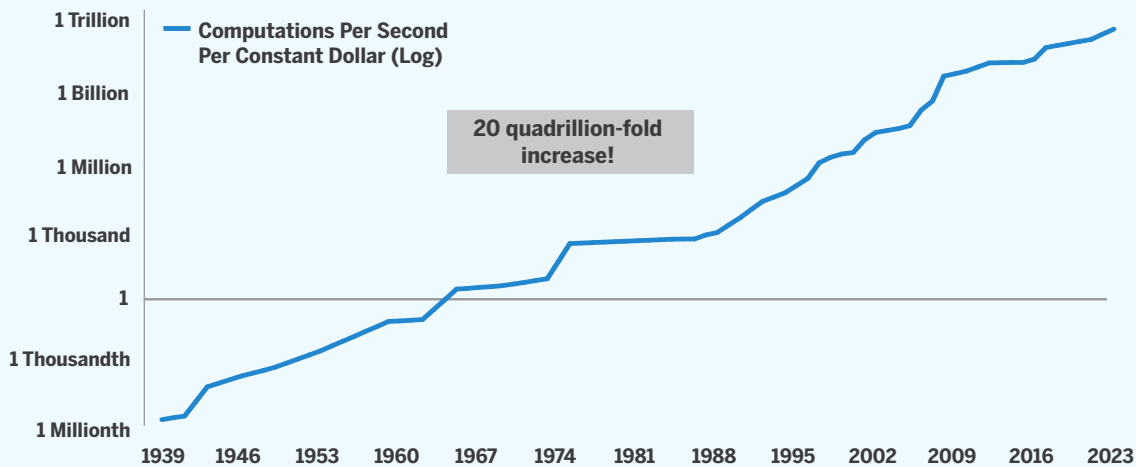




Productivity Miracle

Earnings growth is primarily driven by productivity improvements. We believe nowhere has productivity growth been greater than in the semiconductor industry, where computing power has grown exponentially. For our 400th Alger On the Money, we reflect on how this remarkable progress has created tremendous value for consumers, businesses, and investors. What might be the next long-term productivity marvel?

Exponential Growth in Computing Power



Source: Ray Kurzweil, "The Singularity is Nearer," Penguin Random House, 2024.

- The incredible progress in the efficiency of the microchip and the resulting increase in computational power has been a key driver behind the digital transformation of our economy. As can be seen in the chart above, since 1939, when the first programmable computer was built, there has been a 20 quadrillion-fold increase in the number of computations per second that can be purchased with an inflation-adjusted dollar.
- The drastic decline in the cost of computation has played a significant role in driving deflation within the economy. As an example, over the past 20 years, computer prices have fallen 95%, when adjusted for quality factors such as processor speed, RAM, and hard drive storage, according to the Bureau of Labor Statistics.
- What could be the next driver of exponential growth? Artificial intelligence (AI) training, which directly influences the sophistication of AI models, is advancing over 10 times faster than the computational growth of the microchip!¹ As detailed in our [AI: Exploring Tomorrow's Potential Leaders Today](#) web module, we believe the incredible improvement in AI models could potentially generate a new era of investment opportunities.

¹Source: Epoch AI, OpenAI, and Alger. The calculation of AI's growth rates compares the training computation between Dropout (2012) and GPT-4 (2023), based on PetaFLOPS /day per second. PetaFLOPS is a unit of computing speed, equal to one quadrillion FLOPS (floating operations per second) and serves as a measure of computer performance. Dropout is a regularization technique for reducing overfitting in deep neural networks and was proposed by Hinton et al. in their paper "Dropout: A Simple Way to Prevent Neural Networks from Overfitting" in 2012. Generative Pre-trained Transformer 4 (GPT-4) is an autoregressive language model released in 2023 that uses deep learning to produce human-like text, developed by OpenAI. This calculation should be considered a rough estimate.

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