Valuing a Port: Where the Beauty Lies in the Numbers

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1. Introduction: Seeing Value Beyond the Cranes

In the world of logistics, our eyes are often drawn to the spectacle: container stacks arranged like geometric sculptures—evocative of Josef Albers' *Homage to the Square* series—ship-to-shore cranes choreographed with precision, or trucks traversing the port hinterland. But beneath these scenes lies a quieter, arguably more powerful narrative—the story told by numbers. And it is here, in the mathematics of risk and return, that we find another kind of beauty: the beauty of valuation.

Visual Parallels in Structure and Rythm



Left: Containers stacked in storage, Port of Cartagena, Colombia (photo courtesy of author). Right: Joseph Albers, *Homage to the Square* (exhibit image: Fondazione Stelline e Accademia di Brera, Milano, January 2013, available at: https://www.eventiatmilano.it/2013/11/josef-albers-mostra-milano-fondazione-stelline-accademia-brera/.)

In this For the Beauty of Logistics edition, we shift our gaze from the visual to the analytical. We explore how port facilities—whether publicly financed or privately financed and operated—are valued, not just in the financial sense, but in terms of their strategic, economic, and institutional significance. Let's face it—most people don't get excited about a discounted cash flow model. Port cranes? Maybe. Container stacks towering like modernist sculptures? Absolutely. But spreadsheet tabs named "BetaCalc_FINAL_v3"? Not so much. And yet, that's where some

of the most important actions happen.

Underlying every marine terminal is a financial story waiting to be told—a story of risk, return, investment, and whether a project pencils out. In this edition, we set aside a terminal's infrastructure and equipment to explore something less visible but no less essential: how ports are valued.

Why does this matter? Because ports don't get built, expanded, or transferred without someone—often many someones—asking: *What is this worth?* Project valuation sits at the center of countless decisions:

- Should a private investor bid on a concession?
- How much equity should a public authority ask for?
- What return will satisfy multilateral lenders or institutional investors?

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• Can this project attract finance—or is it all just steel, concrete, and hope?

Understanding valuation isn't just a financial exercise—it's the foundation of credible investment, responsible public-private partnerships, and transparent infrastructure development.

This edition was motivated in part by responses to an earlier article in this series that examined the Panama Canal's toll strategy and business model.⁴ In that piece, we used a set of comparable global infrastructure operators to assess the Canal's performance. The strong interest in that comparative analysis—especially around how multiples are used—sparked this deeper dive into valuation fundamentals.

Our goal is simple: demystify how ports are valued using the building blocks of comparables, multiples, beta, and the Capital Asset Pricing Model (CAPM) formula. This article focuses on early-stage project evaluation from an equity investor's perspective.⁵ We'll walk through two fictional port cases—one a container transshipment hub, the other a multipurpose inland waterway terminal—and use them to explain the logic behind market-based valuation methods.

2. Why Valuation Matters

Valuation might not dazzle like tugs maneuvering an ultra large container vessel at sunrise or a drone shot of cranes and container yards in motion—but it's where the real decisions are made. Beneath every project pitch, concession agreement, or financing plan is one deceptively simple question: *What's it worth?*

In the port world, that question pops up at different moments in a project's development:

- When a private investor is weighing whether to bid on a terminal concession.
- When a project sponsor is trying to figure out how much equity to give up—or hold onto.
- When a public authority needs to justify a long-term lease or attract the right operating partner.
- When development banks and institutional investors are assessing returns against risk.
- Or even internally when planners are choosing between one expansion project and another.

A sound valuation helps answer not just whether a project is viable—but how much capital to invest, what level of risk is acceptable, and whether the expected returns are actually worth it.

And when public money is involved—as it so often is in ports—valuation takes on an even bigger role. It helps ensure that deals are transparent, that public assets aren't underpriced, and that partnerships with the private sector are built on solid, defensible ground.

So while it might not grab headlines, project valuation is what makes port development—and investment possible. It's the bridge between ambition and reality, between concept drawings and financial close.

⁴ See: "The Panama Canal Debate: Sovereignty and Pricing Fairness," published as part of the *For the Beauty of Logistics* series. In analyzing the Panama Canal Authority's pricing power, the article used a set of publicly traded comparables and their financial metrics to determine the reasonableness of Panama Canal tolls. The article can be found here: <u>For the Beauty of Logistics: The Panama Canal Debate – Sovereignty and Pricing Fairness</u>.

⁵ Note: In some financial models—such as those used to value entire enterprises or structured project finance deals—the Weighted Average Cost of Capital (WACC) is also used to reflect the combined cost of debt and equity.

3. Understanding Comparables, Multiples, and Beta (in Plain English)

Valuation, at its core, is part art, part arithmetic—and when it comes to ports, the starting point is usually comparables. Think of comparables as the real estate "comps" of the infrastructure world: what have similar assets sold for, and what are they trading at now? In business valuation, analysts look at publicly traded companies (publicly traded company data are readily available) that resemble the project in question—similar services, similar assets, similar markets—and use them to estimate what a new or unlisted project might be worth.

To make this work, we rely on multiples. The most common in port valuation is EV/EBITDA, which compares a company's enterprise value (EV)—the value of its entire business including debt—to its earnings before interest, taxes, depreciation, and amortization (EBITDA).⁶ There's often a correlation between the size of a company's EBITDA and the multiple it trades at. Larger EBITDA typically signals greater business stability and lower perceived risk—so companies earning billions may trade at higher multiples than smaller port projects generating, say, under \$100 million. In some analyses, analysts will even regress EV/EBITDA against EBITDA size to determine a more tailored multiple for the subject project.

Why EV/EBITDA? Because it strips away differences in capital structure and tax treatment and zooms in on what really matters: how much cash the business generates from operations. But it's not the full story. Because EBITDA excludes depreciation, it doesn't capture how much capital spending (CapEx) is needed to maintain or grow operations. One comparable might need to reinvest half of its EBITDA just to maintain its assets, while another might only require 20%. The one with lower ongoing CapEx is a stronger proxy for free cash flow—and usually justifies a higher multiple. That's why understanding the reinvestment needs of each comparable is important when applying EV/EBITDA. That makes EV/EBITDA especially useful for ports, where ownership models and financing structures can vary dramatically—but only when the underlying capital needs of each asset are understood.

But comparing cash flows alone isn't enough. Investors also want to know how risky those cash flows are and that's where beta comes in. Beta is a measure of how much a project's returns are likely to bounce around compared to the broader market. A beta of 1.0 means the project is expected to move in sync with the market. A beta above 1.0 suggests higher volatility (and risk); below 1.0 means it's likely to be more stable.⁷

In short: multiples give us a market-tested snapshot of value—with risk baked in—while beta helps us break that risk out in a more structured way when we build discount rates. Together, they're the twin pillars of any well-grounded project valuation—especially when you're building up to a discounted cash flow (DCF) model or defending a terminal's price tag at the negotiation table. Both the multiples and DCF approaches ultimately

⁶ To calculate an equity valuation from enterprise value, we would subtract net debt (total debt minus cash on hand). This gives the value attributable to shareholders alone. In formula terms: Equity Value = Enterprise Value – Net Debt. This step is typically needed when assessing investor ownership stakes, share prices, or returns to equity holders—as opposed to evaluating the total business value.

⁷ Beta reflects exposure to market-wide, non-diversifiable risk (also known as systematic risk). It does not capture the specific risks of an individual project—such as permitting delays, cost overruns, or operator performance—which are considered diversifiable. Those risks are typically addressed by adjusting the project's cash flow projections or applying a more conservative valuation multiple.

help investors evaluate risk, just from different perspectives: one through observed market behavior, the other through modeled return expectations.

4. Setting the Stage: Two Hypothetical Port Projects

Before we dive into calculations, let's introduce the stars of our show: two fictional port terminals that capture the diversity of real-world port development.

Case 1: New Horizon Container Terminal (NHCT)

- **Type**: A specialized container terminal focused on transshipment.
- Location: A fast-growing hub in the Eastern Caribbean.
- **Status**: Greenfield project under evaluation by public and private investors.
- Throughput Capacity: 1.5 million TEUs per year.⁸
- **Key features**: Automated RTGs⁹ and quay cranes and strong liner carrier interest.
- **Financing**: A mix of concession terms, sovereign backing, and interest from DFIs (development financing institutions). The project is expected to rely on a relatively high share of debt financing—reflecting both its greenfield nature and the capital-intensive profile typical of automated container terminals.

This is the kind of project that makes PowerPoint slides look good—new, modern, and poised to capture regional trade flows.

Case 2: RiverGate Multipurpose Terminal (RMT)

- **Type**: Multipurpose terminal handling dry bulk, breakbulk, general cargo, and modest container volumes.
- Location: On a navigable river, with solid road and rail connections.
- Status: Brownfield upgrade spearheaded by a public port authority.
- Throughput Capacity: 5 million tons/year.
- Key features: Lower throughput volatility but less automation and standardized handling.
- **Financing**: Public funding covers dredging and berth; private operator to fund backup area and handling equipment. Given the brownfield nature and public-sector lead, the project is expected to involve a more moderate level of leverage.

Think of this one as the utility player—not flashy, but steady and critical to inland connectivity.

⁸ TEU, twenty-foot equivalent unit, refers to the size of a standard marine container. In the context of throughput capacity, this refers to the volume of 20-foot marine containers that can be accommodated annually in a container terminal.

⁹ RTGs refers to Rubber-Tired Gantry Cranes, which are the equipment used for stacking and moving containers within a container terminal's storage yard.

5. Multiples Assessment – How the Market Informs Value

To estimate what these terminals might be worth, we turn to the comparables—the port sector's version of real estate comps. Table 1 presents a simplified set of fictitious port and logistics operators used for illustration.

Company Name	Туре	EV (US \$Billion)	EBITDA (US \$Billion)	EV/EBITDA	Notes
OceanGate Terminals	Container Terminals	18.0	1.95	9.25	Regional focus, high automation
GlobalPort Infra Group	Mixed Cargo Terminals	30.0	3.50	8.60	Diversified assets, large footprint
SeaCoast Holdings	Container Terminals	10.0	1.40	7.14	Listed in Asia
Atlantic Port Partners	Multipurpose Terminals	6.5	1.00	6.50	Bulk and breakbulk cargo
IntermodalLogix Corp	Inland Waterway Terminals	4.0	0.60	6.70	Small container share, lower margins

Table 1. Fictitious Port Operator Comparables and Multiples

Note: In practice, we typically develop a much broader set of comparables—often 20 or more—when conducting a formal valuation. The starting point is often an industry classification system (such as the General Industry Classification Standard for Marine Ports and Services) to identify a range of comparables, but we also consider factors like cargo type, operating model, geographic focus, and financial scale. From there, we filter for practical data availability—focusing on companies with reported figures for Beta, EV, EBITDA, and sometimes WACC. Analysts often summarize the resulting multiples by quartiles (e.g., 25th percentile, median, and 75th percentile) to reduce the impact of outliers on the average. The smaller set in this table is used solely to illustrate the analytical method and logic behind applying valuation multiples.

For RMT, the multipurpose inland terminal, things are trickier. These terminals tend to have more variable cargo mixes and lower equipment intensity. That means earnings can be a bit lumpier and less scalable— which translates into slightly lower market multiples. In our simplified example, the only directly comparable firm—Atlantic Port Partners—has a multiple of 6.5x. To be more conservative, we apply a slightly lower multiple of 6.0x to RMT.

Applying these multiples:

- For NHCT, with projected steady-state EBITDA of USD 80 million, the base case valuation using the 8.2x multiple yields an enterprise value of USD 656 million. If we apply a slightly discounted multiple of 7.5x—perhaps to account for regional or execution risk—the valuation would drop to USD 600 million.
- For RMT, with projected EBITDA of USD 45 million, applying the conservative 6.0x multiple results in an estimated value of USD 270 million.

These valuations, ¹⁰ while illustrative, reflect the same thought process investors and analysts use when evaluating port assets. Market-based multiples are never perfect, but they give us a grounded starting point— one that can be stress-tested, adjusted, and ultimately used to guide pricing, negotiations, and financing.

6. How Is Beta Determined?

Now that we've talked about how to estimate value using comparables and multiples, it's time to shift from *what something might be worth* to *how risky it is to get there*. That's where beta comes in.

In port valuation, beta plays a key role in calculating the discount rate—the return investors expect in exchange for taking on risk. While both beta and multiples aim to assess value, they do so in different ways: multiples reflect market pricing with risk already baked in, while beta helps us isolate and model that risk more explicitly in a discounted cash flow (DCF) framework through something called the Capital Asset Pricing Model (CAPM).

What Is Levered Beta?

Levered beta (sometimes called equity beta) tells us how sensitive a company's returns are to movements in the broader market. It's a risk gauge. A beta of 1.0 means the investment tends to move in line with the market. A beta above 1.0 means it's more volatile (i.e., higher risk, higher potential reward), while a beta below 1.0 means it's more stable.

But levered beta doesn't just reflect the ups and downs of the business—it also captures how much debt the company uses to finance its assets. Why? Because debt magnifies both gains and losses, like putting leverage on a seesaw. The more debt you carry, the more sensitive your returns become to market shifts.

For publicly traded companies, levered beta is often available off-the-shelf from financial databases like Bloomberg, Reuters, or Capital IQ. These betas are calculated statistically by comparing a company's historical stock returns to a broader index like the S&P 500.

From Comparables to Project Beta

For project-based investments like NHCT or RMT, which are not publicly traded, we cannot observe beta directly. Instead, we estimate beta through a three-step process using a set of comparable public companies:

1. Gather Levered Betas from Comparable Companies

Look up published betas for similar businesses—ideally those operating container terminals, multipurpose terminals, or inland ports.

2. Unlever the Betas

Use the debt/equity ratios of each comparable company to strip out the effects of their capital structure. This gives us the unlevered beta, which reflects only the business (asset) risk – not how it is financed.

The debt-to-equity (D/E) ratio simply shows how much debt a company uses compared to the amount of money its owners have put in (equity). A ratio of 1.0 means the company is financed

¹⁰ These valuations reflect enterprise value, which represents the value of the entire business including debt. In a full financial analysis, equity value would be calculated by subtracting net debt (i.e., total debt minus cash on hand) from enterprise value.

equally by debt and equity. If the ratio is higher than 1, the company relies more on borrowing; if it's lower, it's mostly funded by owner capital. More debt usually means more financial risk, resulting in a higher levered beta.

Here's the equation for calculating unlevered beta:

Unlevered Beta = Levered Beta/[1+(1-Tax Rate) x D/E]

3. Re-lever the Beta for the Project's Capital Structure

Once you have an unlevered beta, you can reapply the beta that reflects the capital structure you plan to use for your project. This "re-levered" beta now reflects your project's actual risk profile, and it's ready to be used in the CAPM formula to estimate your discount rate.

After calculating the unlevered betas of our comparables, we can average them to estimate the asset (business) risk for our project. We'll then re-lever that average based on the expected financing structure of each project—NHCT and RMT—to reflect their specific capital mix. These project-specific betas will feed directly into the discount rate calculation in the next section.

In NHCT's case, the higher debt/equity ratio reflects both the capital-intensive nature of container terminals and the typical financing profile of greenfield infrastructure projects with DFI or sovereign participation. For RMT, the more moderate leverage reflects its brownfield character and the lower capital intensity typical of multipurpose terminals.

Table 2 provides sample betas from our fictional comparables. The average unlevered beta from this group gives us a solid benchmark to work with. By re-levering that average based on NHCT's or RMT's financing assumptions, we can estimate a project-specific beta that captures both business risk and financial leverage.

Company Name	Levered Beta	D/E Ratio	Unlevered Beta
OceanGate Terminals	1.15	1.0	0.70
GlobalPort Infra Group	1.05	0.8	0.63
SeaCoast Holdings	1.20	1.2	0.67
Atlantic Port Partners	0.90	0.6	0.69
IntermodalLogix Corp	1.00	0.7	0.67

 Table 2. Sample Betas from Fictional Comparables

That beta becomes a key input to CAPM—and from there, we're just one formula away from calculating what return investors will expect.

7. Calculating the Discount Rate Using CAPM

Once we've estimated a project's beta, we're ready to put it to work in a formula that helps investors answer a fundamental question: how much return should I expect for taking this risk?

That's where the CAPM comes in. Here's the CAPM formula:

Discount Rate = Risk-Free Rate + (β × Market Risk Premium)

What Do These Terms Mean?

Risk-Free Rate:

This is the return you'd get from a super-safe investment—typically a long-term U.S. Treasury bond. It represents the time value of money: if there were *zero risk*, this is what investors would settle for. Right now, that figure often hovers around 4.0%.

Market Risk Premium:

This is the extra return investors expect for choosing the stock market over something ultra-safe like U.S. Treasuries. It compensates for broad market volatility and uncertainty. A common assumption is 6.0% based on long-term historical averages. Note that other risk factors—such as country-specific risks or illiquidity—are sometimes added separately to the discount rate, on top of the CAPM result, depending on the project's location and investor requirements.

• Beta (β):

We covered this earlier, but here's the recap: beta measures how much riskier the project is compared to the market. A beta of 1.0 means it moves in line with the market. Higher than 1.0 means it's more volatile. So the higher the beta, the higher the return investors will demand.

Back to the Future: Two Hypothetical Terminals

So, back to the future—and to the two terminals that have been anchoring our analysis.

Now let's plug in what we've calculated for NHCT and RMT, using the assumptions we've laid out:

- Risk-Free Rate: 4.0%
- Market Risk Premium: 6.0%

New Horizon Container Terminal (NHCT)

- Re-levered Beta = 1.84¹¹
- Discount Rate = 4.0% + (1.84 × 6.0%) = 15.0%¹²

RiverGate Multipurpose Terminal (RMT)

- Re-levered Beta = 1.21¹³
- Discount Rate = 4.0% + (1.21 × 6.0%) = 11.3%

These discount rates tell us what kind of return investors would expect—given the risk profile of each project. They're essential for any discounted cash flow (DCF) analysis, and they also help answer questions like:

• Is the project likely to meet investor expectations?

 $^{^{11}}$ Re-levered beta is calculated by applying the project's assumed capital structure (Debt/Equity = 2.33) to the average unlevered beta from the container terminal comparables in the earlier table. The formula is:

Re-levered Beta=Unlevered Beta×[1+(1-Tax Rate)×(D/E)]

Assuming an average unlevered beta of 0.70 and a tax rate of 25%, NHCT's re-levered beta = $0.70 \times [1 + (1 - 0.25) \times 2.33] \approx 1.84$. ¹² These results reflect the discount rate calculated using CAPM, which captures market (systematic) risk. In practice, other risk factors—such as country-specific risk, illiquidity, or project-specific uncertainty—may be added on top of the CAPM output to arrive at a final discount rate.

¹³ Re-levered beta is calculated using the same formula described in Footnote 7 for NHCT, applying RMT's assumed capital structure (Debt/Equity = 1.0) to the average unlevered beta from the relevant comparables. Using an average unlevered beta of 0.67 and a tax rate of 25%, RMT's re-levered beta = $0.67 \times [1 + (1 - 0.25) \times 1.0] \approx 1.21$.

- Can it sustain this return given its revenue and cost profile?
- Do we need to revisit the capital structure to make the numbers work?

In short, CAPM doesn't just plug in a number. It connects risk to return—and brings a little rigor to the optimism baked into every project forecast.¹⁴

8. Conclusion: The Hidden Geometry of Port Value

Ports are more than infrastructure. Yes, they're systems of steel, concrete, cranes, and cargo—but they're also made up of capital flows, investor expectations, public accountability, and risk. When we talk about valuation, we're not just crunching numbers. We're choosing a lens—a way to see both the promise and the uncertainty baked into every berth, every ton, every deal.

This walkthrough has aimed to demystify the toolkit behind modern port valuation: comparables, multiples, beta, and the CAPM model. Using two fictional but plausible case studies—NHCT and RMT—we've shown how even with imperfect information, a structured and transparent approach can lead to smarter investment decisions, fairer negotiations, and better-aligned public-private outcomes.

In logistics, not all beauty lies in motion. Sometimes, it lies in the numbers—and in understanding what those numbers reveal.

The For the Beauty of Logistics Series

This paper is the sixth installment in Dr. Kent's *For the Beauty of Logistics* series, a collection of short papers that explore how logistics principles intersect with economic, policy, and infrastructural systems to drive innovation, optimize complex processes, and reveal deeper insights into global dynamics. Previous papers in the Series can be found here:

- The Panama Canal Debate Sovereignty and Pricing Fairness Monument Economics Group
- Logistics Reimagined: Advancing the Intelligent Logistics System (Part 1) Monument Economics Group
- Honduras' ICSID Withdrawal and What's at Stake Monument Economics Group
- <u>Gaza's Port to Prosperity: Building a Sustainable Future Amidst Conflict Monument Economics</u> <u>Group</u>
- From Nobel Laureates to the Cellular Supply Chain: Unveiling Logistics Concepts to Foster Wider Understanding of Scientific Research - Monument Economics Group

¹⁴ As noted earlier, we're focusing here on the equity side using CAPM—WACC would be used in a full blended capital structure analysis.