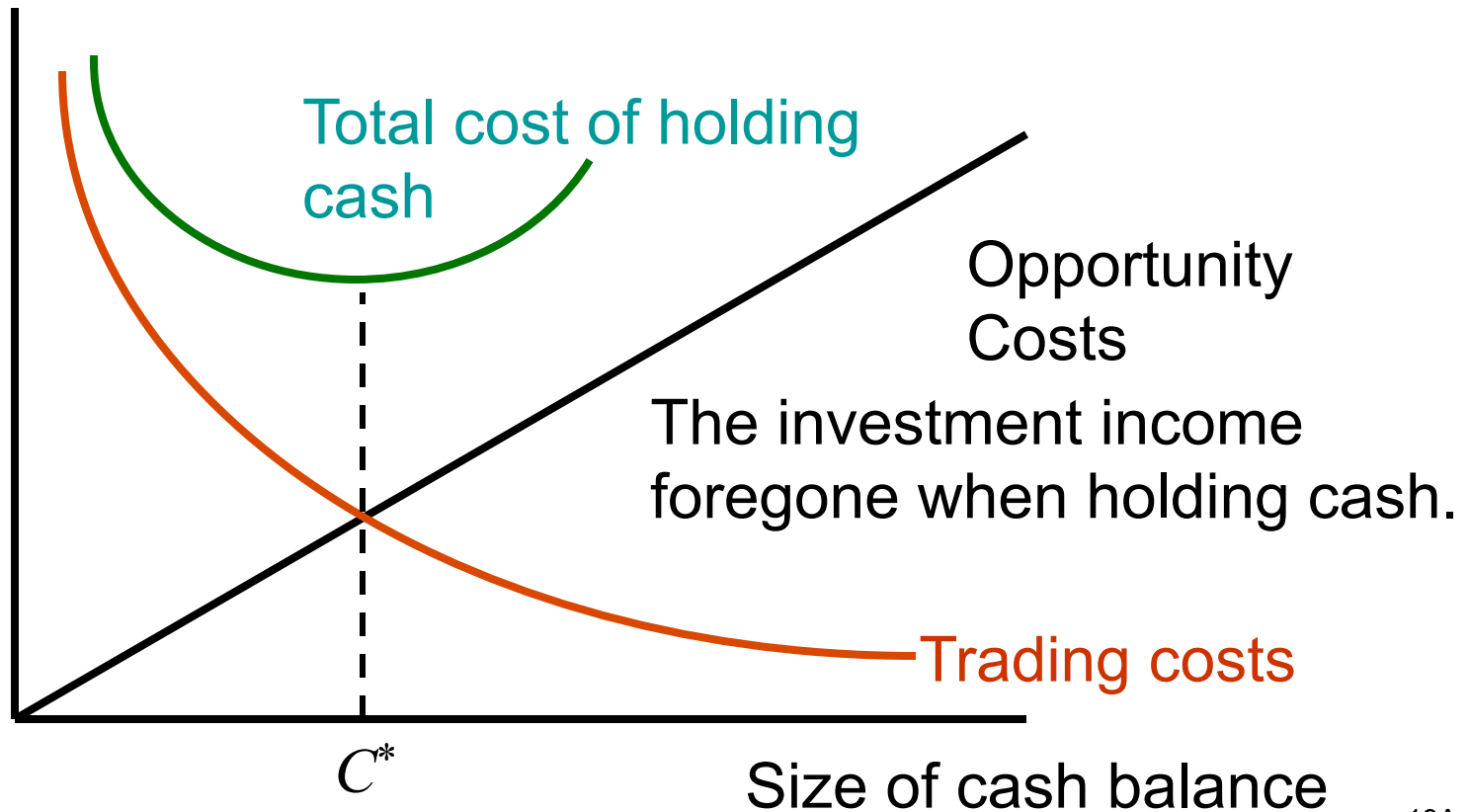


Costs of Holding Cash

Costs in dollars
of holding cash

Trading costs increase when the
firm must sell securities to meet
cash needs.

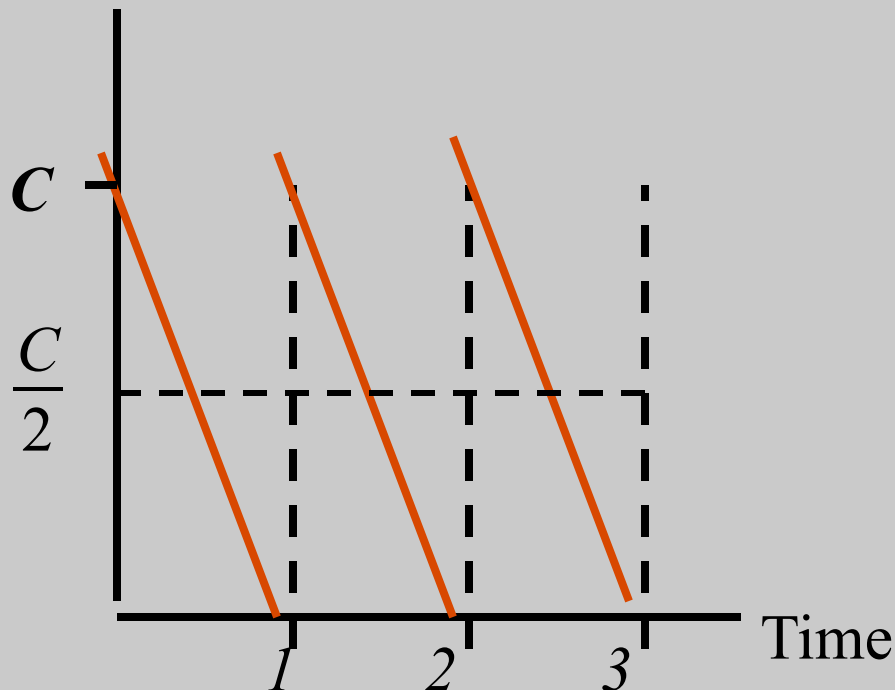


The BAT Model Part I

F = The fixed cost of selling securities to raise cash

T = The total amount of new cash needed

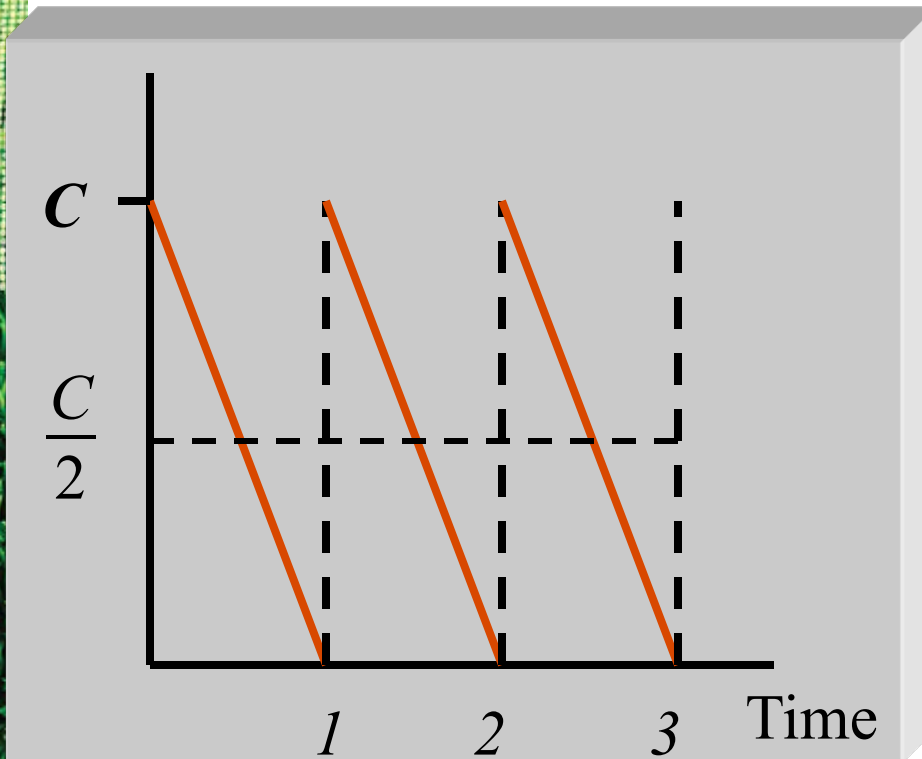
R = The opportunity cost of holding cash, *i.e.*, the interest rate



If we start with $\$C$, spend at a constant rate each period and replace our cash with $\$C$ when we run out of cash, our average cash balance will be $\frac{C}{2}$

The opportunity cost of holding $\frac{C}{2}$ is $\frac{C}{2} \times R$

The BAT Model Part II

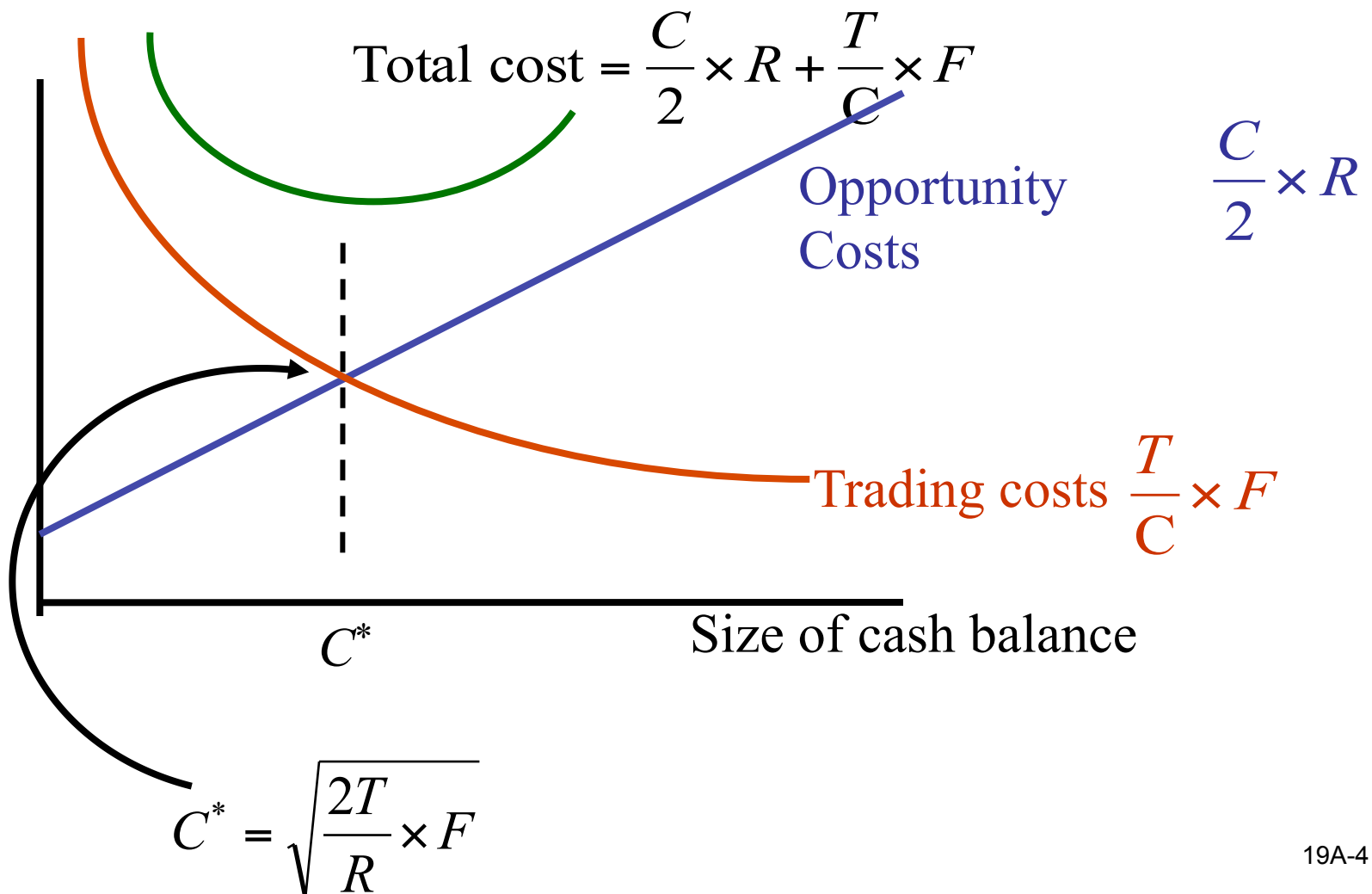


As we transfer $\$C$ each period we incur a trading cost of F .

If we need $\$T$ in total over the planning period we will pay $\$F \frac{T}{C}$ times.

The trading cost is $\frac{T}{C} \times F$

The BAT Model Part III



The BAT Model Part IV

The optimal cash balance is found where the opportunity costs equals the trading costs.

Opportunity Costs = Trading Costs

$$\frac{C}{2} \times R = \frac{T}{C} \times F$$

Multiply both sides by C

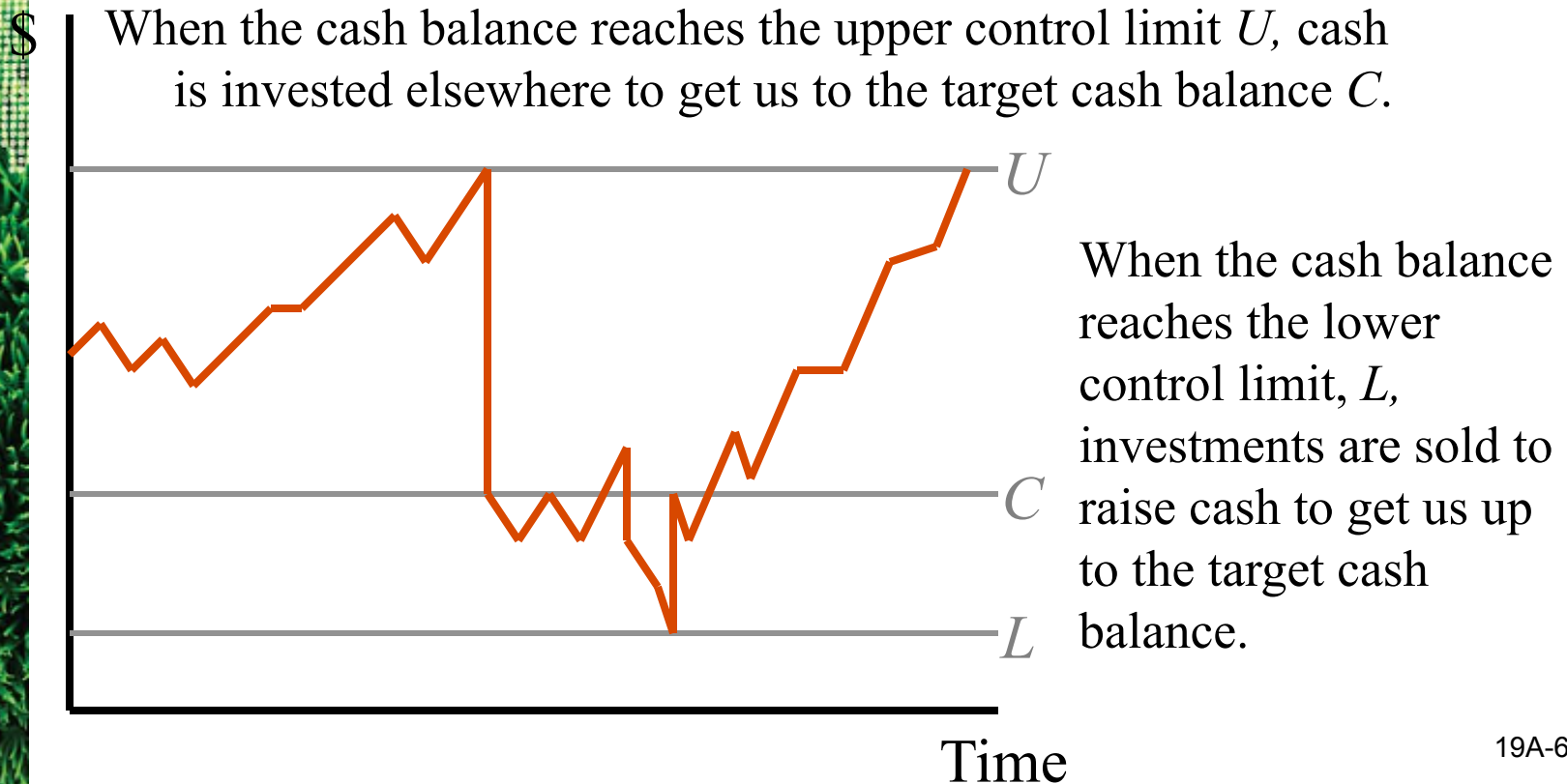
$$\frac{C^2}{2} \times R = T \times F$$

$$C^2 = 2 \times \frac{T \times F}{R}$$

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

The Miller-Orr Model

- The firm allows its cash balance to wander randomly between upper and lower control limits.



The Miller-Orr Model Math

- Given L , which is set by the firm, the Miller-Orr model solves for C^* and U

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

where σ^2 is the variance of net daily cash flows.

- The average cash balance in the Miller-Orr model is:

$$\text{Average cash balance} = \frac{4C^* - L}{3}$$

Implications of the Miller–Orr Model Part I

- 
- To use the Miller-Orr model, the manager must do four things:
 1. Set the lower control limit for the cash balance.
 2. Estimate the standard deviation of daily cash flows.
 3. Determine the interest rate.
 4. Estimate the trading costs of buying and selling securities.

Implications of the Miller–Orr Model Part II

- 
- The model clarifies the issues of cash management:
 - The optimal cash position, C^* , is positively related to trading costs, F , and negatively related to the interest rate R .
 - C^* and the average cash balance are positively related to the variability of cash flows.

Other Factors Influencing the Target Cash Balance

- Borrowing
 - Borrowing is likely to be more expensive than selling marketable securities.
 - The need to borrow will depend on management's desire to hold low cash balances.



End of Chapter