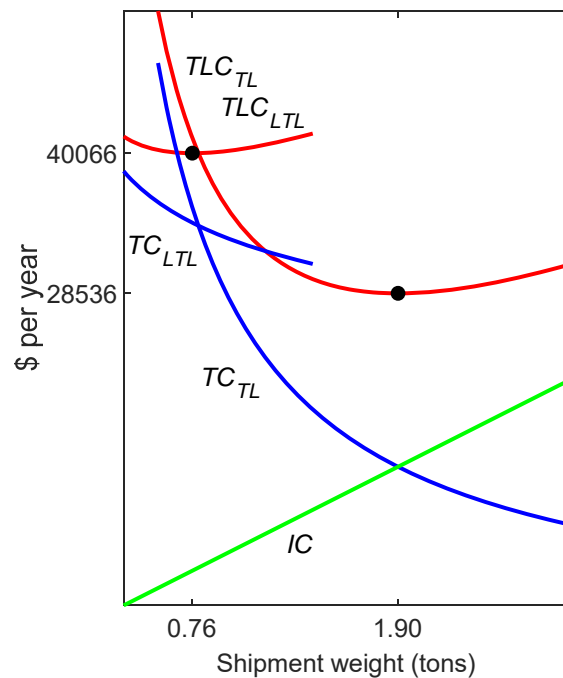
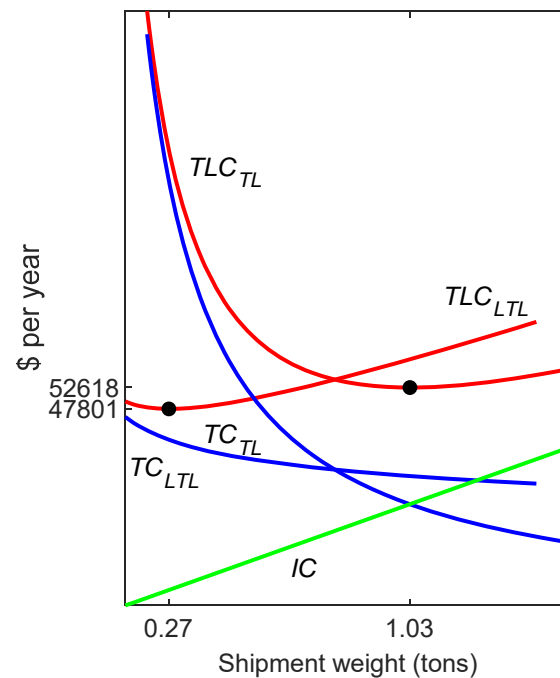


Truck Shipment Example: Periodic

19. If the value of the product increased to \$85,000 per ton, should the product be shipped TL or LTL?



(a) \$25000 value per ton

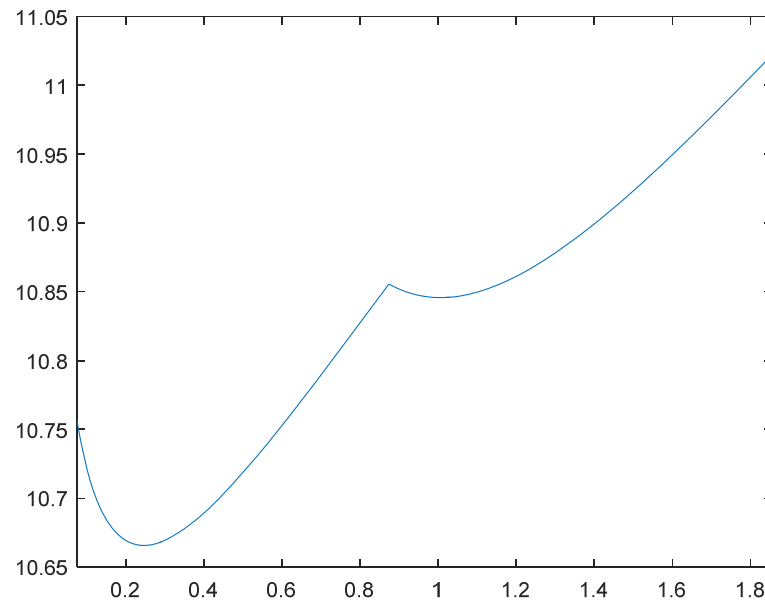
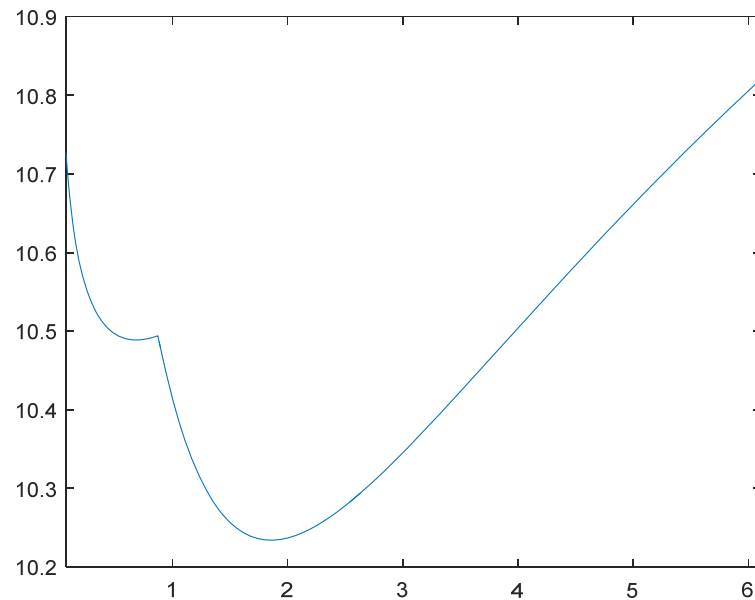


(b) \$85000 value per ton

Truck Shipment Example: Periodic

- Better to pick from separate optimal TL and LTL because independent charge has two local minima:

$$q_0^* = \arg \min_q \{TLC_{TL}(q), TLC_{LTL}(q)\} \quad q_0^* \stackrel{!}{=} \arg \min_q \left\{ \frac{f}{q} c_0(q) + \alpha v h q \right\}$$



Truck Shipment Example: Periodic

20. What is optimal independent shipment size to ship 80 tons per year of a Class 60 product valued at \$5000 per ton between Raleigh and Gainesville?

$$s = 32.16 \text{ lb/ft}^3$$

$$q_0^* = \arg \min_q \{TLC_{TL}(q), TLC_{LTL}(q)\} = 8.5079 \text{ ton}$$

$$TLC_{TL}(q_0^*) = \$25,523.60 / \text{yr} < TLC_{LTL}(q_0^*)$$

Truck Shipment Example: Periodic

21. What is the optimal shipment size if both shipments will always be shipped together on the same truck (with same shipment interval)?

$$d_1 = d_2, \quad h_1 = h_2, \quad \alpha_1 = \alpha_2$$

$$f_{\text{agg}} = f_1 + f_2 = 20 + 80 = 100 \text{ ton}$$

$$s_{\text{agg}} = \frac{(\text{aggregate weight, in lb})}{(\text{aggregate cube, in ft}^3)} = \frac{f_{\text{agg}}}{\frac{f_1}{s_1} + \frac{f_2}{s_2}} = \frac{100}{\frac{20}{4.44} + \frac{80}{32.16}} = 14.31 \text{ lb/ft}^3$$

$$v_{\text{agg}} = \frac{f_1}{f_{\text{agg}}} v_1 + \frac{f_2}{f_{\text{agg}}} v_2 = \frac{20}{100} 85,000 + \frac{80}{100} 5000 = \$21,000 / \text{ton}$$

$$q_{TL}^* = \sqrt{\frac{f_{\text{agg}} r d}{\alpha v_{\text{agg}} h}} = \sqrt{\frac{100(2.5511)532}{(1)21000(0.3)}} = 4.6414 \text{ ton}$$

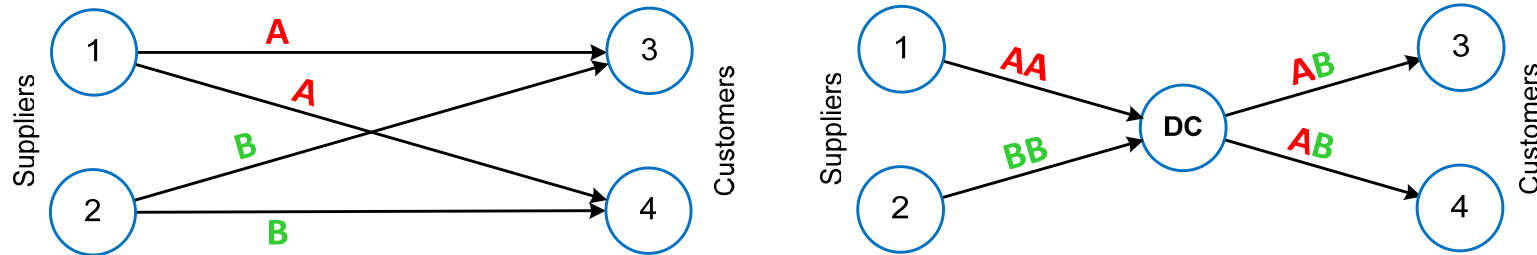
Truck Shipment Example: Periodic

- Summary of results:

	:	f	s	v	q _{max}	TLC	q	t
	-----:							
1:		20	4.44	85,000	6.11	47,801.01	0.27	5.00
2:		80	32.16	5,000	25.00	25,523.60	8.51	38.84
1+2:						73,324.60		
Aggregate:		100	14.31	21,000	19.68	58,481.90	4.64	16.95

Transshipment

- *Direct*: P2P shipments from Suppliers to Customers



- *Transshipment*: use DC to consolidate outbound shipments
 - *Uncoordinated*: determine separately each optimal inbound and outbound shipment \Rightarrow hold inventory at DC
 - *Cross-dock*: use single shipment interval for all inbound and outbound shipments \Rightarrow no inventory at DC

Uncoordinated Inventory

- Average pipeline inventory level at DC:

$$\alpha = \alpha_O + \alpha_D$$

$$= \begin{cases} \alpha_O + \frac{1}{2}, & \text{inbound} \\ 0 + \alpha_D, & \text{outbound} \end{cases}$$

