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Scale Creates Challenges for Modular Systems

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Modular Systems Dialogue

Modular is Like a Jetpack

HYPE

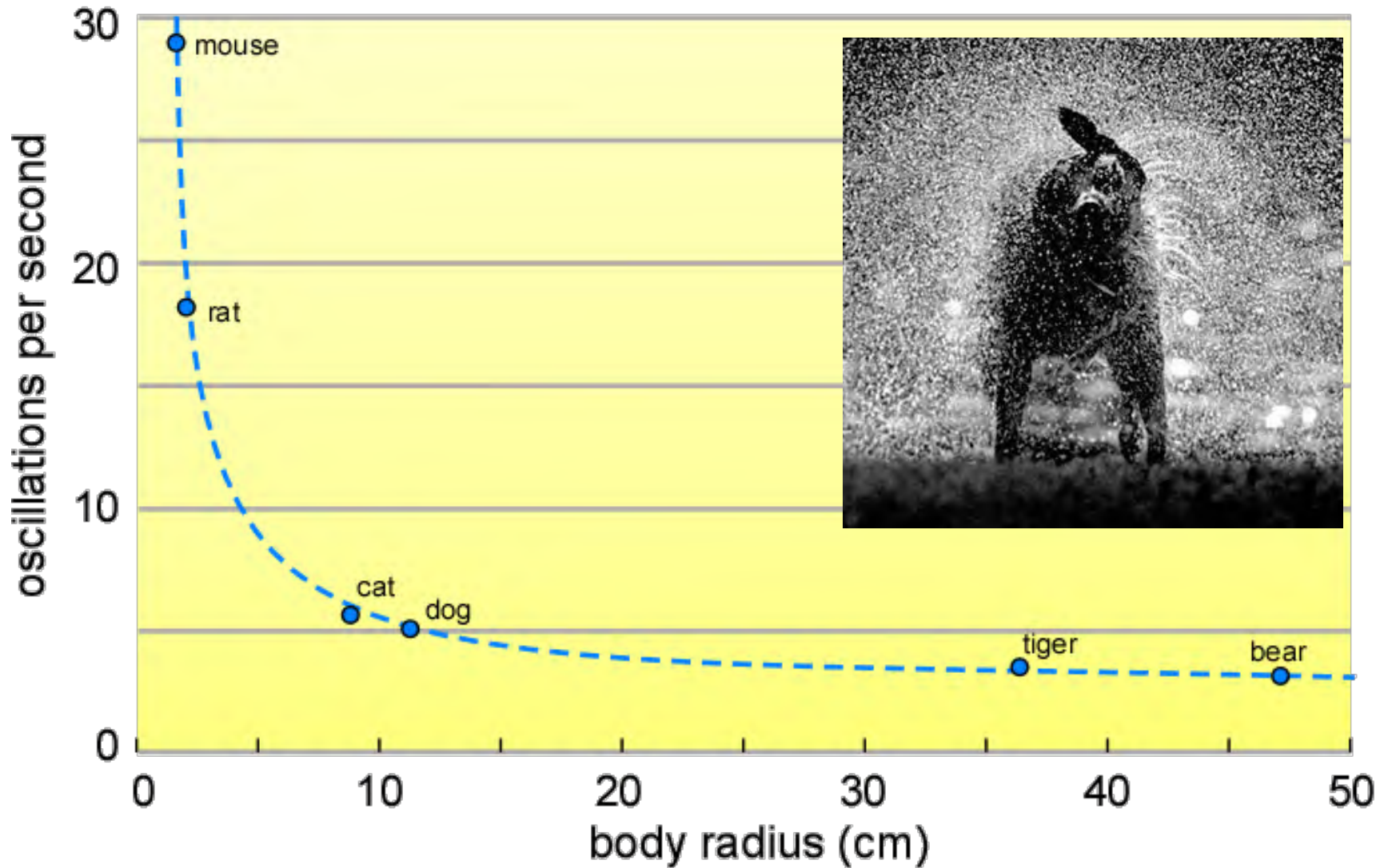


THERMO

ECONOMICS

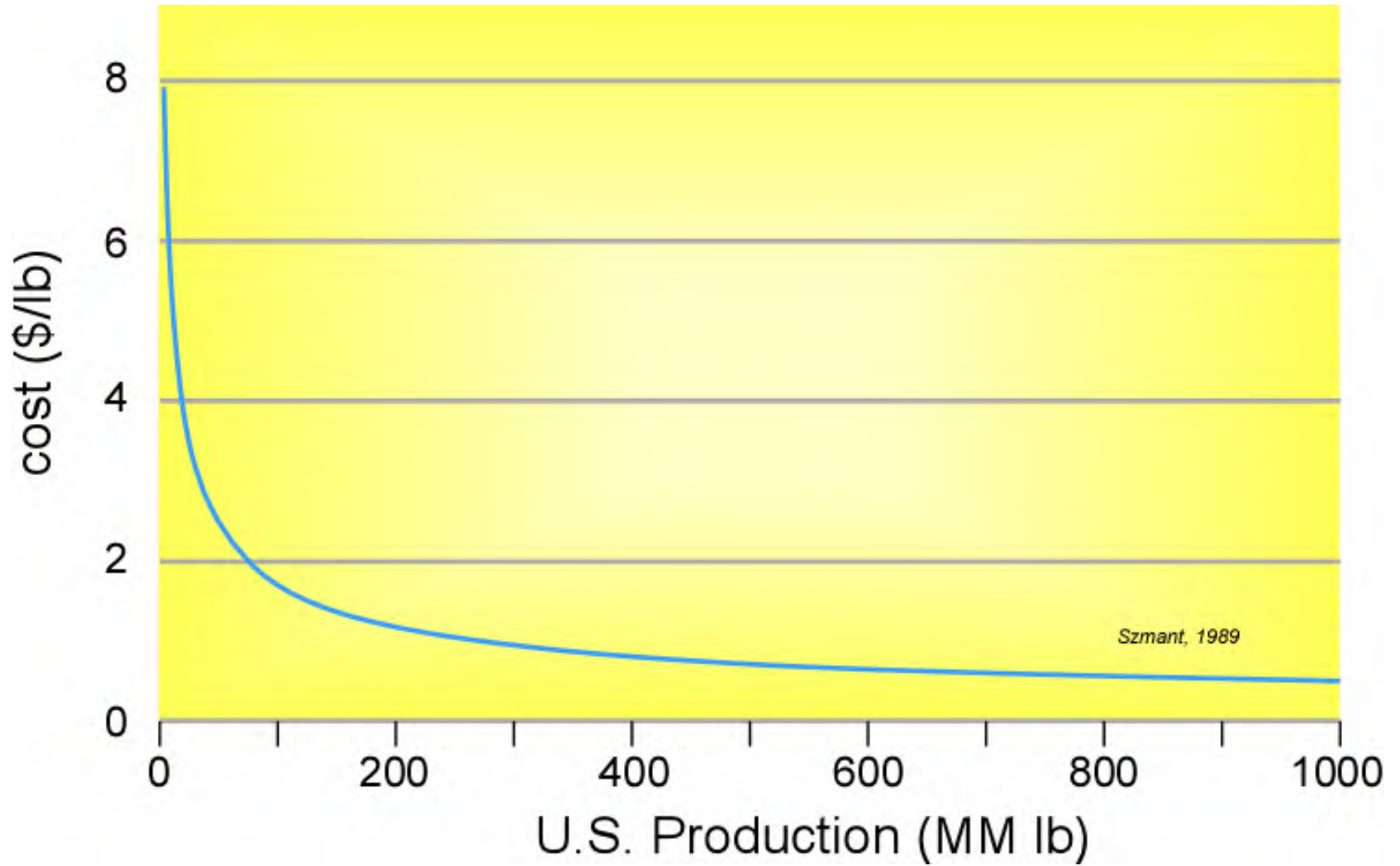
**PRACTICAL
APPLICATION**

Interesting Correlation

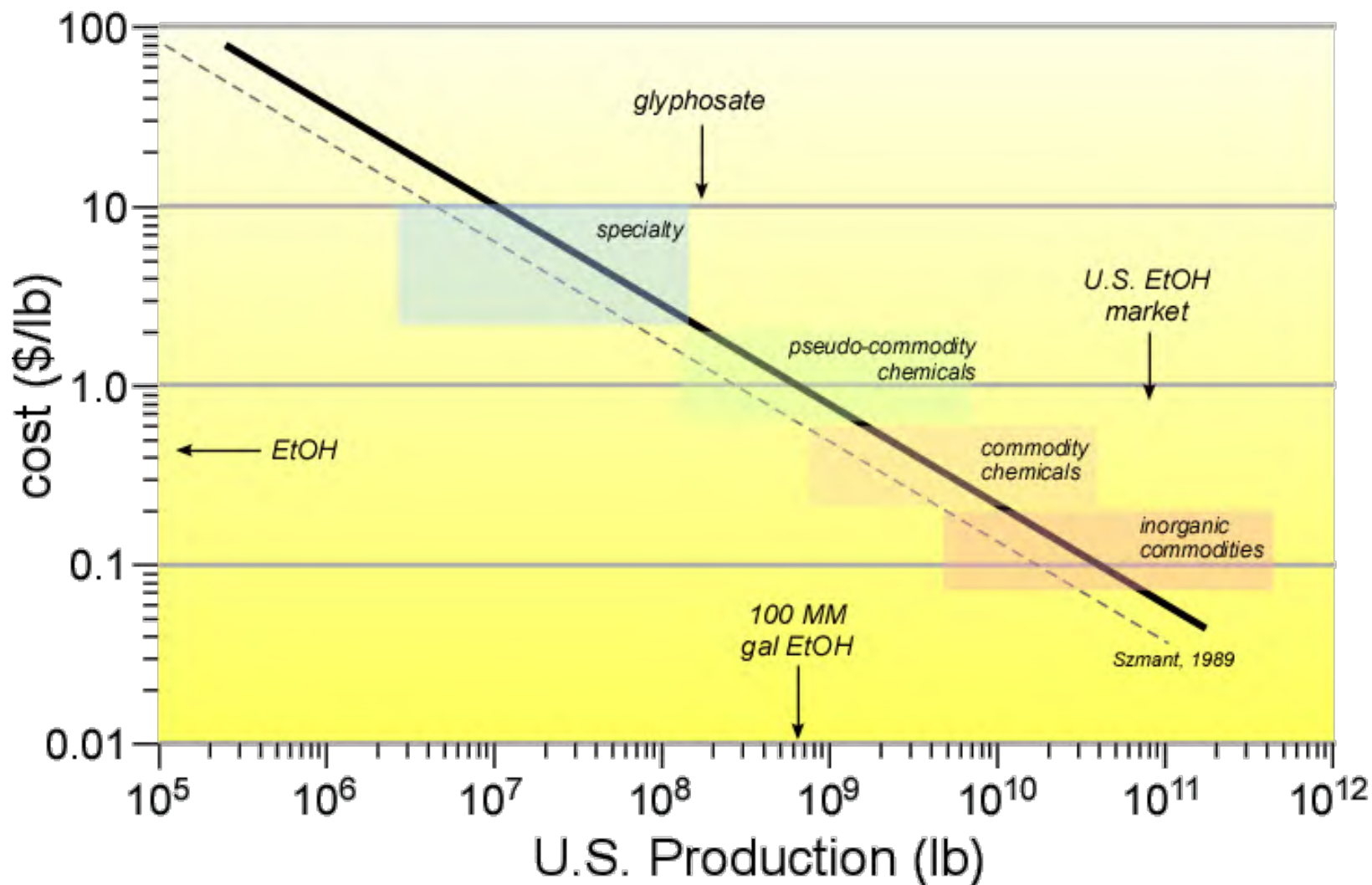


Andrew Dickerson, Grant Mills, Jay Bauman, Young-Hui Chang, David Hu, The Wet-Dog Shake, Fluid Dynamics, 15 October 2010.

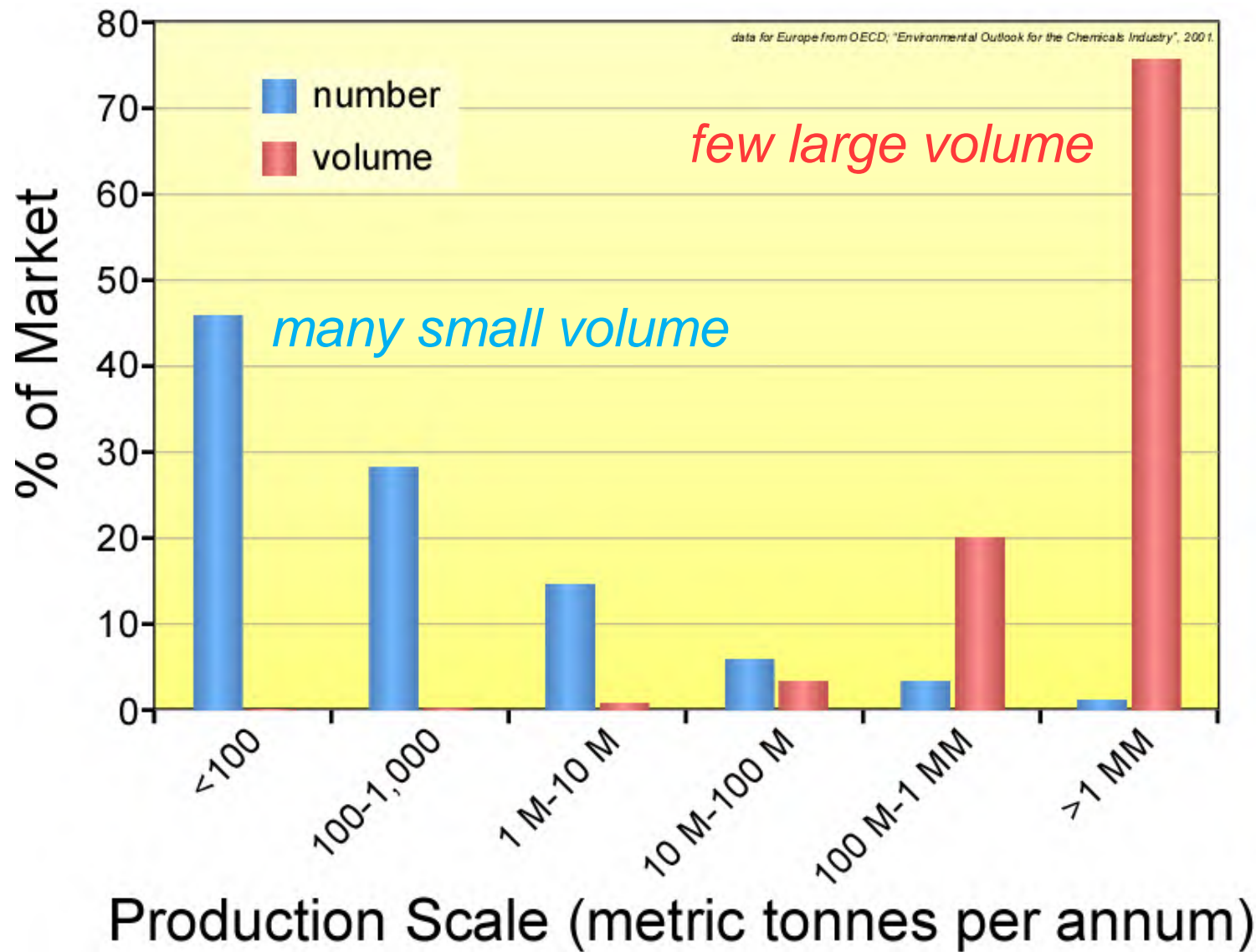
Scale Matters!



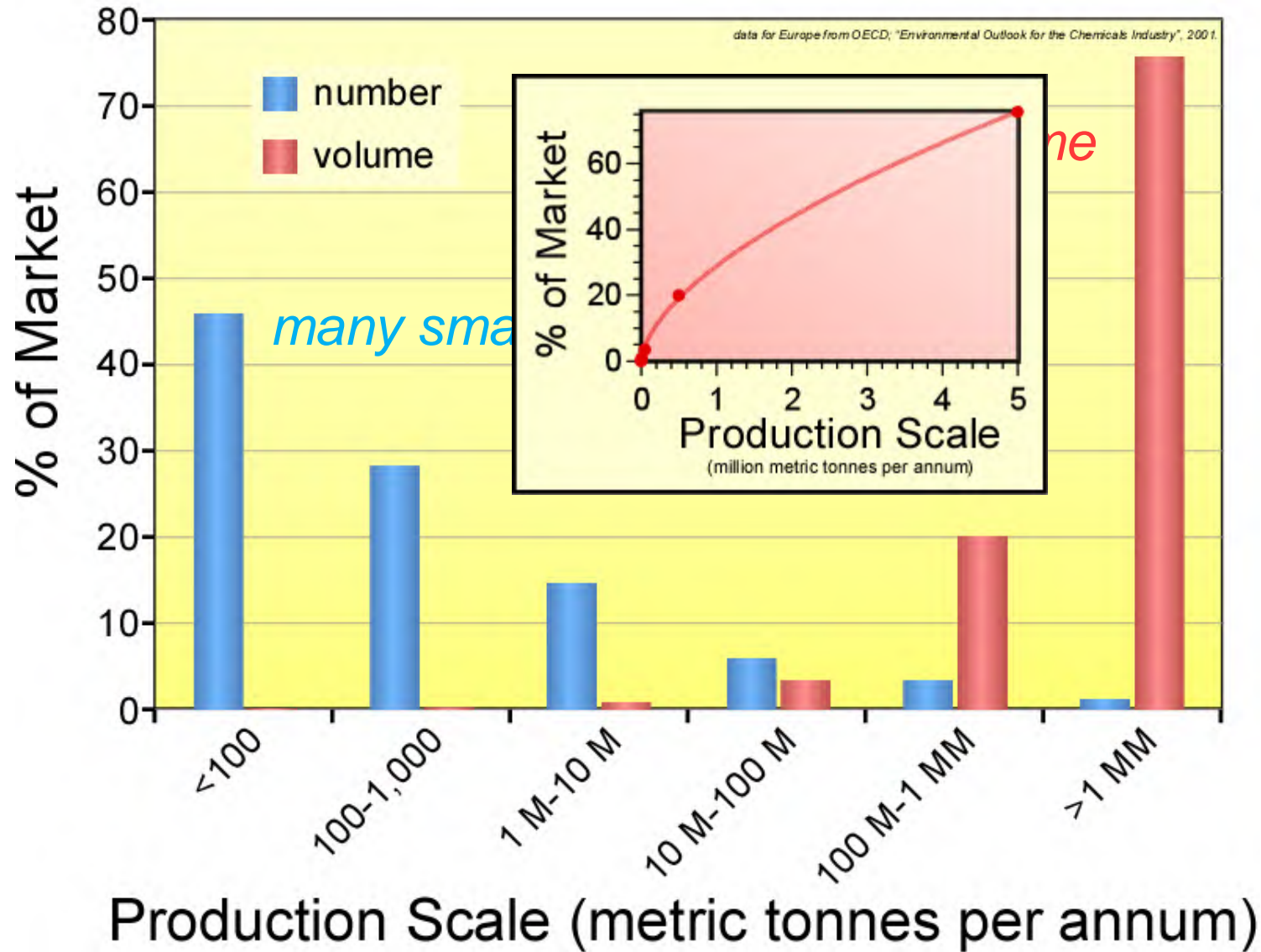
Most Common Version



Scale Falls Quickly in Chemicals



Scale Falls Quickly in Chemicals



Source of Confusion

A mixture containing a valuable chemical is not the same as a valuable mixture of chemicals.

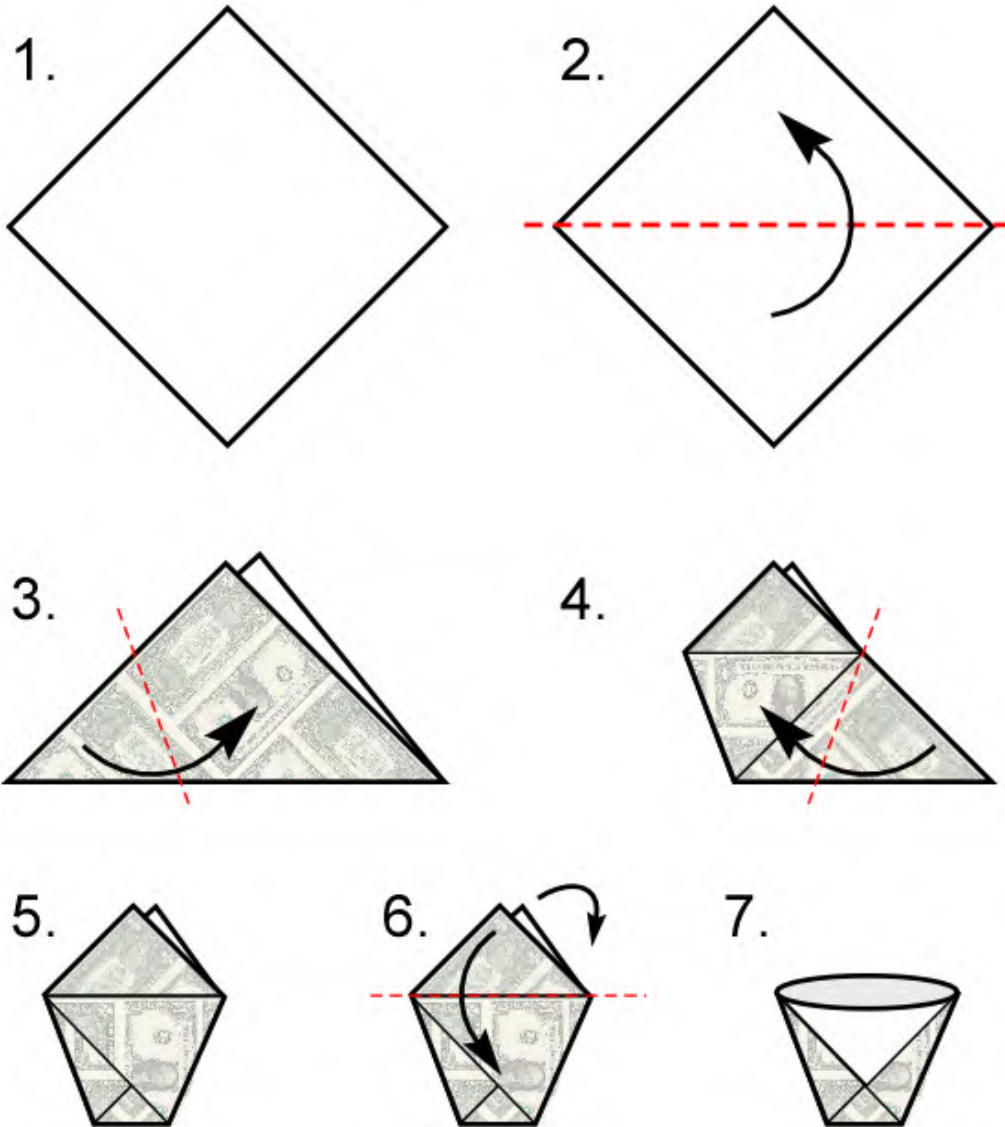
Scale Always Wins



If you are moving mass around, scale reduces cost faster than experience.

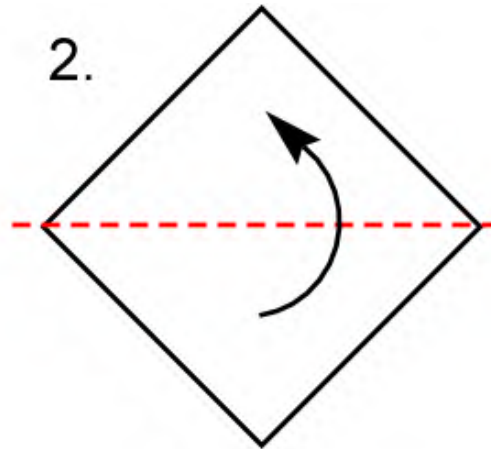
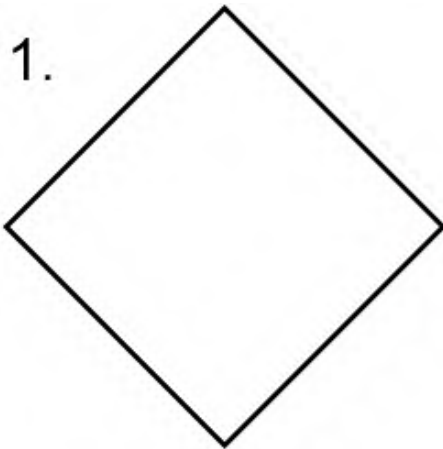
*milk
container shipping
photo finishing
gas separation
latex production
poultry
bread*

Scale is Important – *An Example*



Make a cup with an 8½" square and another with a 4¼" square

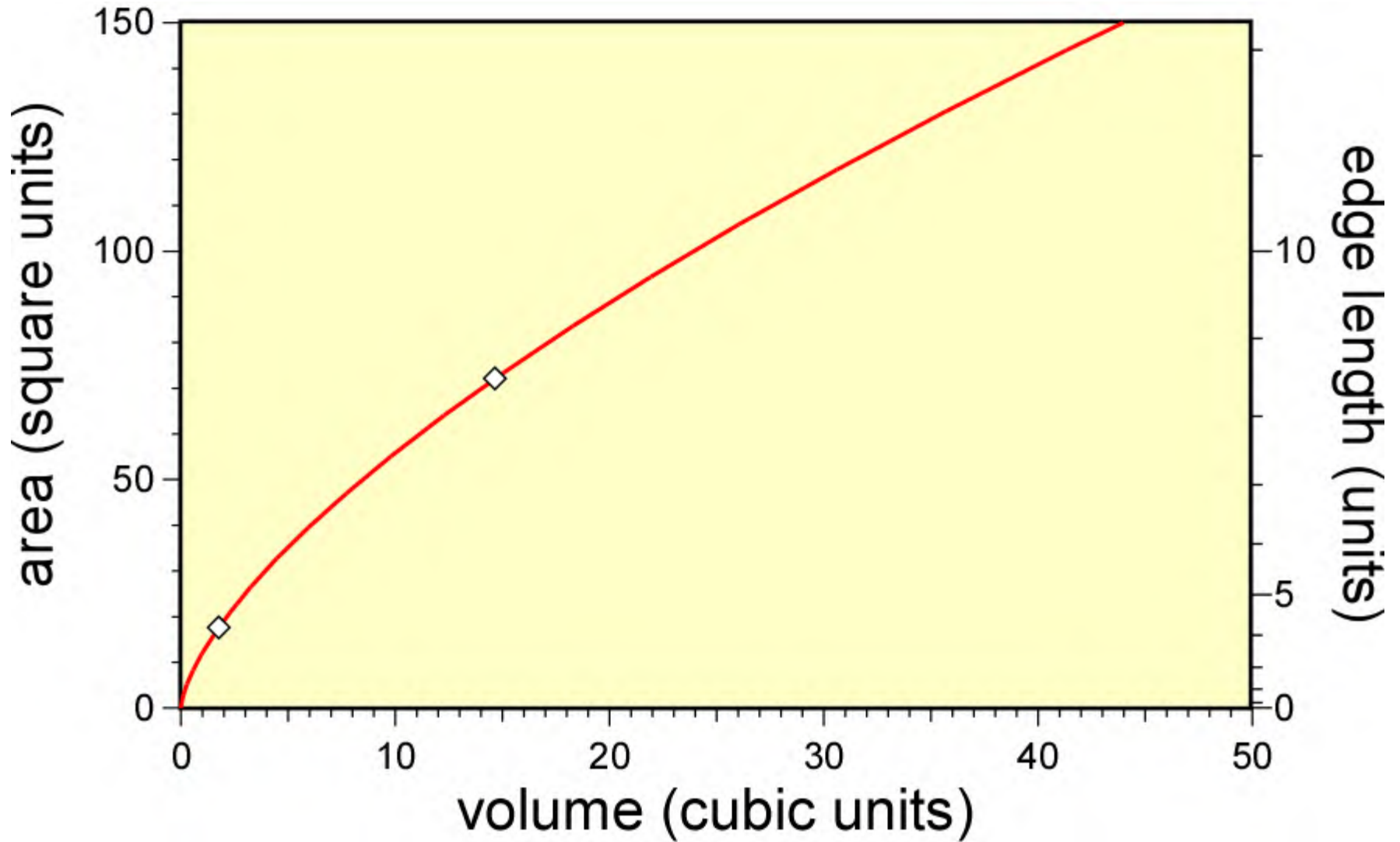
Scale is Important – *An Example*



Make a cup with an $8\frac{1}{2}$ " square and another with a $4\frac{1}{4}$ " square

The bigger cup holds about a cup. The smaller only about $\frac{1}{8}$ of a cup. The amount of paper required increases by the volume to the $\frac{2}{3}$ power.

Power Law



An Example



Path to the Future

