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How Will Higher Fuel Costs Impact the U.S. Warehouse/Distribution Markets?

By Leonard Sahling

The recent trend toward higher oil prices — and greater price volatility — is spurring global companies to reevaluate their supply chains and distribution networks in a quest to find offsetting cost savings. Many analysts are predicting that companies will respond to the higher fuel prices by expanding their distribution networks to include additional distribution facilities in order to reduce the overall distances between these facilities and customer destinations. They're surely correct in principle, but it remains to be seen how big the impact will be.

At present, companies no doubt are drawing up contingency plans for how to tweak their networks under alternative assumptions about oil prices — but they have postponed implementation until (a) the outlook for oil prices becomes clearer and (b) the economic recovery has gained better traction. To date, none of our customers has come to us requesting major changes in their networks owing to higher fuel prices. What we are hearing from them is that they're planning to maintain their existing supply chains as-is for a while, and to operate them at higher rates of capacity utilization than they have in the past. In any event, companies are unlikely to implement whatever expansion plans they do have for their distribution networks until the economic recovery has shifted into higher gear.

Oil Prices

Most analysts and businesspeople expect oil prices to trend upwards in coming years — but are unsure whether these prices will be higher or lower in six months from where they are today. Crude oil is trading today in the spot market at about $70-to-75 a barrel and has ranged from $30-to-145 a barrel during the past two years. (As of June 10, 2010, the futures prices of crude oil closed at $79.57 for December 2010 and at $83.26 for December 2011.) Similarly, No. 2 diesel fuel retails today for about $3.09 a gallon, on average nationwide. And during the past two years, diesel fuel retail prices have fluctuated between $2.00-to-4.75 a gallon.

Insofar as the price of crude oil does trend upwards in coming months, so will the retail prices of gasoline and diesel fuel. Based on historical patterns, every $10 hike in the price of crude oil tends to result in about a $0.25 increase in the price of a gallon of No. 2 diesel fuel.[1] As of June 2010, crude oil was trading at about $70 a barrel. Hence, if the price of crude oil were to climb to $100, $150, or $200 a barrel, the retail price of diesel fuel would rise correspondingly from $3.09 a gallon to about $3.84, $5.09, or $6.34 a gallon.

The Era of Cheap Oil — Fun While It Lasted

Supply chain practitioners regard current oil and fuel prices as being especially high and volatile by comparison with how they behaved in past years. *(See Exhibit 1.)* Adjusted for inflation, constant-dollar oil prices hovered within the narrow range of $20-to-30 a barrel from early 1986 until fall 2003. One analyst has characterized this period as the Era of Cheap Oil.[2]

The Era of Cheap Oil overlapped with the coming of age of the modern logistics/supply chain industry. From the mid-1980s onward, companies began to streamline their distribution networks or supply chains. Their goals were (and still are) to cut operating costs, improve customer service, and sharpen their competitive edge. Toward these ends, they have developed, refined, and implemented sophisticated network modeling tools designed to determine the optimal number, placement, size, and physical attributes of the distribution facilities needed to fulfill their customer service requirements — all provided at the lowest possible operating cost.

In all optimization exercises, tradeoffs are ubiquitous. In the optimization of distribution networks, one of the most important tradeoffs is between inventory-carrying costs and freight-transportation costs. Companies generally find that they can reduce inventories and the associated carrying costs by reducing the number of facilities in their network. However, these reductions in inventories are achieved at the expense of increasing the overall number of freight transportation-miles involved in delivering goods to their final destinations.

The price of diesel fuel is a key variable in this exercise. In general, the lower the cost of fuel, the fewer the optimal number of facilities within distribution networks, but the greater the total number of freight-transportation miles. During the Era of Cheap Oil, companies typically optimized their distribution networks under the assumption that the constant-dollar price of oil would hover around $30-to-35 a barrel. But now that the Era of Cheap Oil has ended, companies are left with what has been described aptly as "inventory-efficient but energy-inefficient supply chains."

Oil today is trading at about $70-to-75 a barrel, and the consensus forecast among businesspeople is that it will trend higher in coming years. Hence, in years to come as companies re-optimize their distribution networks, today's (and tomorrow's) higher oil prices should provide an incentive for them to add extra distribution facilities to their networks in order to reduce the total number and cost of freight-transportation miles-traveled needed to deliver the goods to their final destinations. Hence, in theory, the demand for distribution space should grow faster than it otherwise would, owing to the recent run-up in oil and fuel price. Just how big this effect will be, however, remains to be seen.

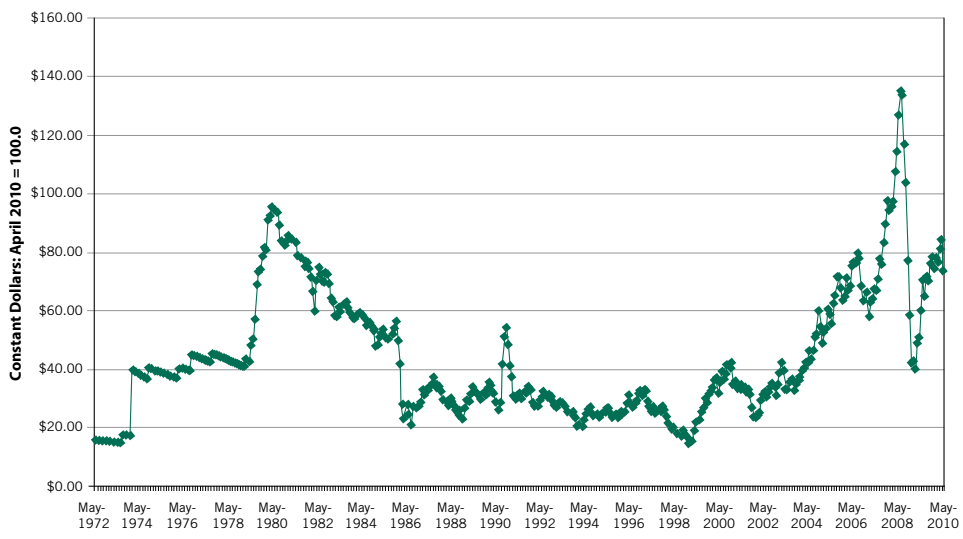
Network Re-configurations

As the economic recovery gains traction and the outlook for oil prices crystallizes, it will be the large national and multinational enterprises that are most likely to revise their distribution networks, not the local players. These companies have been the prime movers in ushering in the new age of the modern logistics/supply chain industry.

In the face of intense competitive pressures, most large North American companies have already optimized and revamped their distribution networks at least once during the past 25 years, resulting in substantial reductions in the number of distribution centers (DCs) used to service the U.S. market. Meanwhile, the U.S. economy has continued to grow, and so have companies' overall needs for distribution space, even as the new DCs used in these newly optimized networks have been re-designed with larger "footprints" and greater cubic space. On balance, during the past 25 years, the overall vacancy rate for the U.S. warehouse/distribution market has exhibited sharp cyclical swings but trended neither upward nor downward, even as the total inventory in-place has continued to grow vigorously. *(See Exhibit 2.)*

Freight transportation has always accounted for the lion's share of logistics costs (50% or more, historically, and rising), and companies often have used network-optimization exercises as a means for curbing the growth of their transportation costs — or sometimes, for shrinking them. By reducing the number of DCs and placing them in strategic locations, companies are able to ship more freight via full truckloads (TLs) and less via less-than-truckloads (LTLs) — at substantial cost savings inasmuch as LTL freight rates are typically 3-to-4 times costlier than TL rates. Plus, in relying more

Exhibit 1: Crude Oil Price, Inflation-Adjusted 1972-2010
Price per Barrel, West Texas Intermediate



Source: Wall Street Journal and Bureau of Economic Analysis.

heavily on TL shipments, truck fleets end up traveling fewer freight-miles and consuming less fuel. For example, when Kimberly Clark reduced its network a few years ago from 70 DCs to nine, its fuel consumption reportedly fell by 473,000 gallons a year. Such cost savings as these have been the driving force behind the tidal wave of network consolidations during the past 15-to-20 years.

Companies must not go overboard, however, in reducing the number of DCs from their networks. Kimberly Clark, for example, shrank the number of DCs within its network to nine — not to one. Here's the reason why: the fewer facilities used to service a given geographic market, the larger the territory that each facility must serve, the longer the average distance of the "final leg" between the facilities and the final destinations, and, thus, the greater the total number of outbound freight-miles needed to deliver the goods into the hands of the final customers. In short, fewer facilities within the network result in higher outbound transportation costs. Hence, companies like Kimberly Clark find that as they reduce the number of DCs, they reach a point where the resulting incremental increases in outbound transportation costs simply outweigh the efficiencies connected with operating fewer DCs. And of course, as the cost of outbound transportation gets more expensive, companies will want to shorten the average distance of the final leg between the facilities and the final destinations — requiring them to add new facilities to their networks.

Experts familiar with network modeling tools agree that network re-optimizations in response to higher fuel prices seldom result in major, large-scale revisions to these previously optimized networks.[3] Rather, the new optimal solutions usually involve only minor tweaks such as either adding one or two DCs to their networks or repositioning one or two DCs to different cities. The new optimal locations identified for these new DCs will vary from company to company, even within the same industry, and will depend on such considerations as sourcing, location of the customer base, cost of carrying inventory, and transportation costs.

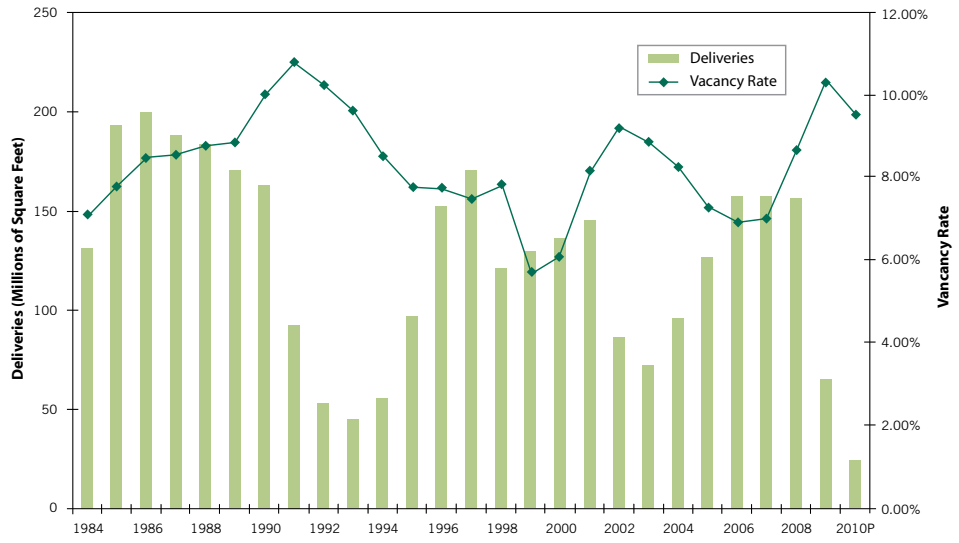
In many cases, companies will opt not to adjust their distribution networks at all. When companies add DCs to their distribution networks, they succeed in shortening the average distance traveled by outbound shipments to final destinations — thereby economizing on freight-miles and fuel consumption. However, these "efficiencies" are obtained at the expense of higher operating costs. Additional personnel must be hired to staff the new facilities, and each new facility entails additional occupancy costs for leasing, utilities, maintenance, and local property taxes.

Even more importantly, as more DCs are added to networks, companies will also end up with larger aggregate inventories. The larger the number of DCs, the smaller the geographic region served by each one, the less often will the Law of Large Numbers succeed in smoothing out random fluctuations in demand, and the larger the safety stock that each one must carry to avoid stock-outs. Some companies will conclude that the transportation cost savings from adding DCs to the network will be more than offset by the higher operating expenses for the additional DCs and from having to carry larger aggregate inventories.

Freight-pooling Hubs

With freight rates climbing, transportation managers have gone back to the drawing boards to analyze product flows

Exhibit 2: U.S. Bulk Warehouse/Distribution Market
31 Major Markets



P: Projections.
Source: ProLogis.

from every origin to every destination. They're searching for ways to aggregate product so that it can be moved in full containers or full truckloads, and they're examining both purchasing and demand patterns.

In many cases, they're finding that the best way to build full container loads and full truckloads is to add another "link" into their supply chains. Adding new links to the supply chain, however, would appear to be antithetical to the industry's long-standing quest for simpler, more compact, and more efficient supply chains. For years, companies have dedicated themselves to streamlining their supply chains — removing redundant, extraneous links; consolidating their distribution networks; and increasing inventory turns.

But these new links are not DCs *per se*, but rather freight-pooling hubs. There are several different types. (1) Cross-dock facilities, for example, are used to collect shipments from several different origins. Inventory is staged at these facilities usually for only 1-to-2 days, or sometimes even less than a day, and then shipped as full outbound truckloads to their next or final destinations. (2) Merge-in-transit facilities are similar to cross-docks, except that inventory may be held there for up to a week or two before being shipped as full outbound truckloads. (3) Transload facilities are usually located near ports. Inbound marine containers from various origins are brought to these facilities, where they are unloaded. The contents are sorted by destination and then shipped as full truckloads or full domestic intermodal cargo containers to the next or final destinations.

In all three cases, the justification for adding an extra link into the supply chain lies in the cost savings from full-container and full truckload transportation. As the costs of freight transportation rise, those cost savings will escalate.

Infill Locations — No Panacea

Higher fuel prices will also spur some companies to reevaluate infill locations for their DCs, even though infill land sites and the associated facility rents tend to be more expensive. In particular, the run-up in fuel prices during the past seven or eight years has shifted the tradeoff between DC lease rates and distances from city center, bolstering the competitiveness of infill sites.

Within Southern California, for example, the city of Ontario is located about 25 miles nearer to the Ports of Los Angeles and Long Beach than the city of Beaumont, and the upward trend in oil prices has enabled landlords to charge higher rents for distribution space in Ontario than for comparable space in Beaumont. Under reasonable assumptions, it turns out that each $10 increment in the price of crude oil will add roughly $0.01 per SF per month to the rent premium that a facility in Ontario will command over one in Beaumont.[4] In other words, if the price of oil were to jump to $100 a barrel from its current price of $70, supply-demand forces in the Southern California marketplace should eventually widen the rent differential between DCs in Ontario and in Beaumont by an additional $0.03 per SF per month above what it was when oil was priced at $70 a barrel.

Shippers will be hard-pressed, however, to find truly comparable distribution facilities in closer-in, infill locations. In many major cities, infill sites are scarce, and it is already extremely difficult to find large-enough infill sites to accommodate the large, modern distribution facilities designed to expedite the rapid throughput of goods — and with enough land for truck storage to facilitate the efficient movement of inbound and outbound trucks. Few companies, we believe, will be willing to forego the efficiencies and scale economies afforded by large, modern DCs in favor of the fuel-efficiencies yielded by close-in, infill locations. We suspect that most companies will continue to prefer locating their DCs in the outlying peripheral areas of big cities — e.g., the Inland Empire outside of Los Angeles and the I-80 or I-55 corridors outside Chicago — despite the longer distances and higher fuel costs.

Other Impacts

With the sharp run-up in oil and fuel prices in recent years, companies have been impelled to innovate and develop new strategies aimed at curbing their rising freight transportation and logistics costs. One such strategy, of course, involves reconfigurations of their distribution networks, as highlighted above, but this is only one of many such strategies.

Higher oil prices will also spur global North American companies to reevaluate their production sourcing networks. In general, Mexican manufacturers are likely to gain market share at the expense of their Asian rivals, and American-based manufacturers are likely to gain market share at the expense of those in Mexico and Asia. However, any manufacturing plants that are moved from overseas to the U.S. are likely to be highly automated, state-of-the-art facilities. (Higher oil prices may well spur a new round of technological innovation involving automated manufacturing processes.)

Many companies will also retool their existing production networks to economize on freight-miles and fuel consumption.

Dell Inc., for example, recently re-organized its global manufacturing network so that each plant now makes all the products required to serve its "local" market, whereas formerly each plant around the world specialized in the manufacture of a narrow selection of products.

Higher oil prices will also unleash new trends in freight transport to improve the fuel-efficiency of the nation's transportation network. Trucks will travel at slower speeds, and truck engines will be retooled to deliver better gas mileage. Companies will continue to extract greater capacity from their existing fleets and facilities by improving cube utilization of truck trailers, eliminating empty truck-runs and deadhead miles, and extending hours of operation.

Freight transport will also shift to more efficient modes of travel. Long-haul trucks will lose market share to domestic intermodal rail, and airplanes will lose market share to trucks and intermodal. Additionally, ocean shipping should gain market share from intermodal rail, because it is more fuel-efficient and cheaper on a per-container basis. Hence, shippers should continue to rely more heavily on the all-water route via the Panama Canal to transport goods to the Eastern U.S., and the East Coast ports should in turn gain market share from the West Coast ports.

Concluding Remarks

In general, companies will respond to the higher fuel prices by expanding their distribution networks to include additional DCs, but it remains to be seen just how big the impact will be. Some will tweak their networks by adding one or two DCs or relocating one or two of them in order to economize on freight-miles and fuel consumption. Some will add a cross-dock, merge-in-transit, or transload facility to their networks to facilitate the shipment of goods by full containers or full truckloads. Yet others will opt not to adjust their networks at all, preferring to search elsewhere for transportation efficiencies and cost savings. On balance, property owners will indeed benefit from the run-up in oil and fuel prices, but not until the unfolding economic recovery has shifted into higher gear.

Endnotes

[1] Professor David Simchi-Levy, "Impact of Crude Oil Volatility on Network Design," power point presentation, undated, p. 4.

[2] Larry Lapide, "Cheap Oil Is Dead — Again," Supply Chain Management Review, March-April 2010, pp, 6-7.

[3] See, for example, Dan Gilmore's interview of Professor David Simchi-Levy of MIT in his article entitled, "Oil Prices and Supply Chain Network Design," Supply Chain Digest, March 20, 2008. See also Professor Simchi-Levy's power point presentation entitled, "Impact of Crude Oil Volatility on Network Design."

[4] Here are the assumptions: (a) Every $10 increase in the price of oil results in a $0.04 per mile increase in fuel costs, where fuel costs increase $0.25 a gallon for every $10 hike in oil prices and trucks average 6 miles per gallon. (b) The distribution facility encompasses 100,000 square feet. (c) The incremental round-trip distance is 50 miles from Ontario to Beaumont. (d) Trucks make 20 trips per day on average, or 600 trips per month. Hence, the maximum rent premium reflecting the "fuel surcharge" amounts to: $0.01 per SF per month — i.e., calculated as ($0.04 x 50 x 600)/100,000 SF.

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