## Supply Contracts



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# Outline

Supply contracts
 Demand distribution
 Wholesale contracts
 Optimal orders
 Buyback contracts
 Revenue sharing contracts



# Single period ordering

- 😹 Seasonal items
- 💉 Perishable goods
- 🖉 News print
- ✓ Fashion items
- many high tech products
- Every item where the lead time is long and the selling season is short

# The Scenario:



Contract is negotiated
 Retailer places order (a single period)
 Supplier makes and sends the stuff
 The selling season takes place
 Accounting (sales, salvage, etc.)

## **Consumer Demand**



Average: 811.54 Std Dev: 154.23

# **Demand Distribution**



# Notations:

Retail Price	R
Wholesale Price	W
Supplier's Cost	С
Salvage Value	S
Quantity Ordered	Q
Actual Retail Demand	d
Retail Demand Density	f(D)
Retail Cum. Demand Distribution	F(D)

# Supply Contracts

#### Prices and costs:

- ✓ Supplier has a cost to make/purchase (C=\$50)
- ✓ Supplier is selling and retail is buying at a wholesale price (W=\$135)
- ✓ Retailer is selling for a retail price (R=\$200)
- ✓ Retailer can salvage (S=\$10)
- Retailer is facing a Newsboy problem and supplier's profit is trivial



### Wholesale Price Contract

Retail	er															
	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Demand	Prob															
400	0.00	\$13,000	\$19,500	\$26,000	\$13,500	\$1,000	-\$11,500	-\$24,000	-\$36,500	-\$49,000	-\$61,500	-\$74,000	-\$86,500	-\$99,000	-\$111,500	-\$124,000
500	0.04	\$13,000	\$19,500	\$26,000	\$32,500	\$20,000	\$7,500	-\$5,000	-\$17,500	-\$30,000	-\$42,500	-\$55,000	-\$67,500	-\$80,000	-\$92,500	-\$105,000
600	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$26,500	\$14,000	\$1,500	-\$11,000	-\$23,500	-\$36,000	-\$48,500	-\$61,000	-\$73,500	-\$86,000
700	0.21	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$33,000	\$20,500	\$8,000	-\$4,500	-\$17,000	-\$29,500	-\$42,000	-\$54,500	-\$67,000
800	0.29	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$39,500	\$27,000	\$14,500	\$2,000	-\$10,500	-\$23,000	-\$35,500	-\$48,000
900	0.19	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$46,000	\$33,500	\$21,000	\$8,500	-\$4,000	-\$16,500	-\$29,000
1,000	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$52,500	\$40,000	\$27,500	\$15,000	\$2,500	-\$10,000
1,100	0.06	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$71,500	\$59,000	\$46,500	\$34,000	\$21,500	\$9,000
1,200	0.02	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$71,500	\$78,000	\$65,500	\$53,000	\$40,500	\$28,000
1,300	0.00	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$71,500	\$78,000	\$84,500	\$72,000	\$59,500	\$47,000
Expec	ted Profit:	\$13,000	\$19,500	\$26,000	\$32,500	\$38,269	\$42,212	\$42,135	\$36,577	\$27,365	\$16,327	\$4,192	-\$8,308	-\$20,808	-\$33,308	-\$45,808
Maximur	n Profit:						1									

Suppli	er:															
	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Demand	Prob															
400	0.00	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
500	0.04	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
600	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
700	0.21	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
800	0.29	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
900	0.19	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,000	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,100	0.06	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,200	0.02	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,300	0.00	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
Expect	ed Profit:	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
Maximun	n Profit:															111

**Total Profit:** \$30,000 \$45,000 \$60,000 \$75,000 \$89,269 \$101,712 \$110,135 \$113,077 \$112,365 \$109,827 \$106,192 \$102,192 \$98,192 \$94,192 \$90,192 111

Maximum Profit



### Wholesale Price Contract

Retai	er															
	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
<mark>Deman</mark>	d Prob															
400	0.00	\$13,000	\$19,500	\$26,000	\$13,500	\$1,000	-\$11,500	-\$24,000	-\$36,500	-\$49,000	-\$61,500	-\$74,000	-\$86,500	-\$99,000	-\$111,500	-\$124,000
500	0.04	\$13,000	\$19,500	\$26,000	\$32,500	\$20,000	\$7,500	-\$5,000	-\$17,500	-\$30,000	-\$42,500	-\$55,000	-\$67,500	-\$80,000	-\$92,500	-\$105,000
600	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$26,500	\$14,000	\$1,500	-\$11,000	-\$23,500	-\$36,000	-\$48,500	-\$61,000	-\$73,500	-\$86,000
700	0.21	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$33,000	\$20,500	\$8,000	-\$4,500	-\$17,000	-\$29,500	-\$42,000	-\$54,500	-\$67,000
800	0.29	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000		\$27,000	\$14,500	\$2,000	-\$10,500	-\$23,000	-\$35,500	-\$48,000
900	0.19	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,	200	\$33,500	\$21,000	\$8,500	-\$4,000	-\$16,500	-\$29,000
1,000	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	<b>\$5</b> 2,000	\$58,500		2.500	\$40,000	\$27,500	\$15,000	\$2,500	-\$10,000
1,100	0.06	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	52,000	<b>*</b> 50,500			\$50,000	¢40 500	¢04.000	<b>©04 500</b>	<b>#0.000</b>
1,200	0.02	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,50	\$52,000	000	) ord	orod	and	400	domo	anda	4
1,300	0.00	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	<u></u>	\$52,000	OUL	) UI U	ereu	anu	000	uema		J
Exped	cted Profit:	\$13,000	\$19,500	\$26,000	\$32,500	\$38,269		\$42,135	Dro	fit_6	00%	t 200	¢12			
Maximu	ım Profit:								FIU	$\Pi = 0$	00.(.	<b>ρΖΟΟ</b>	-၃၂၃	$\mathbf{S}\mathbf{J}\mathbf{+}$		
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40	Profit	t=80	0%\$2	200-	\$135	() =	52.00		\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
50									\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
600	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
700	0.21	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$ 8,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
800	0.29	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
900	0.19	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,000	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000		\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,100	0.06	\$17,000	\$25,500	\$34,000	\$42,500	\$51,00		\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,200	0.02	\$17,000	\$25,500	\$34,000	\$42,500	<u> </u>	0	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
1,300	0.00	\$17,000	\$25,500	\$34,000	\$42,500		500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
Expe	ptod Profit:	\$17.000	\$25 500	\$24,000	CV3		<b>4</b> 500	000 832	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$119,000	\$127,500	\$136,000
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Iota	Profit	L = 80	095	135_	\$50)	-\$6	8 00		\$113,0//	<b>\$112,365</b>	\$109,827	<b>\$106,192</b>	<b>\$102,192</b>	<b>\$98,192</b>	<b>ə</b> 94,192	ə90,192
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# Wholesale Price Contract Expected Profits



R=\$200

W=\$135

C = \$50

S=\$10

# **Optimal Order**

- Mathematics Mat
- At Q\* the probability of selling one more magazine is the probability that demand is greater than Q\*
- The expected profit from ordering the (Q\*+1)st magazine is:
  - ✓ If demand is high and we sell it:
  - If demand is low and we are stuck but can salvage:

✓ (S-C) x Pr( Demand is lower or equal to Q\*)

The optimum is where the total expected profit from ordering one more magazine is zero:

 $\swarrow$  (R-C) x Pr(Demand > Q\*) + (S - C) x Pr(Demand = Q\*) = 0

-----Pr(Demand ? Q\*) = 
$$\frac{R - C}{R ? S}$$
 Q\* = F<sup>-1</sup>  $\frac{?}{?} \frac{R - C}{R ? S ?}$ 

# Wholesale Price Contract Exp Profits (Normal Approx)



# Wholesale Price Contract Exp Profits (Normal Approx)



#### Effects of Wholesale Price on Profits



## Wholesale Price Contract Coordination the Channel

 $Q_{Re tailer}^{*}$  ?  $Q_{Channel}^{*}$ 

$$F^{2}_{2} \frac{?}{?} \frac{R?W}{R?S} \frac{?}{?}? F^{2}_{2} \frac{?}{?} \frac{R?C}{R?S} \frac{?}{?}$$

$$\frac{?R?W}{?R?S}??\frac{?R?C}{?R?S}?$$

# **Buyback Contract**

- The problem: how can the supplier convince the retailer to move towards the optimal order size?
- The supplier offer to the retailer to buy back all unsold items (\$B/item).
- For the retailer this is like a higher salvage value, so he will order more.
- The supplier now shares in the overage risk (he can still salvage, though, at the same price).
- Note: supplier may simply pay (\$B-\$S) rather than actually buy back (unless he has a better use for it)

#### R=\$200 W=\$135 C=\$50 S=\$10 B=\$80

## Buyback Contract Calculations

Retail	er:															
	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Demand	Prob															
400	0.00	\$13,000	\$19,500	\$26,000	\$20,500	\$15,000	\$9,500	\$4,000	-\$1,500	-\$7,000	-\$12,500	-\$18,000	-\$23,500	-\$29,000	-\$34,500	-\$40,000
500	0.04	\$13,000	\$19,500	\$26,000	\$32,500	\$27,000	\$21,500	\$16,000	\$10,500	\$5,000	-\$500	-\$6,000	-\$11,500	-\$17,000	-\$22,500	-\$28,000
600	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$33,500	\$28,000	\$22,500	\$17,000	\$11,500	\$6,000	\$500	-\$5,000	-\$10,500	-\$16,000
700	0.21	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$40,000	\$34,500	\$29,000	\$23,500	\$18,000	\$12,500	\$7,000	\$1,500	-\$4,000
800	0.29	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$46,500	\$41,000	\$35,500	\$30,000	\$24,500	\$19,000	\$13,500	\$8,000
900	0.19	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$53,000	\$47,500	\$42,000	\$36,500	\$31,000	\$25,500	\$20,000
1,000	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$59,500	\$54,000	\$48,500	\$43,000	\$37,500	\$32,000
1,100	0.06	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$71,500	\$66,000	\$60,500	\$55,000	\$49,500	\$44,000
1,200	0.02	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$71,500	\$78,000	\$72,500	\$67,000	\$61,500	\$56,000
1,300	0.00	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,500	\$65,000	\$71,500	\$78,000	\$84,500	\$79,000	\$73,500	\$68,000
Expec	ted Profit:	\$13,000	\$19,500	\$26,000	\$32,500	\$38,538	\$43,423	\$45,769	\$44,654	\$41,231	\$36,654	\$31,385	\$25,885	\$20,385	\$14,885	\$9,385
Mavim	um Profit							1								

Supplie	er:															
<mark>(</mark>	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
<b>Demand</b>	Prob															
400	0.00	\$17,000	\$25,500	\$34,000	\$35,500	\$37,000	\$38,500	\$40,000	\$41,500	\$43,000	\$44,500	\$46,000	\$47,500	\$49,000	\$50,500	\$52,000
500	0.04	\$17,000	\$25,500	\$34,000	\$42,500	\$44,000	\$45,500	\$47,000	\$48,500	\$50,000	\$51,500	\$53,000	\$54,500	\$56,000	\$57,500	\$59,000
600	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$52,500	\$54,000	\$55,500	\$57,000	\$58,500	\$60,000	\$61,500	\$63,000	\$64,500	\$66,000
700	0.21	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$61,000	\$62,500	\$64,000	\$65,500	\$67,000	\$68,500	\$70,000	\$71,500	\$73,000
800	0.29	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$69,500	\$71,000	\$72,500	\$74,000	\$75,500	\$77,000	\$78,500	\$80,000
900	0.19	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$78,000	\$79,500	\$81,000	\$82,500	\$84,000	\$85,500	\$87,000
1,000	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$86,500	\$88,000	\$89,500	\$91,000	\$92,500	\$94,000
1,100	0.06	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$95,000	\$96,500	\$98,000	\$99,500	\$101,000
1,200	0.02	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$103,500	\$105,000	\$106,500	\$108,000
1,300	0.00	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$59,500	\$68,000	\$76,500	\$85,000	\$93,500	\$102,000	\$110,500	\$112,000	\$113,500	\$115,000
Expecte	ed Profit:	\$17,000	\$25,500	\$34,000	\$42,500	\$50,731	\$58,288	\$64,365	\$68,423	\$71,135	\$73,173	\$74,808	\$76,308	\$77,808	\$79,308	\$80,808
Maximu	um Profit:															111
Total P Maximu	rofit: ım Profit	\$30,000	\$45,000	\$60,000	\$75,000	\$89,269	\$101,712	\$110,135	\$113,077 !!!	\$112,365	\$109,827	\$106,192	\$102,192	\$98,192	\$94,192	\$90,192

#### R=\$200 W=\$135 C=\$50 S=\$10 B=\$80

# Buyback Contract Calculations

Retaile	er:													_		
	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Demand	Prob															
400	0.00	\$13,000	\$19,500	\$26,000	\$20,500	\$15,000	\$9,500	\$4,000	-\$1,500	-\$7,000	-\$12,500	-\$18,000	-\$23,500	-\$29,000	-\$34,500	-\$40,000
500	0.04	\$13,000	\$19,500	\$26,000	\$32,500	\$27,000	\$21,500	\$16,000	\$10,500	\$5,000	-\$500	-\$6,000	-\$11,500	-\$17,000	-\$22,500	-\$28,000
600	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$33,500	\$28,000	\$22,500	\$17,000	\$11,500	\$6,000	\$500	-\$5,000	-\$10,500	-\$16,000
700	0.21	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$40,00	\$34,500	\$29,000	\$23,500	\$18,000	\$12,500	\$7,000	\$1,500	-\$4,000
800	0.29	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000		\$41,000	\$35,500	\$30,000	\$24,500	\$19,000	\$13,500	\$8,000
900	0.19	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$5	2,000	\$47,500	\$42,000	\$36,500	\$31,000	\$25,500	\$20,000
1,000	0.10	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58,50		¢59,500	\$54,000	\$48,500	\$43,000	\$37,500	\$32,000
1,100	0.06	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000	\$45,500	\$52,000	\$58 500			\$66,000	\$60,500	\$55,000	\$49 500	\$44,000
1,200	0.02	\$13,000	\$19,500	\$26,000	\$32,500	\$39,000		\$52,000	000	a secolar						
1,300	0.00	\$13,000	\$19,500	\$26,000	\$32,500	\$39.00	.00	\$52,000	800	orde	red a	and 6	00 a	lema	inde	a
Expect	ed Profit:	\$13,000	\$19,500	\$26,000	\$32,500	2	5,423	\$45,769				~~~	+ 4 O F			
Maxim	um Profit:							1	Profi	t=6(	)O' <u>/</u> \$	200-	\$135	)+		
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		( )			-/			\$40,000	\$41,500	\$43,000	\$44,500	\$46,000	\$47,500	\$49,000	\$50,500	\$52,000
600	0.04	\$17,000	\$25,500	\$34,000	\$42,500	\$44,000	\$40,000 \$50,500	\$47,000	\$48,500	\$50,000	\$51,500	\$53,000	\$54,500	\$56,000	\$57,500	\$59,000
700	0.10	\$17,000	\$25,500	\$34,000	\$42,500	\$51,000	\$52,500	\$54,000	\$55,500	\$57,000	\$58,500	\$60,000	\$61,500	\$63,000	\$64,500	\$66,000
800	0.21	\$17,000	\$25,500 ¢oc.coo	\$34,000	\$42,500	\$51,000	\$59,500 \$50,500	\$61,000	\$62,500	\$64,000	\$65,500	\$67,000	\$68,500	\$70,000	\$71,500	\$73,000
000	0.29	\$17,000	\$25,500 ¢25,500	\$34,000	\$42,500	\$51,000	\$59,500 ¢50,500	\$68,000		\$71,000	\$72,500	\$74,000	\$75,500	\$77,000	\$78,500	\$80,000
1 000	0.19	\$17,000	\$25,500 ¢or roo	\$34,000	\$42,500	\$51,000	\$59,500 \$50,500	\$68,000	\$70		\$79,500	\$81,000	\$82,500	\$84,000	\$85,500	\$87,000
1,000	0.10	\$17,000	\$25,500 ¢oc.coo	\$34,000	\$42,500	\$51,000	\$09 ·	\$68,000	\$76,500		86.500	\$88,000	\$89,500	\$91,000	\$92,500	\$94,000
1,100	0.00	\$17,000	\$25,500 \$25,500	\$34,000	\$42,500 \$42,500	\$51,000		\$68,000	\$76.500	<b>_</b>		\$95.000	\$96.500	298.000	299.500	\$101.000
1,200	0.02	\$17,000	\$25,500 \$25,500	\$34,000	\$42,500 \$42,500	\$51,000 \$51	0	\$00,000	000	ordo	rod	and 4		lomo	ndo	A
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#### R=\$200 W=\$135 C=\$50 S=\$10 B=\$80

# Channel profit with Buyback



#### **Optimal Buyback and Wholesale price**

- Higher wholesale price requires a higher buyback rate
- As the wholesale price (and the buyback rate) grows the supplier's share of the profit increases
  - Wholesale price ranges from \$50 (supplier's cost) to \$200 (retail price)
  - Buyback rate ranges from \$10 (salvage value) to \$200.

# Expected Profits with Buyback Contract



R=\$200

W = \$135

C = \$50

S=\$10

B=\$80

# Expected Profits with Buyback Contract



R=\$200

W = \$135

C = \$50

S=\$10

B=\$80

# Expected Profits with Buyback Contract



R=\$200

W = \$135

C = \$50

S = \$10

## **Optimal Buyback Price**

Q<sup>\*</sup><sub>Re tailer</sub> ? Q<sup>\*</sup><sub>Channel</sub>

$$F^{?1} \frac{?}{?} \frac{R?W}{R?B} \frac{?}{?}? F^{?1} \frac{?}{?} \frac{R?C}{R?S} \frac{?}{?}$$

 $\frac{?R?W}{?R?B}??\frac{?R?C}{?R?S}?$ 

$$\mathsf{B} ? \; \frac{?}{?} \frac{\mathsf{R} ? \; \mathsf{S}}{\mathsf{R} ? \; \mathsf{C}} \frac{?}{?} \mathcal{W} \; ? \; \frac{?}{?} \frac{\mathsf{R} ? \mathsf{C} ? \; \mathsf{S})}{\mathsf{R} ? \; \mathsf{C}} \frac{?}{?} \frac{\mathsf{R} ? \mathsf{C} ? \; \mathsf{S})}{\mathsf{R} ? \; \mathsf{C}} \frac{?}{?}$$

# Channel Coordination with Buyback



R=\$200

W = \$135

C = \$50

S=\$10

# Expected Profit with Coordinating Buyback Rate



R=\$200

W = \$135

B\*=\$118

C = \$50

S = \$10

# **Buyback Contracts in Practice**

- 💉 Book publishing
- Periodicals/newspapers
- Price support in consumer electronics

# **Revenue Sharing**

- Supplier still needs to get the retailer to order more
- Another risk-sharing scheme: supplier lowers the wholesale price but takes a percentage (1-p) of the revenue
- Question: how to choose W and p so the retailer will order the optimal amount
- Note: wholesale price has to be lower than the supplier's cost.

# The Players

#### Paramont



#### Blockbuster



#### The Economics of Revenue Sharing

In the video industry, revenue sharing may increase profits for the supplier and the retailer alike, as this hypothetical example reveals.

#### FOR THE RETAILER

	Traditional Pricing	Revenue Sharing
A. Number of tapes purchased	10	30
B. Price per tape	\$60	\$9
C. Purchase cost	\$600	\$270
D. Number of rentals	300	500
E. Total rental revenue (D × \$3/rental)	\$900	\$1,500
F. Retailer's share of rental revenue	\$900 (100%)	\$750 (50%)
G. Retailer's profit	\$300	\$480
H. Profit per dollar of inventory	\$0.50	\$1.78

#### FOR THE SUPPLIER

	Traditional Pricing	Revenue Sharing
I. Number of tapes purchased	10	30
J. Price per tape	\$60	\$9
K. Revenue from selling tapes	\$600	\$270
L. Number of rentals	300	500
M. Total rental revenue (L × \$3/rental)	\$900	\$1,500
N. Supplier's share of rental revenue	\$0 (0%)	\$750 (50%)
D. Supplier's total revenues	\$600	\$1,020
P. Supplier's production and distribution cost (I × \$10/tape)	\$100	\$300
Q. Supplier's profit	\$500	\$720

R= \$200 W= \$40 C= \$50 S= \$10 p= 0.40

# **Revenue Sharing**

Retail	er:															
-	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Demand	Prob															
400	0.00	\$8,000	\$12,000	\$16,000	\$13,000	\$10,000	\$7,000	\$4,000	\$1,000	-\$2,000	-\$5,000	-\$8,000	-\$11,000	-\$14,000	-\$17,000	-\$20,000
500	0.04	\$8,000	\$12,000	\$16,000	\$20,000	\$17,000	\$14,000	\$11,000	\$8,000	\$5,000	\$2,000	-\$1,000	-\$4,000	-\$7,000	-\$10,000	-\$13,000
600	0.10	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$21,000	\$18,000	\$15,000	\$12,000	\$9,000	\$6,000	\$3,000	\$0	-\$3,000	-\$6,000
700	0.21	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$25,000	\$22,000	\$19,000	\$16,000	\$13,000	\$10,000	\$7,000	\$4,000	\$1,000
800	0.29	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$29,000	\$26,000	\$23,000	\$20,000	\$17,000	\$14,000	\$11,000	\$8,000
900	0.19	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,000	\$33,000	\$30,000	\$27,000	\$24,000	\$21,000	\$18,000	\$15,000
1,000	0.10	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,000	\$40,000	\$37,000	\$34,000	\$31,000	\$28,000	\$25,000	\$22,000
1,100	0.06	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,000	\$40,000	\$44,000	\$41,000	\$38,000	\$35,000	\$32,000	\$29,000
1,200	0.02	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,000	\$40,000	\$44,000	\$48,000	\$45,000	\$42,000	\$39,000	\$36,000
1,300	0.00	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,000	\$40,000	\$44,000	\$48,000	\$52,000	\$49,000	\$46,000	\$43,000
Expec	ted Profit:	\$8,000	\$12,000	\$16,000	\$20,000	\$23,731	\$26,788	\$28,365	\$27,923	\$26,135	\$23,673	\$20,808	\$17,808	\$14,808	\$11,808	\$8,808
Maximu	m Profit:							1								

	Suppli	er:															
		Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
- [	Demand	Prob															
=	400	0.00	\$22,000	\$33,000	\$44,000	\$43,000	\$42,000	\$41,000	\$40,000	\$39,000	\$38,000	\$37,000	\$36,000	\$35,000	\$34,000	\$33,000	\$32,000
	500	0.04	\$22,000	\$33,000	\$44,000	\$55,000	\$54,000	\$53,000	\$52,000	\$51,000	\$50,000	\$49,000	\$48,000	\$47,000	\$46,000	\$45,000	\$44,000
	600	0.10	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$65,000	\$64,000	\$63,000	\$62,000	\$61,000	\$60,000	\$59,000	\$58,000	\$57,000	\$56,000
	700	0.21	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$76,000	\$75,000	\$74,000	\$73,000	\$72,000	\$71,000	\$70,000	\$69,000	\$68,000
	800	0.29	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$88,000	\$87,000	\$86,000	\$85,000	\$84,000	\$83,000	\$82,000	\$81,000	\$80,000
	900	0.19	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$88,000	\$99,000	\$98,000	\$97,000	\$96,000	\$95,000	\$94,000	\$93,000	\$92,000
	1,000	0.10	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$88,000	\$99,000	\$110,000	\$109,000	\$108,000	\$107,000	\$106,000	\$105,000	\$104,000
	1,100	0.06	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$88,000	\$99,000	\$110,000	\$121,000	\$120,000	\$119,000	\$118,000	\$117,000	\$116,000
	1,200	0.02	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$88,000	\$99,000	\$110,000	\$121,000	\$132,000	\$131,000	\$130,000	\$129,000	\$128,000
	1,300	0.00	\$22,000	\$33,000	\$44,000	\$55,000	\$66,000	\$77,000	\$88,000	\$99,000	\$110,000	\$121,000	\$132,000	\$143,000	\$142,000	\$141,000	\$140,000
E	Expect	ed Profit:	\$22,000	\$33,000	\$44,000	\$55,000	\$65,538	\$74,923	\$81,769	\$85,154	\$86,231	\$86,154	\$85,385	\$84,385	\$83,385	\$82,385	\$81,385
N	<i>A</i> aximun	n Profit:									!!!						
	Fotal F	Profit:	\$30,000	\$45,000	\$60,000	\$75,000	\$89,269	\$101,712	\$110,135	\$113,077	\$112,365	\$109,827	\$106,192	\$102,192	\$98,192	\$94,192	\$90,192
1	Maxim	um Profit															

R= \$200 W= \$40 C= \$50 S= \$10 p= 0.40

## **Revenue Sharing**

(C

Retail	er:															
	Order:	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
Demand	Prob															
400	0.00	\$8,000	\$12,000	\$16,000	\$13,000	\$10,000	\$7,000	\$4,000	\$1,000	-\$2,000	-\$5,000	-\$8,000	-\$11,000	-\$14,000	-\$17,000	-\$20,000
500	0.04	\$8,000	\$12,000	\$16,000	\$20,000	\$17,000	\$14,000	\$11,000	\$8,000	\$5,000	\$2,000	-\$1,000	-\$4,000	-\$7,000	-\$10,000	-\$13,000
600	0.10	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$21,000	\$18,000	\$15,000	\$12,000	\$9,000	\$6,000	\$3,000	\$0	-\$3,000	-\$6,000
700	0.21	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$25,000	¢22,000	\$19,000	\$16,000	\$13,000	\$10,000	\$7,000	\$4,000	\$1,000
800	0.29	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000		\$26,000	\$23,000	\$20,000	\$17,000	\$14,000	\$11,000	\$8,000
900	0.19	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,		\$30,000	\$27,000	\$24,000	\$21,000	\$18,000	\$15,000
1,000	0.10	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	\$36,000		1000	\$34,000	\$31,000	\$28,000	\$25,000	\$22,000
1,100	0.06	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$28,000	\$32,000	<b>*</b> ***	<b>_</b>		0.11.000	<b>^</b> ^^	<b>*</b> • <b>5</b> •••	<b>*</b> ***	<b>000 00</b> 0
1,200	0.02	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000	\$2	\$32,000	000	ord	orod	and	600	dom	anda	
1,300	0.00	\$8,000	\$12,000	\$16,000	\$20,000	\$24,000		\$32,000	000	UIU	ereu	anu	000	uem	anue	
Expect	ted Profit:	\$8,000	\$12,000	\$16,000	\$20,000	\$23		\$28,365	Drof		200	200	n /	600xt		3
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Pro	fit=8	00%	200%	0.4-8	300?	\$40=	\$32	,000	900	£38.000	£27.000	1200	1300 ¢25.000	1400 \$24,000	1500	1600
Pro	fit=8	00%:	2003	0.4-8	300?	\$40=	\$32	,000	39,000	\$38,000	\$37,000	\$36,000	\$35,000 \$47,000	\$34,000 \$46,000	1500 \$33,000 \$45,000	1600 \$32,000 \$44,000
Pro	fit=80	00 <b>%</b>	2003 \$35,000	<b>).4-8</b>	300? S	\$40= \$94,000	\$32	,000 ,02,000	39,000 \$51,000	\$38,000 \$50,000 \$62,000	\$37,000 \$49,000 \$61,000	\$36,000 \$48,000 \$60,000	\$35,000 \$47,000	\$34,000 \$46,000 \$58,000	1500 \$33,000 \$45,000 \$57,000	\$32,000 \$44,000
Pro 500 600 700	fit=80	<b>00?\$</b> 2 \$22,000 \$22,000	2003 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000	300? S	\$40= \$54,000 \$66,000	\$32 \$55,000 \$65,000	, 000 \$52,000 \$64,000 \$76,000	\$39,000 \$51,000 \$63,000 \$75,000	\$38,000 \$50,000 \$62,000 \$74,000	\$37,000 \$49,000 \$61,000 \$72,000	\$36,000 \$48,000 \$60,000 \$72,000	\$35,000 \$47,000 \$59,000	\$34,000 \$46,000 \$58,000 \$70,000	\$33,000 \$45,000 \$57,000	\$32,000 \$44,000 \$56,000
Pro 600 700	fit=80 0.04 0.10 0.21 0.29	<b>90%</b> \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000	\$40= \$66,000 \$66,000	\$32 \$53,000 \$65,000 \$77,000	, 000 \$52,000 \$64,000 \$76,000	900 339,000 \$51,000 \$63,000 \$75,000	\$38,000 \$50,000 \$62,000 \$74,000	\$37,000 \$49,000 \$61,000 \$73,000	\$36,000 \$48,000 \$60,000 \$72,000	\$35,000 \$47,000 \$59,000 \$71,000	1400 \$34,000 \$46,000 \$58,000 \$70,000 \$82,000	1500 \$33,000 \$45,000 \$57,000 \$69,000 \$21,000	\$32,000 \$44,000 \$56,000 \$68,000
Pro 600 700 800	fit = 80	<b>90</b> 25,000 \$22,000 \$22,000 \$22,000 \$22,000	2007 \$33,000 \$33,000 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000 \$44,000 \$44,000	\$55,000 \$55,000 \$55,000 \$55,000	\$40= \$66,000 \$66,000 \$66,000 \$66,000	\$53,000 \$65,000 \$77,000 \$77,000 \$77,000	, 000 \$52,000 \$64,000 \$76,000 \$88,000 \$88,000	900 339,000 \$51,000 \$63,000 \$75,000	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000	1300 \$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000	1400 \$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000	1500 \$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$33,000	1600 \$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000
Pro 500 600 700 800 900 1.000	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10	<b>322,000</b> \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40= \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$33,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000	, 000 \$52,000 \$64,000 \$76,000 \$88,000 \$88,000 \$88,000	900 339,000 \$51,000 \$63,000 \$75,000 \$99, \$99,000	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000	1400 \$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000	1500 \$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000
Pro 600 700 800 900 1,000	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06	<b>00</b> ?\$2 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, 000 \$52,000 \$64,000 \$76,000 \$88,000 \$88,000 \$88,000	\$00 \$39,000 \$51,000 \$63,000 \$75,000 \$99, \$99,000 \$00,000	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 20	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 \$97,000	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$110,000	1400 \$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000	1500 \$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000 \$105,000	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$116,000
Pro 500 600 700 800 900 1,000 1,100 1,200	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02	<b>00</b> 252,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40 = \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, OOO \$52,000 \$64,000 \$76,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000	\$00 \$39,000 \$51,000 \$63,000 \$75,000 \$99, \$99,000 \$00,000	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 000	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$20,000	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000	1400 \$34,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000	1500 \$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000 \$105,000	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000
Pro 500 600 700 800 900 1,000 1,100 1,200 1,300	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02 0.00	<b>00</b> 252,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>).4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40 = \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, OOO \$64,000 \$76,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000	\$00 \$39,000 \$51,000 \$63,000 \$75,000 \$99, \$99,000 \$00,000 <b>800,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 \$97,000 \$900	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$108,000	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$110,000	1400 \$34,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000	1500 \$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000 \$105,000 \$117,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$116,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02 0.00 red Profit:	<b>322,000</b> \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>).4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40 = \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, OOO \$64,000 \$76,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000	\$00 \$39,000 \$51,000 \$63,000 \$75,000 \$99, \$99,000 \$00,000 <b>800,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 900 ered	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 and	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$107,000 \$110,000	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 <b>Clem</b>	\$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000 \$105,000 \$117,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$114,000 \$114,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300 Expect	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02 0.00 ted Profit:	<b>00</b> 252,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>).4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, OOO \$64,000 \$76,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000	\$00 \$39,000 \$51,000 \$63,000 \$75,000 \$99,000 \$99,000 \$99,000 <b>8000</b> <b>8000</b> <b>Prof</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000 \$74,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 \$97,000 \$97,000 \$97,000 \$97,000 \$97,000 \$97,000	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$0000 <b>and</b> \$40-	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$110,000 \$110,000 \$110,000 \$5,000 \$5,000 \$5,000	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 \$118,000	\$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000 \$105,000 \$147,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$116,000 \$116,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300 Expect	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02 0.00 ted Profit:	00252 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000 \$22,000	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>).4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40 = \$54,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, OOO \$64,000 \$76,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000 \$88,000	339,000 \$51,000 \$63,000 \$75,000 \$99,000 \$99,000 \$99,000 <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000 \$86,000 \$77,000 \$86,000	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 000 <b>ered</b>	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$108,000 <b>and</b> \$40-	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$107,000 \$140,000 \$440,000 \$500 \$500	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 \$118,000 \$118,000 \$148,000 \$148,000 \$148,000 \$148,000 \$148,000 \$148,000 \$140,000 \$100,000\$	\$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$93,000 \$105,000 \$147,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$114,000 \$114,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300 Expect	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02 0.00 ted Profit: 00 orc	00252 \$22,000 \$20,000 \$20,000 \$20,000 \$20,000 \$20,000 \$20,000 \$20,0	2003 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000 \$33,000	<b>D.4-8</b> \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 \$44,000 <b>\$44,000</b>	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40= \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000	, OOO \$64,000 \$76,000 \$88,000 \$80,000	339,000 \$51,000 \$63,000 \$75,000 \$99,000 \$99,000 \$99,000 <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000 <b>Ord</b> <b>fit = 8</b>	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 000 <b>ered</b> 00 ?(\$	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$108,000 \$90,000 <b>and</b> \$40- 200°	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$107,000 \$107,000 \$410,000 \$410,000 \$5,0000\$5,000 \$5,0000\$5,000\$5,0000\$5,0000\$5,0000\$5,0000\$	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 \$118,000 \$149,000 \$149,000 \$149,000 \$149,000 \$149,000 \$149,000 \$149,000 \$149,000 \$140,000\$100,000\$100,000\$100,000\$100,000\$100,000\$100,0	\$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$105,000 \$105,000 \$147,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$114,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300 Expect	fit = 8 0.04 0.10 0.21 0.29 0.19 0.10 0.00 0.02 0.00 ted Profit: 0 orc	00252 \$22,000 \$20,000 \$20,0	2003 \$33,000 \$30,000 \$30,000 \$30,000 \$30,000 \$30,00	0.4-8 \$44,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,0	\$00? \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000 \$55,000	\$40= \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$74,923	, OOO \$64,000 \$76,000 \$88,000 \$80,000	339,000 \$51,000 \$63,000 \$75,000 \$99,000 \$99,000 \$99,000 <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000 <b>Ord</b> <b>fit = 8</b>	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 000 <b>ered</b> 00?(\$	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$90,000 <b>and</b> \$40- 2000	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$107,000 \$107,000 \$107,000 \$5,000\$5,000 \$5,0000 \$5,0000 \$5,0000 \$5,0000 \$5,0000 \$5,0000 \$5,0000\$5,0000\$5,0000\$5,0000\$5,0000\$5,0000\$5,0000\$5,000\$5,000\$5,0000\$5,0000\$5,0000\$5,0000\$5,000\$5,0000\$5,0000\$5,000\$	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 \$118,000 \$148,000 \$148,000 \$148,000 \$148,000 \$148,000 \$148,000 \$148,000 \$140,000\$100,000\$100\$100\$100\$100\$100\$100\$10	\$33,000 \$45,000 \$57,000 \$69,000 \$81,000 \$105,000 \$105,000 \$147,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$68,000 \$80,000 \$92,000 \$104,000 \$104,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300 Expect 80 Pr	fit=8 0.04 0.10 0.21 0.29 0.19 0.10 0.00 0.02 0.00 ted Profit: 0 orc ofit=6	00252 \$22,000 \$20,000 \$20,0	2003 \$33,000 \$30,000 \$30,000 \$30,000 \$30,000 \$30,000 \$30,00	0.4-8 \$44,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,000 \$40,0	300? \$ \$55,000 \$5,	\$40= \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$74,923	, OOO \$64,000 \$76,000 \$88,000 \$80,000	339,000 \$51,000 \$63,000 \$75,000 \$99,000 \$99,000 \$99,000 <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000 <b>Ord</b> ( <b>fit = 8</b>	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 000 <b>ered</b> 000?(\$	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$90,000 and \$40- 2005	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$107,000 \$107,000 \$5000 \$500) \$500) \$0.6=	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 <b>dem</b> + <b>\$64</b> ,	\$33,000 \$45,000 \$57,000 \$81,000 \$105,000 \$117,000 \$147,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$88,000 \$92,000 \$104,000 \$116,000
Pro 600 700 800 900 1,000 1,100 1,200 1,300 Expect 80 Pr	fit = 80 0.04 0.10 0.21 0.29 0.19 0.10 0.06 0.02 0.00 ted Profit: 00 ord	00252 \$22,000 \$20,000 \$20,0	2003 \$33,000 \$30,000 \$30,000 \$30,000 \$30,000 \$30,000 \$30,00	0.4-8 \$44,000 \$40,000 \$40,0	300? \$55,000 \$55,00	\$40= \$54,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000 \$66,000	\$3,000 \$65,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$77,000 \$74,923	, OOO \$64,000 \$76,000 \$88,000 \$80,000	339,000 \$51,000 \$63,000 \$75,000 \$99,000 \$99,000 <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$99,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b> <b>\$90,000</b>	\$38,000 \$50,000 \$62,000 \$74,000 \$86,000 \$86,000 <b>Ord</b> ( <b>Fit = 8</b> 6	\$37,000 \$49,000 \$61,000 \$73,000 \$85,000 \$97,000 000 <b>ered</b> 000?(\$	\$36,000 \$48,000 \$60,000 \$72,000 \$84,000 \$96,000 \$108,000 \$108,000 \$108,000 \$90,000 \$108,000 \$90,000 \$400- 2000	\$35,000 \$47,000 \$59,000 \$71,000 \$83,000 \$95,000 \$107,000 \$107,000 \$100,000 \$55,000 \$500 \$500 \$500 \$0.6=	\$34,000 \$46,000 \$58,000 \$70,000 \$82,000 \$94,000 \$106,000 \$118,000 <b>dem</b> + <b>\$64</b> ,	\$33,000 \$45,000 \$57,000 \$81,000 \$93,000 \$105,000 \$147,000 <b>ande</b>	\$32,000 \$44,000 \$56,000 \$88,000 \$92,000 \$104,000 \$104,000

# Expected Profit with Revenue Sharing



R= \$200

\$40

\$50

\$10

0.40

W =

C =

S=

D =

# **Optimal Revenue Share**

$$Q_{R}^{*}$$
 ?  $F^{?1} \frac{?}{?} \frac{p?R?W}{p?R?S} \frac{?}{?}$ 

$$\frac{? p?R?W}{? p?R?S}, \frac{?}{?}, \frac{?R?C}{?R?S}, \frac{?}{?R?S}, \frac{?R?C}{?R?S}, \frac{?}{?R?S}, \frac{?}{?R}, \frac{$$

p?W?
$$\frac{(R?C)}{R?(C?S)}$$
? $\frac{S?(R?C)}{R?(C?S)}$ 

# Coordination with Rev. Sharing



# Revenue Sharing (Normal Approx)



(c) Yossi Sheffi, MIT

R= \$200

\$40

\$50

\$10

0.76

W =

C =

S =

n =

## Summary

- Wholesale contracts give too much risk and not enough expected reward to the retailer
- To make the retailer order more (and increase the channel's profit) the supplier has to take on part of the risk
- Kisk sharing mechanisms covered include:
  - Buybacks; revenue sharing
- < Other mechanisms
  - Options contracts
  - Quantity-flexibility (refund on a portion of the unsold units)
  - Sales-rebate (rebate on unsold units above a threshold)
  - ✓ There are many other mechanisms
- Each mechanism can coordinate the channel with various allocations of the profit between the retailer and the supplier.

