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Computing Lost Profits in Business Interruption Litigation: A General Model

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Abstract

This paper focuses on business interruption litigation and how to compute lost profits as a remedy. The main contribution of the paper is development of a general model of economic damages which assesses lost profits by measuring the incremental changes in revenue, variable costs, and fixed costs. Prior treatments can be understood as special cases to this general model. Several sources of economic damages can now be considered due to business interruption, including changes in prices, quantity sold, variable cost structures, fixed costs, and extraordinary expenses. We also offer case examples using the proposed framework and provide practitioners with suggestions for damages estimation.

KEYWORDS: business interruption, damages, lost profits

Introduction

High impact events such as Hurricane Katrina, the 2010 Gulf Oil Spill or tornadoes draw attention to the fact that business operations can be severely interrupted by man-made or natural disasters, and are associated with large collateral damages. Natural catastrophes like fires, floods, and high winds can be disruptive events that lead to economic losses for many businesses. Other operational disruptions can arise due to a breach of contract, a tort, a fraud, a condemnation, misappropriation of intellectual property, or an antitrust violation. This paper focuses on business interruption litigation and how to compute lost profits as a remedy, assuming that liability for a loss has been established.

Lost profits arise when some wrongful conduct or omission by one party causes harm to another party, in which case the wronged party may recover lost profits as a compensation for the loss. Measuring lost profits for business interruption has been discussed in other articles, books, and book chapters.[1]

We believe the prior literature has been too narrowly focused, and suggest a broader analytical framework is a more appropriate place to begin before making limiting assumptions as to what factors are driving lost profits. This lost profits framework should address three key questions: (1) is the interruption permanent or temporary?; (2) what profits would have been expected "but-for" the interruption?; and (3) what underlying changes in economic factors cause lost profits damages? [2] We also offer case examples using the proposed framework and provide for damages practitioners some practical advice.

Temporary and Permanent Business Interruptions

"Temporal Issues" refers to the relative permanence of the interruption loss. Lost business value is the preferred remedy instead of lost profits in the case of a permanent interruption. As a result, the practitioner should ask if the interruption is permanent or temporary, and whether the damages period is bounded by any date-specific issues. We believe there are three primary business interruptions categories: (1) temporary operational interruption followed by a resumption to normal operations, in which case one generally estimates lost profits during this "closed" interruption period; (2) temporary operational interruption followed by destruction of the business, in which case lost profits are computed for the temporary period and lost business value is calculated from the date of business

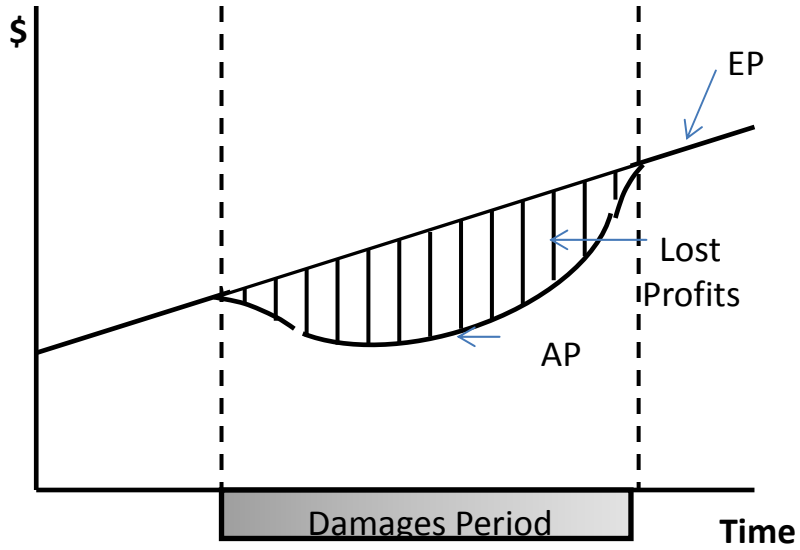
[1] See Foster and Trout (1989); Foster, Trout, and Gaughan (1993) ; Plummer and McGowin (1993); Lazear (2001); O'Brian and Gray (2011); and Gaughan (2009). Also see Trugman (2008), Chapter 21.

[2] For example: possible changes in a number of factors, including economies of scale, quantity, prices, variable production costs, fixed costs, and extraordinary expenses.

destruction forward; and (3) operational interruptions which have a clear start date but indeterminate or "open" end date. In the third situation, one may rely on contract duration if such is available or offer the court a range of lost profit assessments of different time periods until normal operations are presumed.[3] The first two categories are illustrated in Figures 1 and 2.[4]

In Figure 1 the interruption is marked the time period labeled damages period. Expected profits in this case relate are EP. The actual profits are AP. Lost profits are the difference between expected and actual profits during the damages period.[5]

Figure 1



In Figure 2 the interruption starts at the first dashed line and Expected Profits indicated by EP. As shown, Actual Profits drop off dramatically due to the interruption. The "Lost Business Value" represents lost economic benefits after

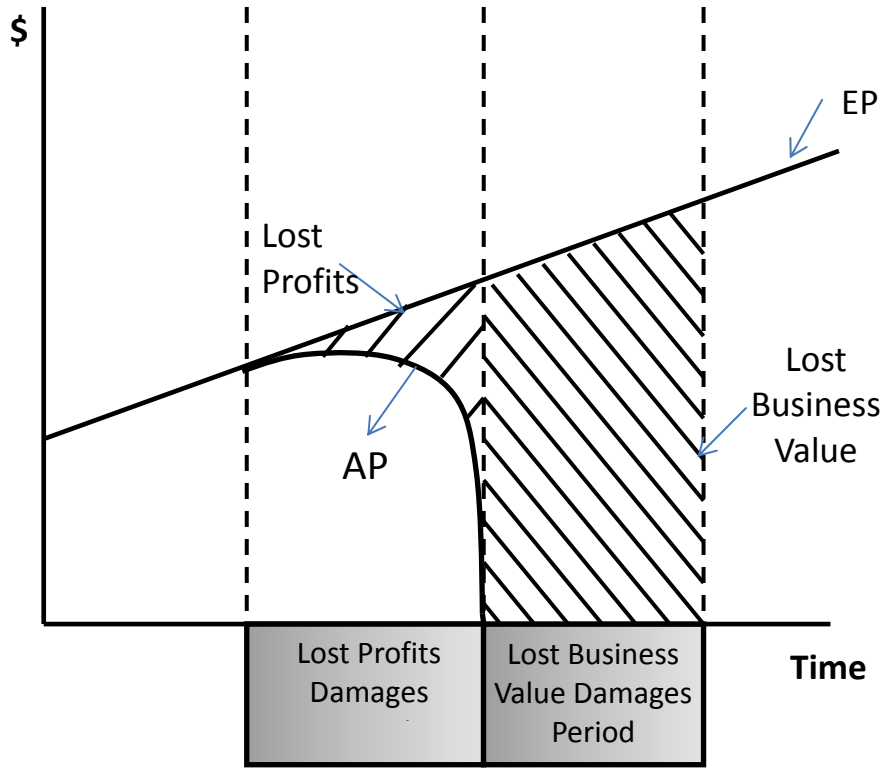
[3] Gaughan, *op cit*, pp.66-73, provides a related discussion and adds another category, "open" losses in which interrupted operations continue after some period with revenue or growth rate reduced and it is unknown when if ever normal operations will resume. Also see Foster and Trout. *loc cit.* Of course, damages cease in any situation if mitigation profits exceed but-for profits. Examples of such instances appear below.

[4] These figures are derived from Hitchner (2011). pp. 1033-1035.

[5] Of course, one generally must assess future lost profits as present value as of date of trial, not shown here, using an appropriate discount rate and to past lost profits one may need to add estimated prejudgment interest computed as simple interest using a statutory rate for the venue.

operational shut-down. [6] The damages practitioner should calculate total damages by subtracting Actual Profits from Expected Profits and adding Lost Business Value.

Figure 2



Three Approaches to Damages Assessment

Figures 1 and 2 compare the profits that the injured party expected to make with the profits that it actually made to assess the lost profits due to the business interruption. These models introduce the conceptual approach to damages.[7]

[6] The end point shown here to lost business value is a heuristic implicitly assuming an income method of lost business value assessment with future loss bound by perhaps 5 to 7 years of future cash flow plus a terminal value. A discussion of the relative merits of this valuation method and a review of business valuation in general are beyond the scope of this paper.

[7] Nancy Fannon (2011) lists four methods, before/after, yardstick, sales projection, and market model. We've consider sales projection to be part of the before/after method and have not discussed the market share method because it is not used often as the other methods, the exception being patent infringement cases. Also, while we generally agree that the approaches imply data -

Damages practitioners will likely measure these losses using one of two methods: "the before/after" approach or the "yardstick approach." The before/after approach, which economists refer to as a time series approach, considers and contrasts the profits before and the profit after an event and calculates lost profits as the difference between the two. This approach presumes sufficient data is available for each period to conduct the analysis and that the event causing the interruption is time specific. The yardstick approach is a cross section approach in which the analyst examines the profits of similarly situated companies during the damages period. It suggests that a computation of lost profits should be based on a comparison of actual target company profits with a measure of expected profits that reflect economic and market experiences of similar companies.

Both the before/after and yardstick methods are widely accepted by practitioners and the courts, however simple use of either approach is not recommended. Events other than the one leading to the lawsuit may have contributed to lost profits. For example, one of the authors was asked to compute lost profits from actions of a defendant that took place in August 2000. Unique aspects of the company meant a yardstick approach wasn't feasible. Furthermore, as it turned out, a simple before/after approach wasn't exactly appropriate either. Specifically, during the initial stages of applying the before/after approach inquiries revealed a number of other events happened in the 1995 to 1999 period which also had potential to adversely impact profits, including death of a founder, weather-related set back in available goods for sale, discovery of possible fraud in electricity invoices submitted to the firm, and a boycott by suppliers against owner/operators of the company. As discussed below, in consideration of these other factors, an average 1995-1999 profit margin was used in lost profits estimation. Failure to consider such factors opens the expert to challenge by opposing counsel's expert.

If the damaging event took place in a period of rapidly changing economic conditions for the industry, then steps should be taken to reflect these changes in lost profits analysis. Similarly, in using a yardstick approach, the analyst should expect to be challenged on the grounds that the target company may not be sufficiently comparable to other businesses in the same competitive market.

Choosing a damages methodology is often not as easy as selecting one of the two methods cited above. In utilizing the before/after approach, related economic and competitive factors before and during the damages-causing event should be considered by the expert as possible sources of damages separate from the lawsuit. Also, if the business is new or a start-up (i.e., it has yet to demonstrate profitable operation) some aspects of the yardstick approach may be

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gathering tactics, the key distinction is the different perspectives on how the expert analyzes the data.

applicable. Such blended methods constitute a third approach which is a hybrid of the before/after and yardstick approaches.

What Specific Economic Factors Account for Lost Profits?

Profits are defined and measured as Revenue (Sales) less those Costs and Expenses incurred in generating those sales in the business. This is a very general expression and the damages expert needs to carefully consider the facts of the case in order to know which factors account for lost profits. To an economist, Revenue (R) can be expressed as Price (P) times Quantity (Q) sold. Costs (C) can be expressed as Fixed Costs (F) and Variable Costs (V). Variable Costs vary directly with quantity (Q), whereas practitioners often assume Fixed Costs (F) are unaffected by small changes in quantity (Q) sold. In addition, some situations involving a business interruption may involve the incurrence of Extraordinary Expenses, E.

(1) Profits (π) = P*Q – V – F - E

It is important to note that profit can vary with a variation in P, Q, V, F, or E. However, often times damages experts who assess lost profits damages due to business interruption tend to ignore price and cost considerations, mistakenly focusing only on lost sales quantity (Q) using the following expression:

(2) Lost Profits = Lost Revenue – Avoidable Variable Costs[8]

Equation (2) ignores Fixed Costs entirely causing the expert to focus on various ways of computing lost revenue and conducting an analysis of variable costs, using measures before and after the event causing the interruption.[9] This is actually a specialized case of a more general model of lost profits in which changes in P, V, and F, (or various combinations) not just Q can be and are explicitly considered. Key factors cannot always be expected to stay the same.

[8] See Foster and Trout, *op cit*. p.9 "Courts have generally agreed with economists on this proposition, and fixed costs (or overhead expenses in accounting terms) are nearly always ignored in measuring lost profits." While relatively straightforward, there are a number of underlying assumptions made when using this expression, *viz*., prices do not change, quantity sold falls, overhead costs do not change, cost structures do not change, and no new costs are incurred because of the disruption. Surfacing these assumptions in a generalized model is a goal of our paper.

[9] Dunn (2005) Section 6, provides an excellent discussion of the legal aspects of calculating lost profits damages.

What if there are changes in fixed costs or changes in prices or changes in marginal costs of production, or the interruption impacts factors like economies of scale? It is also possible that the interruption causes the firm to incur extraordinary costs, E, perhaps due to extra advertising or legal expenses, or similar spending that does not vary directly with production, V, or add to overhead, F.

While one can treat each of these and other situations as exceptions to the base lost profits model in equation (2) we believe a more generalized model of lost profits is needed.

General Case

To provide a formal description of the generalized model, we next provide a series of equations which describe profits before and after a disruption.

Revenue but-for an "event" (for example, a breach of contract, tort, fraud, or other actions) = R_B

(3) $R_B = P_B * Q_B$, where P_B is the price and Q_B is the quantity but-for the event

Profits but-for the event = Π_B

(4) $\Pi_B = R_B - F_B - V_B$, where F_B is the fixed cost and V_B is the variable cost (in the but-for world)

Actual Revenue after the event = R_A

(5) $R_A = P_A * Q_A$, where P_A is the actual price and Q_A is the actual quantity

Actual Profits after the event = Π_A

(6) $\Pi_A = R_A - F_A - V_A$, where F_A is the actual fixed cost and V_A is the actual variable cost

In the most general case, damages suffered because of the event are estimated as $\Pi_B - \Pi_A$. Substituting the expressions for but-for and actual profits from the equations above, we have:

(7) $\Pi_B - \Pi_A = (R_B - R_A) - (F_B - F_A) - (V_B - V_A)$

The first term, (R_B - R_A), in the generalized expression above (7) shows damages suffered because of changes in revenue which can be due to price and/or quantity changes (such as price erosion or lost sales). The second term, (F_B – F_A), refers to the change in fixed costs because of the event. These changes in fixed costs may include additional legal and other expenses incurred due to the bad act. That is, $F_A = F_B + E$ where E is extraordinary expenses. The last term, (V_B - V_A), refers to reduction in variable costs due to the sales decline suffered due to the event.[10]

Equation (7) is very general but a slight improvement can help the practitioner focus on measuring lost profits. This equation can be expressed in terms of profit margins (in terms of percentages). We have, respectively,

(8) $\Pi_B - \Pi_A = VM_B*R_B - VM_A*R_A$

where VM is the variable margin in terms of percentages,

$VM_B = VM_A + \Delta VM$ and $R_B = R_A + \Delta R$

Replacing VM_B and R_B, and including changes in fixed costs we have:

(9) $\Pi_B - \Pi_A = R_A * \Delta VM + \Delta R * \Delta VM + \Delta R * VM_A$ + Changes in Fixed Costs

That is, lost profits damages are due to changes in revenue and changes in the profit margin which are additive after accounting for price-quantity interactions plus fixed costs changes.

Special Case 1

Let us assume that in the "before" and "after" scenarios, the price did not change and fixed costs do not change. That is, $P_B = P_A = P$ and $F_B = F_A$. Expanding out the expression for but-for revenue, $R_B = P_B*Q_B$ and actual revenue, $R_A = P_A*Q_A$ in equation (7) one obtains:

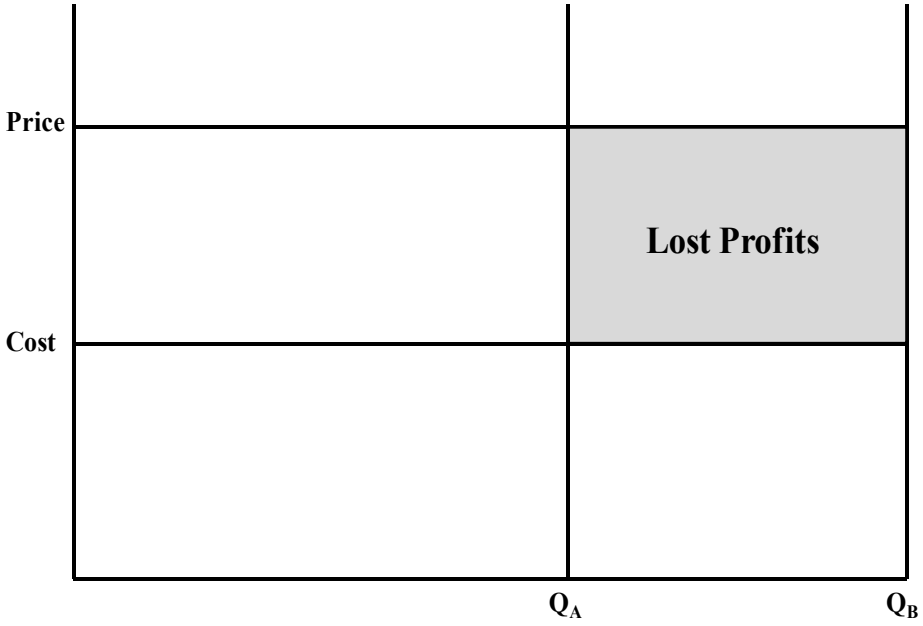
(10) $\Pi_B - \Pi_A = [P*(Q_B - Q_A)] + E - [V*(Q_B - Q_A)]$

This expression assumes that changes in variable costs occur only because of a change in quantity. The term "V" or per unit variable costs don't change with a change in quantity, i.e., we are assuming there are no economies of scale.

[10] The equations below discuss in detail the changes in variable costs related solely to changes in quantity and other changes in variable costs such as those related to economies of scale.

In this situation, damages are driven only by the change in quantity and extraordinary expenses, E, if there are any. Such a situation is likely to occur when the injured company operates in a highly competitive market and there are no economies of scale. This case is shown in Figure 3 without changes in fixed expenses.[11]

Figure 3



Special Case 2

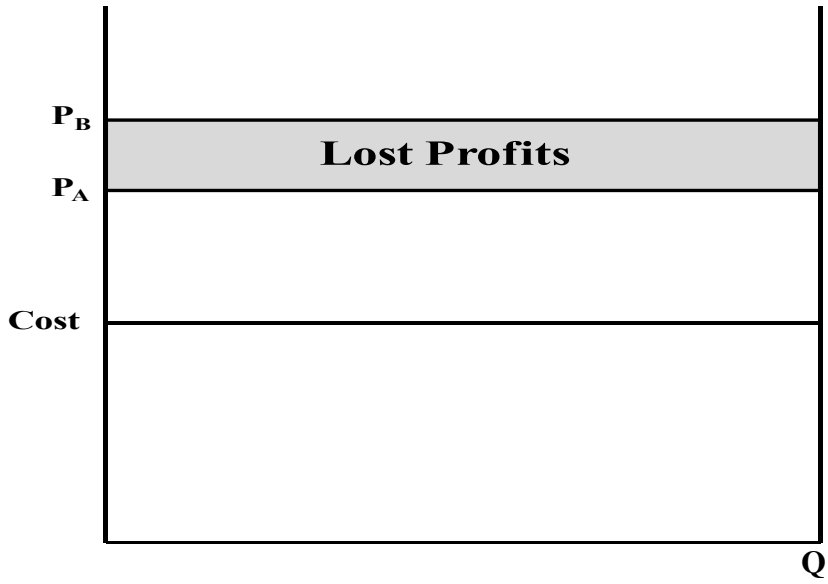
In another situation, there may be a change in price only. Given that $Q_B = Q_A = Q$, and $C_A = C_B = C$, lost profits then are:

$$(11) \quad \Pi_B - \Pi_A = R_B - R_A = [P_B*Q - CQ] - [P_A*Q - CQ]$$

This case is shown in Figure 4.[12]

[11] This figure is derived from Strong (1995).
[12] *Ibid*.

Figure 4



Special Case 3

It may be that during the damages period, not only do the prices erode but quantity sold also falls as shown in Figure 5. In this situation, care must be taken not to double count lost profits as noted by area P_B, P_A, Q_A, and Q_B in the chart below.

Profits before interruption are $P_B*Q_B-C*Q_B$ and profits after interruption are $P_A*Q_A-C*Q_A$. The lost profits are, again, estimated by comparing actual and but-for profits. That is,

$$(12) \quad \Pi_B - \Pi_A = [P_B*Q_B-C_B] - [P_A*Q_A-C_A]$$

Rearranging the equation and substituting in the fixed and variable components of C_A and C_B yields:

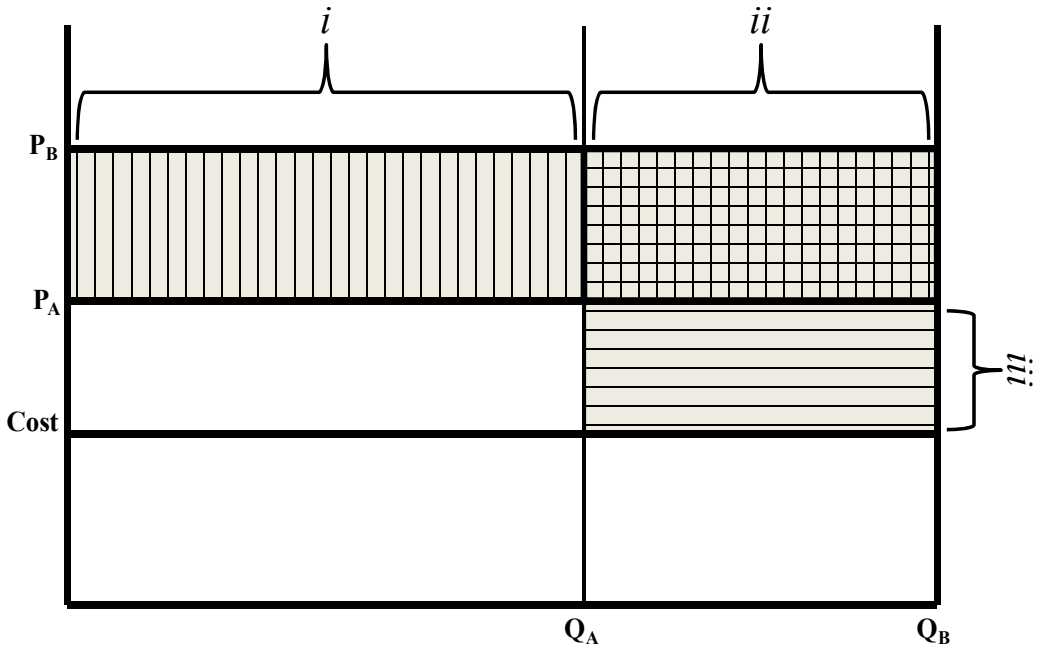
$$(13) \quad \Pi_B - \Pi_A = (P_B-P_A) *Q_A + (P_B) * (Q_B-Q_A) - (F_B - F_A) - (V_B - V_A)$$

Or,

(14) $\Pi_B - \Pi_A = (P_B\text{-}P_A)*Q_A + (P_B)*(Q_B\text{-}Q_A) - (V_B - V_A)$ assuming there are no changes in fixed costs.[13]

The first term, $(P_B\text{-}P_A)*Q_A$, in equation (14) is damages suffered because of changes in revenue which are due to price erosion only with "after" sales quantity. The second term, $(P_B)*(Q_B\text{-}Q_A)$, refers to the damages due to reduced sales with 'before' price. The third term, $(V_B - V_A)$, refers to avoided variable costs due to reduced sales.

Figure 5



Where ***i*** = Lost Profits due to price reduction
ii = Lost Profits due to price reduction and lost sales
iii = Lost Profits due to lost sales

[13] Expansion of equation (12) includes a term, $(P_B\text{-}P_A)*(Q_B\text{-}Q_A)$ appears two times due to reduced price and reduced sales. To prevent double counting of lost profits one of these terms has been removed from the subsequent equations. This potential double counting is shown in Figure 5 as area *ii.*

Four Case-Specific Examples[14]

1. Lost Sales plus Fixed Costs less Avoided Variable Costs: Open Loss Period

An example of a breach of contract claim leading to loss of profits and damages due to the changes in fixed expenses is provided by a 2001 case between a fish market business in San Francisco and the Port Authority of San Francisco.

> "In August 2000, the Port issued a Notice to Vacate a leased building described as Wharf J-10 located at Fish Alley, between Leavenworth and Hyde Street in Fisherman's Wharf due to the deteriorated and dangerous condition of the substructure. One of the building's tenants, the F. Alioto Fish Company (the "Plaintiff") sued the Port alleging breach of contract on the part of the Port ((Case No. 318-360.) The case proceeded to jury trial in December 2001. The Court awarded the Plaintiff a total of $3,018,833 in damages. On June 26, 2002, the trial court granted the Plaintiff's motion for attorney's fees in the amount of $299,580. The Port appealed the judgment and the award of attorney's fees. On January 9, 2004, the Court of Appeal affirmed the jury verdict. [15]

The court award of $3,018,833 in damages was based on expert witness testimony regarding an analysis similar to the Special Case 1; namely, damages included lost profits for 4.5 years, $218,833, measured as past and future revenue less avoided variable costs, plus the change in fixed costs measured by construction costs of $2,800,000.[16] The exact duration of lost profits was unknown as of trial date so the expert offered the court three options each with different times and costs for reconstruction and for lost profits and the jury chose one.

[14]Examples which combine lost profits and lost business value are not listed here because they are unusual. They sometimes arise in antitrust litigation, yet may also arise in business interruption disputes if appropriate. See Gaughan, *op cit.* for discussion of an antitrust case in which this framework was suggested; namely, *Farmington Dowel Products Co. v. Forster Manufacturing Co*., 421 F2n 61 (1st Cir. 1970). Also see Hitchner, *op cit*. for list of differences between lost profits and business value calculations.

[15] May 4, 2004 Memorandum to San Francisco Port Authority Commissioners

[16] Cost of restoration and reconstruction was based on an engineering study made available by defense counsel.

2. Change in Prices, Variable Costs, and Extraordinary Expenses: Closed Loss Period

An example of this type of economic loss arose in a construction defect case in which the owners of a new apartment complex sued the general contractor for damages arising from water intrusion which led to gaps in lease revenue. In such cases, determining the start of the loss period and sources of net loss can be especially challenging.

As noted in prior literature a loss period can be characterized as time-bound ("closed") or open-ended ("open") or indeterminate.[17] In a new apartment complex involving water intrusion, we needed to determine the start date of damages given a number of possibly important and related factors. For example, because 83% of average rainfall in San Francisco Bay Area happens in the five-month period from November to March, leaks were not obvious until the rainy season began. In addition, it takes time to fully lease out a new apartment complex, plus the fact that there was a seasonal factor to these rentals due to school calendars and related factors. There was also a normal amount of turnover in the five building apartment complex and the amount of vacancies at any one time was subject to local economic conditions, lease rates and local housing alternatives. Timing of repairs and re-construction was another factor to consider because phases of construction proceeded on a building-by-building basis for more than one year.[18]

In terms of the equations above, we had to be concerned about net loss in revenue (actual apartments leased compared to 'but-for' or predicted leases), avoidable variable costs due to revenue decrease, extraordinary fixed costs (costs of repairs and reconstruction), and one-time costs incurred due to water damage and/or repair efforts, including special expenditures to retain current leaseholders such as short-term rent reductions, gift certificates, and cleaning of apartments and cars dirtied by construction efforts. Rent reductions, a price change, merited special consideration because of the facts that (i) the apartment manager normally used rent reductions to incentivize occupancy to desired levels, (ii) occupancy was seasonal, and (iii) the lease terms varied from monthly to quarterly or annual leases. This meant that even after re-construction was completed and occupancy restored to a 'but-for' level, the end date for lost profits was measured by the

[17] See Trout op cit.

[18] In these types of cases, it is important to work closely with the client and individual or firm in charge of repair and reconstruction to determine timing of repairs, phases, and if relocation of tenants is required. In past cases, our interaction with such individuals impacted plans to use some apartments as swing space, sometimes called 'hoteling' to offset costs of removing tenants entirely but temporarily off the property. Other cases have involved relocation in programmed phases rather than all tenants removed for the entirety of reconstruction.

remaining number months of below expected lease-revenue until but-for lease rates were resumed. This was the expected lease revenue would have been received if expected rates of leases had been maintained rather than disrupted by the water intrusion.

3. Temporary Profit Loss as Sales less Change in Avoided Variable Costs: Closed Loss Period

Another example of a business interruption involved a personal injury to a manager/owner of a contractor business that built swimming pools. In April 2005, an elderly driver backed her car across the street from her house, hitting and pinning the contractor/manager against the rear of car he had been standing behind, thus crushing both knees. Pool construction continued after the accident albeit at a changed pace and the business underwent adjustments in variable expenses, including the need to hire workers to substitute for some of the manager's activities.

In this case damages analysis did not involve price changes but we did consider both the loss in expected revenue as compared to actual revenue, and changes in variable costs before and after the accident as the owner/manager hired substitute workers to do some of the tasks he was unable to do after the injury. Revenue expected was estimated based on a regression analysis of revenue before the injury date with adjustments for trend, seasonality, and local housing permits. Our assessment was that economic losses were temporary because they stopped as of December 2007 when, due to the housing decline, mitigation profits exceeded those predicted. Average profit margin based on variable costs before April 2005 was 54% compared to 39% after the injury date. Loss analysis thus incorporates this variable cost change by measuring lost profits as the difference between predicted revenue multiplied by pre-accident margin and actual revenue multiplied by actual profit margin.

4. Change in Revenue and Variable Costs, plus Extra Costs: Closed Loss Period

An example of this type of case involved a business that manufactured and sold pre-packaged homes. The plaintiff sued its insurance carrier for bad faith in handling claims. Key management personnel had time diverted from operations and business development to focus on actions and expenses an insurance carrier would normally handle, including investigation, hiring attorneys, attending legal hearings such as depositions and trials, related travel and office support work.

During the damages period, the firm changed accounting systems and the growth rates of the industry exploded for a short time before succumbing to the overall housing decline in the mid-2000s. Due to its very rapid growth, one might have expected the 'learning curve' phenomenon and economies of scale to surface. However, experienced managers were tied up dealing with claim-processing and problem-solving issues and had to hire new operational managers to provide substitute functions and the most senior manager was not available to train and guide new staff.

In this situation, damages were estimated as lost revenue times the profit margin prior to the damages period, plus actual sales in the damages period times the difference between actual incremental profit margin and but-for incremental profit margin. In addition, extra costs for travel by management to legal hearings and extra attorney fees were included. Assessed damages stopped when losses no longer exceeded mitigation profits.

Selected Estimation Issues

Calculating lost profits can be challenging in practice for several reasons. First, there are many causal factors (occurring simultaneously) which are hard to measure and/or a lack of data may make the use of the regression approach not the most appropriate method. The fish market case discussed earlier was such a case. A regression model of the fish market's sales indicated a steady decline for several years prior to the disruption. However, the sales decline was due to economic factors and reorganization of the business before the interruption. As a result, the actions of the San Francisco Port Authority were confounded with these other factors. The solution in this instance was to derive lost profits by simply taking the difference between real average revenue for pre-disruption period, 1995-1999, and real actual revenue after the disruption less avoided variable costs.

Second, determining the level of avoided variable costs is sometimes difficult. To determine which costs varied with sales in the apartment complex case, accounting records were acquired. However, the expenses categories changed over time and the data needed to be spliced and aggregated to be made time-consistent. In other cases where the data is insufficient, the analyst needs to use judgment in deciding which costs are variable. For example, one could include as variable costs the cost of goods sold as well as other elements that are likely to vary directly with sales.

Third, forecasting future revenue sometimes can't be a simple linear extrapolation of prior revenue trends. In the swimming pool contractor case discussed earlier, it was necessary to include several controls in the revenue model to appropriately capture the revenue pattern. To proxy for industry monthly

trends in housing, data on housing building permits in the contractor's local area were used following its conversion from annual data to monthly data. The conversion was achieved by assuming constant monthly compound growth rates between the midpoints of each year. In addition, the model also included both a time trend and its square to more completely describe the revenue growth pattern.

Fourth, sample sizes are often small in lost profits cases, which can lead to difficulties. In some cases the R-squared for the estimating regression equation is high, but the coefficients of interest are individually statistically insignificant. As long as the coefficients are jointly significant, the estimating equation often can be utilized. This is because the analyst is concerned about forecasting revenue and is not concerned about the direct significance of each control variable.

Conclusion

Estimating damages in business interruption litigation can be complex for many experts. The expert needs to assess lost profits by measuring the incremental changes in revenue (sales), variable costs, fixed costs and possible extraordinary expenses. We have presented a general model which is open to several sources of economic damages due to business interruption including changes in five factors: prices, quantity sold, changes in variable cost structures, fixed costs, and unusual expenses due to the disruption. In addition, we have included three special cases and four case-specific examples. We understand with five factors there are many more possible combinations of factors than those listed here. Our goal in this paper is not to present all possible factor combinations but to show and discuss those factor combinations the practitioner reasonably may encounter in business interruption litigation. This implies some preliminary research is needed to identify which factors have changed. We also suggest care be taken so as not to double count damages such as shown in Figure 5 for changes in both price and quantity sold. The main point is that lost profits need not be restricted to lost revenue less avoided variable costs, the often-cited but limiting approach suggested by equation (2). With so many business-interruption litigation proceedings occurring, we encourage experts to consider the use of this more general model when relevant to the facts and circumstances of each dispute.

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