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Escalation Estimating: Lessons Learned in Addressing Market Demand

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Where we left off in episode one (2007 paper)

This paper continues the authors' paper from 2007 which is available from AACE International [4]. That paper was a primer on best escalation estimating best practices. It covered the following topics:

- escalation basics and principles;
- the capex and market pricing situation circa early 2007;
- escalation versus contingency;
- economists, macroeconomic forecasting and price indices;
- applying price indices to project costs;
- forecast accuracy;
- factoring in the effects of EPC capital market demand;
- using price indices to normalize historical project costs;
- escalation on contingency (and escalation risks);
- perceptions and bias (customers, business and politics); and
- putting escalation estimating/economics knowledge and tools into action.

We ask the reader to do some homework and review that paper. This paper will focus on lessons learned by the authors (working in an alliance called the Center for Cost Engineering at www.c4ce.com) in the course of implementing the best practices through customized escalation estimating tools at owner and contractor companies.

Escalation Estimating Definitions, Principles and Best Practices

Escalation can be defined as changes in price levels driven by underlying economic conditions. Escalation reflects changes in price-drivers such as productivity and technology as well as changes in market conditions such as high demand, labor shortages, profit margins, and so on. Escalation includes the effects of, but differs from, inflation which is a general change in prices caused by debasement of the value of a currency or other monetary policy impacts. Escalation also differs from contingency. While these are both "risk funds", these cost types must be estimated and managed separately.

In our 2007 paper, we encouraged cost engineers to understand these definitions and start moving towards better escalation forecasting by using best practices which we summarized as follows (with the last bullet added this year):

- get economists (or at least their input) on board;
- use probabilistic methods;
- estimate and manage escalation and contingency distinctly;
- use timely market intelligence that is specific to your industry (and address the fact that our market is capex-driven); and
- work with business on developing shared market scenarios.

The reason that the first bullet is a best practice is self-evident. Escalation is based on underlying economic principles, and the experts in that field are economists. However, given that economists don't usually understand capital projects and capex markets very well, their input merely supports the cost engineer, it does not replace them.

The second bullet recognizes that escalation estimates (like any estimate) involve uncertainty, and escalation estimates must address and convey that uncertainty (i.e., range or accuracy information) to management.

The third bullet recognizes that risks are difficult to understand, estimate, and manage. Experience has shown that when escalation and contingency get lumped together, it tends to result in confusion during project planning and poor change management during project execution.

The fourth bullet recognizes that the markets within which our projects are executed are relatively small and unique, that they are not well covered by economics literature or price index information, and that market conditions can change quickly. You cannot depend solely on a government source, magazine, website index or an inflation projection from your finance department.

The final, and new bullet, recognizes that most capital estimates are supporting business investment decisions (at least for owners). Most business decision models include forecasts of revenue and operating costs as well as capital costs. It only makes sense that the revenue, operating and capital estimates all be based on the same economic scenario. For example, if an oil producing company is assuming oil price (and revenue) will increase from $90 to $120/barrel, then the project escalation estimate should reflect that economic market scenario as well, even if the economists and press are saying oil price will drop to $70.

Lesson Learned #1: The authors have not found a company yet that was using all of the best practices in this list.

Pricing and Capex Trends, Then and Now

In early 2007, we reported on historical price trends and how estimators had responded to recent price volatility. In summary, until 2003, escalation was a nuisance to most cost engineers (i.e., "just use 3 percent per year") and it was often buried in line-item costs. In late 2003 and through 2004, process industry capex investment and prices went ballistic in those capex markets. Increases in Asian demand and limited global supply after years of under-investment were the primary causes.

Periodically in 2005 and through 2006 economists and the press reported that general pricing levels were about to level off or decline based on the assumption that asymptotic trends cannot be sustained for long (i.e., markets will correct over time). As an example of this shortsightedness, Engineering News Record magazine reported in December 2006 that "Construction's inflationary cycle turned the corner during 2006 and will continue heading downhill through 2007 and 2008". [3] Few predicted continued escalation.

However, a few economists suggested otherwise. In an April 2007 article entitled *What Spending Slowdown?* Michael Mandel (**Business Week** magazine's chief economist) suggested that we "Forget those antiquated government statistics" and look at capital spending overseas. He reported that global capex by US firms (including non-residential construction) was up 18.1 percent in the fourth quarter of 2006 over the previous year, and few economists had paid this fact any attention in their "slowdown" prophesies[5]. Similarly, Candida Scott of the Cambridge Energy Research Associates (CERA) reported in February 2007 that there will be "no relief to costs rises during 2007!"[7].

Mr. Mandel and Ms. Scott were right. The government statistics were and are failing in the current market. In a June 2007 editorial, **Engineering News Record** blamed their lousy "downhill" price forecast of just six months earlier on the costs of labor "that does not show up in statistics" (implicitly admitting that their own wage-based labor cost indices were effectively irrelevant) [8].

These articles were confirming the authors' contention that we must pay attention to and tie our price indices and escalation estimating to capital spending (i.e., the demand that drives our industry prices when put in balance with limited supply of commodities and services of all kinds). Base wage and commodity indices are not enough.

What happened to capital project prices in 2007? CERA reported in its global *Downstream Capital Cost Index* that costs through the third quarter 2007 increased 14 percent over the same period in 2006 (this new index is the first one to be published that appears to track overall process industry prices) [6]. The *Turner Constuction Building Cost Index* showed a 7.7 percent increase for the US commercial market reflecting a slower market in that sector [1].

What about capital project prices for 2008? A recent forecast for oil and gas capex in 2008 called for a global capex increase of 11 percent, while a chemical industry forecast called for a 15 percent capex increase [2,9]. Mining and metals industry capex is growing at similar rates despite using much of their new found cash for acquisitions and buy-backs. With continued limited supply of commodities and services, process industry capital project price increases should again be in the 5-15 percent range in 2008 depending on project content, size and location. Commercial projects will see lower escalation.

Lesson Learned #2: Most publications still don't "get it" when it comes to the process industries. They still are locked to the Bureau of Labor Statistics (BLS) Producer Price Indices (PPI) and similar government input measures. However, the new CERA downstream capital cost index, the Turner index and others which use market intelligence beyond government indices, are bright beacons on the horizon.

Putting Capex Indices to Work

Process plant capex (engineering, procurement, fabrication and construction) is a micro-economy in which many prices are disconnected from what the government agencies and economists track. The prices that have become disconnected are for items and services whose prices are usually based on competitive bidding (usually with very few bidders in a tight market). Economists in general have trouble surveying bid pricing, especially where the product is not a constant. The bids include risk premiums, allowance for productivity changes, and other markups that are very difficult to reliably measure or survey, but can be reasonably predicted.

The authors' approach to the market challenge is to adjust the available wage and commodity pricing indices with a *capex market adjustment factor*. For example, if capex increases in a region by a dramatic percentage in a year, then fabricators and contractors in that region will be able to increase their bid prices by a factor that is greater than the percentage increase in their underlying wages and commodities. Just how much they can raise their prices depends on their market power. The capex market adjustment factor used by the authors is a simple exponent applied to the capex increase. For example, if the underlying wages and other costs to a contractor increase by 8 percent (1.08), the market capex increases by 25 percent (1.25x), and the capex exponent (or market power) factor is 0.5, then the typical price increase in the contractor's bids is calculated as follows:

Bid price increase = $1.08 \times 1.25^{0.5} = 1.08 \times 1.12 = 1.21$ or 21 percent increase

The capex exponent or factor may vary from zero (many suppliers; just pass through costs) to 0.5 or 0.6 (few bidders). Each fabrication, contract, or other type of cost will have its own capex factor that must be determined empirically or estimated based on experience. Note that when capex decreases, this relationship predicts that contractors may not be able to pass through their cost increases (and even work at a loss).

Table 1 applies this concept with real indices. The first row (a) is an index of construction employment costs which shows construction labor costs increasing at 3 to 4 percent per year from 2003 to 2007. Using a U.S. process industry capex index (c) and a 0.5 exponent, the capex adjusted index for contracted labor is in the 6 to 11 percent range.

		2003	2004	2005	2006	2007(est)
Compensation Index	**a**	93	97	100	103	107
annual increase as a factor	b		1.04	1.03	1.03	1.04
annual increase as a %			4%	3%	3%	4%
Capex Index	**c**	107	122	129	147	168
annual increase as a factor	d		1.14	1.06	1.14	1.14
Capex market factor at **0.5**	$e=d^{0.5}$		1.07	1.03	1.07	1.07
annual increase as a %			7%	3%	7%	7%
Contractor Index	**b*e**		**1.11**	**1.06**	**1.10**	**1.11**
annual increase as a %			11%	6%	10%	11%

Table 1 – Example Application of a Capex Market Adjustment Factor to Labor Costs

Table Data Sources:

(a) Bureau of Labor Statistics (BLS) (www.bls.gov), Employment Cost Index, Construction, Series: CIU2012300000000I (B)
(c) Bureau of Economic Analysis (www.bea.gov), Table 5.3.3, Real Private Fixed Investment by Type, Quantity Indexes; for Mining, Exploration, Shafts and Wells

This example shows how a cost engineer can use two published government indices to derive a reliable proxy index for labor costs in our industry. Note that most publications such as the *Chemical Engineering Plant Cost Index* base their labor cost indices more or less directly on the BLS or similar sources (e.g., 3 to 4 percent rather than 6 to 11 percent expressed in Table 1).

The selection of indices will vary depending on the circumstances. First, the regional coverage of the selected capex index must be applicable to the regional nature of the cost. Since construction labor is regionally sourced, it is therefore driven by regional capex. Engineering and major equipment items are typically globally sourced and therefore are driven by global capex. Additionally, the capex factor (e.g., 0 to 0.5) will vary by project size. For example, small projects will likely draw more competitive bids than a mega-project and therefore the capex market factor will be lower for the small projects (say 0.1 vs. 0.5).

In the two years since the author's conceived of this method of index usage, it appears to be working well based on our own cost observations and validation by some of the authors' clients. While this actual data is proprietary, the authors have observed that the previously mentioned CERA Downstream Capital Cost Index is tracking well with the authors' observations.

Figure 1 illustrates compares how a traditional BLS-based index such as the Chemical Engineering Plant Cost Index (CHEPCI) with and without capex adjustment compares to the CERA index (shown here in annual cost factor format). As can be seen, the CERA and CHEPCI-capex-adjusted are almost the same except for 2004 which likely represents a lag in CERA as fixed price work was finished off during the first boom year.

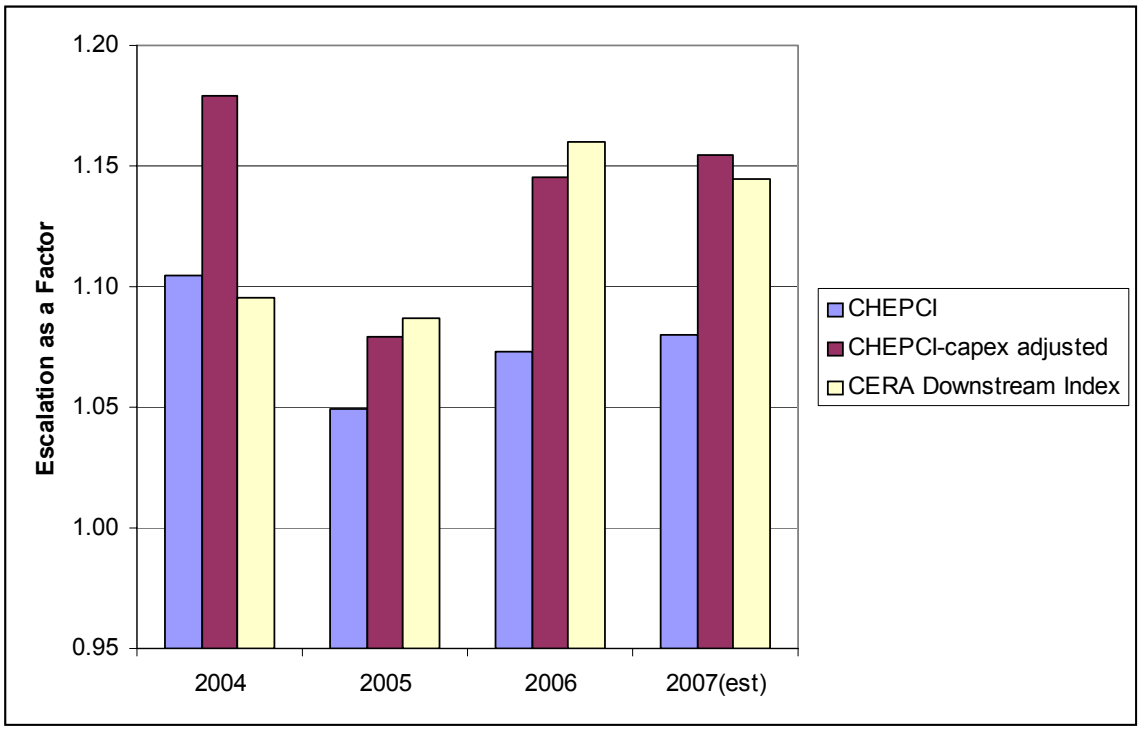

Figure 1 – Comparison of the CHEPCI, CHEPCI-Capex Adjusted, and CERA Indices

Lesson Learned #3: After two years of use, the escalation estimating method using a capex market factor espoused by the authors appears sound (however, no downward capex cycle has been experienced yet to test its applicability in the negative direction).

Working with Economists

The method above requires the input of economists to provide base forecasts of traditional indices (e.g., compensation, steel, etc.) as well as process industry capex indices to be used to develop capex adjustment factors. When the authors conceived of this method in 2005, none of the economists contacted were providing process industry capex forecasts as a regular service or subscription. One economics firm, *Global Insight*, was providing fairly granular forecasts of traditional commodity indices for the US as a "canned" subscription. Most economists are willing and able to provide indices on a

consulting basis, although the consulting can be quite costly depending on whether there are relevant historical data sources the consultants can base their forecasting upon.

None of the economics consultants identified by the authors can truly be said to be specialists or experts in engineering, procurement, fabrication and construction for the process industries. This creates a challenge for cost engineers to educate the economists in exactly what is needed to support project cost escalation estimating. Another challenge is that the economists often offer broad-based consulting services (e.g., procurement support, energy pricing, etc.), and this can create a tendency for them to lose focus on escalation estimating needs. But all of that is manageable with good communications.

Fortunately, with increasing support from industry clients and from working with cost engineers such as the authors, the sources of economics data are improving, albeit not quite "off-the-shelf." While not endorsing any consultant, *Global Insight* for one has devoted considerable effort to understanding and providing the information needed. *CERA*, while focused on the energy industries (a reasonable proxy for the process industries as a whole), has strong EPC knowledge and is working to support cost engineers in their escalation estimating. There are other major firm such as *Oxford Economics*, and the *Economist Intelligence Unit*, that are worth approaching. The process industry benchmarking firm, *Independent Project Analysis* recently announced a new non-BLS index product for its customers, but it was not yet available at time of this paper's publication.

Lesson Learned #4: Acquiring information from economics consultants is not plug-and-play or inexpensive. Capex forecasts are still custom products. Expect to spend time in specifying what you need and in working with the cost engineers and economists to get it done. The authors' goal is to work with select economists until a more or less standardized product is readily available.

Forecasting Accuracy; Dealing with Probabilities

A challenge of escalation estimating, by any method, is the reliability or accuracy of the forecasts (as can be said for estimating contingency). The first question clients ask is "how well did this method do in forecasting the recent market?" The answer has been, "it is getting better, but its not there yet".

The first challenge has been getting indices from economists that correspond to the markets of interest, particularly local wage rates and regional and global capex for the subject industries (commodity prices such as steel are well covered). It was not until recently that appropriate indices were being provided.

The next challenge is the difficulty (or impossibility?) of "calling a market turn". The current level of pricing is well above the long term trend line and unless "things are different this time", there will eventually be a market correction in which prices will drop to something closer to the long term trend (or at least level off until core inflation brings the rest of the market to the same elevated level). The problem has been that economists have an ingrained belief in responsive markets and tend to forecast that the correction will happen sooner than later. For example, in every year since 2004, the economists have called for steel prices to decrease or at least level off in the coming year and it did not happen (despite occasional dips). At the time of writing this paper, they again called for steel prices to drop in 2008, and again, it is not happening as raw material prices continue to climb (despite a softening economy).

The economist's (and their macro-economic model) correction bias highlights the importance of probabilistic assessment. There are several ways to handle this. A simple way is to allow for a predetermined "range" (e.g., for a p70 confidence of under run, add 2 percent to each index). A more sophisticated way is to use "range estimating" for the index values (with ranges determined with input from the business, team and economists) and monte-carlo modeling to provide a probabilistic escalation estimate output. Another way is to present the economists with (or ask them for) economic scenarios that reflect market changing events or assumptions (e.g., hiccup in China's economy) and, after assigning probabilities to the scenarios (again, with business, team and economist input), subject the cost model to Monte-Carlo.

The advantage of probabilistic methods is that even if the resulting forecast is inaccurate, management will have had the opportunity to really understand the risks and make an informed decision on how to address that risk. Lacking that understanding, the authors have seen companies swing from overly optimistic forecasts in 2004 (immediate price correction), to overly pessimistic forecasts in 2007 (no price correction ever).

Lesson Learned #5: There is no crystal ball, just more or less information and understanding upon which to base decisions. Insight from economists, the data, the modeling method, and probabilistic outputs will always be better than "guessing" which tends to reflect extremes.

Roadblocks (and Opportunities)

As with all estimating, management tends to have unrealistic expectations of escalation estimate accuracy. Expect to spend a fair amount of time in education and 'expectations management" with an emphasis on the use of the best market intelligence and probabilistic thinking. There is also a tendency of engineers to want more detail (e.g., use 40 or 50 indices rather than 15 or 20) which is generally unwarranted in terms of yielding better accuracy (although it may help politically).

Business development organizations often don't communicate well with engineering or estimating groups. A best practice is to have the business development group base their investment decision models on the same economic scenarios as you developed your escalation estimate on. Working to get alignment on assumptions is a challenge, but can help improve team integration.

Others will challenge the use of capex indices to develop corrected proxy factors just because it is a new estimating approach that is not covered by the literature. Be prepared to discuss the obvious shortcomings of government indices and how the basic principles of supply and demand can help overcome those shortcomings.

The costs and time it takes to deal with acquiring the services of and working with economists can be burdensome. The economist may not seem to "get it" or their motivation may be other than just supporting the task at hand. The authors have supported the owners in these dealings, but in the end, all parties need to be motivated to develop a good working relationship. In terms of costs, remind the business that escalation may be the largest single cost account in an estimate (especially mega-projects of long duration), and the cost of this best practice is rather negligible in comparison to the risk that is being addressed.

Maintenance of the tool (primarily index database updates every quarter) can be a challenge at companies that do not have a cost engineering organization or equivalent. Again, the authors have supported the owners in this task, but in the end, it is a best practice for the owner to take ownership of this core competency.

Lesson Learned #6: Most of the roadblocks to best practice implementation require excellent communications to overcome. A clear understanding of principles, objectives, roles and responsibilities go a long way. These challenges are a good opportunity to improve working relationships with business and management.

The authors have presented some basic escalation estimating principles and methods that will allow estimators to estimate escalation costs rationally. We have also presented lessons learned from the authors' experience, with the general learning being that in times of price volatility, estimators must use best practices including working with economics consultants (although it may be a bit costly and time consuming). Escalation estimating is an owner core competency. However, few companies are using this or other best practices or are even aware of them. Most published indices are still relatively useless for office and field labor and fabricated item costs, with a bright spot or two on the horizon. The capex adjusted indexing method covered by this paper is working based on past data, although it is a work in progress for improved forecasting for which probabilistic methods are necessary to improve understanding and decision making. Successfully implementing this new methodology will require excellent communications with the business, clients, teams and others.

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