Thought Leadership

Issues Related to the Measurement of Economic Obsolescence

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The cost approach is often used in the unit valuation of industrial or commercial taxpayer properties. In a cost approach unit valuation, one common area of dispute is the identification and quantification of economic obsolescence. This discussion (1) summarizes several generally accepted methods to measure economic obsolescence, (2) provides guidance related to several economic obsolescence measurement controversies, and (3) includes several illustrative examples of economic obsolescence analyses.

Introduction

When commercial or industrial property is valued for state and local property tax purposes, the valuation objective is typically to estimate the value of property subject to ad valorem property tax. In these valuations, the property owner—or the taxpayer corporation—pays property tax based on the assessed value of its taxable property.

The cost approach is a generally accepted unit valuation approach to estimate the value of the taxpayer property. In a unit valuation, the cost approach is applied so as to value all of the taxpayer property in the aggregate. This discussion focuses on one component of the cost approach—the measurement of economic obsolescence.

The amount of economic obsolescence related to the subject taxable property is often an issue of controversy for three primary reasons:

1. Economic obsolescence may result in a large downward adjustment to the cost of the taxable property.
2. If the source of economic obsolescence is poorly explained in the valuation report, this valuation adjustment is sometimes (inappropriately) viewed as a "plug" number that artificially reduces the value of the taxable property.
3. The estimation of economic obsolescence often (and appropriately) involves the "resourcefulness and creativity" of the experienced valuation analyst.[1]

This discussion addresses several areas of controversy and potential confusion surrounding the measurement of economic obsolescence.

This discussion focuses on property tax valuations related to commercial or industrial property, where the subject taxable property is part of an income-producing business enterprise. This discussion is relevant to valuations where a cost approach valuation method is used to estimate the value of all of the subject taxable property in the aggregate (i.e., where the cost approach method is performed as part of a unit valuation).

These types of property tax valuations are often associated with taxpayer corporations that operate in the communications, energy, and transportation industries. However, this discussion may also be relevant to commercial taxpayers that operate in the processing, extraction, entertainment, hospitality, and health care industries. In other words, this discussion may be relevant to the owner of any industrial or commercial property that is valued by reference to the cost approach.

Definition of Economic Obsolescence

Economic obsolescence is one component in the application of the cost approach. Therefore, it may be helpful to understand the cost approach prior to any discussion of economic obsolescence.

The cost approach is based on the principle of substitution. This principle indicates that an individual would not pay more to purchase a fungible asset than the cost to construct an asset with similar utility.

Analysts commonly consider one of the following cost approach valuation methods to value property:

1. Reproduction cost new less depreciation (RPCNLD) method
2. Replacement cost new less depreciation (RCNLD) method

Historical cost or trended historical cost are sometimes used as a proxy for either replacement cost new or the reproduction cost new in the unit valuation.

Whichever cost approach valuation method is performed, the analyst should consider the following elements in the analysis:

1. All components of cost (including developer's profit and entrepreneurial incentive)
2. All forms of depreciation (including physical deterioration, functional obsolescence, and economic obsolescence)

One generally accepted cost approach property valuation formula is presented below:

Reproduction cost new (RPCN)
– Curable functional obsolescence
= Replacement cost new (RCN)
– Physical depreciation
= RCN less physical depreciation
– Incurable functional obsolescence
– External obsolescence
= Value indication

In the above property valuation formula, and in generally accepted property valuation practice, economic obsolescence is considered to be one component of external obsolescence.

The textbook *The Appraisal of Real Estate* defines external obsolescence as follows:

> External obsolescence may be caused by economic or locational factors. It may be temporary or permanent, but it is not usually curable on the part of the owner, landlord, or tenants.[2]

Table 1 presents alternative definitions of economic obsolescence from various authoritative sources. There are three characteristics of economic obsolescence that are consistent among the alternative definitions presented above and in Table 1.

First, economic obsolescence is not caused by the actions of the property owner. That is, the property owner (e.g., the corporate taxpayer) cannot cause or correct economic obsolescence—it arises from factors beyond the control of the property owner.

Second, economic obsolescence results in a deduction from the cost measurement in order to conclude value—it cannot result in an increase in value.

Third, economic obsolescence is not necessarily permanent. This is because the factors that cause economic obsolescence tend to change over time. These economic obsolescence causation factors are presented later in this discussion.

The crux of economic obsolescence, however, is not easily identified by reviewing the definitions presented in this discussion. What is implicit from the economic obsolescence definitions is that economic obsolescence exists when the commercial or industrial property owner cannot earn a fair return on the subject property, after all other value decrements have been accounted for.

A fair rate of return is one that is commensurate with the amount of risk. This rate of return varies depending on the nature of the subject assets. The starting point in a rate of return analysis is often the taxpayer company's cost of debt, cost of equity, or weighted average cost of capital. The fair rate of return may be adjusted up or down from one of these rates, depending on the nature of the subject assets.

The terms fair rate of return and required rate of return are used synonymously in this discussion.

To illustrate the fair rate of return, let's consider a simple example. Let's assume the taxpayer owns a piece of manufacturing equipment that can only manufacture Internet-enabled eyeglasses (iGlasses).

This tangible personal property is in like-new condition, it was designed and built after substantial research and development efforts. And, it performs

Table 1
Definitions of Economic Obsolescence

Valuing Machinery and Equipment—*Economic obsolescence* (sometimes called "external obsolescence") is a form of depreciation where the loss in value of a property is caused by factors external to the property. These may include such things as the economics of the industry; availability of financing; loss of material and/or labor sources; passage of new legislation; changes in ordinances; increased cost of raw materials, labor, or utilities (without an offsetting increase in product price); reduced demand for the product; increased competition; inflation or high interest rates; or similar factors.[1]

Guide to Property Tax Valuation—External obsolescence relates to a decrease in the subject property's value due to influences that are external to, or outside of, the subject taxpayer property. The two common components of external obsolescence are: (1) locational obsolescence and (2) economic obsolescence.

Locational obsolescence occurs when the location of the subject taxpayer property results in (1) a decrease in property income or (2) an increase in operating costs. Economic obsolescence occurs when the taxpayer corporation property owner can no longer earn a fair rate of return on the ownership/operation of the subject property.[2]

IAAO Handbook—External obsolescence is a loss in value from forces outside the property and is almost always considered incurable. Like incurable functional obsolescence external obsolescence can be measured by either the sales comparison or the capitalization of income method.[3]

WSATA Handbook—a temporary or permanent impairment of the utility or salability of an improvement or property caused by factors external to the property. External obsolescence may result from adverse market conditions. Because of its fixed location, real estate is subject to external influences that usually cannot be controlled by the property owner, landlord, or tenant. This loss in value is sometimes referred to as external obsolescence.[4]

Notes:
1. *Valuing Machinery and Equipment: The Fundamental of Appraising Machinery and Technical Assets*, 3rd ed., (Washington, D.C.: American Society of Appraisers, 2011), 89.
2. Robert F. Reilly and Robert P. Schweihs, *Guide to Property Tax Valuation* (Chicago: Willamette Management Associates, 2008), 262.
3. *Property Assessment Valuation*, 3rd ed., (Kansas City, Missouri: International Association of Assessing Officers, 2010), 302.
4. *Appraisal Handbook, Unit Valuation of Centrally Assessed Properties* (Western States Association of Tax Administrators, Committee on Centrally Assessed Properties, August 2009), XVI-8 to XVI-9.

all of its intended functions flawlessly. It would cost $100 million to design and reproduce this machine.

Let's also assume that two years after the machine was put in use, iGlasses turned out to be a disastrous flop with consumers, and demand for this novel product was effectively zero on the valuation date. Since the owner cannot earn a return on the ownership and operation of the iGlasses manufacturing machine, the market value of the hypothetical iGlasses manufacturing equipment is not much more than scrap value.

The reason why this equipment is no longer as valuable as when it was put in use is related to the existence of economic obsolescence. There is nothing inherently wrong with the subject equipment—it performs the functions it was designed to perform. Rather, external factors have resulted in a substantial decrease in the equipment's value.

The attributes of economic obsolescence will be further illustrated by the following:

1. A discussion of the factors that typically indicate the existence of economic obsolescence
2. An overview of the generally accepted methods used to measure economic obsolescence
3. Illustrative examples that quantify economic obsolesce for hypothetical taxpayer property owners

Qualitative Economic Obsolescence Considerations

One criticism of certain economic obsolescence analyses is that the concluded economic obsolescence is not properly supported. The analysts who assert this criticism may even agree with the math that supports the economic obsolescence measurement.

However, these analysts fundamentally disagree with the premise that the economic obsolescence measurement proves that the taxpayer's tangible property is less valuable.

That is, these analysts may agree that the taxpayer's manufacturing plant is underutilized and

"[A] credible economic obsolescence analysis will typically articulate the cause of the economic obsolescence."

it is reporting record low profit. However, these analysts will disagree that this condition makes the plant tangible property assets less valuable.

Therefore, a credible economic obsolescence analysis will typically articulate the cause of the economic obsolescence. This section discusses potential causes of economic obsolescence.

As noted earlier, economic obsolescence is *external* to the taxpayer property—that is, the property owner can neither cause nor correct economic obsolescence.

Obsolescence that is internal to the property is often considered to be functional obsolescence. An example of this type of obsolescence is a five-year-old widget manufacturing machine that can produce 100 widgets per hour when a modern widget manufacturing machine can produce 200 widgets per hour.

In this example, the value decrement associated with the older machine is property-specific.

The factors that cause economic obsolescence are related to both:

1. the subject property and
2. the industry or economy the subject property competes in.

The valuation textbook *Guide to Property Tax Valuation* (*GPTV*) lists 10 illustrative factors that are external to the commercial or industrial property owner and that may result in a value decrement of the subject property. This information is reproduced in Table 2.

Representative factors from that list include the following:

1. Increasing competition in the taxpayer industry
2. Rapid technological change in the taxpayer industry
3. Decreasing demand for the taxpayer's goods or services

The Table 2 factors affect economic obsolescence because they result in the property owner being unable to earn its required rate of return on its assets. This economic obsolescence concept is further explained in the Measuring Economic Obsolescence section of this discussion and with the illustrative examples included in that section.

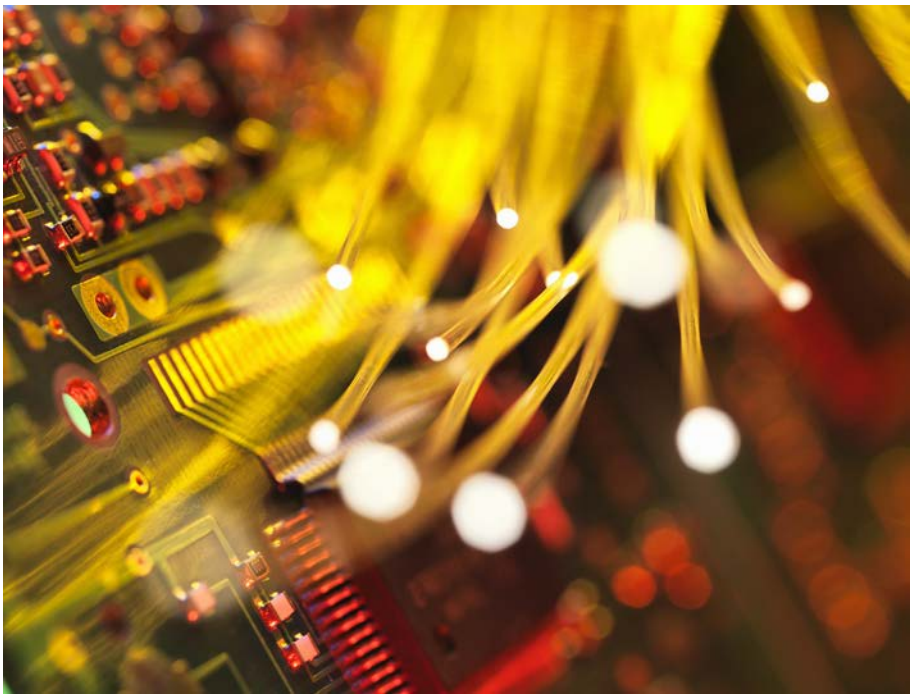
Analysts can uncover potential economic obsolescence (i.e., qualitative economic obsolescence factors) by analyzing the taxpayer company, the subject industry, and the general economy in which the taxpayer competes.

Table 2
Factors That May Indicate the Existence of Economic Obsolescence

- The subject taxpayer corporation industry is highly regulated.
- The taxpayer corporation and/or the subject taxpayer industry actual rate of return on assets is less than the taxpayer corporation and/or taxpayer industry cost of capital.
- The taxpayer corporation and/or subject taxpayer industry rates of return are decreasing.
- The taxpayer corporation property and/or the subject taxpayer industry has over capacity (i.e., the taxpayer corporation and/or subject taxpayer industry assets are underutilized).
- The subject taxpayer industry competition is increasing.
- The subject taxpayer industry demand is decreasing.
- The taxpayer corporation and/or the subject taxpayer industry supplier costs (e.g., raw materials, utilities, freight, etc.) are increasing.
- The taxpayer corporation and/or subject taxpayer industry labor costs are increasing.
- The subject taxpayer industry is experiencing technological change and improvement (e.g., cell phone usage reduces the demand for telephone land lines in the telecommunications industry).
- There is legislation or administrative authority requiring additional taxpayer corporation property and/or subject taxpayer industry capital expenditures (e.g., the required installation of pollution control devices).

Source: Robert F. Reilly and Robert P. Schweihs, *Guide to Property Tax Valuation* (Chicago: Willamette Management Associates, 2008), 266.

This type of analysis often involves both independent research and interviews with taxpayer company management.



Telecommunications Company Example

Let's consider a qualitative analysis related to the tangible property owned by an integrated telecommunications company (a "telecom").

The hypothetical telecom company ("ABC Co.") provides internet connectivity, landline telephone service, and wireless telephone services to retail consumers nationwide.

Let's assume that each of these three segments represents exactly one-third of the overall ABC Co. business.

The tangible property of ABC Co. is subject to property tax, and the analyst values the subject property on a unit valuation basis using a cost approach.

The analyst researched the telecom industry. The analyst's research focused on industry demand, profitability, regulation, and outlook.

The partial results of the industry analysis are presented below (all data are from S&P Capital IQ):

- The industry is "highly capital intensive, as providers need to invest heavily in expanding and enhancing their network."[3]
- Industry profit margins declined in 2014, and stabilized in 2015, due to (1) a consumer shift towards value pricing plans and (2) a more competitive landscape (lower prices), which are expected to persist in the foreseeable future.[4]
- Capital intensity increased over the last five years as spending levels outpaced growth. Higher spending related to broadband offerings is driving capital investment.[5]
- There is "limited upside in free cash flow for most wireless and wireline providers due to the challenging industry landscape that lies ahead, as growth prospects remain bleak."[6]
- "The carriers have long competed on price, but S&P Capital IQ sees a shift toward competing on speed. In the past few years, telcos made investments aimed at more than doubling the broadband connection speeds available to households, thus bringing the telcos' speeds more in line with those offered by competitors."[7]
- Prior to 2003, internet connections were made using copper cable. In 2003, the industry switched to fiber-optic connections (FTTP, or fiber to the premises). Now, fiber to the node, or FTTN, is being deployed rather than FTTP.

  Deploying FTTN is quicker and requires less invested capital than deploying FTTP.
- US wireless carriers will "continue to look for growth through . . . extensive capital investments to improve infrastructure and service."[8]
- "Entering new markets as a telecom provider can bring additional expenses, and the risk of an inadequate return."[9]

These data suggest that the telecom industry is becoming increasingly competitive. This competition is projected to lead to decreased profit margins. These data also suggest that technology is rapidly changing in the telecom industry, so telecom companies such as ABC Co. may be required to invest in new capital to remain competitive.

The above-described industry factors suggest that companies that compete in the telecom industry may own property that is subject to economic obsolescence.

An industry analysis is often one aspect of an economic obsolescence analysis. An economic obsolescence analysis should also consider if/how the general industry factors affect the subject taxpayer and its property.

For example, the telecom industry as a whole may be experiencing increasing competition, but the subject taxpayer may be adding customers and improving profit margins. Or, the subject taxpayer financial results may be inferior to the results of the industry as a whole.

In this example, the analyst reviewed the industry data relative to ABC Co. The analyst concluded that all of the industry data presented above is relevant to the specific markets in which ABC Co. competes. All of the factors listed above affect ABC Co.

Having researched data that suggest that the ABC Co. property may be subject to economic obsolescence, the next steps performed by the analyst are to finalize these preliminary conclusions and to quantify the economic obsolescence.

Generally accepted methods to quantify economic obsolescence are presented later in this discussion. The following is another example of a qualitative economic obsolescence analysis.

Pipeline Company Example

The qualitative analysis related to the ABC Co. focused primarily on an industry analysis. However, a company-specific analysis may also be relevant. This is because economic obsolescence can affect an entire industry—or it can only affect certain companies in an industry.

Let's consider a company-specific qualitative economic obsolescence analysis using a hypothetical pipeline company (PipeCo) that distributes natural gas in the West.

The following list summarizes important events in the PipeCo history:

- PipeCo was formed in May 2013.
- PipeCo obtained regulatory approval for a proposed 200 mile pipeline in December 2013.
- PipeCo entered into transmission contracts with four electric utilities throughout 2014.
- In the first half of 2015, PipeCo prepared budgets that reflected a 90 percent utilization based on its contractual relationships and market analysis.
- In the second half of 2015, an existing pipeline near (but not in) the PipeCo service area filed an application to expand its pipeline into the PipeCo service area.
- Construction on the PipeCo pipeline was completed in March 2016.
- In April 2016, one of the PipeCo customers was shut down due to low demand, and the PipeCo expected utilization decreased from 90 percent to 70 percent; PipeCo accordingly revised its projections downward.
- The overall market for the transmission of natural gas in the West was strong in 2015 and 2016, and expected to remain strong over the next five years.
- S&P Capital IQ warns that "overbuilding and concerns over deceleration of dividend growth have been weighing on valuations [of pipeline companies]."[10] Additionally, S&P Capital IQ indicates that "midstream has committed too much capital."[11]

PipeCo competes in a strong segment of the oil and gas industry, and it has a brand new pipeline. These factors are generally not indicative of economic obsolescence.

However, a closer look at the company-specific factors reveals the potential for economic obsolescence. This is because the PipeCo demand has decreased, and its expected return on investment has likewise been recently adjusted downward. Both of these factors—reduced demand and decreasing profit margins—are indicative of economic obsolescence.

As illustrated by the PipeCo example, a qualitative economic obsolescence analysis should consider the subject taxpayer's industry and how the taxpayer properties are deployed in that industry.

The next section of this discussion describes the generally accepted methods used to measure economic obsolescence.

Measuring Economic Obsolescence

There are three generally accepted methods to measure economic obsolescence. These methods include the following:

1. The inutility analysis method
2. The direct comparison of property with and without obsolescence method
3. The capitalization of income loss method

The Inutility Analysis Method

As stated in the textbook *Valuing Machinery and Equipment* (*VM&E*), the inutility analysis method "measures the loss in value by reducing the capital investment from rated capability to the actual operating level to 'balance' the plant."[12]

The inutility formula and an illustrative example of this method are presented in *VM&E*.

This method may not be the best method for complex industrial or commercial properties that have multiple lines of business, or that otherwise have different categories of tangible property that are unrelated to each other.

This is because the inutility that is measured only relates to the assets that are associated with the production of the good or service considered in the inutility formula. These assets may not represent all taxable assets owned by the taxpayer.

For example, let's return to the hypothetical telecom described above, ABC Co. Let's assume that the analyst measured the ABC Co. inutility related to the property used in the ABC Co. wireline segment at 50 percent.

This economic obsolescence conclusion only relates to one of the ABC Co. segments, or 33 percent of the overall business.

Therefore, the analyst has effectively concluded that the property used in 33 percent of the business suffers from 50 percent economic obsolescence. Or, the analyst has concluded about 17 percent obsolescence for the entire property.

In this example, the analyst cannot extrapolate 50 percent obsolescence for all ABC Co. property, since the analyst has not performed an economic obsolescence for all ABC Co. property.

The inutility analysis method is best suited to the following situations:

1. Properties where all assets contribute to the production of a similar good or service
2. Unit valuations where an inutility analysis can be performed for each taxpayer business or operating segment

The inutility analysis method would be an appropriate method to measure economic obsolescence related to PipeCo since all material PipeCo assets are related to the pipeline.

In situations where the inutility method is appropriate, analysts should consider that the inutility method may overstate or understate economic obsolescence.

This result may occur because the inutility method does not consider the property owner's return on assets.

For example, an inutility analysis related to PipeCo would only consider the fact that the pipeline utilization declined from 90 percent to 75 percent; it would not consider the company's income from the operation of its pipeline assets.

If PipeCo was able to increase prices to offset the reduced demand, it may be able to earn its required return on assets in spite of the lost customer. In this situation, the inutility method may overestimate the amount of economic obsolescence.

Conversely, if oversupply has caused prices to fall, then the decline in the PipeCo return on assets may be much greater than what would be indicated by analyzing inutility alone. This suggests that the inutility method may underestimate the amount of the economic obsolescence.

When using the inutility method to estimate economic obsolescence, the analyst may also consider the taxpayer's ability to earn a fair rate of return on its assets.

The Direct Comparison of Property With and Without Obsolescence Method

This method is described in the textbook *The Appraisal of Real Estate* using an illustrative example. It is also described in *GPTV*, where it is referred to as the paired sales comparison method.

In this method, economic obsolescence is estimated by comparing the value of the subject property (presumably, with economic obsolescence) to the value of property without economic obsolescence. The value of the comparable property in this method is usually based on transaction data.

This method is challenging to perform for complex commercial or industrial properties because there is often a lack of transaction data that is sufficiently comparable to the subject property for this method to produce credible results.

Comparable transaction data are hard to identify for analyses of complex commercial or industrial properties because these properties:

1. tend to be fairly unique (i.e., the "comparable" sales may not be sufficiently similar to the subject property) and
2. often sell with intangible assets as part of an operating business.

The Capitalization of Income Loss Method

The capitalization of income loss method is a commonly used methods to measure economic obsolescence in the case of complex commercial and industrial property.

According to the textbook *The Appraisal of Real Estate*, the capitalization of income loss method "is applied in two steps. First, the market is analyzed to quantify the income loss. Next, the income loss is capitalized to obtain the value loss affecting the property as a whole."[13]

To perform this procedure, the analyst may compare a measure of the taxpayer's current period profitably to either:

1. the profitably when there was no identified economic obsolescence,
2. the profitability of guideline companies, or
3. the profitability based on the projections that led to the investment decision.

The analyst may also consider alternate measures of profitability. Each of the comparative measures of profitability represent an estimated fair rate of return for the taxpayer.

A list of alternative measures of economic obsolescence from *VM&E* is reproduced in Table 3.

One common way to perform the capitalization of income loss method is to compare an actual return measure (e.g., return on assets) with a required return measure (e.g., weighted average cost of capital, or WACC). There are many possible variations of this procedure, and all are comparative in nature.

If a property had a required return of $10, an actual return of $8, and a direct capitalization rate of 10 percent, the income shortfall would be $2, and

Table 3
Alternative Measures of Economic Obsolescence

[M]easures of economic obsolescence can be developed based on the following:

- Analyses of industry returns—compare the returns on invested capital in the industry the subject property operates in to returns of general or all industries.
- Supply/demand relationships—determine if competition is increasing because of a surplus of supply or a decline in demand, causing margins to decline; develop a relationship showing a supply/demand imbalance or a trend showing increasing supply over demand.
- Gross margin analysis—compare the gross margins (product price less raw material cost) of the past to current gross margins, show how gross margins are declining.
- Product or raw material price changes—show how margins are declining because the product price is stable, while the raw material prices are increasing, resulting in a decline in earnings (see gross margin analysis above).
- Stock prices—compare the stock price of companies in the subject industry to a benchmark such as the company net book to a similar ratio in the general market to show a lower stock price/net book ratio for stocks in the subject industry.
- Sales transactions—calculate the magnitude of economic obsolescence for a similar property acquired in the market by comparing the cost indicator of value prior to deducting economic obsolescence to the actual sales price. (The difference is economic obsolescence.)
- The relationship between replacement cost new and the cash flows the hypothetical replacement facility is capable of generating—compare the replacement cost new to the income indicator of value for the same property; the difference is economic obsolescence.
- Other economic evidence indicating that the value of the subject property has been reduced by external factors—look for indications of reduced earnings, reduced utilization, changes in use, idle or shutdown plants in the industry or a restructuring within the industry, among others.

Source: *Valuing Machinery and Equipment: The Fundamental of Appraising Machinery and Technical Assets*, 3rd ed., (Washington, D.C.: American Society of Appraisers), 79–80.

the capitalization of income loss would equal $20 (i.e., $2 divided by 10 percent).

This $20 economic obsolescence conclusion could be subtracted from the concluded amount of the property's replacement cost new less physical depreciation and functional obsolescence.

This comparative procedure is similar to the direct comparison of property with and without obsolescence method described above because both are based on a *with*-economic-obsolescence measure to a *without*-economic-obsolescence measure.

Unlike the direct comparison of property with and without obsolescence method, the capitalization of income loss method is based on alternative measures of income rather than the value of the subject assets.

This method is commonly used for complex industrial and commercial property because it overcomes the challenges of the other two generally accepted methods listed above—it doesn't rely on transaction data and it generally accounts for disparate items of property working together as part of a single integrated business enterprise.

Several issues related to the income shortfall method are discussed next.

Independence from the Income Approach

One inappropriate procedure that some analysts use to estimate economic obsolescence is as follows:

1. Estimate the subject taxpayer's unit value using an income approach.
2. Estimate the RCN after subtracting physical depreciation and functional obsolescence of the taxpayer assets.
3. If the value from number one is less than the value from number two, subtract the first number from the second number in order to measure the economic obsolescence.

The procedure described above is essentially a plug to force the cost approach value to equal the income approach value. Therefore, this procedure does not result in a concluded value from the cost approach. Instead, the concluded value from the so-called cost approach is simply one more income approach conclusion.

This makes all of the cost approach procedures performed prior to this "plug" procedure irrelevant. The concluded cost approach value of the subject property would be the same regardless of whether subject property RCN was $1 trillion, $1 billion, or $1 million.

If the analyst exclusively relied on a yield capitalization method and an RCNLD method using the "plug" procedure described in this section, he or she cannot claim to have performed two independent valuation methods that are mutually supportive of the overall concluded value. This is one potential problem with using the "plug" procedure.

Another potential problem with the "plug" procedure arises if the subject taxing jurisdiction requires the analyst to perform a cost approach. Since this "plug" procedure results in an income approach valuation method, the analyst may not be able to rely on this method to meet the statutory requirement of considering a cost approach.

Alternative Measures of Income Loss

Some income shortfall analyses rely on a single measure of income shortfall. For example, the analyst will estimate economic obsolescence by comparing the taxpayer's return on assets to its WACC. If these values are 9 percent and 11 percent, respectively, the concluded economic obsolescence will be 18 percent (i.e., 9 percent divided by 11 percent, minus one).

This method to measure economic obsolescence is supported by authoritative texts and is generally accepted.

Depending on the specific facts and circumstances regarding the subject assets, it may be appropriate or persuasive to include multiple comparative measures of income loss in the economic obsolescence analysis. The use of mutually supportive measures is common in property valuation.

An example of this type of analysis is presented in Exhibit 1.

As presented in Exhibit 1, the analyst has calculated three separate return measures for the subject company. And, the analyst has compared the return in the most recent year with the average return over the preceding years.

Although any one of the measures would have supported the concluded 35 percent obsolescence adjustment, the use of multiple ratios, and the analysis of multiple years, provides additional support and increased credibility for the conclusion.

An alternative procedure to calculate economic obsolescence would be to compare the most recent year's returns to the historical maximum returns. This procedure is known as the best of the best method, or the blue chip method.

The income shortfall analysis may result in subject company rates of return that are greater than the benchmark (or required) rates of return. This situation may suggest that (1) the subject company owns

Exhibit 1
ABC Co.
Economic Obsolescence Measurement
Income Shortfall Method

ABC Co. Financial Fundamentals and Ratios	2015	2014	2013	2012	2011	2010	2010 to 2014 Average
EBITDA	19,000	30,000	48,000	49,000	37,000	36,000	40,000
Total Assets	185,000	205,000	235,000	260,000	280,000	300,000	256,000
Invested Capital [a]	175,000	200,000	230,000	250,000	275,000	300,000	251,000
Revenue	50,000	55,000	70,000	67,000	60,000	100,000	70,400
EBITDA Return on Total Assets	10.3%	14.6%	20.4%	18.8%	13.2%	12.0%	15.8%
EBITDA Return on Invested Capital	10.9%	15.0%	20.9%	19.6%	13.5%	12.0%	16.2%
EBITDA Return on Revenue	38.0%	54.5%	68.6%	73.1%	61.7%	36.0%	58.8%

Calculation of Economic Obsolescence:

	Based on Return on Total Assets	Based on Return on Invested Capital	Based on Return on Revenue
2015 ABC Co. Rate of Return	10.3%	10.9%	38.0%
2010 to 2014 Average ABC Co. Rate of Return	15.8%	16.2%	58.8%
Indicated Economic Obsolescence [b]	35.1%	32.9%	35.4%
Concluded Economic Obsolescence Percentage [c]	**35%**		

EBITDA = Earnings before interest, taxes, depreciation, and amortization
Notes:
[a] Invested capital is defined as working capital plus tangible assets plus other assets.
[b] Calculated as: (average return − 2015 return) ÷ by average return.
[c] Based on the average of the total obsolescence indications..

valuable intangible property (which may be exempt from property tax), (2) the subject company tangible property does not suffer from economic obsolescence, or (3) the income shortfall method is not a reliable method to estimate economic obsolescence.

Reconciling the Data

In Exhibit 1, the various ratios analyzed resulted in similar economic obsolescence conclusions. However, this does not always occur in practice.

The analyst may encounter one ratio that suggests no economic obsolescence, another ratio that suggests 80 percent economic obsolescence, and a third ratio that suggests 25 percent economic obsolescence.

Or, the subject company ratio that is analyzed in the economic obsolescence analysis (e.g., the taxpayer return on assets) may be 12 percent, and the comparative ratios may range from 4 percent to 25 percent, with a mean and median of 18 percent and 14 percent, respectively.

When the economic obsolescence market data leads to inconsistent results, the analyst has two options:

1. Reconcile the data to reach an economic obsolescence conclusion.
2. Conclude that the data is unreliable so there must be no economic obsolescence.

While it may be less controversial to conclude no economic obsolescence than to support a more nuanced economic obsolescence analysis, the latter is generally a more appropriate procedure. This is especially true if the qualitative analysis suggest that the subject property suffers from economic obsolescence.

Before discussing how to reconcile the data (either market data or company-specific data), it is helpful to consider why it is more acceptable to rely on data that are widely dispersed than to ignore economic obsolescence altogether.

Actual market data reflect unique company-specific or property-specific factors, and therefore the individual data points within a data set are justifiably different. This is particularly true for commercial and industrial taxpayers/property owners, which are the primary subject of this discussion.

Taxpayer companies that compete in the same industry own different assemblages of tangible and intangible assets and are affected by different economic factors.

For example, the demand drivers for railroad companies is different depending on the goods they transport; airline companies that compete on different terms (price versus amenities) earn different profit margins; and electric utilities that generate power using different raw materials have vastly different utilizations.

The point of these examples is to illustrate how different companies that compete in the same general industry could earn different profit margins, which in turn could suggest different amounts of economic obsolescence.

"While it may be less controversial to conclude no economic obsolescence than to support a more nuanced economic obsolescence analysis, the latter is generally a more appropriate procedure."

The market data used in a unit valuation rarely result in a tight range. Reconciling these data is part of the property valuation process.

If all companies in a particular industry earned exactly the same profit margins and traded at exactly the same pricing multiples, then there would be little need for analysts or unit valuations at all. The analyst's role is to reconcile the different data and reach valuation conclusions based on those data and the specific facts of the subject company.

If guideline company data are used, the following procedures can be performed by the analyst to reconcile disparate economic obsolescence market data:

- Adjust the historical financial statements of the guideline companies to remove the effects of one-time or nonrecurring income and expense items.
- Focus on a subset of the guideline companies that are most similar to the subject company.
- Analyze the particular industry subgroups the guideline companies compete in to understand differences in the guideline company ratios.
- Select different ratios for the comparative analysis.
- Place more emphasis on the comparative ratios that are more tightly clustered and less emphasis on the comparative ratios that are less tightly clustered.
- Exclude certain particularly high or low guideline company ratios.
- Consider the potential effects of recent major events in a company's history that may skew the indicated ratios, such as mergers, divestitures, product expansion, and so on.

When the comparable market data are widely dispersed, the analyst should use his or her professional judgment to reconcile the various market data that are used in an economic obsolescence analysis.

Excluding Intangible Personal Property

One common misconception about the cost approach is that it excludes value from all intangible personal property. If the capitalization of income loss method is improperly applied, the cost approach value could include value from intangible personal property.

This can be illustrated using an example. Let's consider a hypothetical 10-year-old coal-fired electric generating facility (the "Facility") with a power purchase agreement to sell substantially all of the Facility's generating capacity.

This power purchase agreement (the "PPA") provides substantial cash flow to the Facility owners based primarily on the capacity it has allocated to the PPA counterparty; the Facility earns income regardless of how much electricity it actually produces.

The Facility also is reimbursed for its coal costs via the PPA. With the PPA in place, the Facility is one of the most profitable electric generating plants in its region.

Finally, let's assume that over the decade since the PPA was originally executed, the price of electricity (the Facility output) and price of coal (the Facility input) have changed such that the facility cannot profitably produce electricity on and around the valuation date without the PPA in place. That is, without the PPA in place, the Facility would sit idle.

Since the PPA terms provide for Facility income that is greater than what is generally available in the market, the PPA is a valuable intangible asset.

In this example, the analyst decided to value the Facility property using the cost approach, which was performed on a unitary basis. The analyst analyzed economic obsolescence in the cost approach using the capitalization of income loss method.

In this example, the economic obsolescence analysis is based on Facility income, both historical and projected. However, the analyst will reach materially different economic obsolescence conclusions depending on how historical and projected income is estimated in the capitalization of income loss method analysis.

Let's consider the following two procedures the analyst can use to estimate the Facility income:

- First, the analyst can rely on actual historical and projected income, adjusted only for nonrecurring income and expenses. This income includes revenue from the PPA.
- Second, the analyst can estimate pro forma historical and projected Facility income as if the Facility operated without the PPA in place.

Using the first procedure to estimate Facility income results in no economic obsolescence. This is because the various measures of Facility profit are all near the high end of the comparable range and are all equal to or exceed the Facility required return on investment.

This procedure to estimate economic obsolescence results in a cost approach conclusion that includes value attributable to the PPA intangible asset. Therefore, this procedure results in a cost approach value that includes both tangible assets and intangible assets.

If the objective of the valuation is to conclude a value of the Facility tangible assets only, the analyst can either:

1. recalculate economic obsolescence so it does not include value from the PPA intangible asset or
2. subtract the value of the PPA intangible asset from the concluded cost approach value.

Using the second procedure to estimate the Facility income, the analyst estimated economic obsolescence of 70 percent (obsolescence was not 100 percent in this example because the analyst concluded that the market for coal-fired electric generating facilities would improve in the future).

This is because the various pro forma measures of Facility income are all substantially below the comparable range of profit margins and below the Facility required return on investment.

Since income is calculated excluding the benefit of the PPA intangible asset, this economic obsolescence analysis does not result in value being attributed to the PPA intangible asset.

If the facility RCN before economic obsolescence (but after all other forms of depreciation and functional obsolescence) was $1 billion, then these two different procedures to estimate economic obsolescence result in facility values that are over $700 million apart.

The conclusion of 70 percent economic obsolescence is more consistent with the qualitative analysis related to the Facility than a conclusion of no economic obsolescence.

As discussed above, the market for coal-fired electric generating plants has deteriorated to such an extent that coal-fired plants were idle rather than producing electricity around the valuation date (in this hypothetical example).

This situation is illustrative of the existence of economic obsolescence because high coal prices and low electricity prices are *external* to the Facility assets.

One simple sanity check on the concluded value is to consider the possible acquisition market for the subject tangible property, assuming no intangible assets were sold with the subject tangible property. In the electric generating facility example, it may be unrealistic to conclude that the Facility owner could sell the Facility (absent the PPA) for $1 billion when it cannot profitably generate electricity.

This example illustrates how a cost approach value conclusion can include value attributable to taxpayer intangible assets. This example also illustrates the importance of an economic obsolescence analysis that is consistent in terms of both the qualitative analysis and the quantitative analysis.

As shown in this example, if the subject taxpayer owns valuable intangible assets that contribute to its income, the analyst should consider if and how that income ought to be adjusted in a capitalization of income loss method. It may not be appropriate to estimate the amount of income loss based only on the subject taxpayer's reported financial statements.

Low Returns Due to Poor Management

Some analysts assert that the reason property is not earning its required rate of return is due to poor management decisions, rather than due to economic obsolescence that is inherent to the subject property.

The primary rationale for this argument is that since the taxpayer cannot earn its required rate of return on its assets, the assets should not have been acquired and put into place to begin with. Some analysts argue that the existence of overcapacity (for example) proves management made a bad business decision and overbuilt; that is, excess demand does not prove the existence of economic obsolescence.

This argument is most often made in regard to the RPCNLD method, since this method is based on estimating the cost to construct an exact replica of the subject assets.

The use of the RCNLD method generally obviates the need for this argument since the RCNLD method is based on the cost to construct a substitute for the subject assets, and the hypothetical substitute often cures the supposed bad decisions made by the taxpayer company management.

For example, let's assume a machine can produce 100 widgets, but there is only demand for 50 widgets. The RPCNLD method would typically be based on the cost to recreate the 100-widget machine, and the value would be reduced for economic obsolescence due to overcapacity.

Alternatively, the RCNLD method may estimate the cost to recreate a machine capable of producing 50 widgets, so there would not be a need to estimate additional obsolescence related to excess capacity (i.e., supposedly poor management).

There are two potential problems with the assertion that the value decrement in the subject assets is related to management and not economic obsolescence.

First, the mere existence of overcapacity (for example) that occurs after the assets have been put in place does not prove taxpayer management made a bad decision. To blame management for a poorly conceived asset mix is to argue that the decision to invest in the particular assets was a demonstrably bad decision at the time it was made.

This argument fails to recognize that at any given point in time taxpayer management and other stakeholders are making the best decisions they can with the information that is available to them at that time.

In unit valuations, the subject assets are typically owned by large corporations with experienced executive management teams. It often takes months, or even years, from conceptualizing an investment decision to having those assets in place.

The investment decision may be subject to review by internal taxpayer management, external consultants, outside directors, equity owners, lenders, and other stakeholders. Presumably, none of these stakeholders want the taxpayer to make a bad investment decision.

Of course, industry and economy factors change over time and these external changes will affect how

historical investment decisions are perceived. What looked like a good investment decision on day one may look like a bad investment decision one year later.

However, if the investment decision was sound at the time it was made, it is disingenuous to blame management when external factors cause the taxpayer to earn a below-market rate of return on its investment.

In fact, external factors that contribute to low rates of return on assets are generally regarded as indicators of economic obsolescence (see Table 2) rather than indicators of poor management.

Second, this argument ignores the economic reality surrounding the assets as of the valuation date (such as overcapacity, for example).

The objective of unit valuations for property tax purposes is to estimate the value of taxpayer assets as of a specific point in time. The standard of value is often something akin to market value, which is often defined to consider the following factors:

- The transaction is between a willing buyer and a willing seller.
- Both parties are knowledgeable of all relevant facts and circumstances (both presently and prospectively).
- Neither party is under compulsion to buy or sell.
- The property is subject to a reasonable exposure time.

The valuation question is essentially some form of: What would the subject assets sell for? This question does not care what events led to the existence of the subject assemblage of assets.

It is not an internally consistent argument in a RPCNLD method to simultaneously conclude that:

1. the actual asset mix is less valuable than the RCNLD of the subject assets (due to poor management and not external factors) and
2. the market value of the subject assets, should ignore the RCNLD of the subject assets (the market value should simply ignore the supposedly poor management decisions).

The above assertion is inconsistent because it suggests that the hypothetical willing buyer would value the subject assets based on their reproduction cost while ignoring the actual utility of the subject assets (it would ignore the reproduction cost).

And, the above assertion suggests that a hypothetical willing buyer would pay for a 100-widget capacity even though there is only demand for 50 widgets.

Conclusion

There is a shortage of comprehensive authoritative literature dealing with the measurement of economic obsolescence in unit valuations prepared for property tax purposes. This is unfortunate since this topic is often a component of property tax disputes.

This discussion provides several procedural suggestions surrounding the identification and measurement of economic obsolescence.

Economic obsolescence analyses are necessarily quantitative in nature. However, a credible economic obsolescence analysis will also be supported with an analysis of the qualitative factors that contribute to the indicated economic obsolescence.

There are few absolutes when it comes to economic obsolescence analyses. Therefore, economic obsolescence analyses require the professional judgment of the experienced analyst.

This analyst judgment often requires thoughtfulness and creativity. This is because the taxpayer assets (1) are often special purpose in nature and (2) are often used in complex business operations.

Notes:

1. *Valuing Machinery and Equipment: The Fundamental of Appraising Machinery and Technical Assets*, 3rd ed., (Washington, D.C.: American Society of Appraisers, 2011), 80.
2. *The Appraisal of Real Estate*, 14th ed. (Chicago: The Appraisal Institute, 2013), 6.
3. "Industry Surveys—Telecommunications," S&P Capital IQ, January 2016, 9.
4. Ibid., 21–22.
5. Ibid., 24.
6. Ibid., 28.
7. Ibid., 38.
8. Ibid., 41
9. Ibid., 56.
10. "Industry Surveys—Oil, Gas & Consumable Fuels," S&P Capital IQ, December 2015, 5.
11. Ibid., 34.
12. *Valuing Machinery and Equipment: The Fundamental of Appraising Machinery and Technical Assets*, 3rd ed., 77.
13. *The Appraisal of Real Estate*, 14th ed., 635.

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