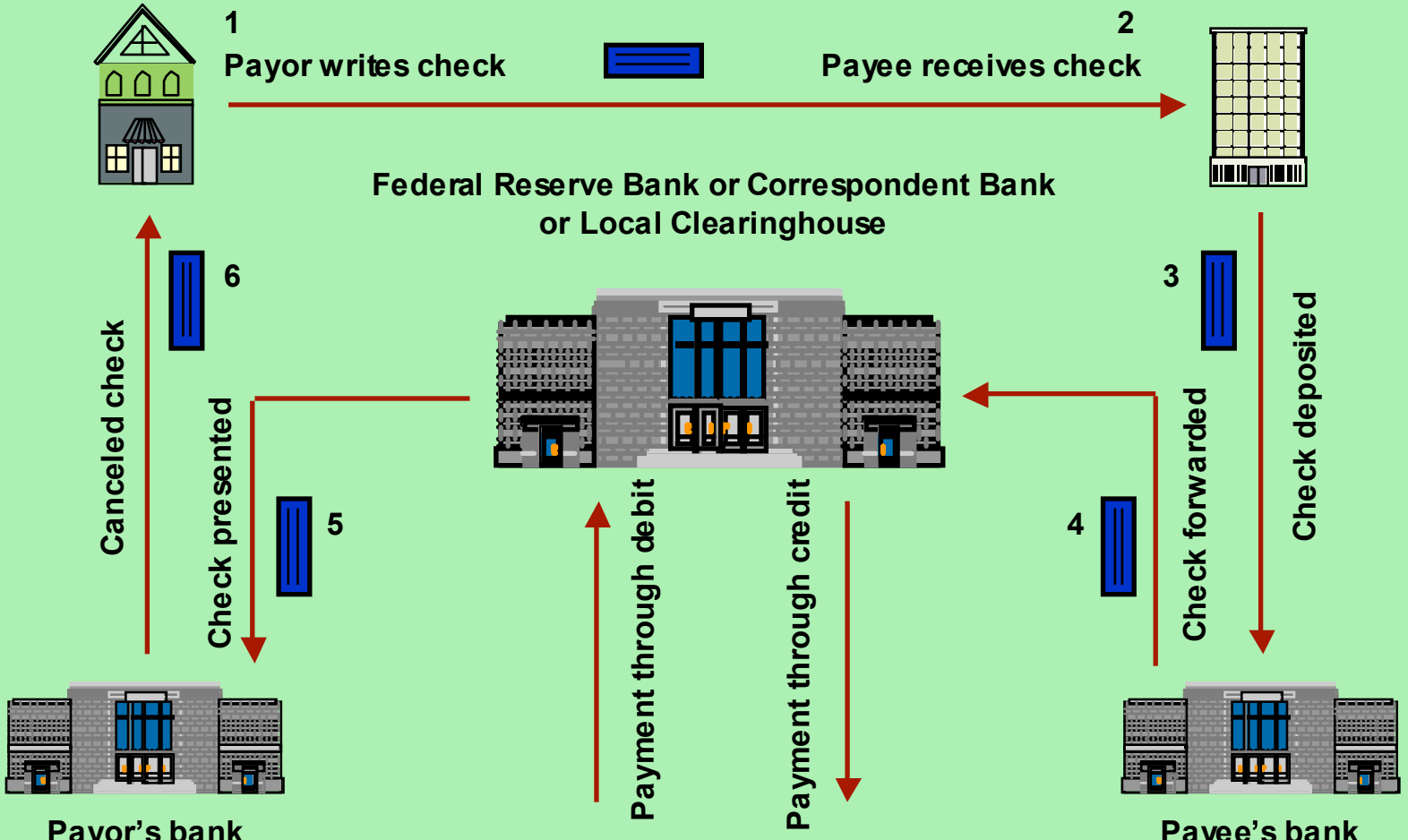
  - Net float

    The overall difference between the firm's available balance and its book balance

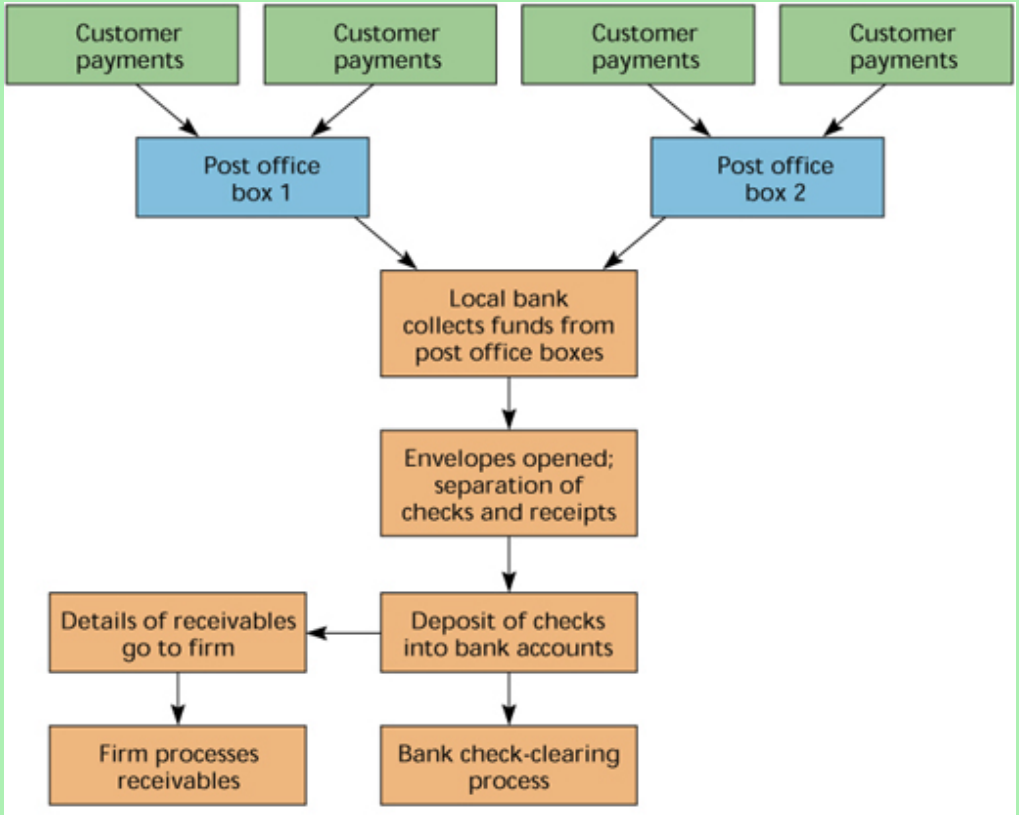
T19.6 Float Management



T19.7 Check Clearing Illustrated

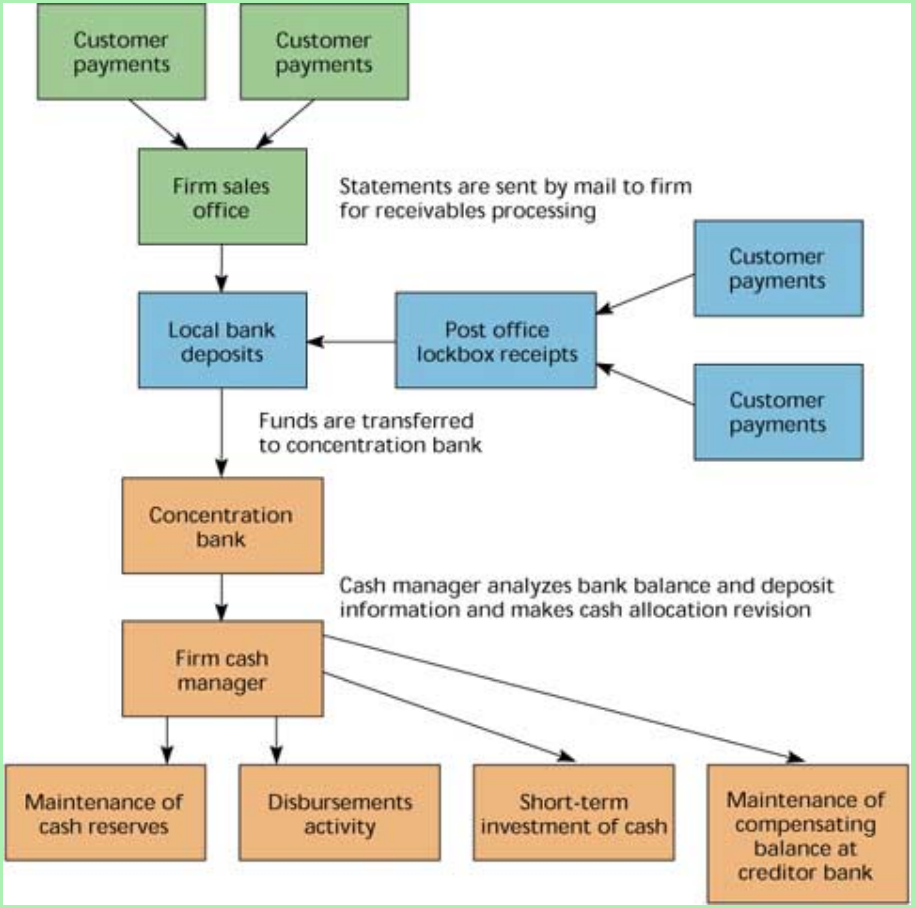


T19.8 Overview of Lockbox Processing (Figure 19.3)

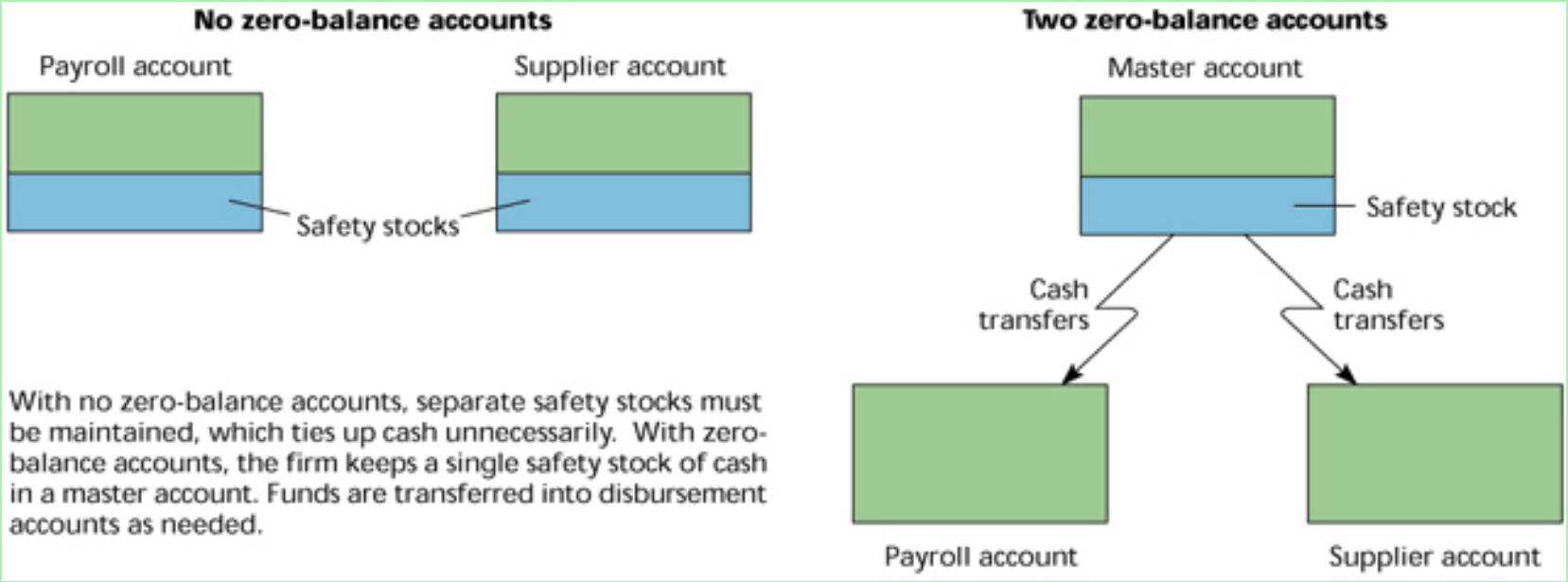


The flow starts when a corporate customer mails remittances to a post office box instead of to the corporation. Several times a day the bank collects the lockbox receipts from the post office. The checks are then put into the company bank accounts.

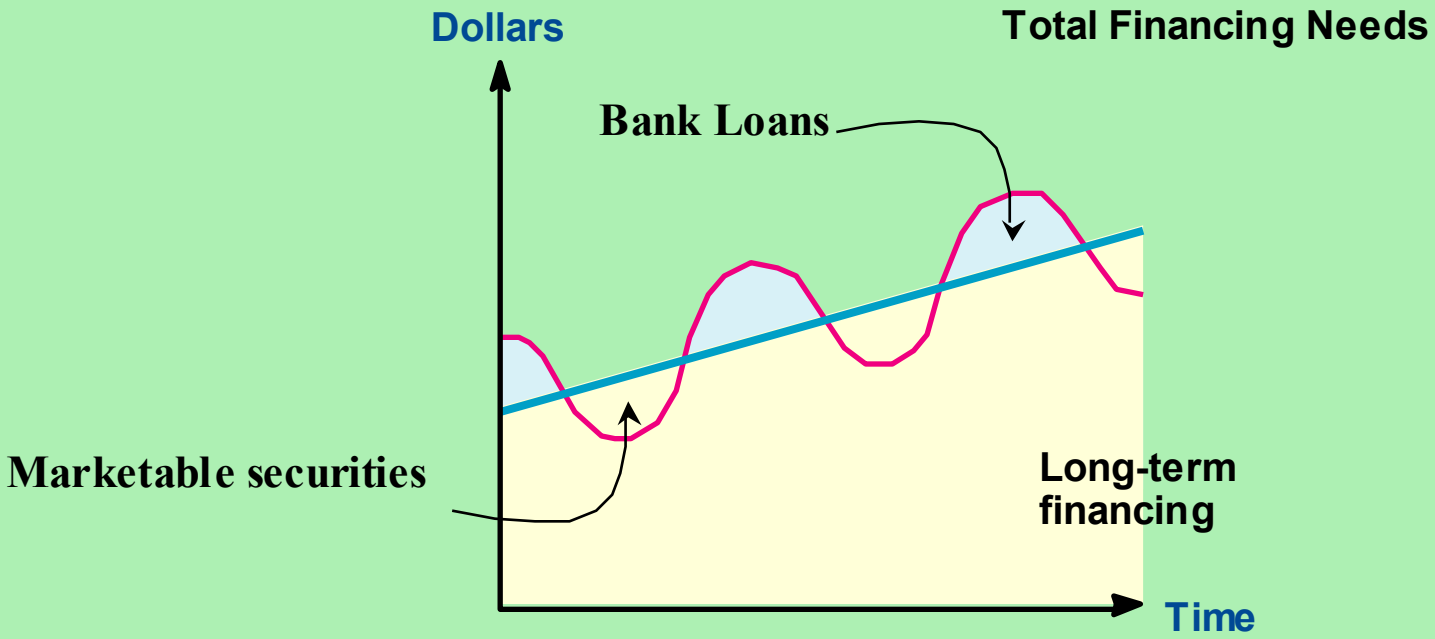
T19.9 Lockboxes and Concentration Banks in a Cash Management System (Figure 19.4)



T19.10 Zero-Balance Accounts (Figure 19.5)



T19.11 Temporary Cash Surpluses (Figure 19.6)



T19.12 Characteristics of Short-Term Securities

- Maturity
  - Interest Rate Risk
- Default Risk
  - Risk that principal and interest will not be paid
- Marketability
  - Ability to sell the asset for cash quickly
- Taxes
  - Tax treatment of interest payments

T19.13 Money Market Securities

Instrument	Issuer	Maturity	Risk, Marketability Denomination
Canadian Treasury Bills	Government of Canada	at issue: 91, 182, 365 days	no default risk good secondary market $10,000 minimum
Commercial paper	Finance companies Large companies Banks	few weeks to 270 days	backed with credit lines no secondary market $100,000 and up
Bankers acceptances	Stamped commercial paper	few weeks to 270 days	backed by bank which "stamps" them good secondary market $100,000 minimum
Certificates of Deposit	Chartered Banks	at issue: 91, 182, 365 days	active trading markets $100,000 and up
Dollar Swaps	Chartered Banks	30, 60, 91 & 182 days at issue	product of financial engineering active trading $100,000 and up

T19.14 Chapter 19 Quick Quiz

1. What are some reasons for firms holding cash?

   Classical motives: precautionary, transactions, speculative

2. What is the difference between liquidity management and cash management?

   Liquidity management *concerns the optimal quantity of liquid assets to hold;* cash management *concerns the optimal collection and disbursement of cash*

3. What is a controlled-disbursement account?

   A controlled disbursement account is an account to which the firm transfers an amount that is sufficient to cover demands for payment.

T19.15 Solution to Problem 19.2

- Each business day, on average, a company writes checks totaling $25,000 to pay its suppliers. The usual clearing time for the cheques is four days. Meanwhile the company is receiving payments from its customers each day, in the form of cheques, totaling $40,000. The cash from the payments is available to the firm after two days.

  a. Calculate the company's disbursement float, collection float, and net float.

  b. How would your answer to part *(a)* change if collected funds were available in one day instead of two?

T19.15 Solution to Problem 19.2 (continued)

a. Disbursement float = ___ ($25,000) = $_____

Collection float = 2($_____) = $80,000

Net float = $_____ - $_____ = $_____

b. Disbursement float = ___ ($25,000) = $_____

Collection float = 1($_____) = $_____

Net float = $_____ - $_____ = $_____

T19.15 Solution to Problem 19.2 (concluded)

a.	Disbursement float = 4 ($25,000)	=	$100,000
	Collection float = 2($40,000)	=	$ 80,000
	Net float = $100,000 - $80,000	=	$ 20,000
b.	Disbursement float = 4 ($25,000)	=	$100,000
	Collection float = 1($40,000)	=	$ 40,000
	Net float = $100,000 - $40,000	=	$ 60,000

T19.16 Solution to Problem 19.11

- Tobacco Leaf Treehouses, Inc., a Kentucky company, has determined that a majority of its customers are located in the Pennsylvania area. It therefore is considering using a lockbox system offered by a Canadian bank located in Pittsburgh. The bank has estimated that use of the system will reduce collection time by two days. Based on the following information, should the lockbox system be adopted?

Average number of payments per day	600
Average value of payment	$1,250
Variable lockbox fee (per transaction)	$ .30
Annual interest rate on money mkt. securities	6.0%

T19.16 Solution to Problem 19.11 (continued)

Average number of payments per day	600
Average value of payment	$1,250
Variable lockbox fee (per transaction)	$ 0.30
Annual interest rate on money mkt.securities	6.0%

PV = 2(_____)($1,250) = $_____

Daily interest rate = $1.06^{1/365}$ = .01597% per day

NPV = $_____ - [$0.30(600)/.0001597] = $_____

Should the system be adopted?

T19.16 Solution to Problem 19.11 (continued)

Average number of payments per day	600
Average value of payment	$1,250
Variable lockbox fee (per transaction)	$ 0.30
Annual interest rate on money mkt.securities	6.0%

PV = 2(600)($1,250) = $1,500,000

Daily interest rate = $1.06^{1/365}$ = .016% per day

NPV = $ 1,500,000 - [$0.30(600)/.00016] = $375,000

Since the NPV of the action is positive , the lockbox system should be (accepted/rejected).

T19.16 Solution to Problem 19.11 (concluded)

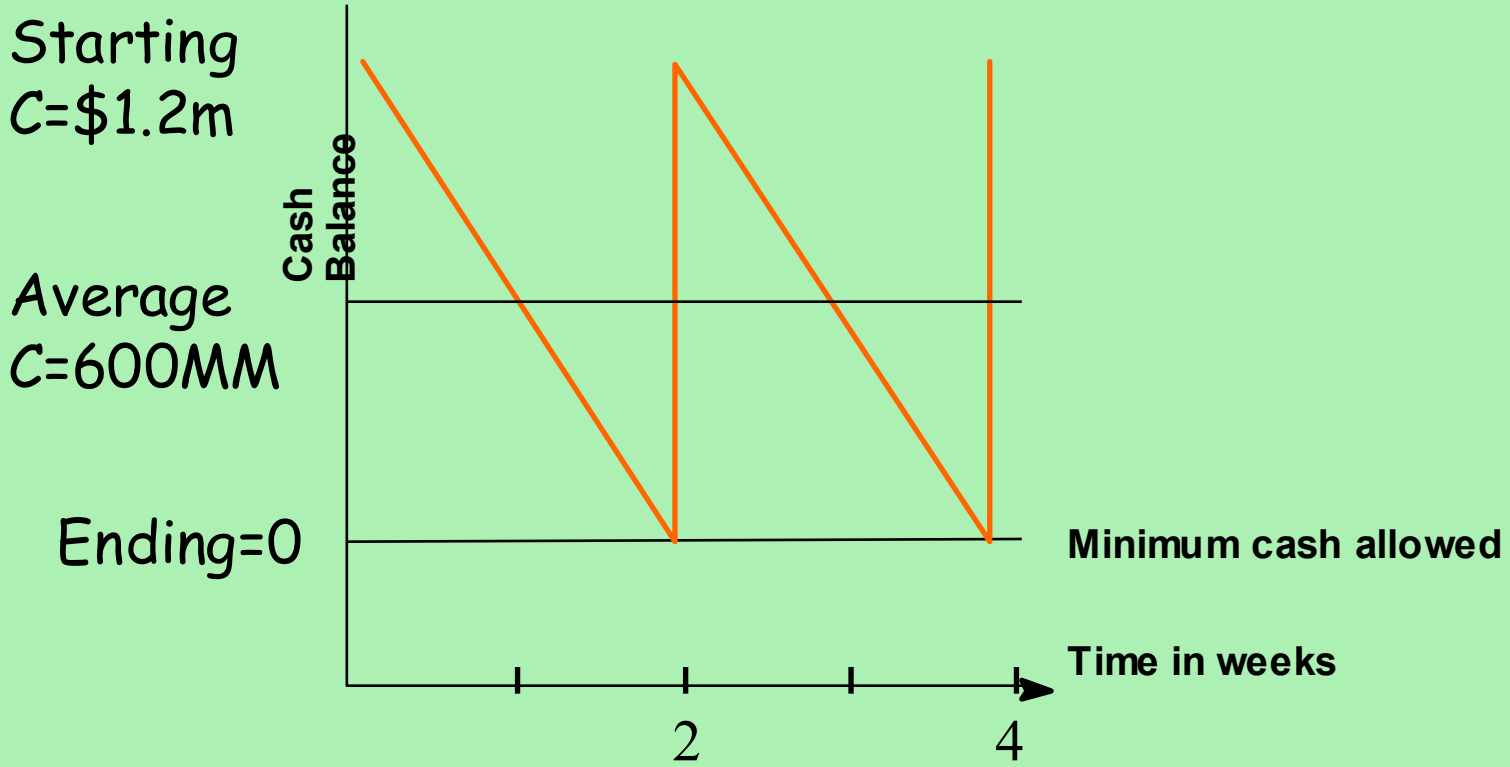
- How would your answer change if there were a fixed charge of $20,000 per year in addition to the variable charge?

  With the fee,

  NPV = $375,000 - [$20,000/.06]
  = *$41,667*

  so the lockbox system should be accepted even if the fee is charged.

T19.A1 Cash Balances for Golden Socks



T19A.2 Cost minimization model

We seek to find the minimum cost of meeting Golden Sock's short-term cash needs

- F = Fixed cost of selling securities to replenish cash
- T = Total amount of new cash needed for transactions purposes over the relevant planning period (e.g. over a year)
- R = Opportunity cost of holding cash (e.g. the interest rate on marketable securities)

T19.A3 Opportunity cost

- This is the average balance times the foregone interest
- Opportunity costs ($) = (C/2)*R

Initial Cash Balance	Average Cash Balance	Opportunity Costs
		R=10%
C	C/2	C/2*R
$ 4,800,000	$ 2,400,000	$ 240,000
2,400,000	1,200,000	120,000
1,200,000	600,000	60,000
600,000	300,000	30,000
300,000	150,000	15,000

T19.A4 Trading cost

- This is the average transaction times the cost per transaction (F)
- Trading costs ($) = (T/C)*F

Total Disbursements during the period T	Initial Cash Balance C	Trading Costs F=$1,000 T/C*F
$ 31,200,000	$ 4,800,000	$ 6,500
31,200,000	2,400,000	13,000
31,200,000	1,200,000	26,000
31,200,000	600,000	52,000
31,200,000	300,000	104,000

T19.A5 Optimal Solution

- Differentiate the Total Cost with respect to the cash balance to find the...

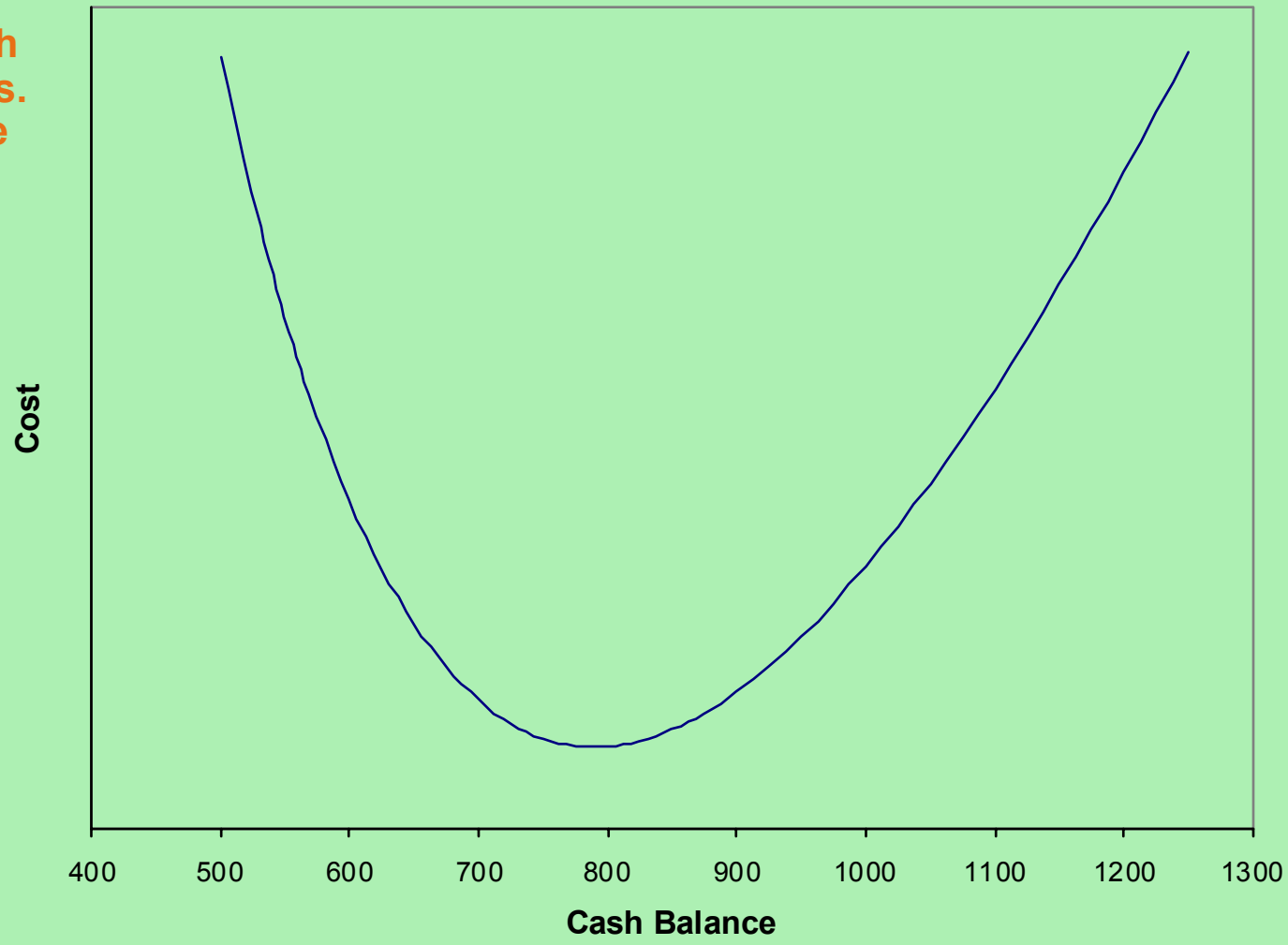
Optimal Cash Balance =

$$C^* = \sqrt{\frac{2TF}{R}}$$

T19.A6 Costs and Benefits

- Optimal Balance (C*)
  - C=SQRT(2TF/R) = $790,000
- Opportunity Costs
  - C/2*R= $40,000
- Trading Costs
  - T/C*R=$40,000

T19.A7 Graph Total Costs vs. Cash Balance

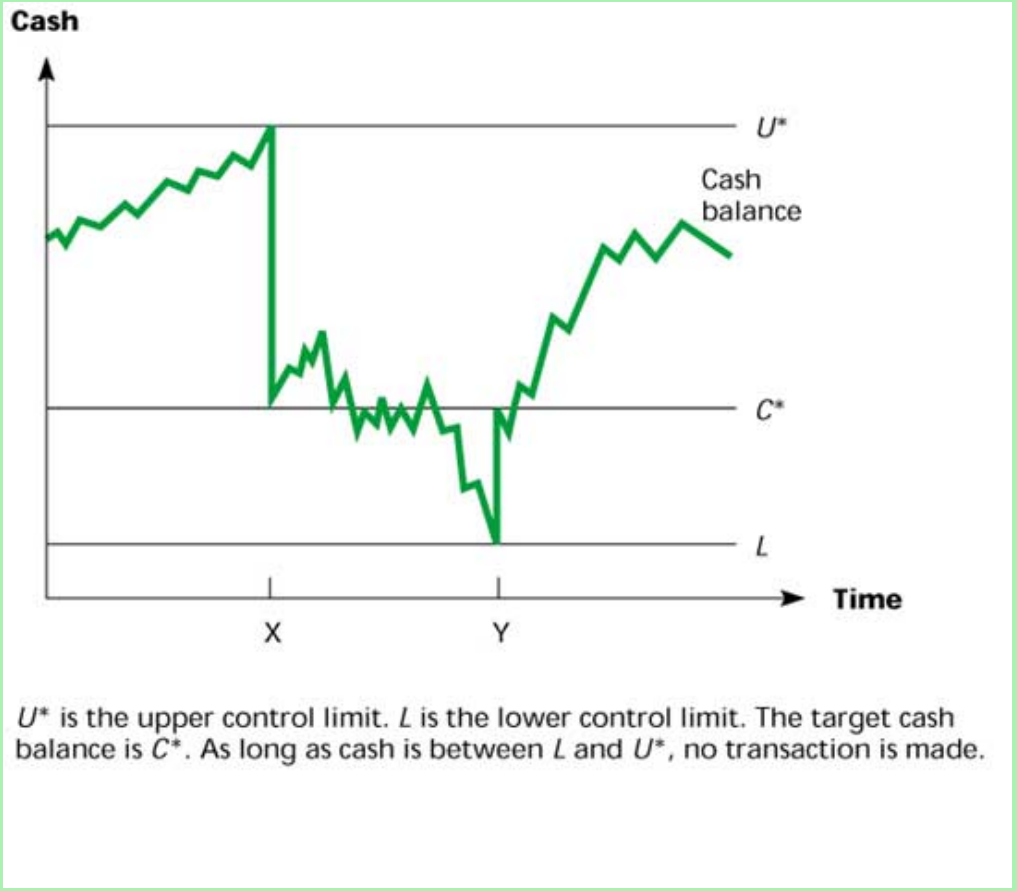


T19.A8 Summary Baumol-Allais-Tobin Model

Model limitations

- Model assumes constant net disbursement rate
  - Rarely the case, in most industries.
  - Uncertainties over both disbursements and inflows in many firms
  - Oil?
- No room for uncertainty
  - Cash flows are replenished the instant they run out.
- There is another model for more complex cash models

T19.A9 The Miller-Orr Model (Figure 19A.2)



U^* is the upper control limit. L is the lower control limit. The target cash balance is C^*. As long as cash is between L and U^*, no transaction is made.

T19.A10 Miller-Orr control model

- For comparison of costs and benefits, we have EXPECTED balances, in comparison with the Baumol model
- For Miller-Orr, the firm sets the lower limit (L), then the target cash level and the upper boundary are:

$$C^* = L + \sqrt[3]{\frac{3F\sigma^2}{4R}}$$

$$H^* = 3C^* - 2L$$

T19.A11 Miller-Orr Results

- If cash flows follow this pattern, then the average cash balance will be:

$$\frac{4C - L}{3}$$

T19.A12 Example Calculation

- Suppose we have the same parameters as before, with annual R=10%, and F=$1,000.
- We also need a number for σ, the standard deviation of daily cash flows: $2,000

  The variance (σ^2) is then 4,000,000
- We need the Effective Annual Rate for 10% compounded daily, so a daily opportunity cost.

$$\sqrt[365]{1.10} - 1 = 0.000261 = R$$

T19.A13 Value of the control parameters

- Assume L=0

$$C^* = 0 + \sqrt[3]{\frac{3*1{,}000*4{,}000{,}000}{4*0.000261}} = \$22{,}568$$

$$H^* = 3*22{,}568 = \$67{,}704$$

T19.A14 Miller-Orr Manager Responsibilities and Model Implications

- Set the lower control limit (L)
- Estimate the standard deviation of daily cash flows
- Determine the interest rate
- Estimate trading costs of buying and selling MES

Model Implications

- 1) Best return point (Z) is increasing in trading costs (F) and decreasing in opportunity cost (R)
- 2) Z and C (average cash balance) are positively related to the variability of cash flows
- 3) Model shows usefulness of operations research for Finance