AIRCURRENTS

CAPTURING THE GEOGRAPHIC VARIABILITY OF CONSTRUCTION COSTS WITH THE AIR SPATIAL COST INDEX

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EDITORS NOTE: In this article, Anthony Hanson, a principal analyst in AIR's exposures group, explains the current property valuation landscape, the role that the spatial cost index in AIR's industry exposure databases plays in developing better property value distributions, and why this leads to more realistic and reliable estimates of loss.

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INTRODUCTION

Catastrophes often expose flaws in residential and commercial property valuations that had previously gone undetected. Property valuations represent the full cost to replace a building in the event of a total loss, which makes understanding the current replacement value of a property especially critical. However, companies continue to face challenges—both at the point of underwriting and during policy renewals—in maintaining reliable replacement values.

One of the most valuable components of all AIR's catastrophe models is their underlying industry exposure database (IED). Each IED is built from the bottom up to develop an independent, high-resolution view of risk counts, building attributes, and replacement values at various geographic resolutions.

An important feature of the IED is the spatial cost index (SCI), which measures the average variation in cost to build an identical structure in different locations within a country. It captures the variation in the cost of construction based on the local changes in supply and demand for individual cost factors, such as construction materials, labor, and contractor markup. The impact of the spatial cost index in developing robust IEDs is considerable. By using a spatial cost index to fine tune local construction costs, AIR can produce more accurate loss estimates for all of its modeled perils.

CHALLENGES TO PROPERTY VALUATION

Property valuation can be complex and there are a multitude of issues for an insurer to consider. While using national average construction costs can give a reasonable estimate of exposure value at the country level, the building cost for a similar structure (e.g. single-family home) can vary from one community to the next, deviating from the national average by up to 30% or more. There can be many reasons for this. Frequently it is due to the local availability of construction expertise or labor. For example, if the labor supply is constrained by shortage of local expertise or too much demand for the available labor, construction costs will increase.

A simple approach to property valuation at the national level only requires information about the average floor area and building cost. The example in Figure 1 shows the unit cost per square meter for commercial buildings for various materials at the national level. This assumes that construction costs per unit area for various construction types are uniform across the country. However, property valuations based on these costs would only reflect the regional differences in the floor area for each material type—not the differences in construction costs across communities and regions.

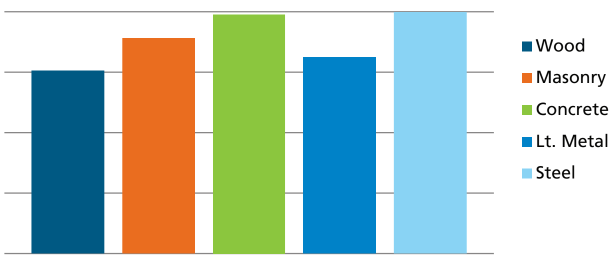

Figure 1. Costs per square meter by material type at the national level. Note that regional differences, not shown here, can be significant. (Source: AIR)

Therefore, to quantify these variations in cost, AIR exposure analysts develop spatial cost indices based on the local differences in supply and demand.

HOW IS THE SPATIAL COST INDEX CONSTRUCTED?

Developing a SCI requires a host of high-resolution information from survey data on construction practices. This level of granularity is particularly important in developing an SCI as it enables a more realistic assessment of the spatial distribution of construction costs. While lower geographic resolution SCIs available in construction cost manuals for some countries may offer some guidance on construction cost differences, they do not provide a comprehensive view.

The SCI captures the relative cost of its component parts—materials, labor, and contractor markups—at a localized level. An analysis of real estate trends is used to determine the geographic distribution of the relative movements in these component costs. Because high-resolution survey data is difficult to obtain for all countries, variations in the component parts have to be measured using other data. A literature review of the latest research on building costs and the causes of materials price movements provides some insight into the most common variables that drive the construction cost.

Table 1 shows the variables that go into the SCI, categorized into economic and geographic factors.

Table 1 – Impact of Economic and Geographic Variables on Construction Costs (Source: AIR)

Variable	Effect on Cost	Reasoning
Per Capita Income	Positive	Higher markup on labor and materials, ability to charge more because of perceived value
Unemployment	Negative	Increases supply of labor, decreases demand for services
Land Price	Positive	A measure of wealth that is a proxy for size of the plot, distance to the city center and quality of neighborhood
Suburbanization	Positive	Measures the housing density of single family homes.
Undeveloped Buildable Land	Negative	More available land outside the central business district; charge less because of lower perceived value
Remoteness	Positive	Scarcity of nearby materials and labor

The first three variables in Table 1 are economic factors. Per capita income can increase costs because consumers are able and willing to pay more for a higher perceived value. Unemployment usually decreases costs because it is an indicator of the health of the economy and higher unemployment lowers the demand for labor. Land price is a function of several location attributes, including the quality of public amenities, safety, and proximity to the city center, and higher land prices generally increase construction costs.

The next set of cost drivers are socio-geographic factors. With suburbanization, there is a correlation between housing density and lot size; as density increases, the lot sizes become smaller and the cost increases. Larger areas of undeveloped buildable land translate into relatively easy expansion at lower price levels. Not surprisingly, remoteness drives up the cost of material and labor, because materials not available locally have to be transported a long way or labor has to be brought in and housed during construction.

Slight differences in the economic and geographic indicators described above can have a significant effect on lowering or increasing the values in a spatial cost index. To illustrate the significance of these variables, spatial cost indices for Germany are illustrated in Figure 2.

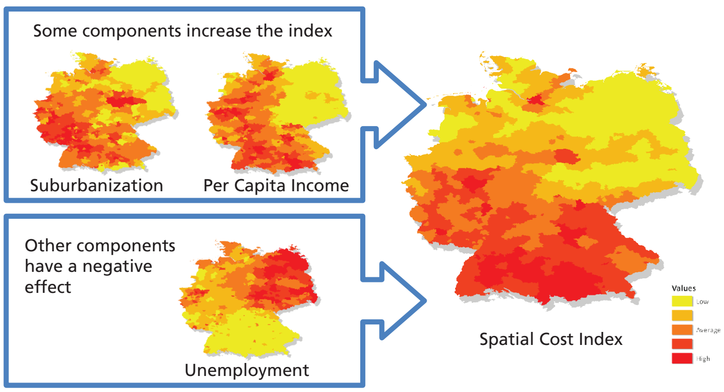

Figure 2. Spatial variation in economic and geographic data impacts a Spatial Cost Index (Source: AIR)

The box on the upper left shows an area in the southwest with higher suburbanization and an overall higher standard of living, which increases the relative costs. (Note that reds and oranges in Figure 2 indicate higher values in the spatial cost index; yellow indicates lower values.) In the northeast of the country, where there is more farming and less industry, costs are lower and correspond to lower values in the spatial cost index. The box in the lower left shows low rates of unemployment in the south of Germany and significantly higher rates of unemployment in the northeast. As unemployment increases, the values in the spatial cost index decrease.

IMPACT OF THE SCI ON THE AIR INDUSTRY EXPOSURE DATABASES

AIR construction engineers, demographers and statisticians develop an industry exposure database (IED) for every country modeled by AIR—which currently number 96. In conjunction with AIR's advanced disaggregation techniques (see AIR Current "Exposure Disaggregation: Building Better Loss Estimates") for accurately locating buildings at a high resolution, AIR has also developed high-resolution construction distributions, which capture the proportion of risks represented by various construction types (see the AIR Current "Construction Distributions: An Essential Element of Robust Industry Loss Estimates"). The replacement values contained in the IED are developed using a rebuild cost approach based upon the costs derived from the SCIs, the risk counts (number of properties), and the construction distributions. This approach enables AIR exposure analysts to provide a highly accurate view of the built environment.

Figure 3 illustrates the spatial distribution of the replacement values of commercial risks at the 1 km grid in the Czech Republic. The inset shows two areas in increased detail—one in the city of Brno (east of Prague) and the other in a rural area to the north.

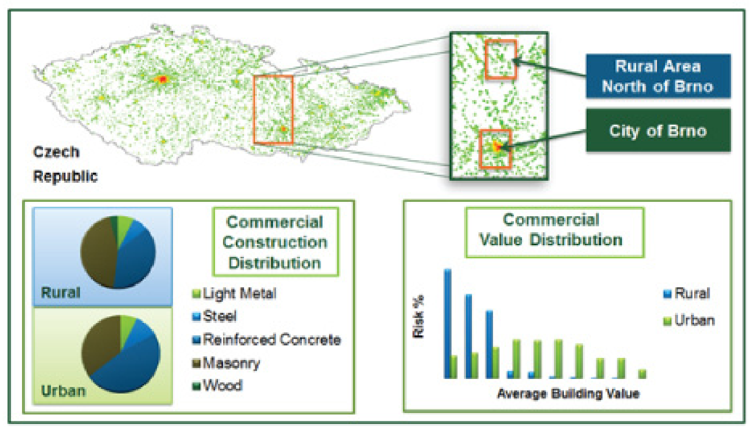

Figure 3. AIR IEDs provide a high resolution view of the built environment (Source: AIR)

To classify the building types in the area, AIR used its construction distributions to compare values by construction in these areas. Indeed, as would be expected for an urban area, the city of Brno is home to a significant number of reinforced concrete structures while the rural area has more masonry and wood structures.

Using the SCIs, the lower right chart provides further guidance on the values. There is a larger proportion of communities with lower average buildings values in rural areas and, as expected, there is a larger proportion of communities with higher average building values in the urban areas. Leveraging the high-resolution construction distributions and SCI, AIR is able to provide a comprehensive and detailed view of building costs.

CLOSING THOUGHTS

Of the many risk parameters that impact catastrophe loss estimates, replacement cost is one of the most significant. If a property is under valued by 20%, so too will be the modeled losses. Clearly, the reliability of model output is only as good as the quality of the exposure data used as input.

AIR invests significant resources in the development of its high-resolution industry exposure databases. The level of detail and reliability of the AIR IEDs provide a more nuanced view of construction costs, ensuring more reliable catastrophe risk management.

Indeed, AIR's industry exposure databases are instrumental in helping individual companies better manage catastrophe risk. Companies can validate their own loss distributions by comparing detailed loss results from all models against CATRADER® industry losses. Using the TruExposure™ benchmarking module, companies can assess exposure data quality by comparing the construction, occupancy, and replacement value mix in individual portfolios to industry averages as represented in AIR IEDs.

AIR developed the first industry exposure database more than 20 years ago and continues to innovate with the development of a unique property-specific databases for nearly 100 countries across the globe.

ABOUT AIR WORLDWIDE

AIR Worldwide (AIR) is the scientific leader and most respected provider of risk modeling software and consulting services. AIR founded the catastrophe modeling industry in 1987 and today models the risk from natural catastrophes and terrorism in more than 90 countries. More than 400 insurance, reinsurance, financial, corporate, and government clients rely on AIR software and services for catastrophe risk management, insurance-linked securities, detailed site-specific wind and seismic engineering analyses, agricultural risk management, and property replacement-cost valuation. AIR is a member of the Verisk Insurance Solutions group at Verisk Analytics (Nasdaq:VRSK) and is headquartered in Boston with additional offices in North America, Europe, and Asia. For more information, please visit www. air-worldwide.com.