Artificial Intelligence in the Knowledge Economy

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Goal: Build framework that contributes to

1. **Organize discussion about AI's labor market impact.**

2. **Guide empirical analysis.**

3. **Guide policy.**

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   How is AI different from previous automation & why this matters?

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   e.g., Brynjolfsson, Li, Raymond (QJE25) vs Berger et al (2014).

   Can we rationalize this evidence? What new data do we need to collect?

3. **Guide policy.** Effects of regulating AI's autonomy?

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	Codifiable	**Non-Codifiable**
Manual	Robots	Physical AI
Cognitive	Enterprise Software	**AI**

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Essential idea of this paper:

AI's scalability $\rightarrow$ Reorganization

Outline

1. Canonical model of knowledge economy.
   - Production relies on cognitive, non-codifiable (tacit) knowledge.
   - ORGS form to make best possible use of available knowledge.
2. Introducing AI (tech that can automate knowledge work).
3. Economic impact of autonomous AI.
4. Role of AI autonomy.
5. Rationalization of seemingly contradictory empirical evidence.

Pre-AI Knowledge Economy

Antràs, Garicano, Rossi-Hansberg (2006); Fuchs, Garicano, Rayo (2015)

Model: Pre-AI Knowledge Economy

- Unit mass of humans, each endowed with one unit of time and exogenous knowledge $z \sim G$ with full support over $[0, 1]$.

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- Upon entering market, firms hire "workers" to produce.
  - Each worker uses her time and knowledge to pursue a project.

    All projects ex ante identical.
  - Problem comes up while pursuing each project.

    Difficulty of problems: $x \sim U[0, 1]$ independently across projects.
  - Worker with knowledge z produces one unit of output if $z \geq x$.

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- Firms can also hire another human as "solver."

Model: Pre-AI Knowledge Economy

Main idea: Hierarchy shields solvers from routine work—allowing them to specialize in the exceptional problems ("management by exception").

> *"We do not do much routine work with details. They never get up to us. I work fairly hard, but on exceptions."*
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> Alfred Sloan, former head of General Motors (GM), 1924

Model: Pre-AI Knowledge Economy

- Production workers ask solver for help when stuck.
- Asking for help consumes $h \in (0, 1)$ units of solver's time regardless.

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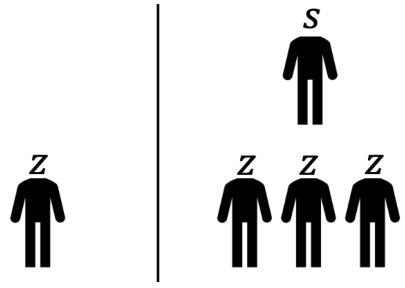

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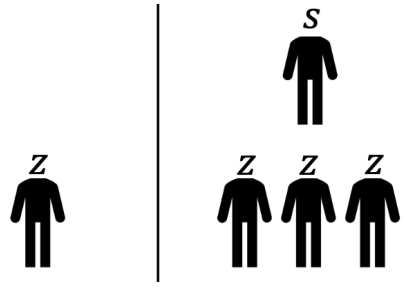

- Homogeneous knowledge in bottom layer is wlog because PAM.
- Maximum two-layers for simplicity.

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Pre-AI Equilibrium when $G(z) = z$ and $h = 1/2$

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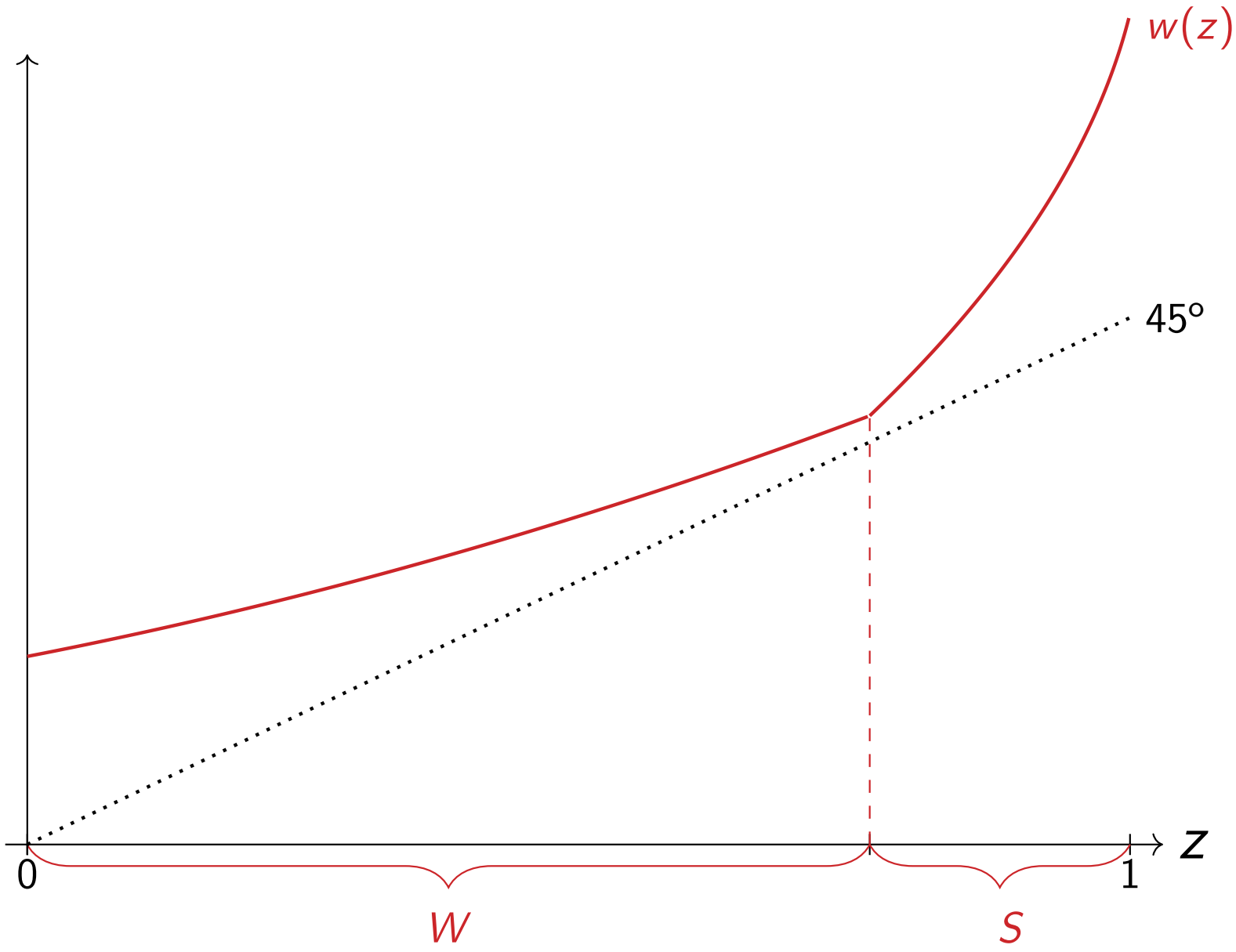

Introducing AI

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Three key developments guide our approach.

1. Rise of general-purpose AI foundation models ("digital brains").
2. Ambitions of autonomous "AI agents" (beyond chatbots).
3. AI can perform non-codifiable knowledge work at scale.

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2. Ambitions of autonomous "AI agents" (beyond chatbots).
3. AI can perform non-codifiable knowledge work at scale.
    a. Machine time (i.e., "compute") not tied to any digital brain.
    All compute can be used with best digital brain available.
    b. Machine time (i.e., "compute") large relative to human time.
    Human-AI interactions constrained by human time.

How we model AI: Benchmark

- Technology that:
  1. Is available to all firms for free.
  2. Mimics human with knowledge $z_{\mathrm{AI}} \in (0, 1)$.
  3. Requires compute to run.

     Normalization: 1 unit of compute needed to mimic 1 human.

- Amount of compute μ is large.

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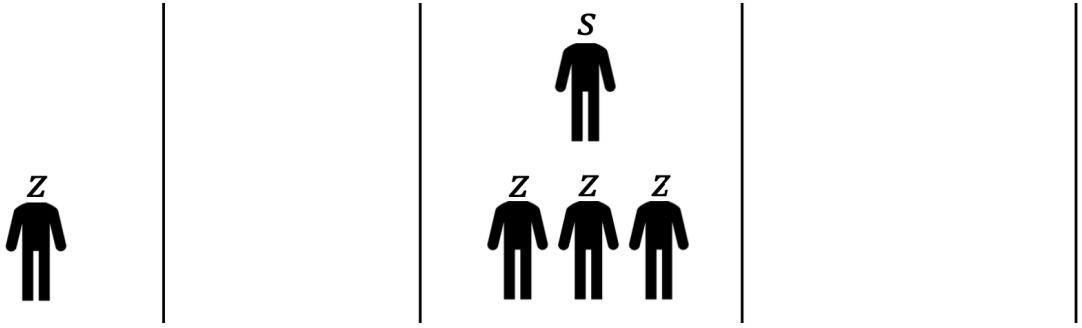

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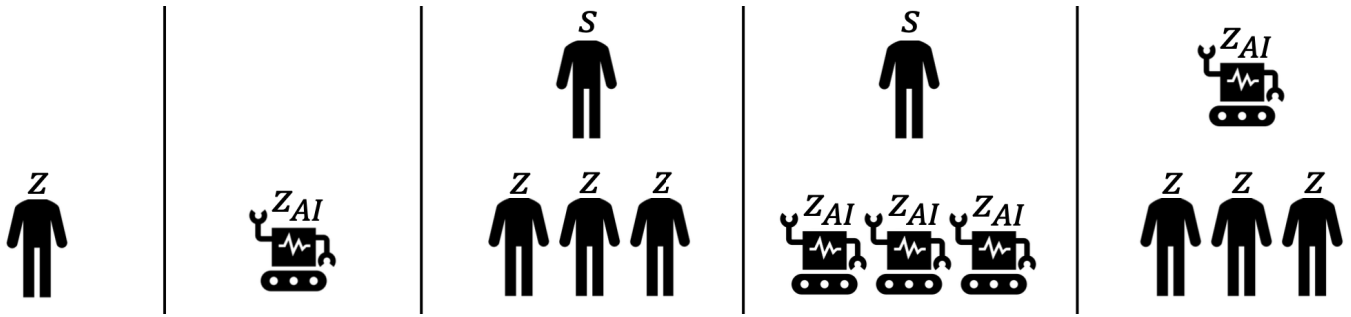

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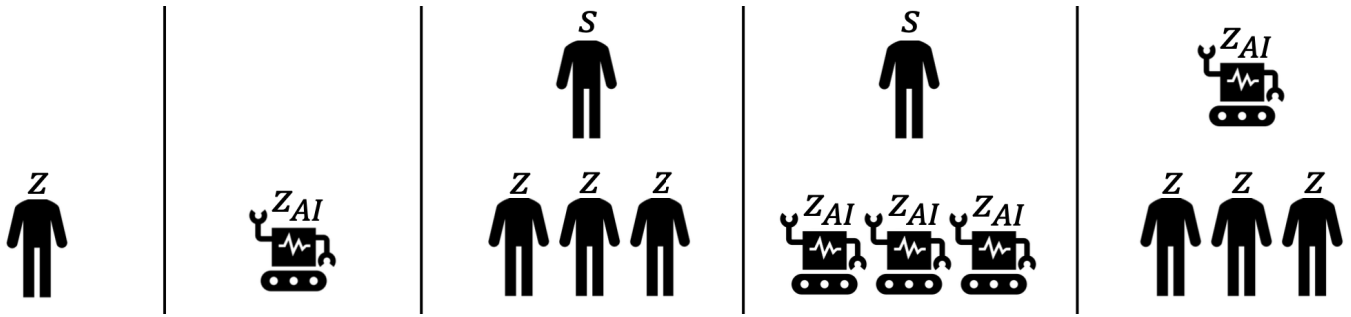


- Amount of compute μ is large:

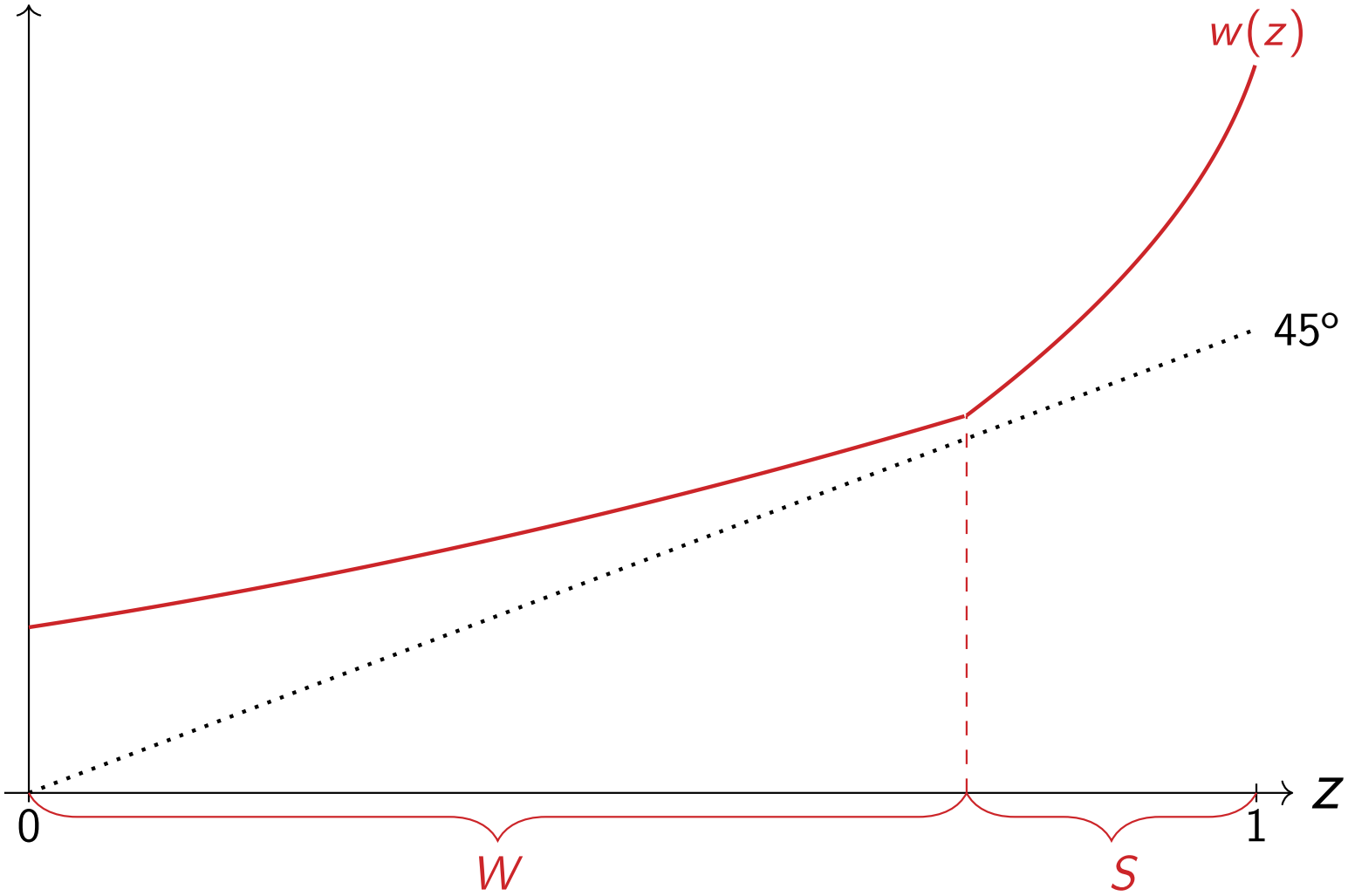
  Some compute must be used in independent production.

  Equilibrium rental rate of compute and $w(z_{\mathrm{AI}})$ are thus z_{AI}.

Illustration: Pre-AI vs Post-AI Equilibrium

$G(z) = z$ and $h = 1/2$.

From Pre- to Post-AI Equilibrium – Basic AI



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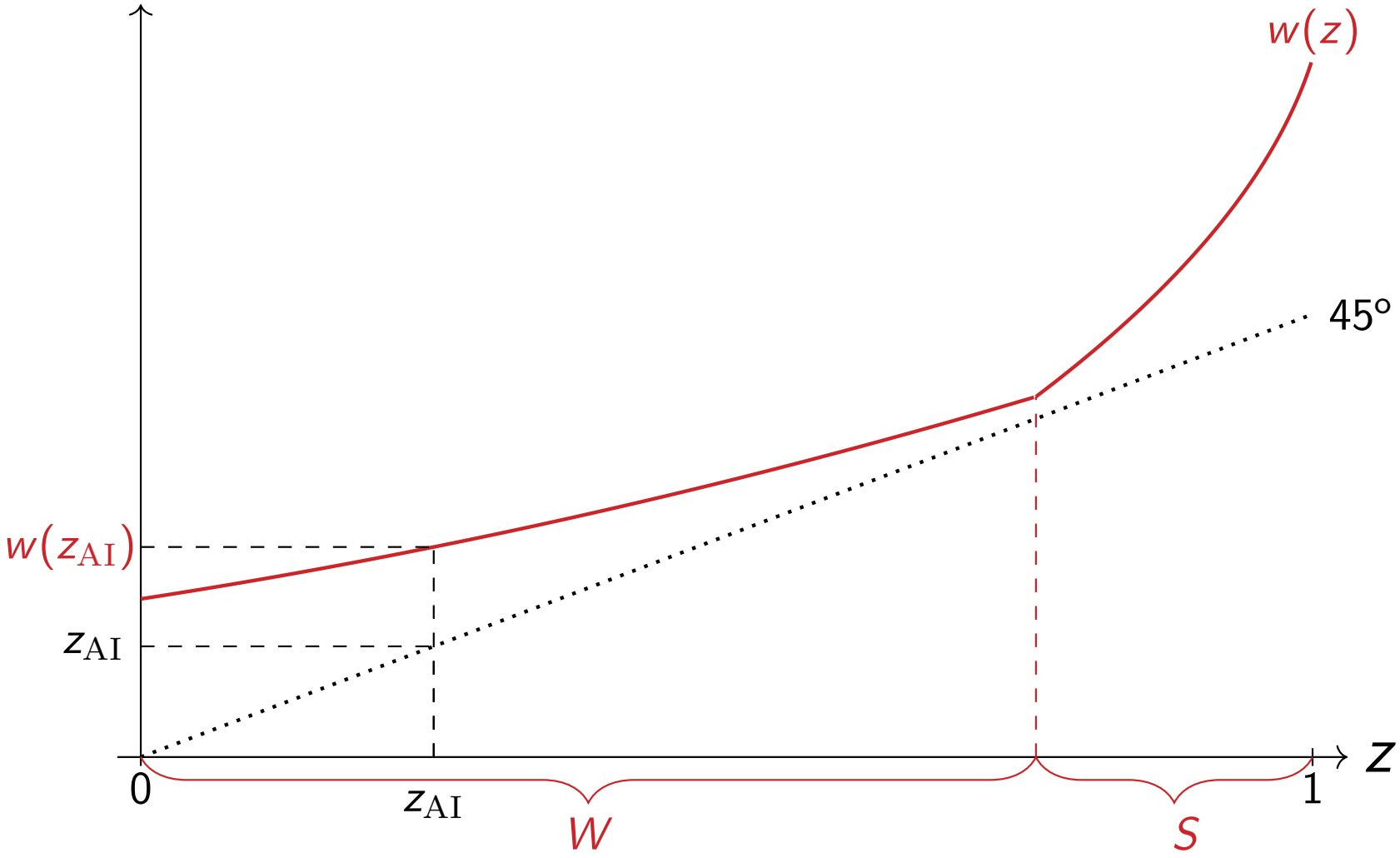

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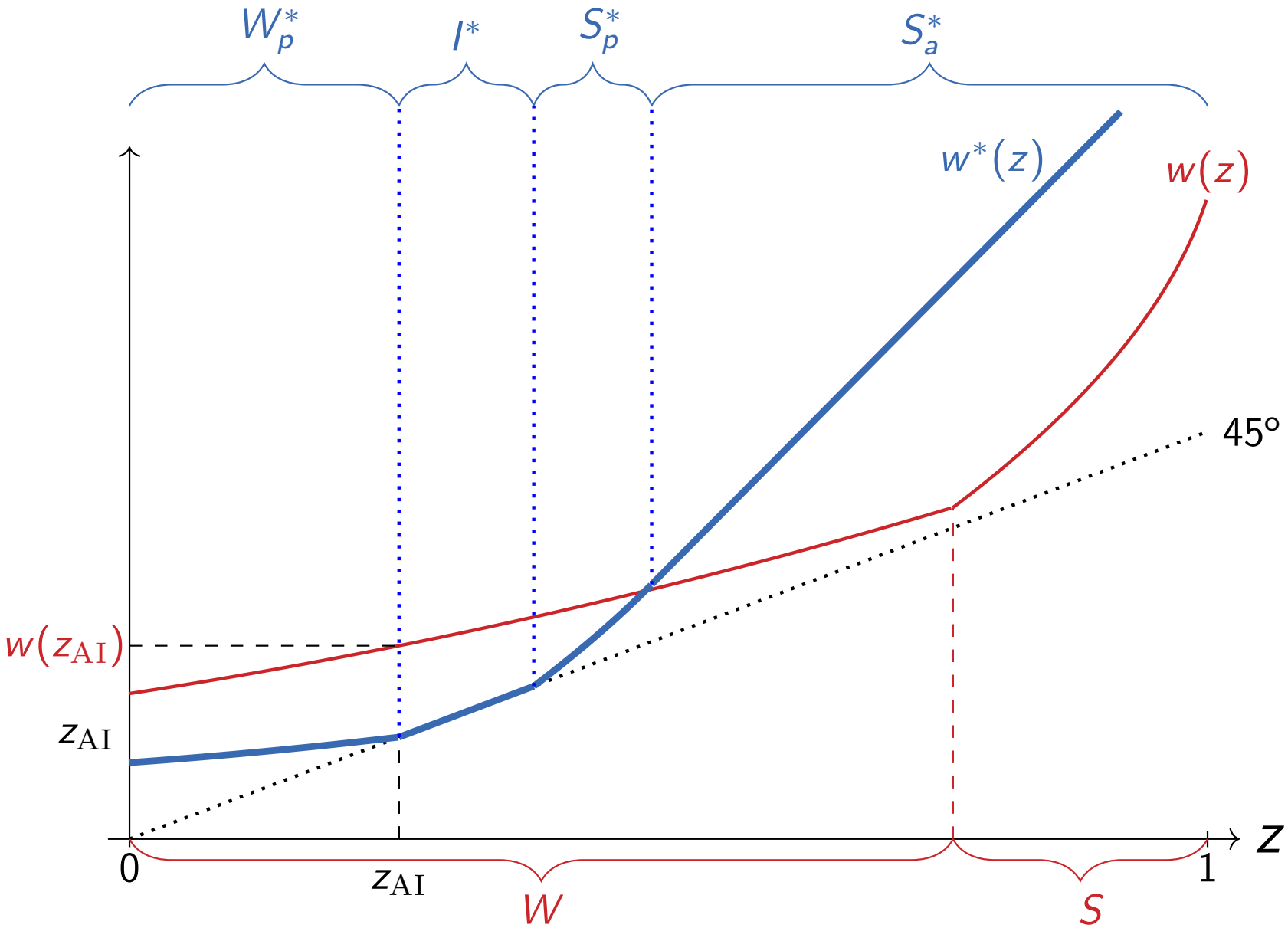

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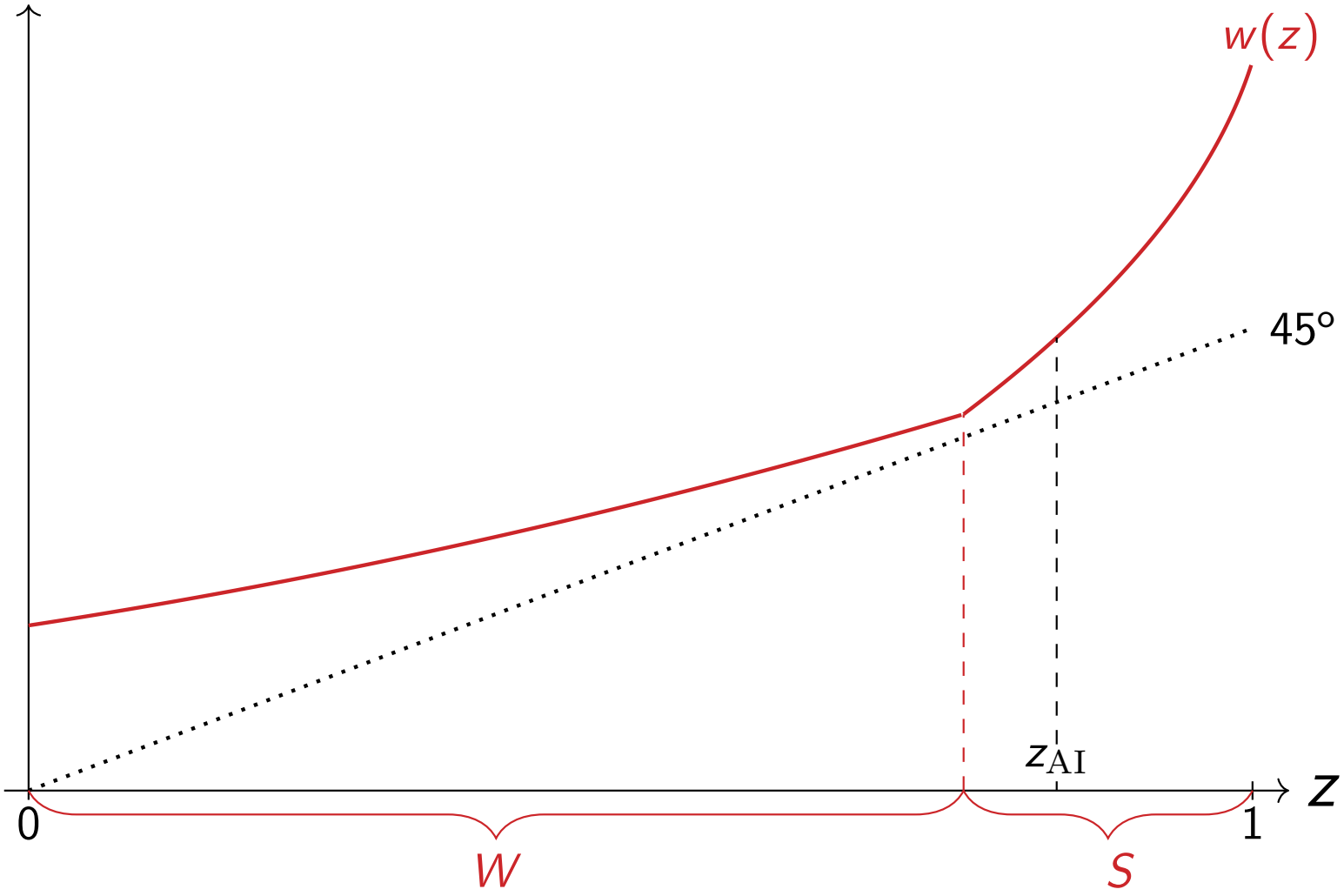

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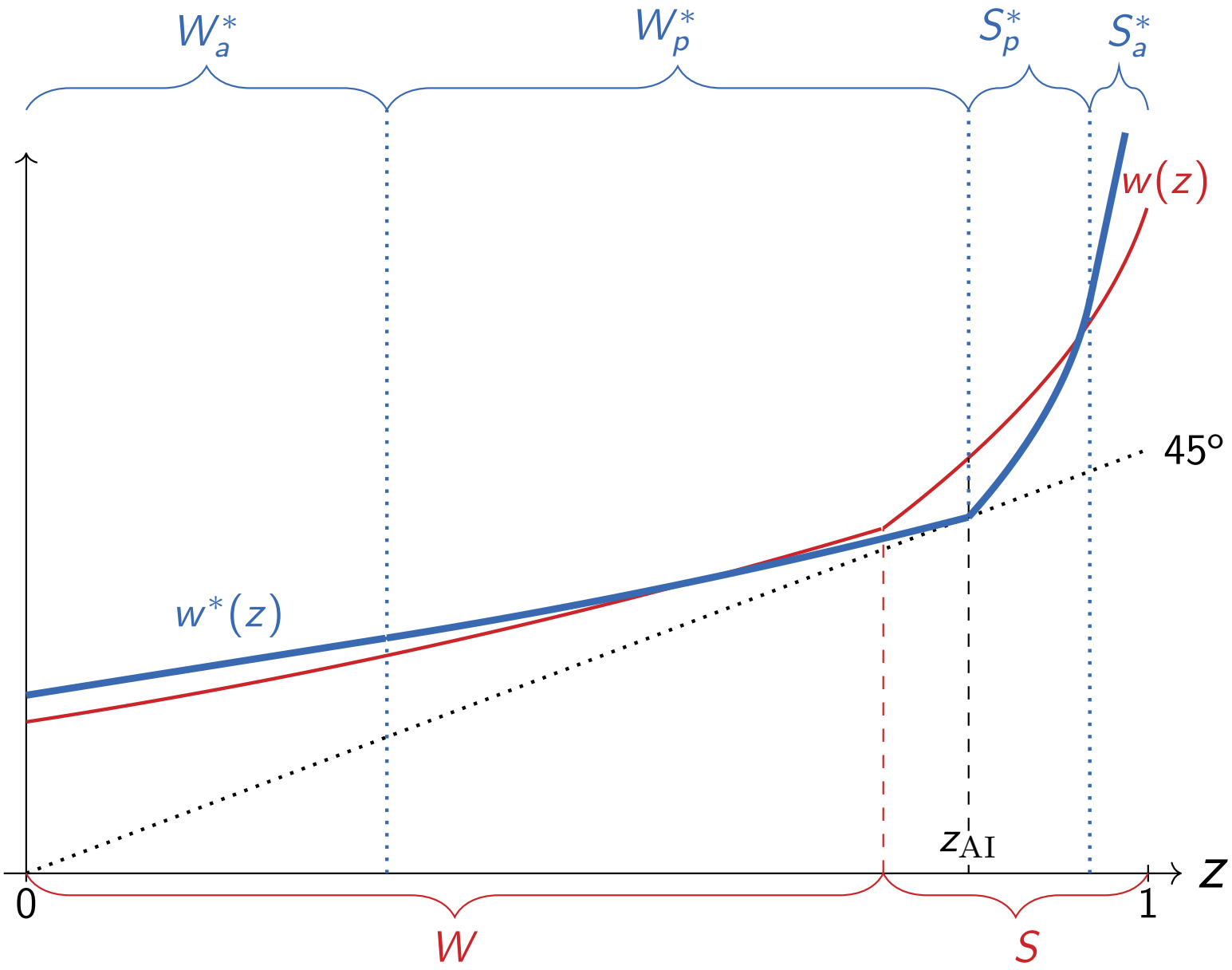

4. The Role of Autonomy

Non-Autonomous AI

- So far, we have focused on autonomous AI, which can be:
  - Worker (autonomously pursue projects).
  - Solver (provide problem-solving advice).

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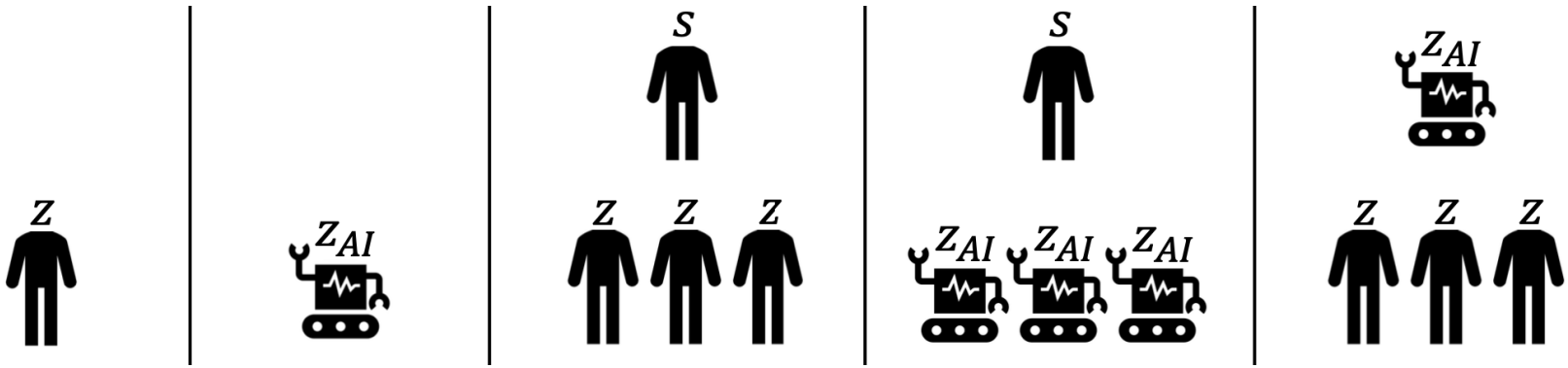

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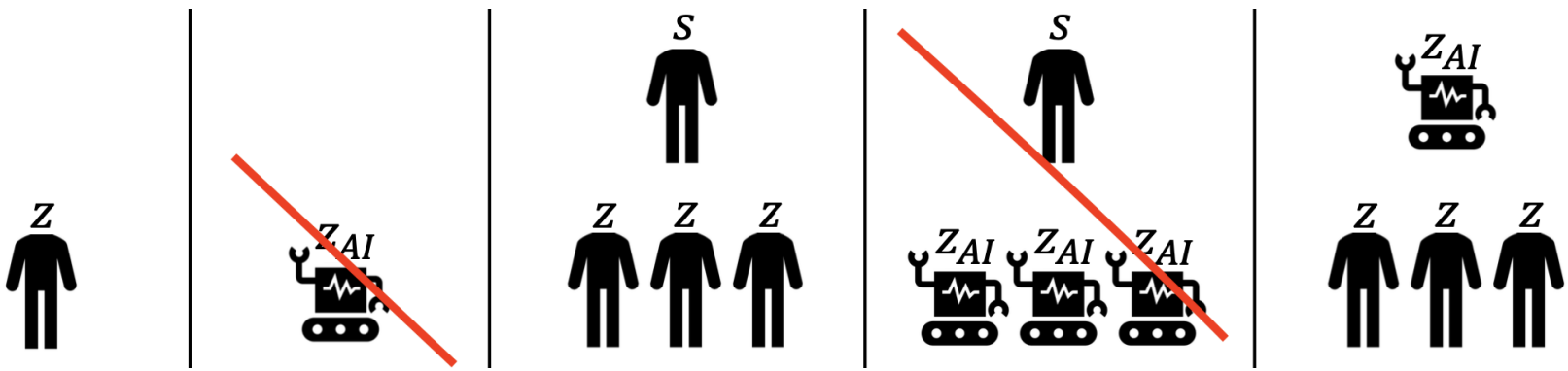
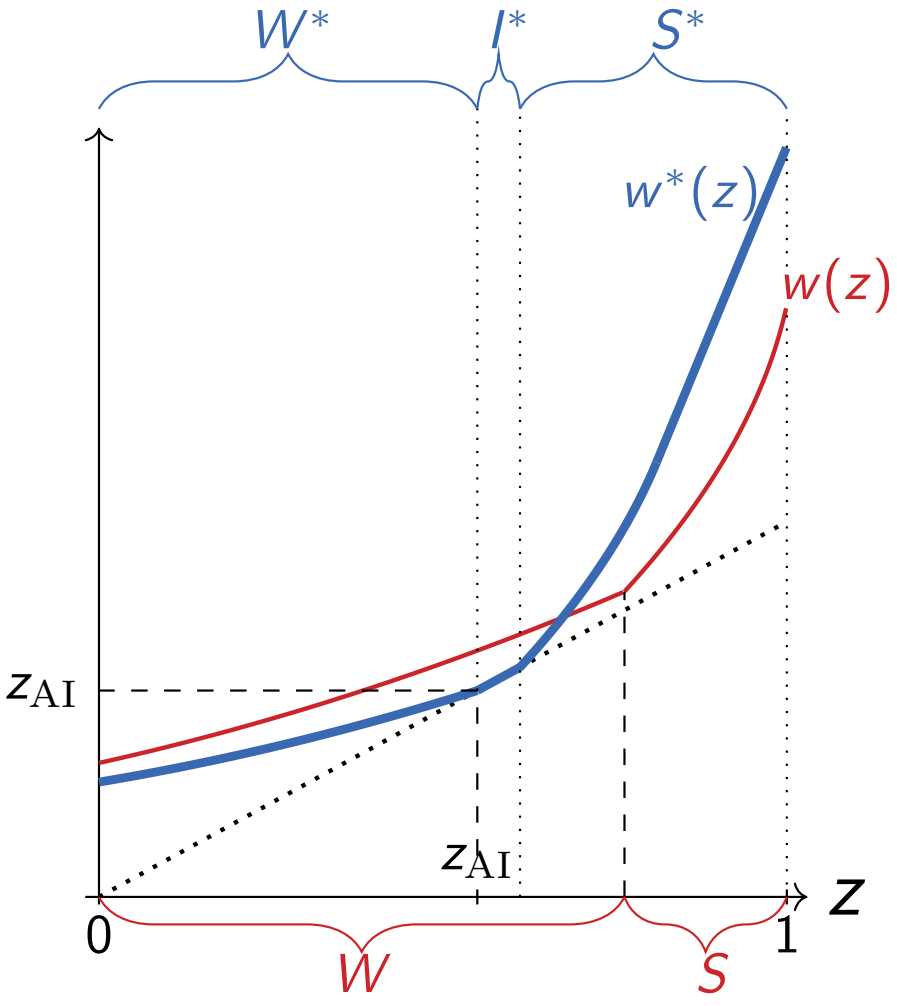


Autonomous AI vs Non-autonomous AI



- Introducing autonomous AI increases labor income inequality.

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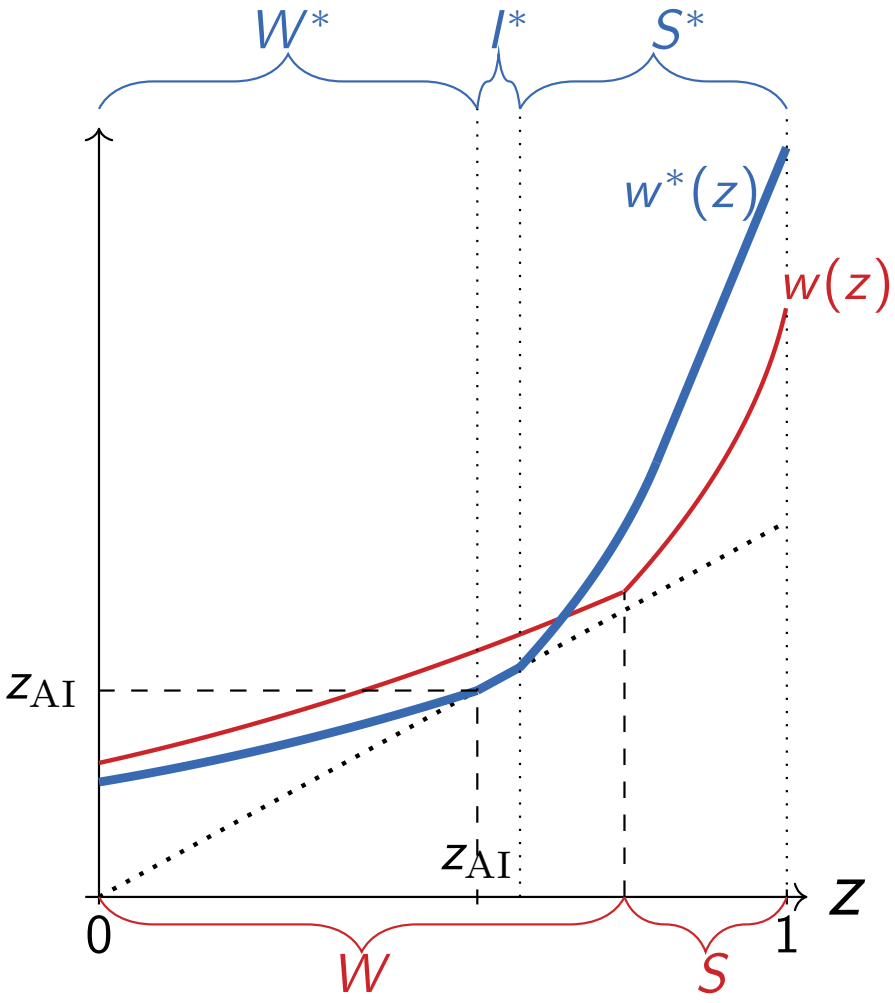

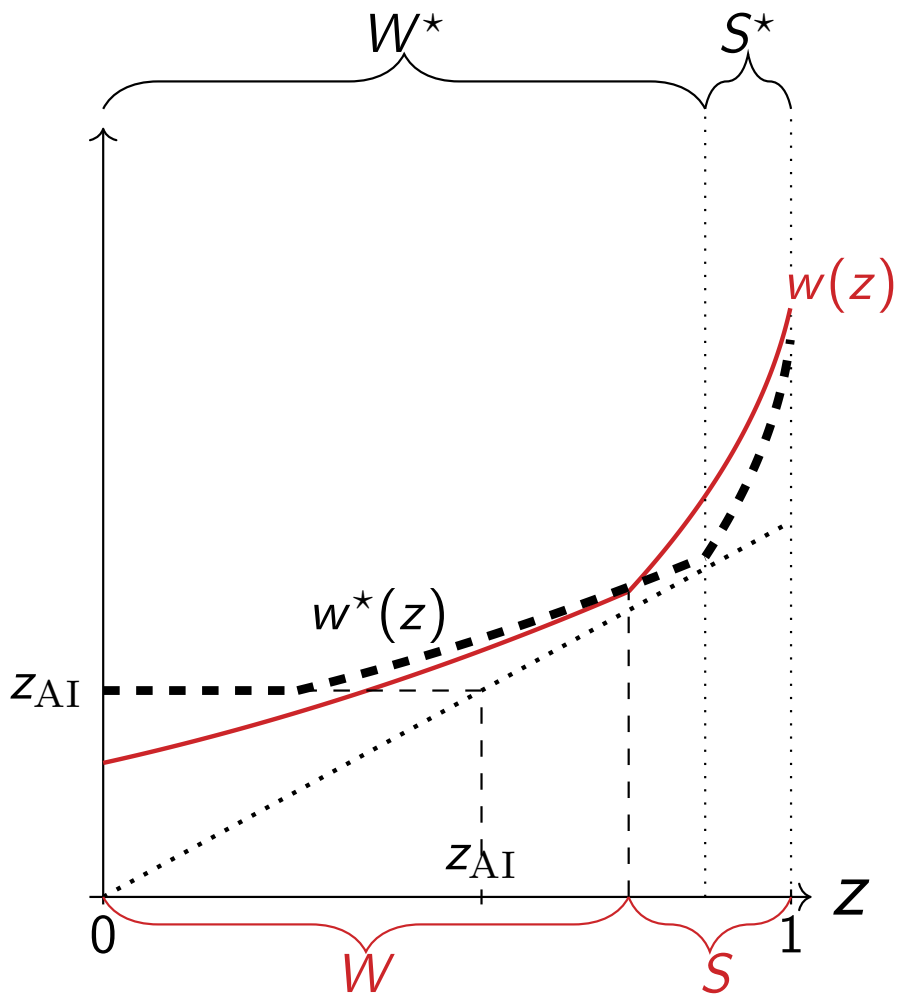

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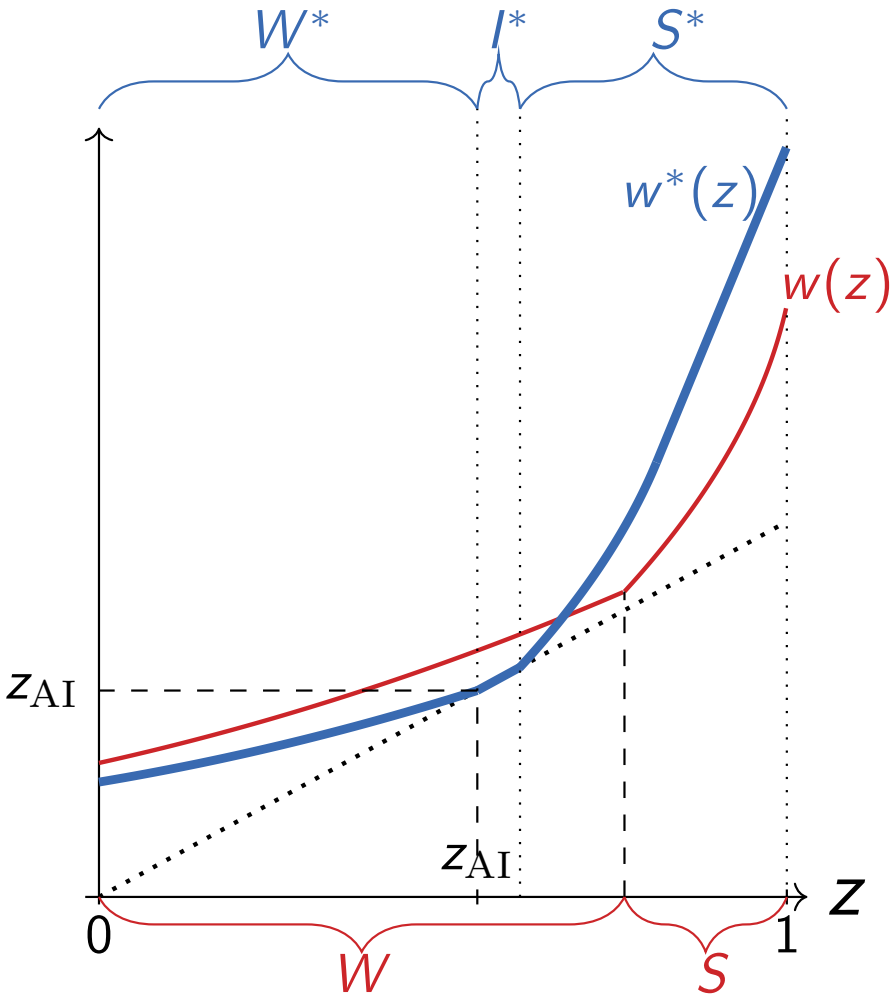

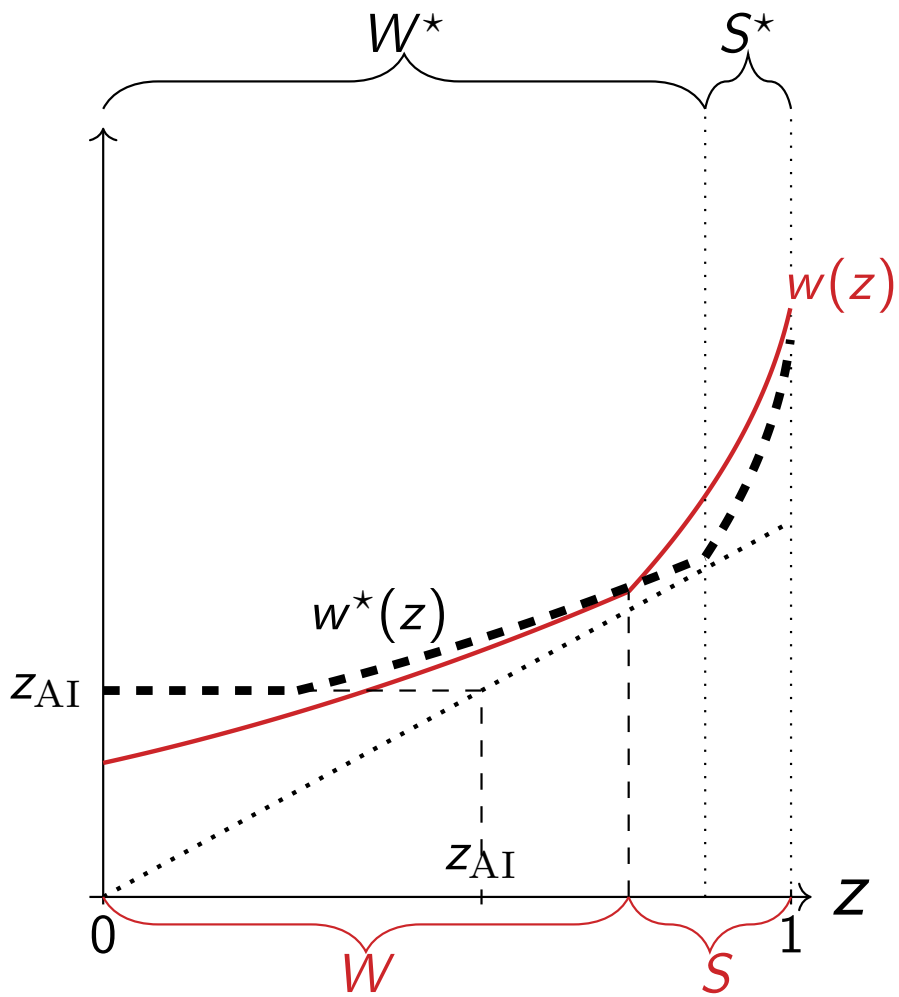

- Introducing autonomous AI increases labor income inequality.
- Introducing non-autonomous AI decreases labor income inequality.
- Aggregate output larger with autonomy than with non-autonomy.

Can rationalize seemingly contradictory evidence

- AI benefits the least knowledgeable the most.

  Brynjolfsson, Li, Raymond ('25), Caplin et al. ('24), Dell'Acqua et al. ('23), Noy Zhang ('23), Peng et al ('23), Wiles, Munyikwa, Horton ('23), ...

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Our results suggest need to control for AI's autonomy.

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   Tradeoff between aggregate output and inequality.