



Cost-Differential Frontier (CDF) Tool
Distant suppliers may offer a unit cost that is up to 30% lower than that of a local producer, while requiring that the order be placed far in advance of the demand season. The choice between a distant or local supplier thus often comes down to how much is known about demand when the order has to be placed. What is the monetary value of being able to postpone finalizing an order until demand is known?

Setting the order quantity in the face of uncertain demand results in mismatch risk. Ordering an insufficient quantity results in lost sales and disgruntled customers. If demand turns out to be less than what was ordered, inventories increase and it may be necessary to sell products at a discount.

Lead Time

Lead time t varies from 0 (make-to-order production; order placed with full knowledge of demand) to 1 (make-to-stock production; longest lead time). Longest lead time equals $t = 1$: if the full lead time is 100 days, represented as $t = 1$, a relative time of 30 days is represented as $t = 0.3$.

Zero Lead Time

The company knows the exact level of its customer demand and is able to produce exactly the quantity demanded.

Mismatch Costs

Costs from overstocking or stockouts.

Overstocking and Stockouts

Ordering too many, or too few, products due to an over- or underestimation of customer demand.

Residual or Salvage Value

Is based on the unit cost paid when acquiring the item, which is then reduced by inventory holding cost, obsolescence risk, and liquidation losses.

Demand Volatility

Expresses how much noisier the demand forecast becomes as lead time increases and is calibrated using a relative lead time of 1. For example, an 85% volatility for the full lead time drops to $85\% \times \sqrt{.2} = 38\%$ if lead time is reduced to $t = 0.2$.

Quick Start Guide

Cost-Differential Frontier Tool

Quickly access the Cost-Differential Frontier (CDF) tool at <http://cdf-oplab.unil.ch/> to calculate the per-unit cost reduction required to compensate for the stockouts and excess inventories that result from having to place an order before knowing demand which is the case when ordering from distant suppliers.

Sample Problem:

A Swiss company is sourcing a product from a distant supplier that requires that the order be placed 100 days before demand is known. The unit cost offered by the distant supplier is 22% cheaper than the local supplier.

Price per unit sold:	CHF 100
Swiss unit cost (make-to-order cost):	CHF 60
Offshore unit cost (make-to-stock cost):	CHF 47
Demand volatility:	85%
Residual value:	CHF 40

The CDF analysis (green curve) shows that the unit cost offered by the distant supplier must be 23% cheaper than a local supplier that is able to produce to order once demand is known just to compensate for having to place the order when in possession of only relatively poor demand information. The apparently compelling offshore unit cost does not cover the demand volatility exposure. The value of the responsiveness made possible by producing locally is likely to offset offshore cost advantages, such as low wage rates, when demand volatility is high and the unit loses value if not sold during the initial demand period.

As residual value increases, the mismatch cost decreases (orange curve). Here, the residual value is CHF 48 and the required cost differential for the full lead time is only 15%, showing that the mismatch cost alone is less than the 22% cost differential offered by the distant supplier. The Total Cost of Ownership (TCO) tool made available by the US Reshoring Initiative <http://www.reshorennow.org/> alerts to an additional CHF 6 in costs such as extra packaging, duties, and insurance required because of the extended supply chain, raising the offshore unit cost from CHF 47 to CHF 53 and low-ering the cost differential from 22% to 11%. The CDF and TCO tools thus combine to provide a compelling case for the value of responsive local production.