

Factors Determining the Market Value of Upstream Properties

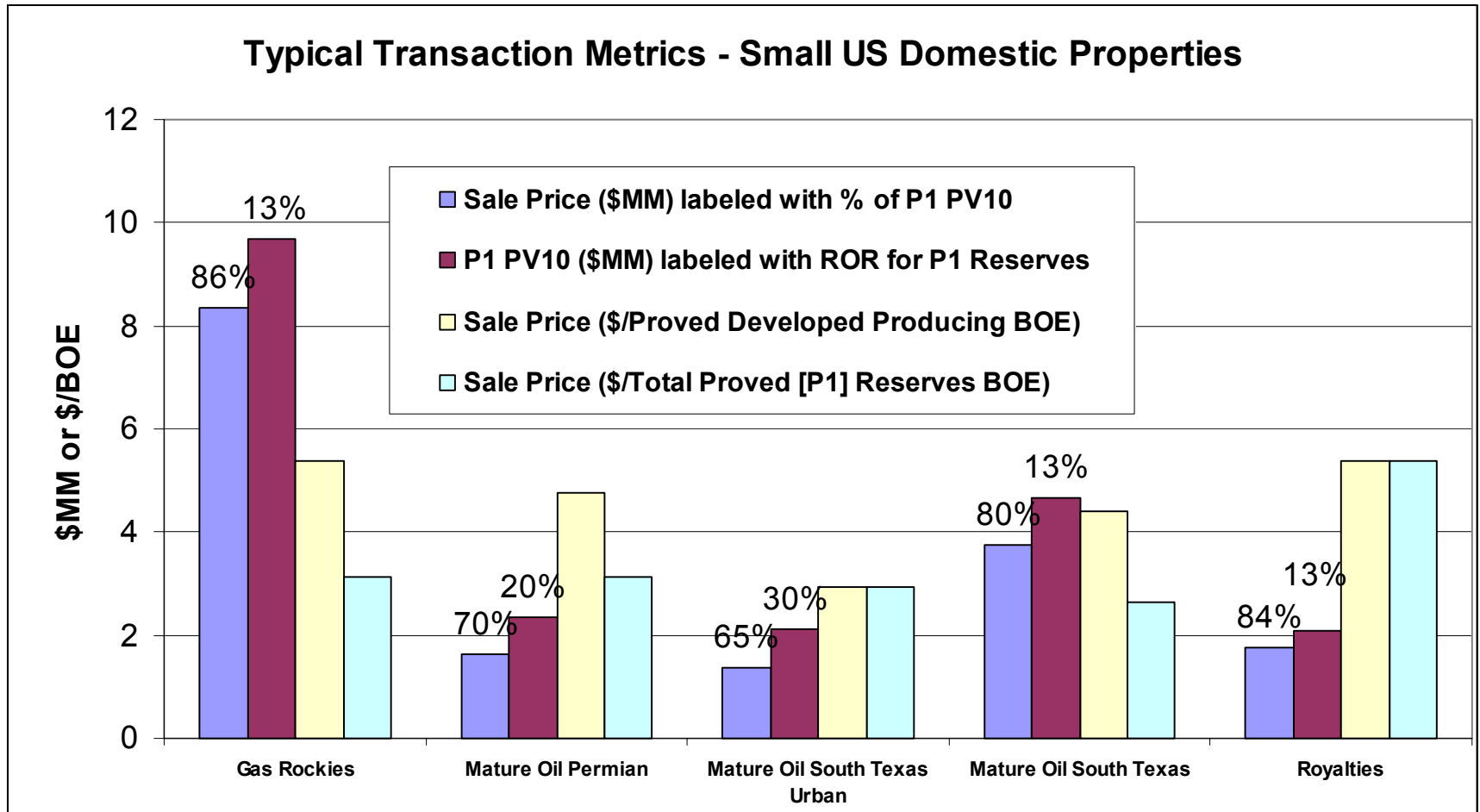
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Analysis of transactions involving exploration and production assets shows a substantial difference between purchase prices and values derived from discounted cash flow analysis adjusted for technical risk. We discuss various factors that determine the Market Value of upstream opportunities

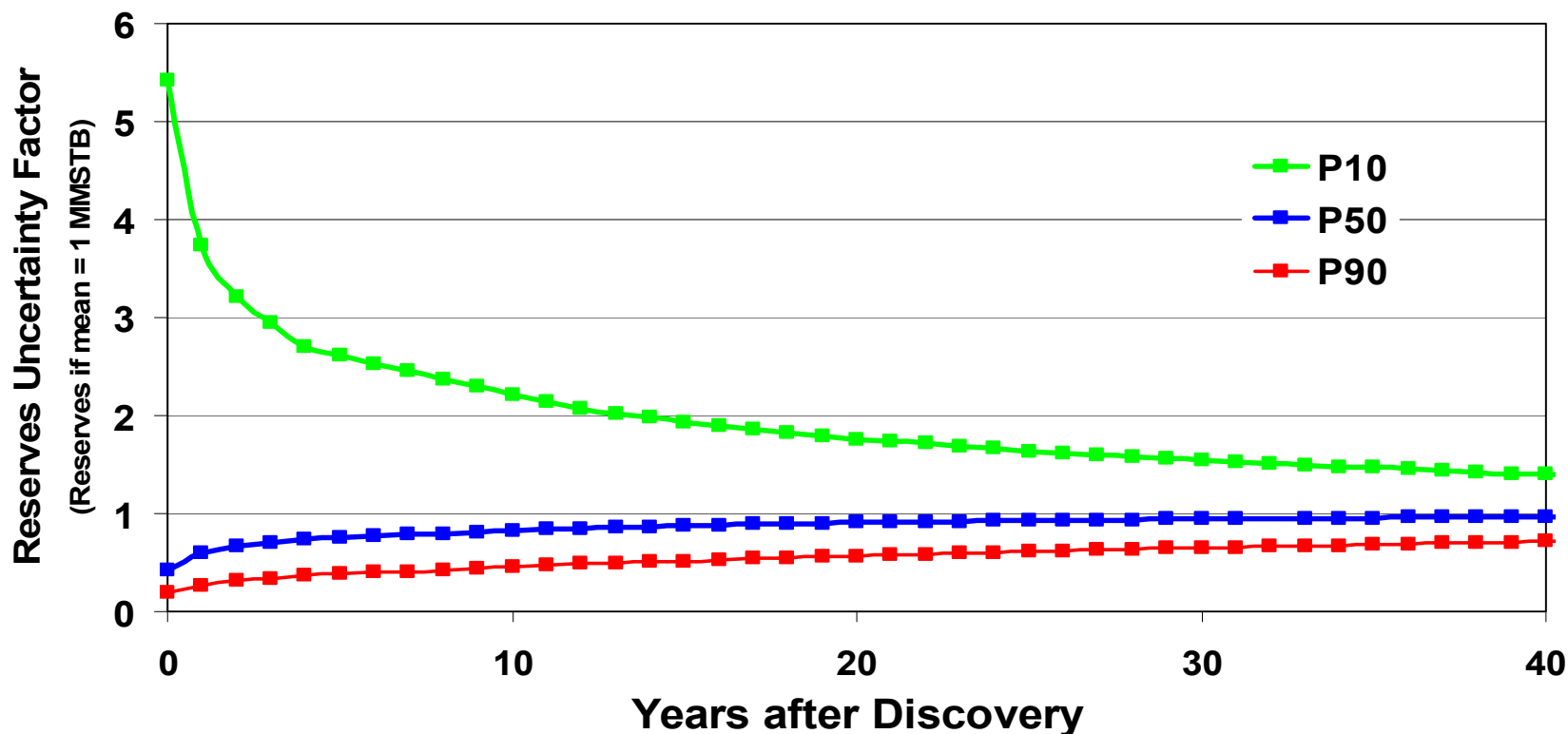
- *Location and circumstances of buyer and seller*
- *Reserves and Resource Estimation Methods*
- *Discount Rates*
- *Price Scenarios*
- *Risk Aversion*
- *Commercial, Political, Logistical and Bureaucratic Issues (“Country Risk”)*
- *Portfolio Effects*
- *Tax and Cost Recovery Effects*
- *Operatorship, Business Unit and Working Interest Effect*

The basis for valuing transactions appears to be driven in part by local performance metrics. Thus small US domestic evaluations concentrate on Proved Reserves, pre-tax, whereas large international transactions tend to concentrate on Expected or Proved and Probable Reserves, after tax

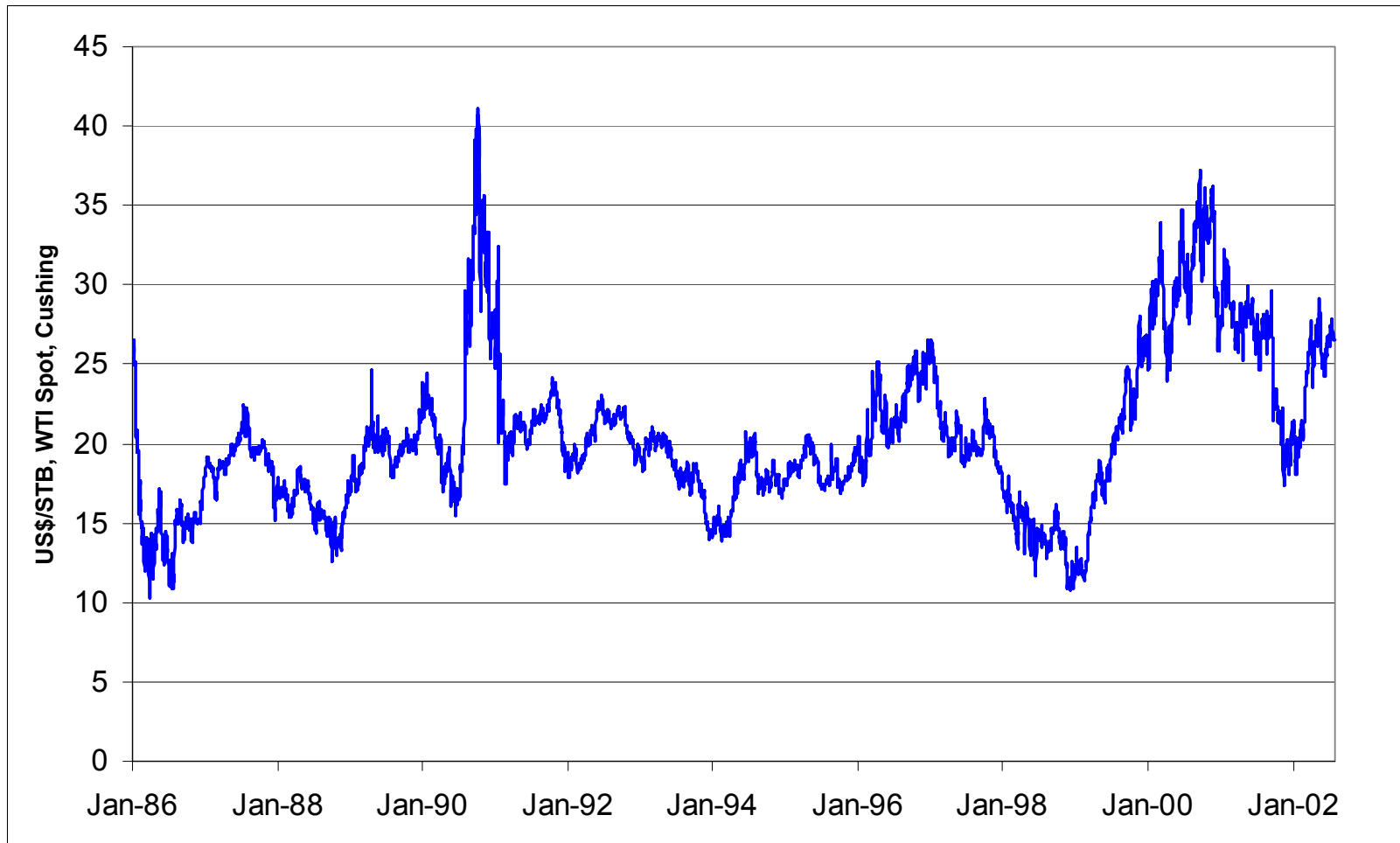


Proved Reserves (P1, or P90 if probabilistic) provide a very conservative basis for valuation; even Proved & Probable Reserves (2P, or P50 if probabilistic) understate the Mean (Expected) Value, particularly in the early years when there is still considerable uncertainty in the distribution.

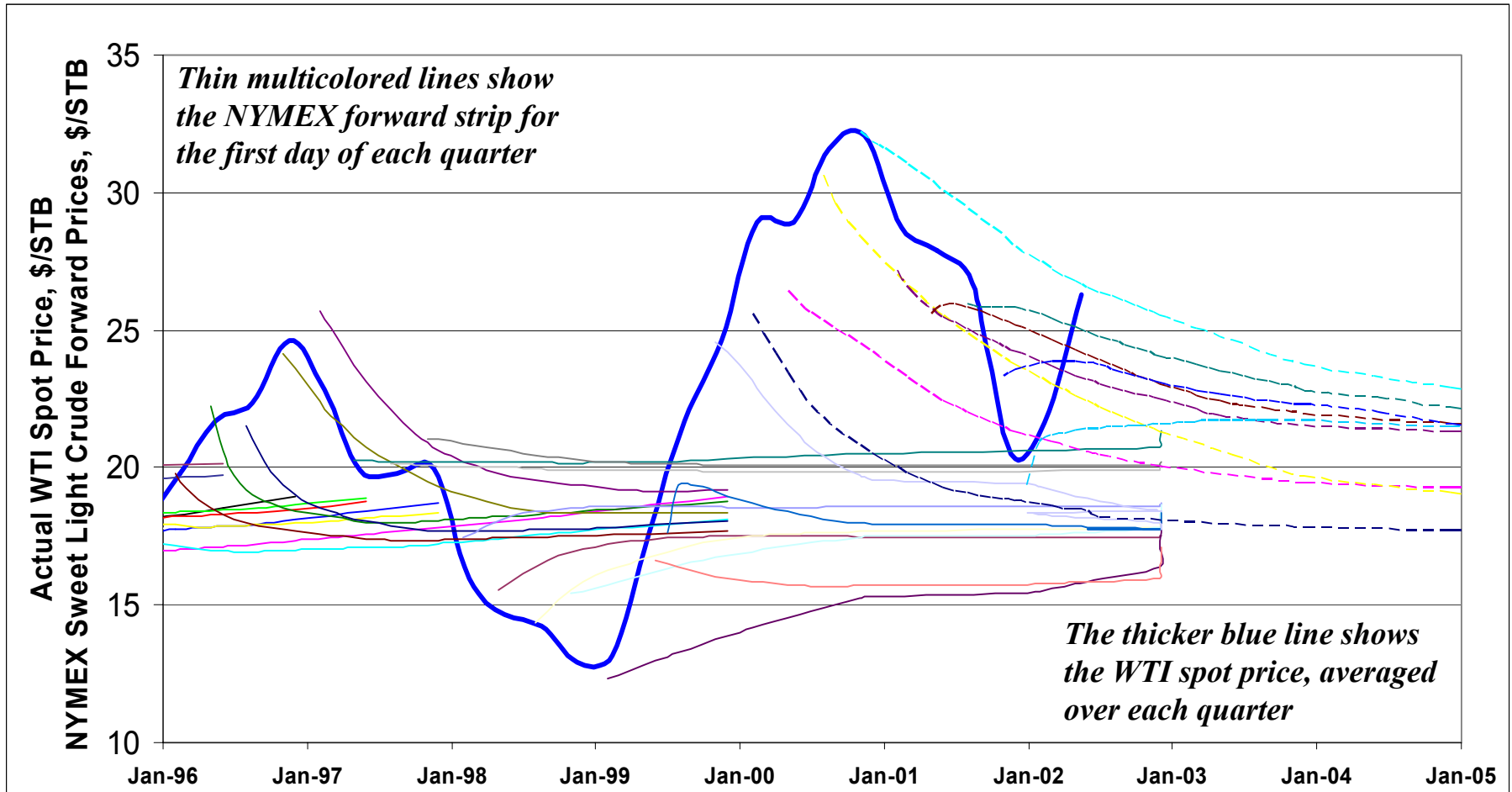
Reserves-Probability Distribution from USGS Growth Statistics - Oil Fields



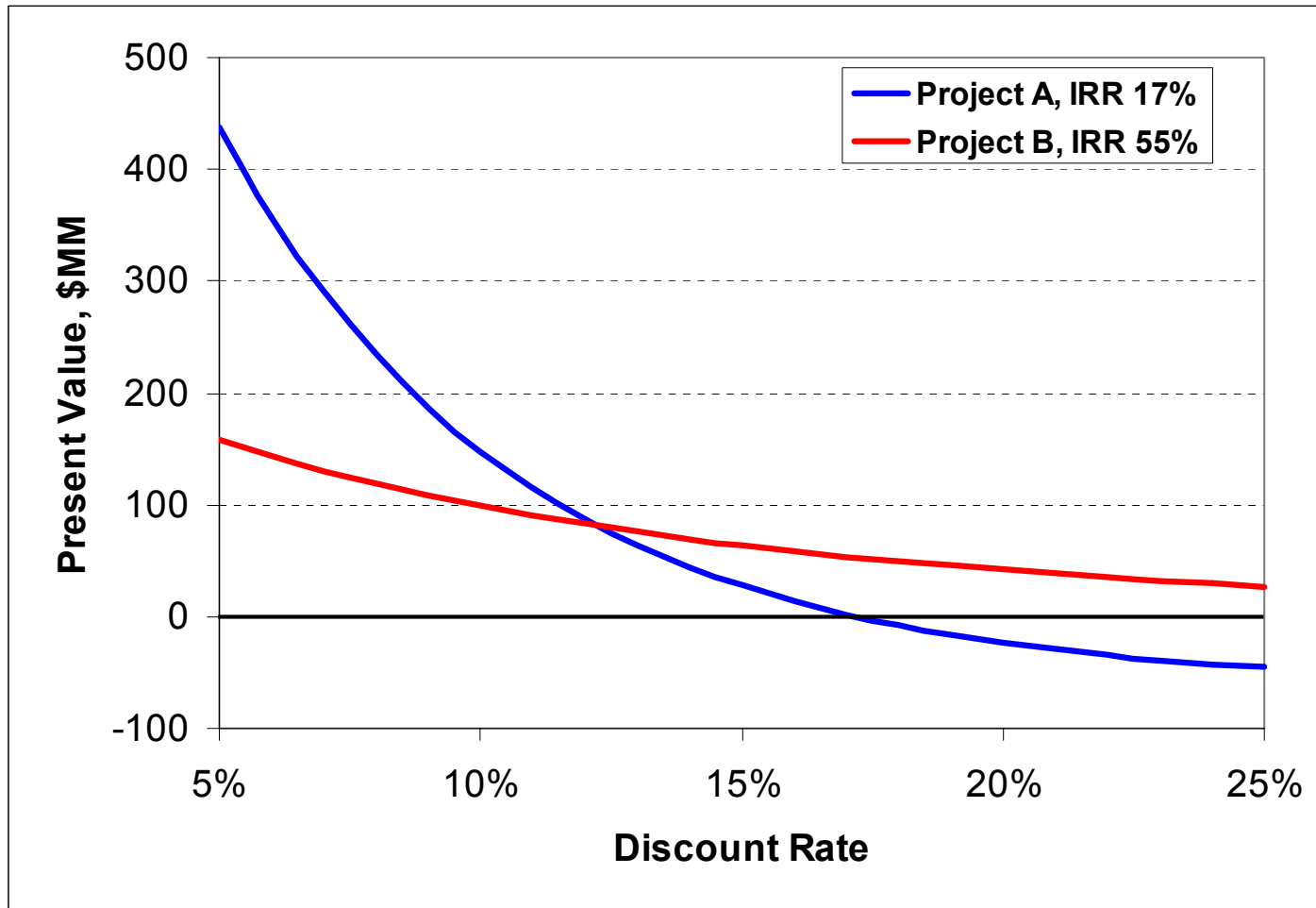
During periods of high price volatility, significant differences can arise between buyers' and sellers' price expectations. Historically, prices in competitive bidding situations have been set by buyers with the most aggressive price forecasts or planning assumptions.



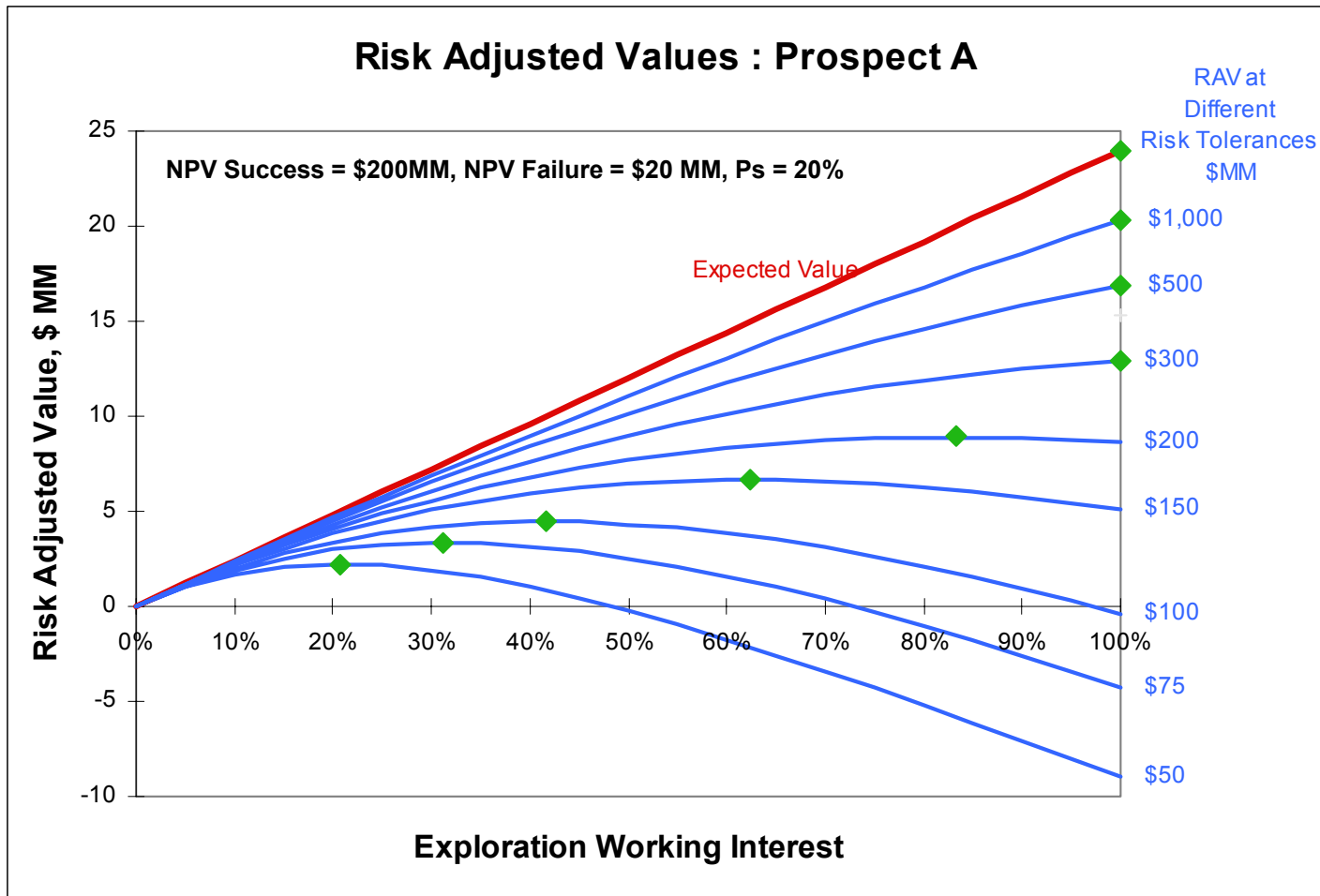
We see a trend of companies moving from arbitrary corporate planning forecasts to the use of forward price curves such as NYMEX Sweet Light Crude (WTI). Transactions involving near-term production can be hedged. There is more consensus on values, as the forward strip tends to regress towards a mean



Many companies use internal rates of return or variable hurdle rates to account for risk. Profiles of NPV versus discount rate for two actual projects demonstrate the pitfalls of this approach. We recommend accounting for risk by adjusting the NPV calculated using the firm's Weighted Average Cost of Capital (WACC)

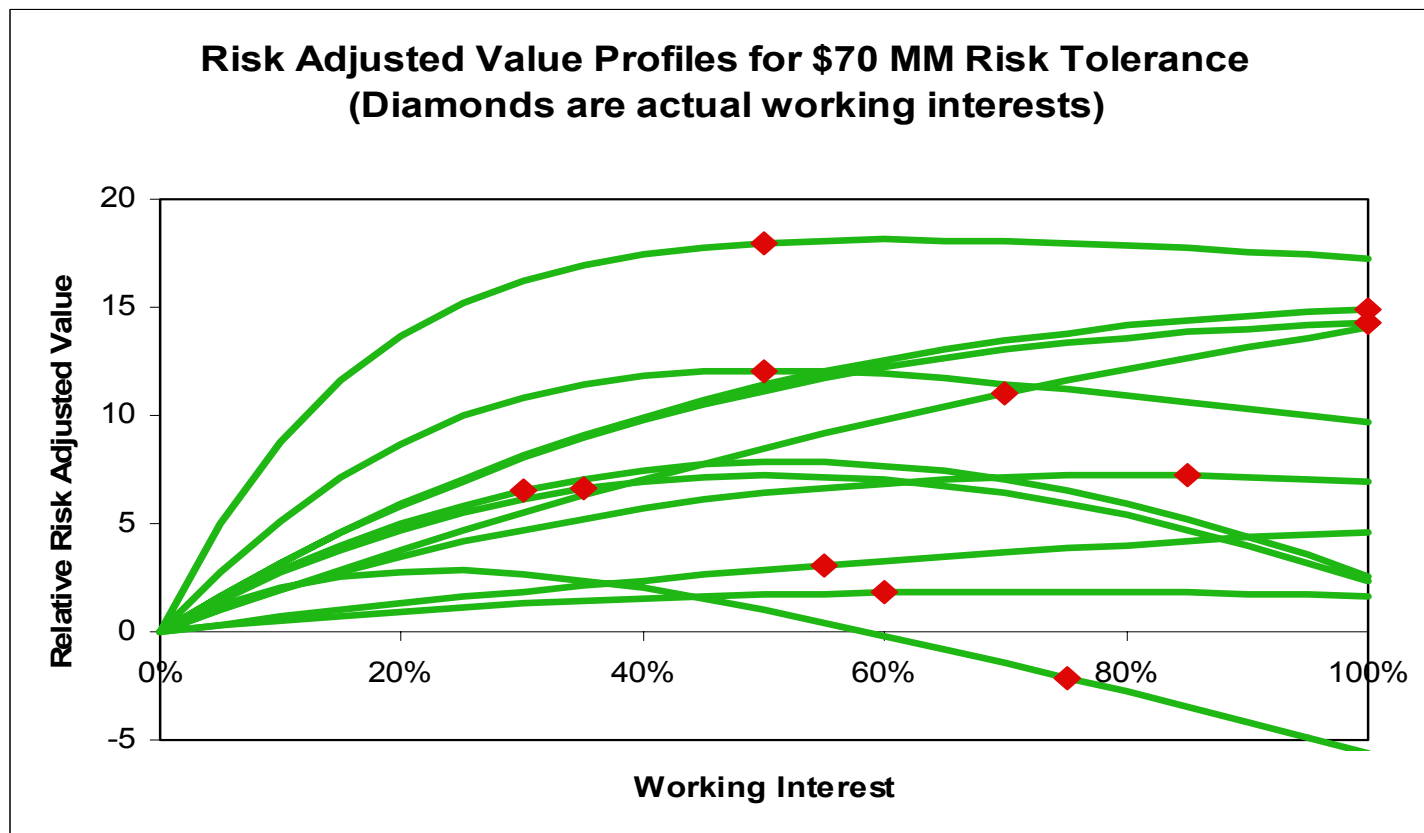


The possibility of a total loss means that companies will value exploration opportunities at less than the Expected Value. The concept of Risk Adjusted Value offers a method for quantifying this effect, using a parameter called Risk Tolerance [see Cozzolino (1977), or Mackay (1995)]

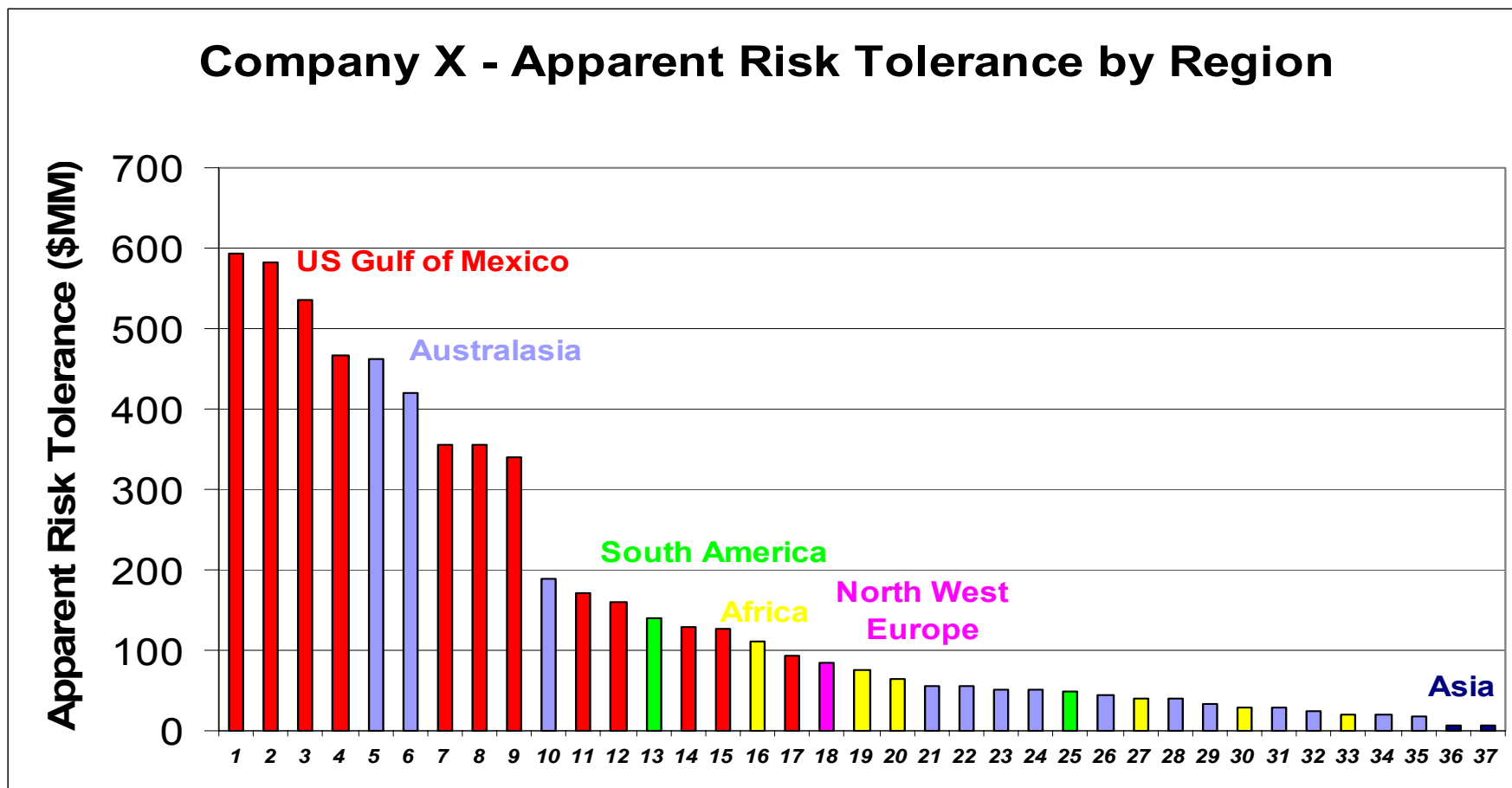


Green Diamonds indicate Optimum Working Interest (maximum RAV for given RT) **Moyes & Co., Inc.**

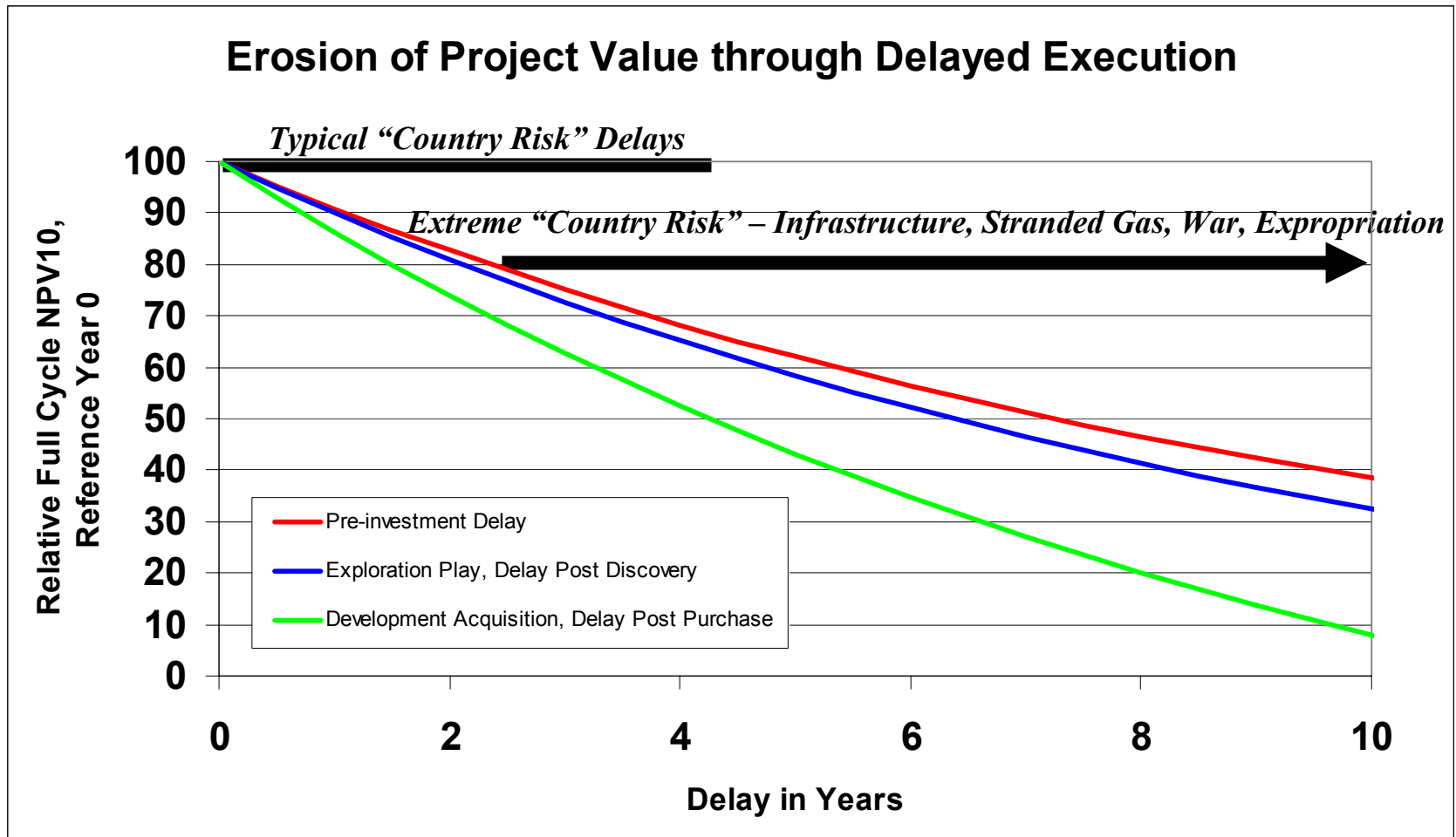
We may calculate a firm's Apparent Risk Tolerance by assuming that, on average, the firm will acquire the optimum working interest appropriate to the firm's RT. An ART of \$70 MM was calculated from this historical snapshot of ARCO International's New Ventures (non-core area) exploration portfolio



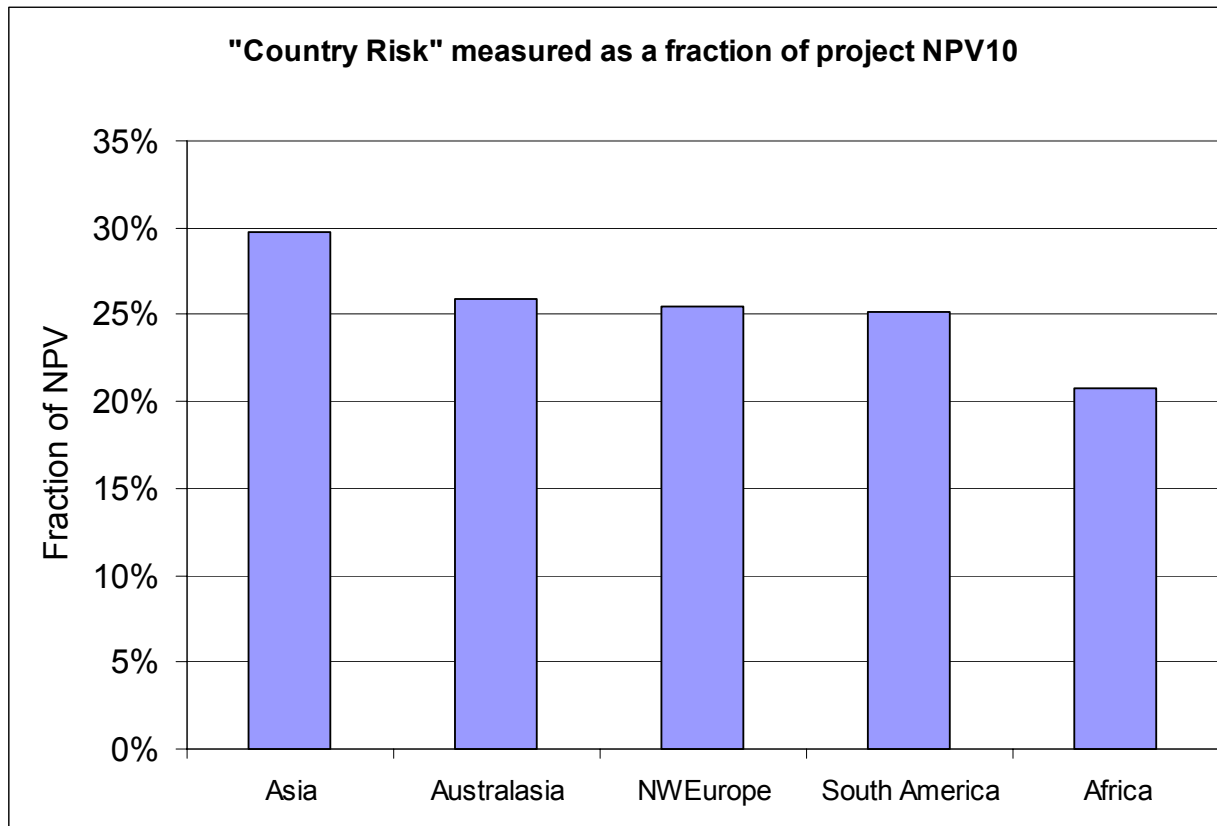
The values of ART calculated for the exploration portfolio of Company X show systematic differences between regions. The US GoM has easy access to services, infrastructure and markets, a benign regulatory environment and transparent business practices, and provides a baseline for measuring “country risk”



Most evaluations tend to make “best-in-class” assumptions for project execution. “Country risk” incorporates the political, bureaucratic, logistical and commercial delays that generally characterize international projects. “Country risk” discount may be thought of as the expected (mean) delay.

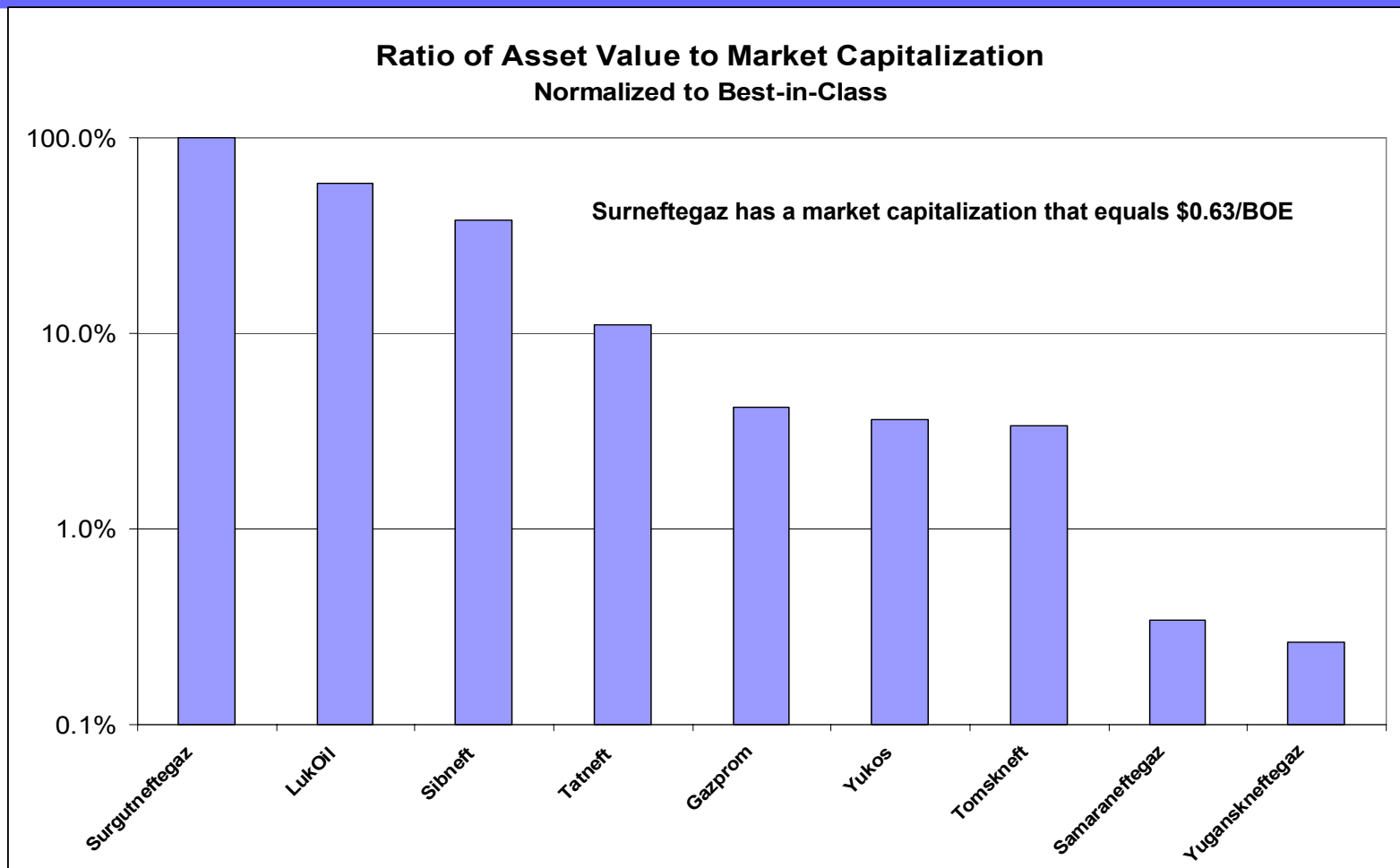


Using Company X's average Risk Tolerance in the relatively risk-free GoM, we can determine what fraction of the NPV of a successful development gives the same Risk Adjusted Value. This fraction provides a quantitative estimate of the firm's "Country Risk", here averaged for large regions to maintain anonymity.

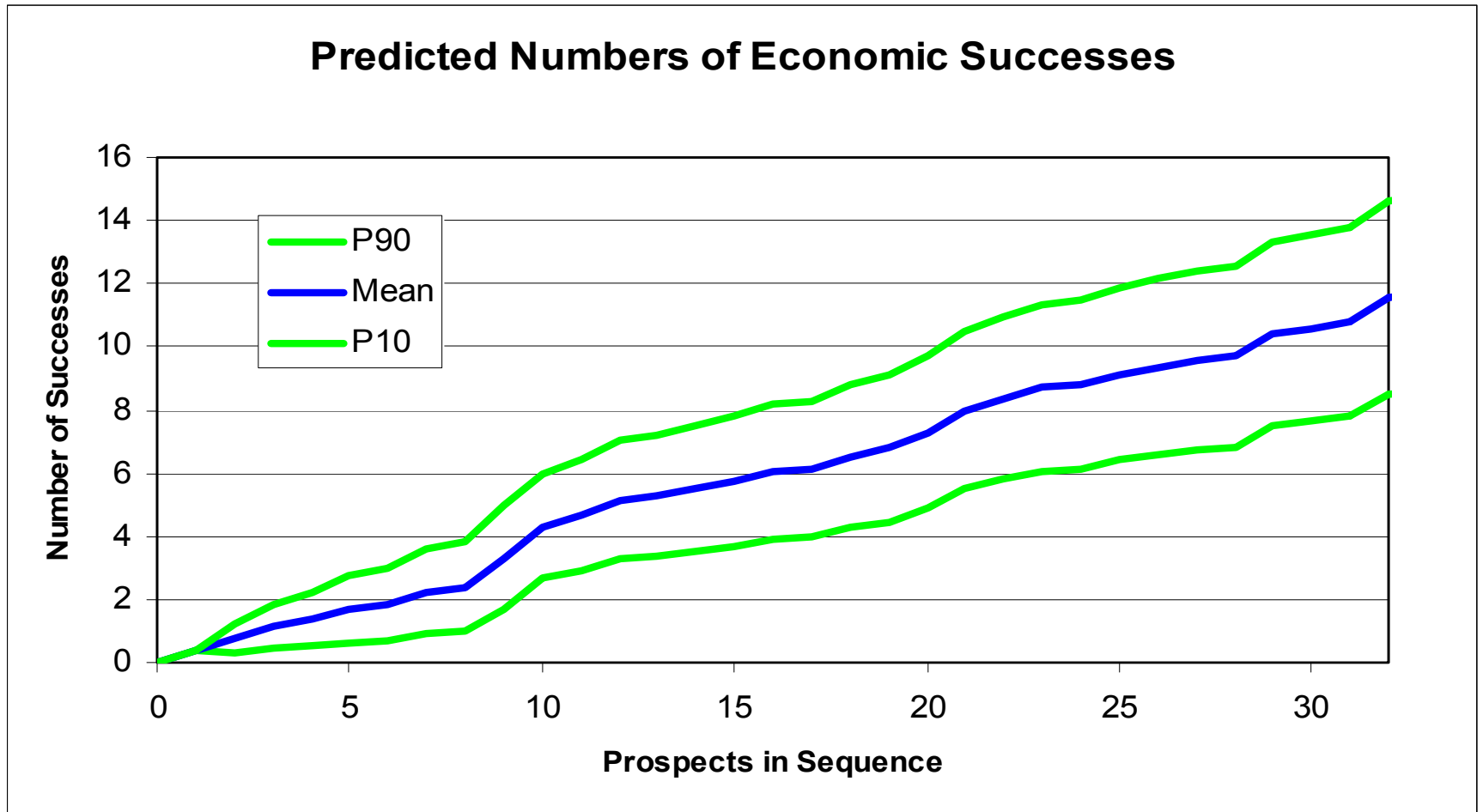


Note that there may be particular upstream circumstances that modify general perceptions of regional risk – specific infrastructure or environmental issues that relate to individual projects

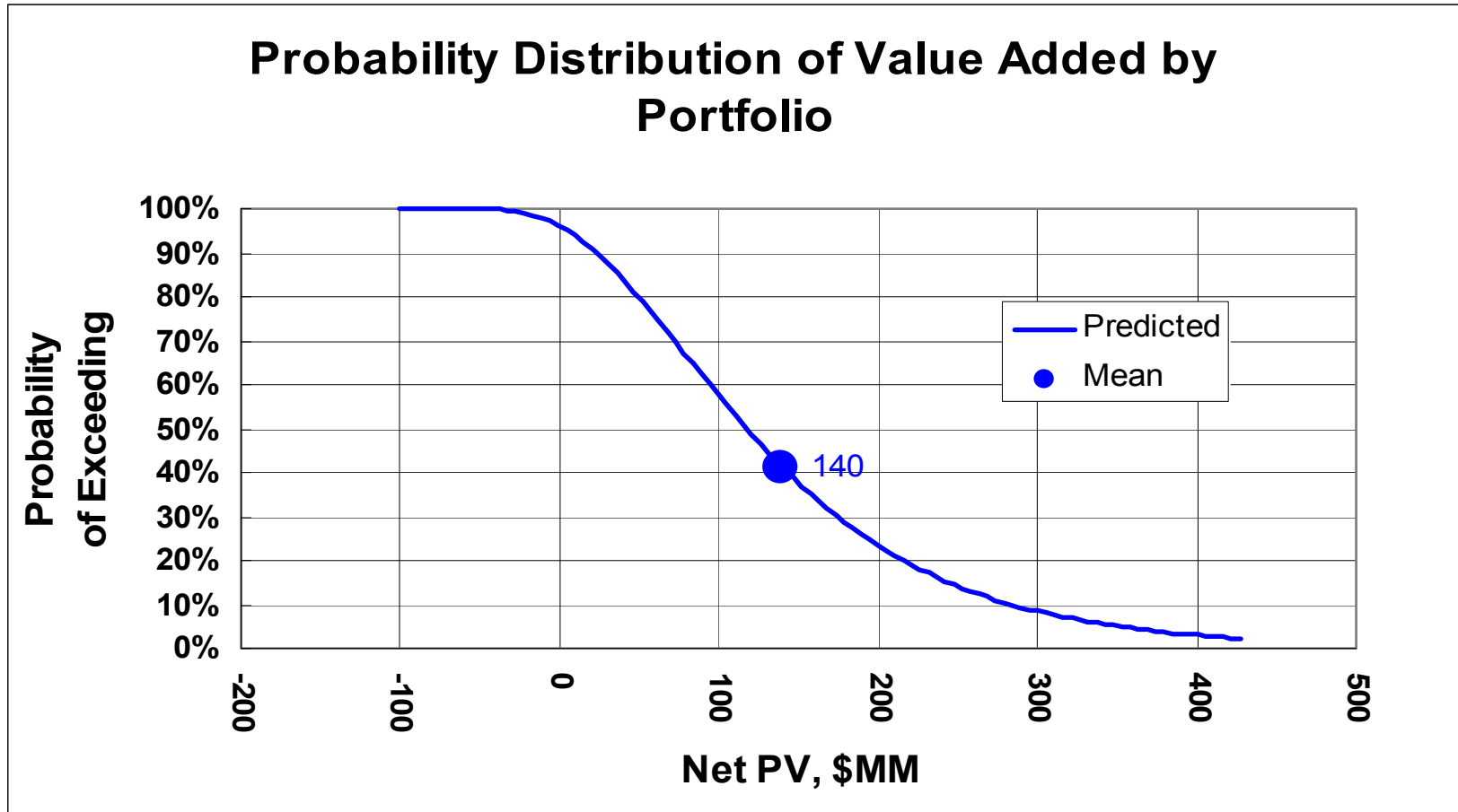
In corporate transactions, the ratio of FMV to DCF NPV may vary by firm. Black, of Stanford Law School, has argued that the significant variation in values for Russian assets is a function of corporate governance. There is a strong correlation between these 1999 data and corporate governance behavior as scored by Black.



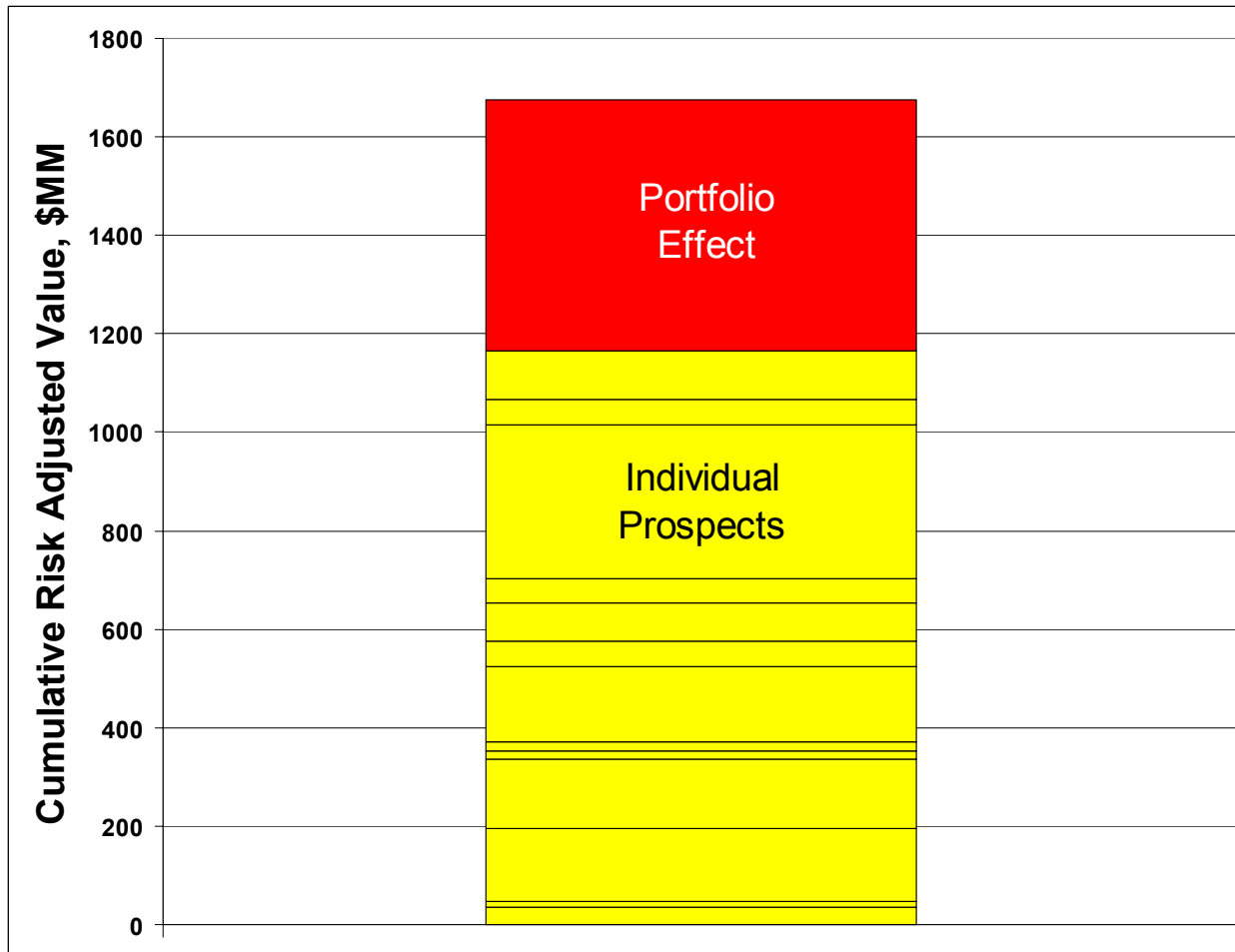
For a portfolio of exploration prospects, the likelihood of complete failure becomes extremely low. Company Y holds a portfolio in the Gulf of Mexico, characterized by mainly prospects with moderate risk. We can model the probability range of numbers of successes, assuming that all wells are drilled.



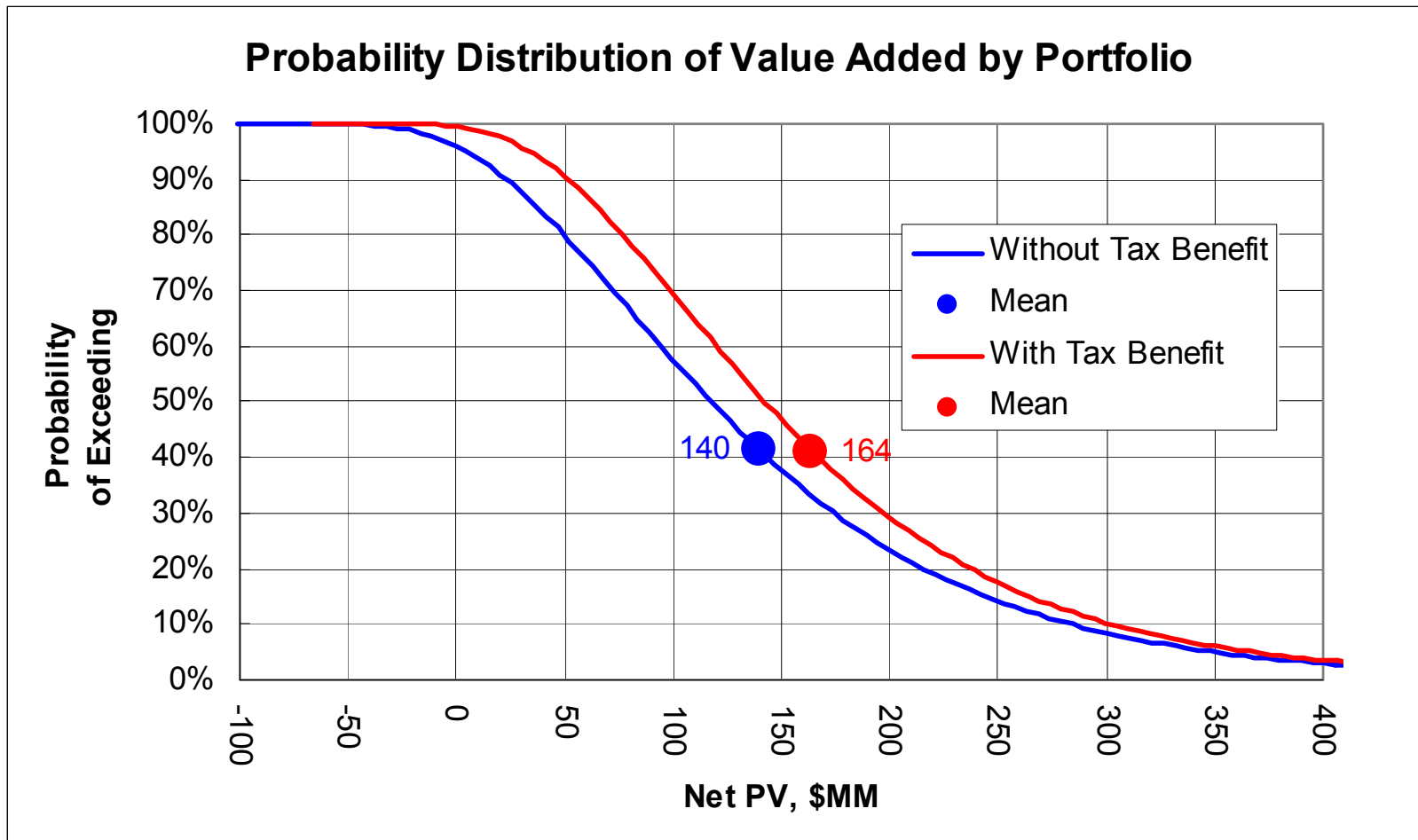
By combining the probability ranges of reserves for each prospect, the probabilities of success, and the reserves-present value functions for each prospect, we can derive a probability range of value added from the drilled-up portfolio, illustrated again by Company Y's Gulf of Mexico portfolio.



The Risk Adjusted Value of the portfolio is larger than the sum of the RAVs of the individual prospects, mainly due the greatly reduced chance of failure. In this example, the value of Company X's Gulf of Mexico portfolio is over 40% higher than the sum of the individual prospects



Tax or Cost Recovery consolidation enables dry hole write-offs, use of loss-carry-forwards, and accelerated realization of expense and capital depreciation deductions. Company Y's portfolio is increased in value by 17% solely from the ability to write off dry holes at a 35% tax rate. Ring-fencing can have a significant impact.



Fair Market Values for individual assets may be enhanced if operatorship is available. There are important intangible benefits that increase the value of a Business Unit compared to the value of its portfolio. The value per percentage point of Working Interest may vary for different WI in the same asset

- *Operator drives project timing; added value comes from
 - *the ability to tailor programs to corporate goals**
- *Business Unit valuations combine portfolio, tax efficiency and operator benefits; added value comes from
 - *repeatable, predictable growth performance*
 - *local knowledge and experience*
 - *the ability to capture additional opportunities**
- *The value, per point, of different working interests in the same asset can be different
 - *risk aversion effects lead to higher RAVs per point for smaller WI*
 - *a smaller WI may be affordable to a much larger number of purchasers*
 - *there can be a premium paid for a small WI due to buyer's ability or desire to raise funds or initiate a trade**

Determining the Fair Market Value of an upstream properties for sale, funding or simple valuation purposes is a complex procedure. Nevertheless, FMVs can be derived on a consistent basis by following a number of steps

- *Appropriate evaluations of reserves and/or resources, incorporating technical risk and an appropriate treatment of uncertainty, and an appropriate forward price forecast*
- *Recognition of the local standards (metrics) used to value transactions*
- *Recognition of the various factors that determine the relationship of Fair Market Value to a risk-appraised technical value (NPV10)*
- *Maintenance of a database to allow the extraction of comparable transactions which allows quantitative analysis of these factors*

We have developed these analyses building on the work of a number of authors. More detailed discussions of evaluation techniques, the use of preference theory in decision-making, and the interesting issue of the impact of corporate governance in emerging markets, may be found in the following.

- *Black, B., in prep., 2001, The Corporate Governance Behavior and Market Value of Russian Firms, Stanford Law School John M. Olin Program in Law and Economics, Working Paper No. 212*
- *Cozzolino, J. M., 1977, A Simplified Utility Framework for the Analysis of Financial Risk, SPE6359, in Proceedings SPE Economics and Evaluation Symposium, Dallas, 21-22 February, 1977*
- *Mackay, J.A., 1995, Utilizing Risk Tolerance to Optimize Working Interest, SPE30043, in Proceedings SPE Economics and Evaluation Symposium, Dallas, 26-28 March, 1995*
- *Moore, C. R. K., 2001, Exploration Program Evaluation at ARCO International - A Case Study in Techniques and Pitfalls, presented at the Geological Society Petroleum Group Bath Conference on Risk, May, 2001*