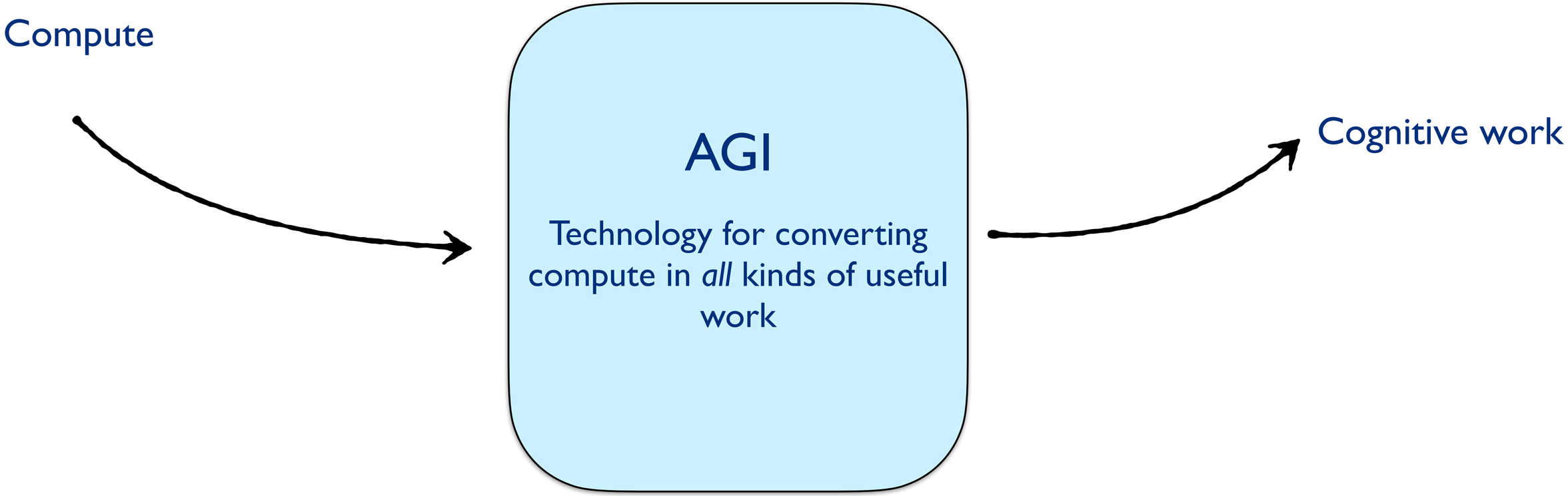
THE FINANCIAL CONSEQUENCES OF MASS AUTOMATION

Pascual Restrepo (Yale)

A Country Of Geniuses In A Data Center



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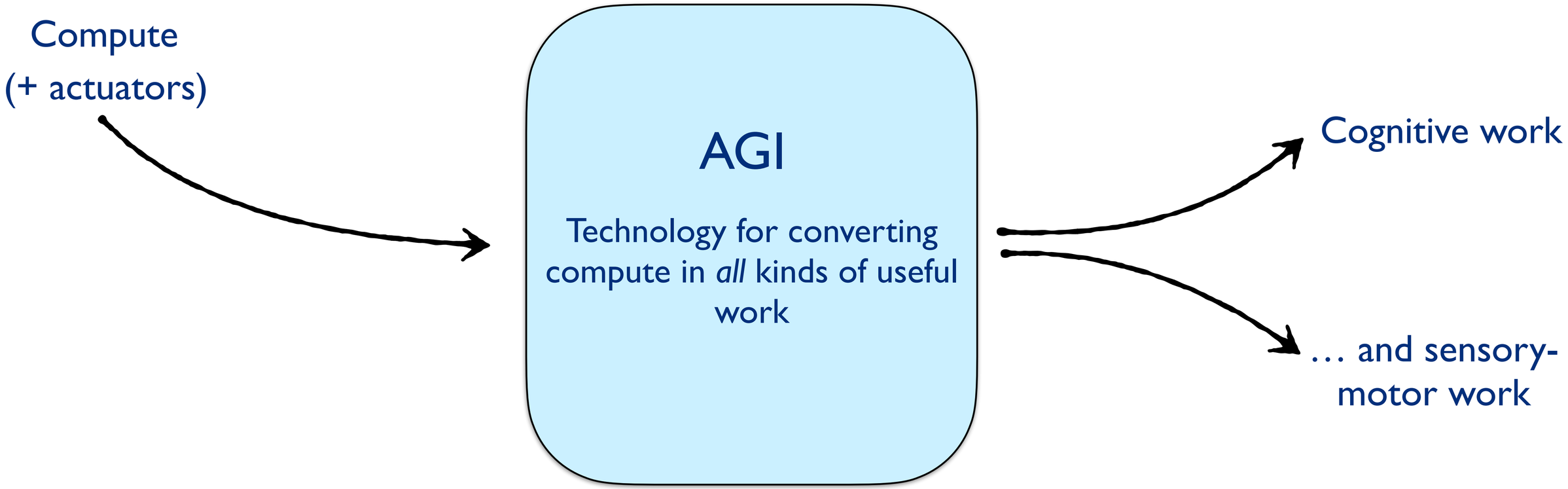

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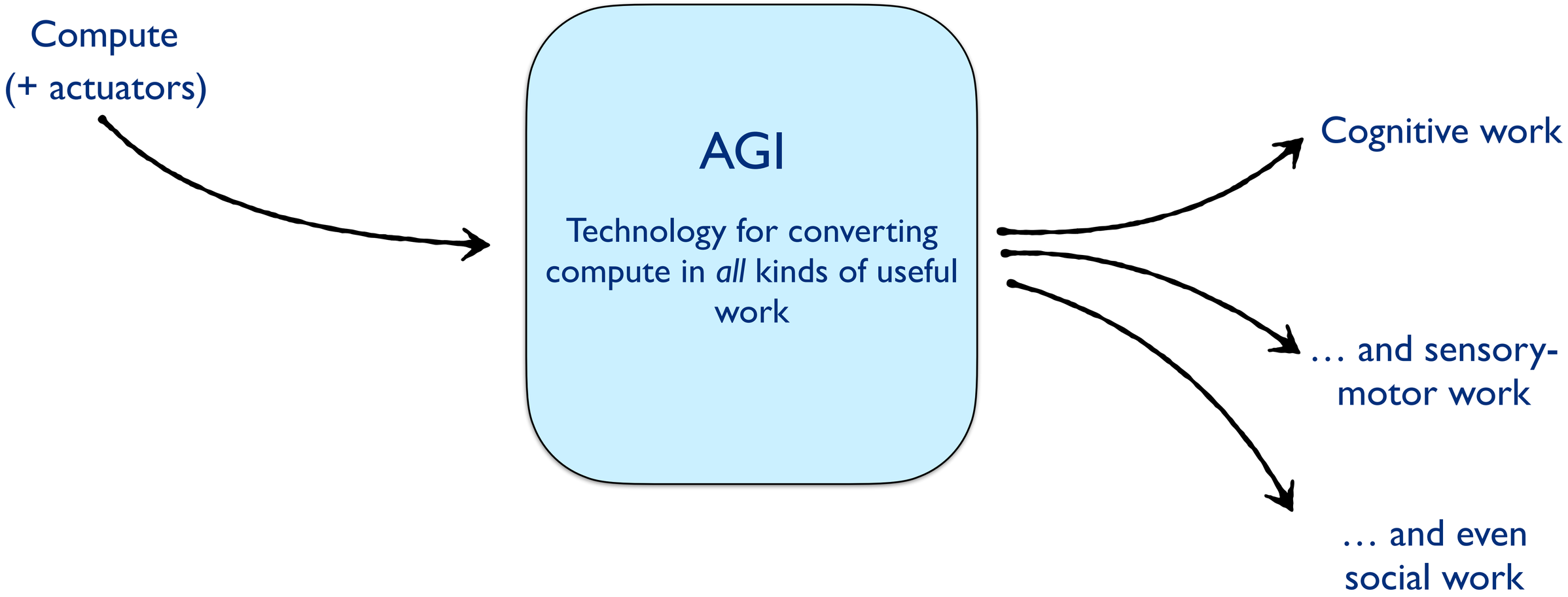
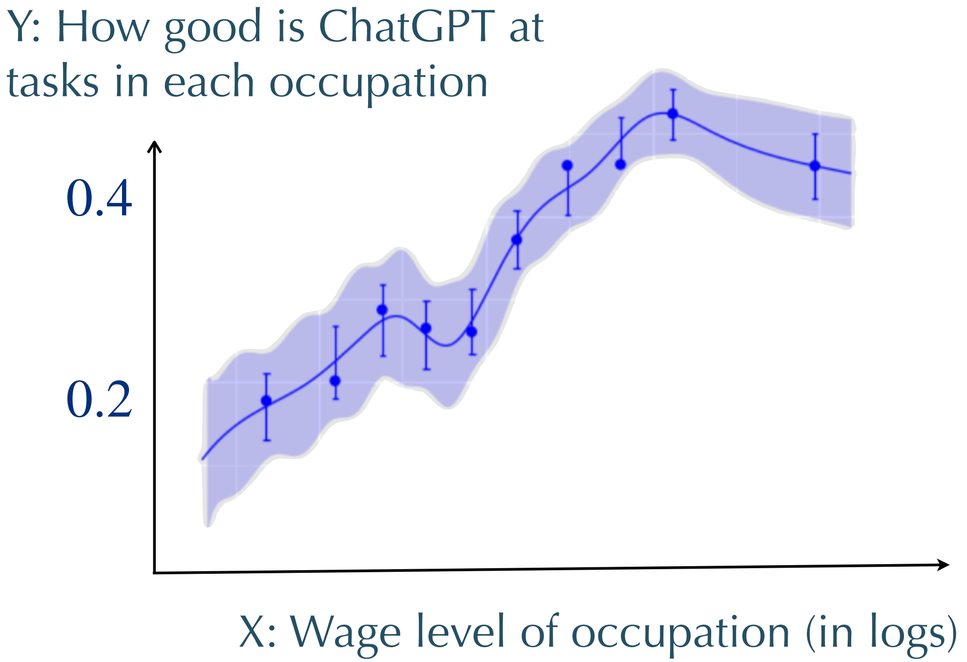


Implications For Income Distribution

- **Labor income:** reduces relative value of cognitive work

  ~ Widespread exposure. Some uneven gains / losses.

- **Financial implications:** capital income, stock markets, return to wealth r



From "GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models" by Elondou et al.

Net Income Shares

- Suppose AI allows me to substitute 1 hour of cognitive worker for 1M units of compute (ie tokens)
  - ~ This compute produced instantaneously by $\phi_k \in (0,1)$ workers.
  - ~ Any implications for capital income, financial markets, or r?
  - ~ <u>No:</u> equivalent to cognitive worker being $1/\phi_k$ times more productive
  - ~ Change in **gross factor shares**—capture how value generated (on site vs indirect).
  - ~ But no changes in **net factor shares**—who gets income generated

Net Capital Income=Monopoly Rents + Time

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- Production plan $\mathscr{P} = \langle -\gamma, -\phi(s), q(s), \delta \rangle$ at capacity k; stochastic depreciation δ

  ~ $\gamma\, k$: labor required to setup plan

  ~ $\phi(s)\, k$: labor input for running plan s periods ahead

  ~ $q(s)\, k$: output s periods ahead

  ~ output backloaded (ie $q(s)/\phi(s)$ increasing in s)

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  ~ Financier $C_{\mathscr{P}}(r+\delta) = \left(\gamma + \int_0^\infty \phi(s) e^{-(\delta+r)s}\right) / \left(\int_0^\infty q(s) e^{-(\delta+r)s}\right)$

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- Market clearing

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  ~ Financier $P = C_{\mathscr{P}}(r+\delta)\, W$

- Wedge $D_{\mathscr{P}}(r) = \frac{C_{\mathscr{P}}(r+\delta)}{C_{\mathscr{P}}(\delta)} \geq 1$

  ~ Extra financial delay between when labor used (engineer) and value generated (financier)

  ~ Net labor share $= 1/D_{\mathscr{P}}(r)$

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  - ~ Output grows at rate $g < \delta$, $D(r) = \dfrac{r+\delta+\phi-g}{\delta+\phi-g}$

Automation Lengthens Time Delay Of Production

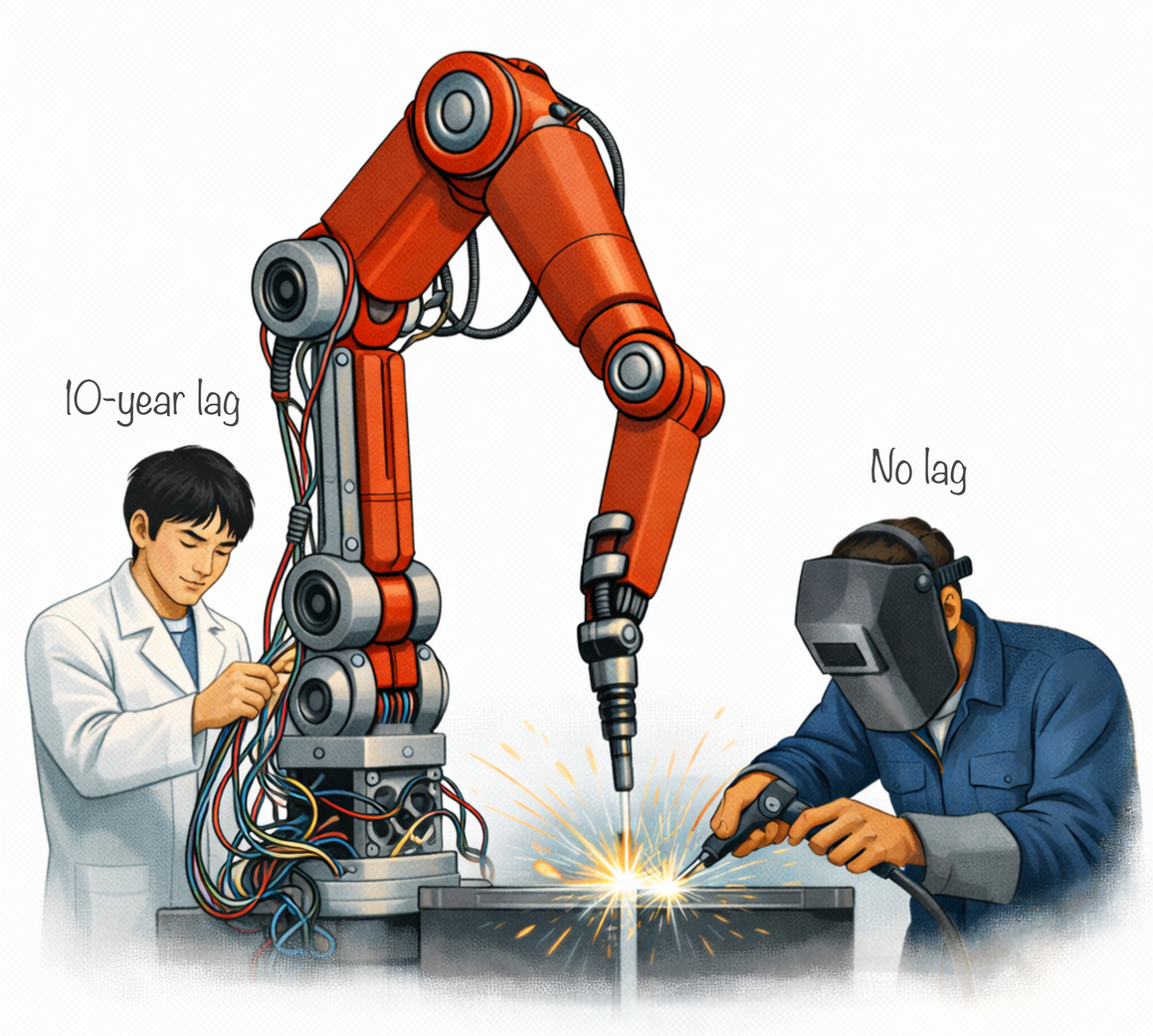
- Plan $\mathscr{P}_L$ produced with labor
- Labor substituted by machine services
- Machine services produced upstream, with plans $\mathscr{P}_K$
- Resulting delay function

$$D_{new}(x) = D_{\mathscr{P}_L}(x)\, D_{\mathscr{P}_K}(x)$$

- Resulting labor share

$$S = \frac{1}{D_{\mathscr{P}_L}(r)} \frac{1}{D_{\mathscr{P}_K}(r)}$$

~ ie, substitution lengthens time-delay of production



This Effect Can Be Massive For AI-Driven Substitution

- Plan $\mathscr{P}_L$ produced with labor
- Labor substituted by AI services
  - ~ Produced by labs using compute
  - ~ Produced by data-centers, stacking microchips and replacing over time
  - ~ Produced by highly specialized machines, made by ASML engineers

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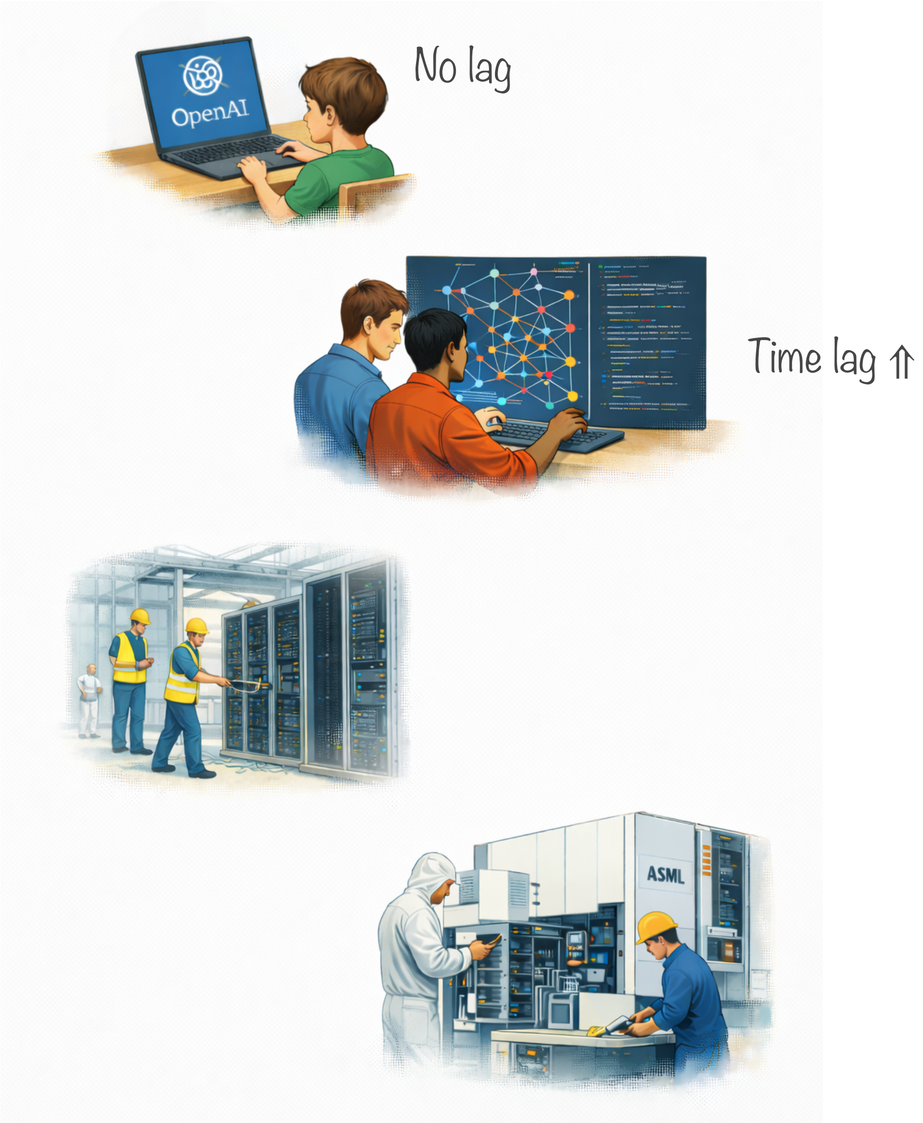

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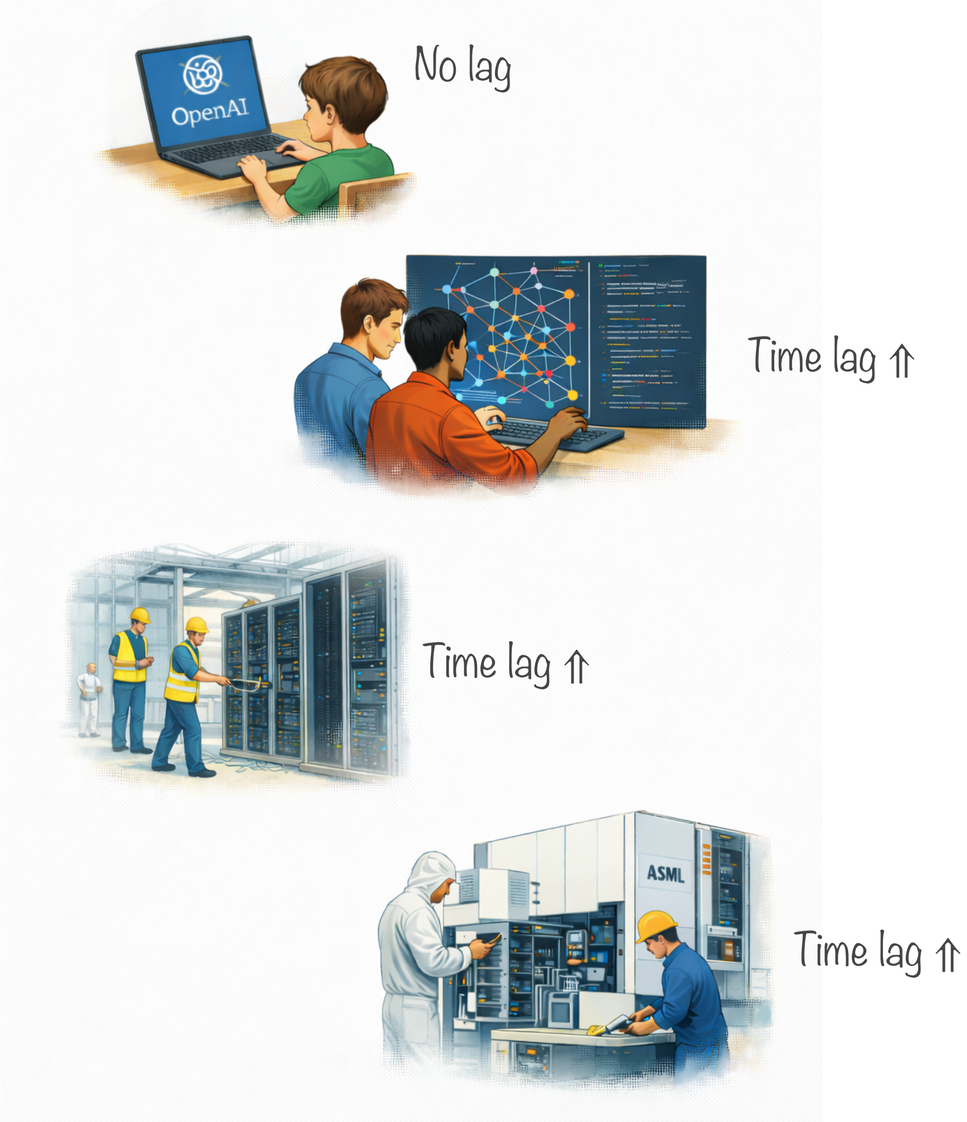

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  - ~ Time-lag of production arbitrarily long

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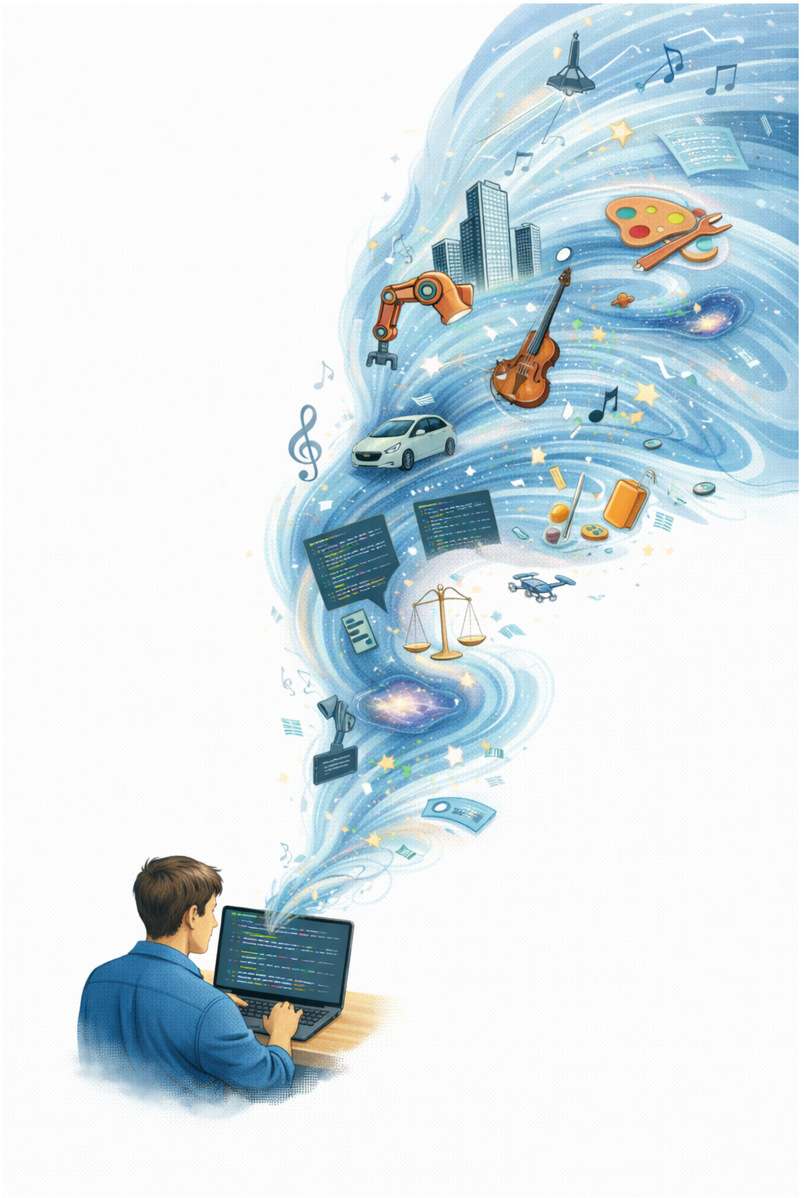

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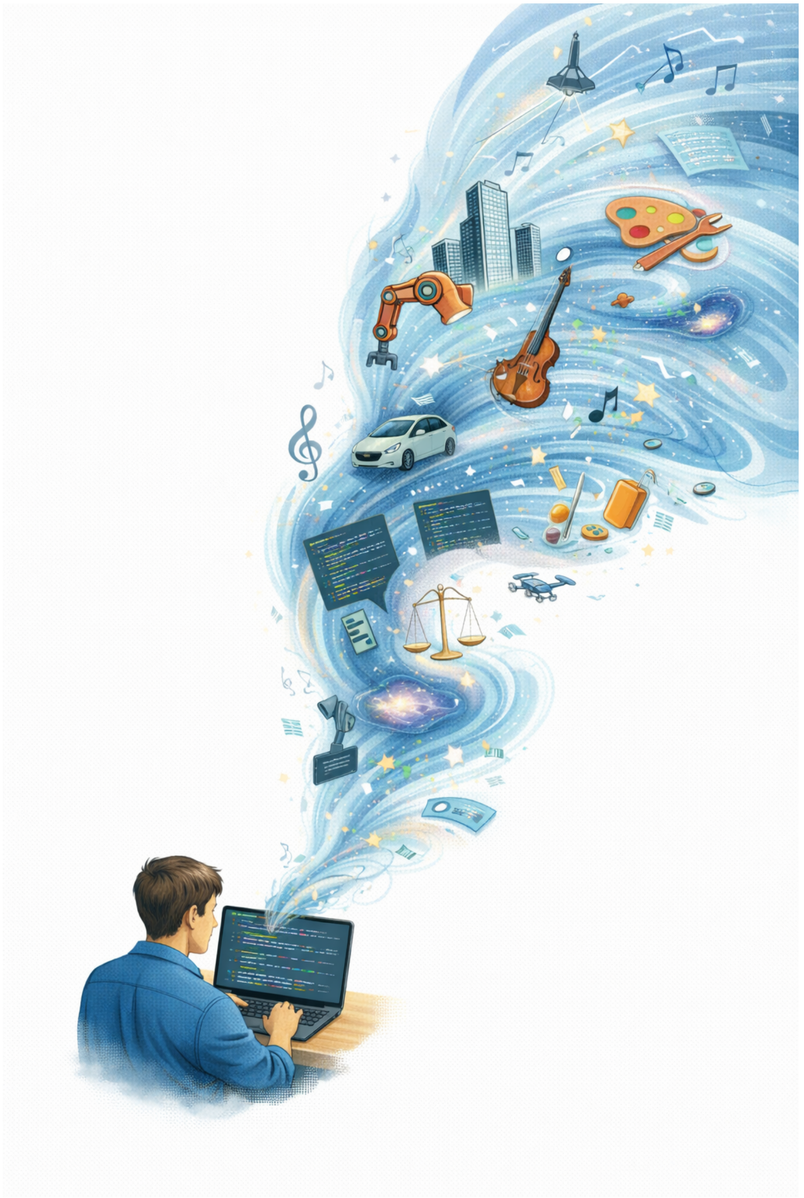

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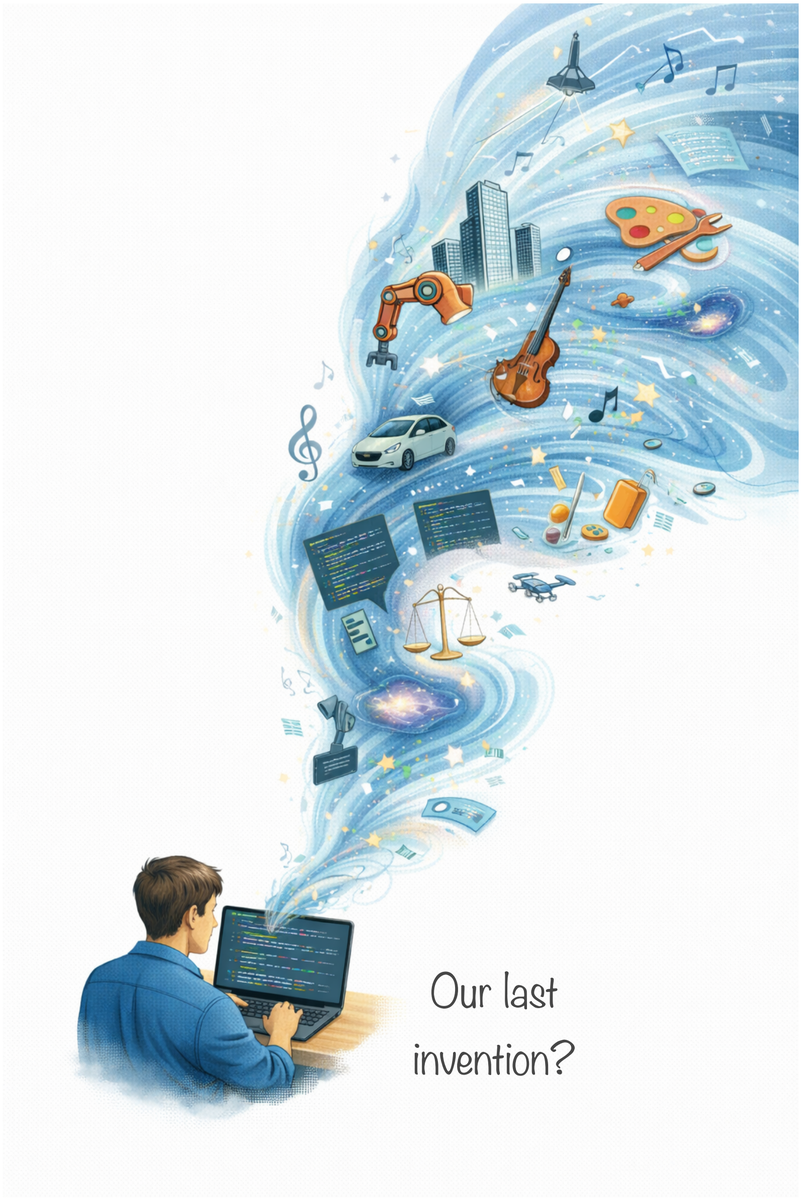

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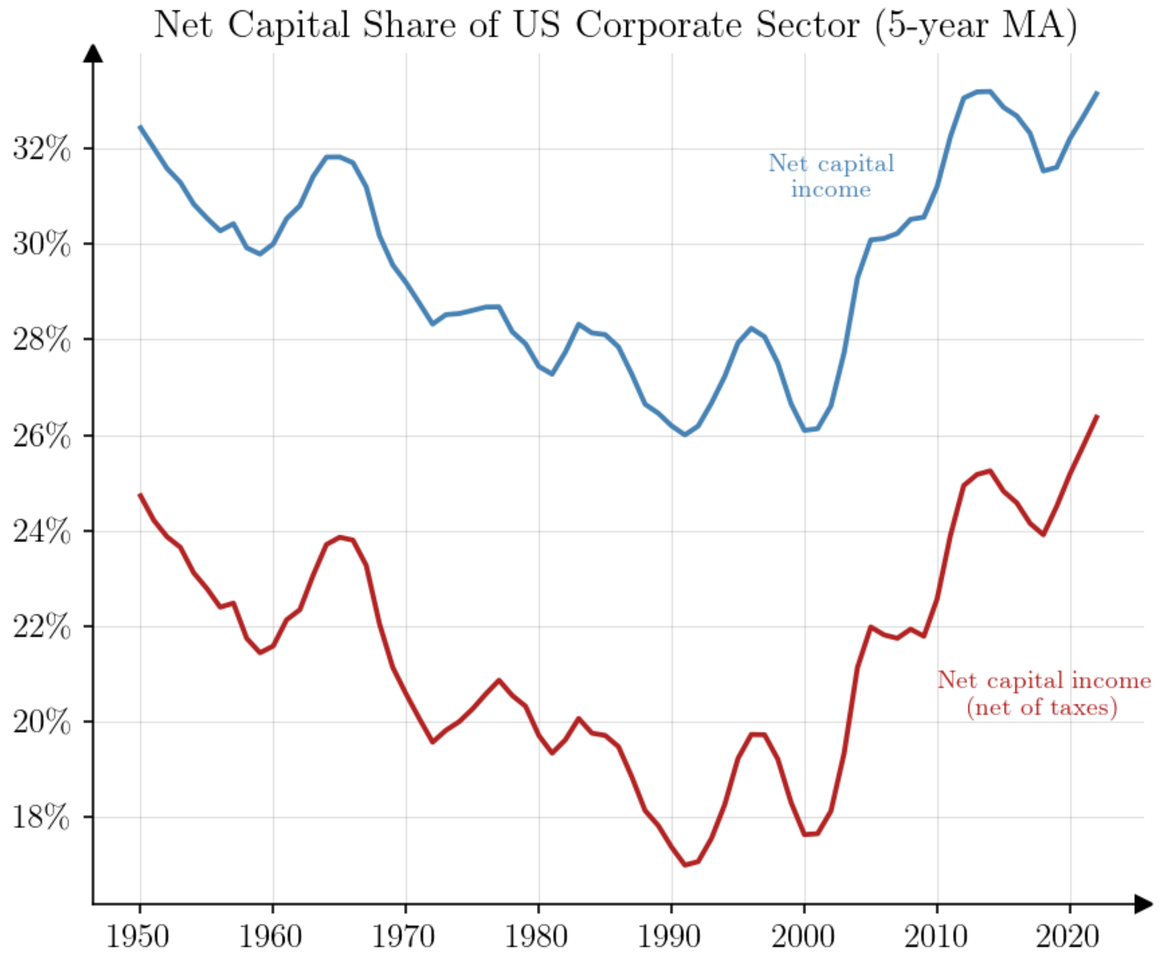

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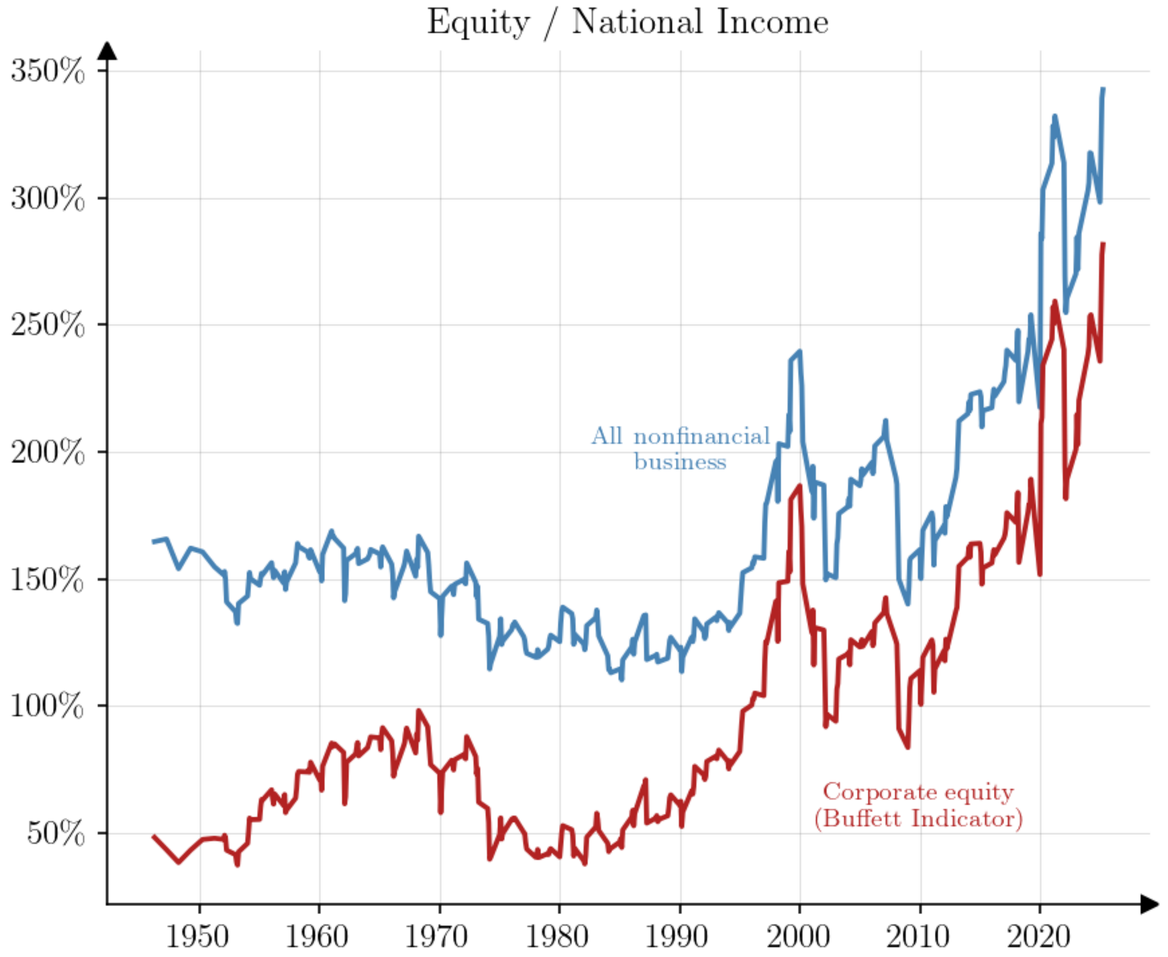

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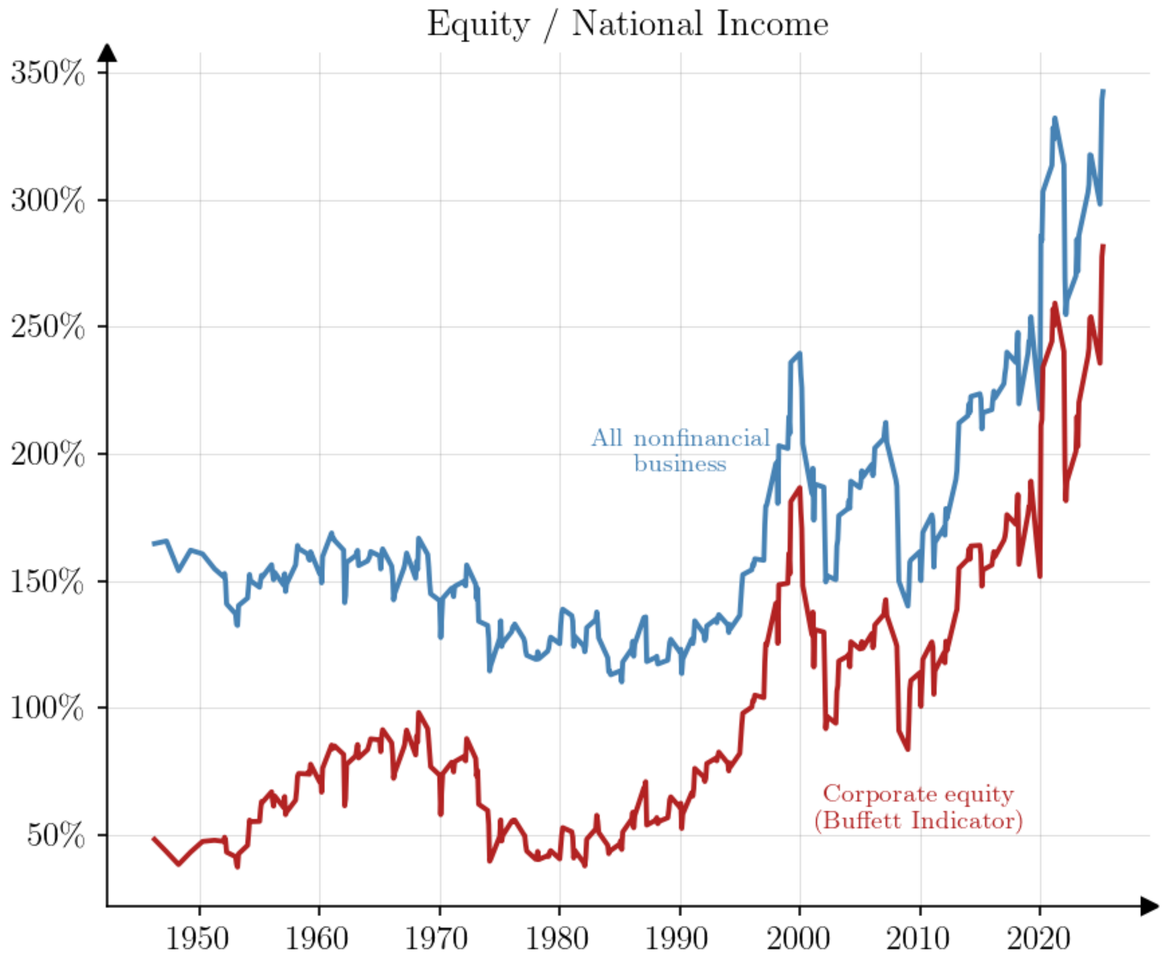

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- Investment boom (who is funding it?)