Employment Protection, Adjustment Costs, and Technology Adoption

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Structure

- Policy insights
- Main idea
- Data and stylized facts
- General equilibrium model of tech adoption
- Quantitative implementation
- Endogenous innovation
- Social planner
- Conclusions

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Policy insights

- Technology policy and labor market policy are complements
  - Labor regulation discourages tech adoption; flexicurity promotes tech upgrading

- Market solution: not only underinvestment in R&D but also directed away from transformative technical change towards low-growth trajectory

- Social planner can restore optimal investment levels and direction through targeted support

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Main idea

- Innovation and technology adoption are different things
- Adoption requires complementary investments, training and restructuring of tasks inside the firm, and also impacts labour demand
- Costs of restructuring increase with employment protection legislation
- Minimum productivity threshold for firms to adopt
- Set of adopters (downstream) determine private return to R&D (upstream)
- Social rate of return is higher as firms do not internalize full societal benefits from tech diffusion

Core mechanism: EPL affects adoption and innovation

- Stricter employment protection
- Higher restructuring costs
- Lower technology adoption
- Lower expected returns to innovation
- Less innovation in transformative technologies

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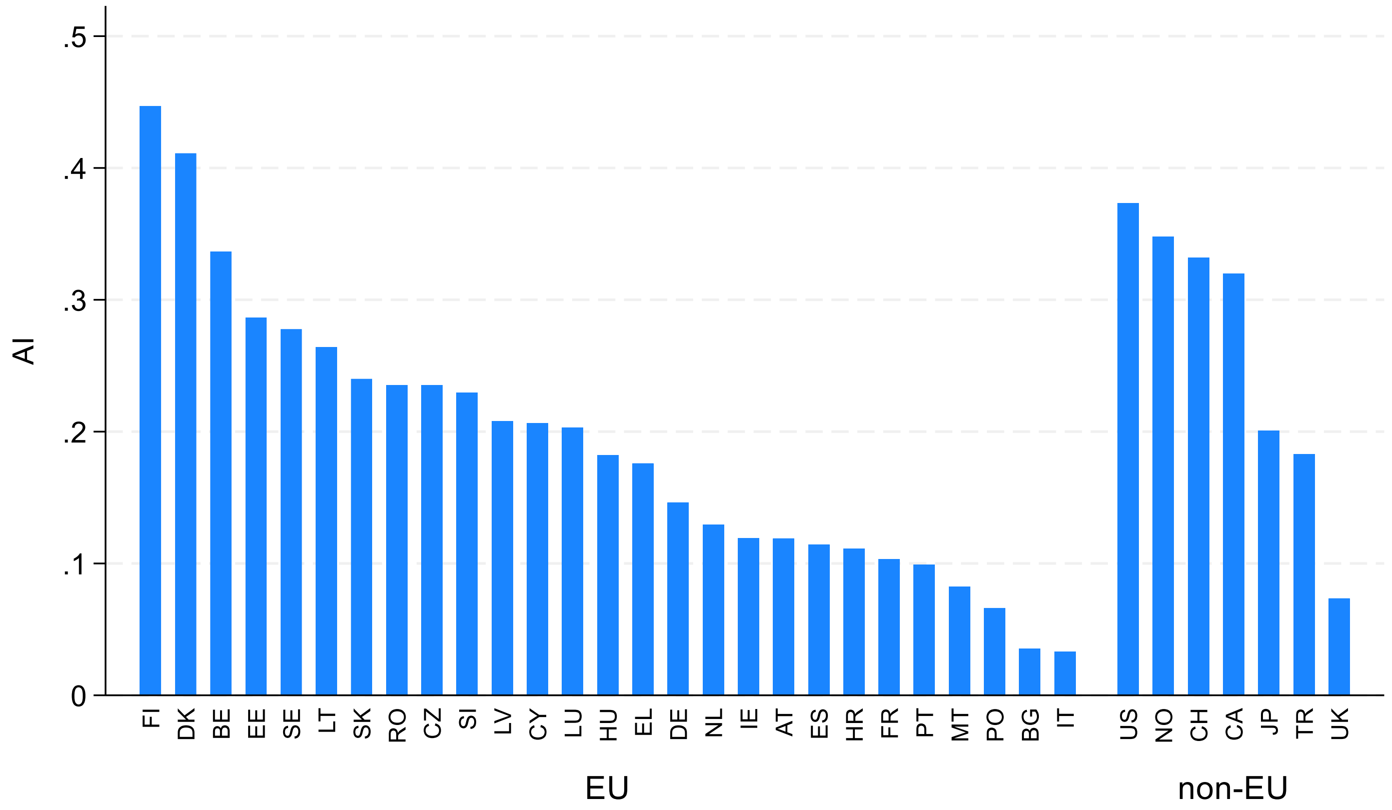
Data and stylized facts

Flash Eurobarometer 559 survey on “Startups, Scaleups and Entrepreneurship”, conducted between February and April 2025

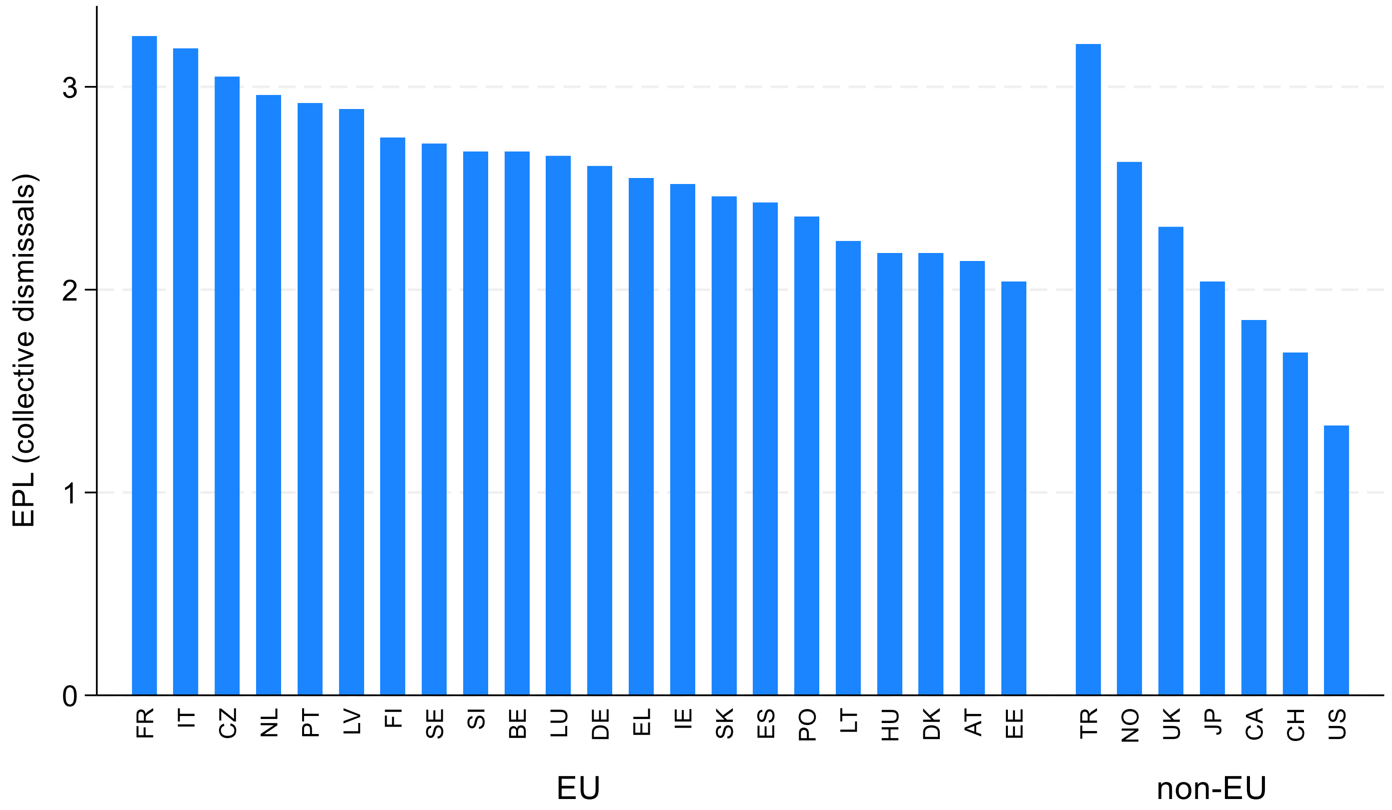
combined with

OECD Employment Protection Legislation and Product Market Regulation indicators

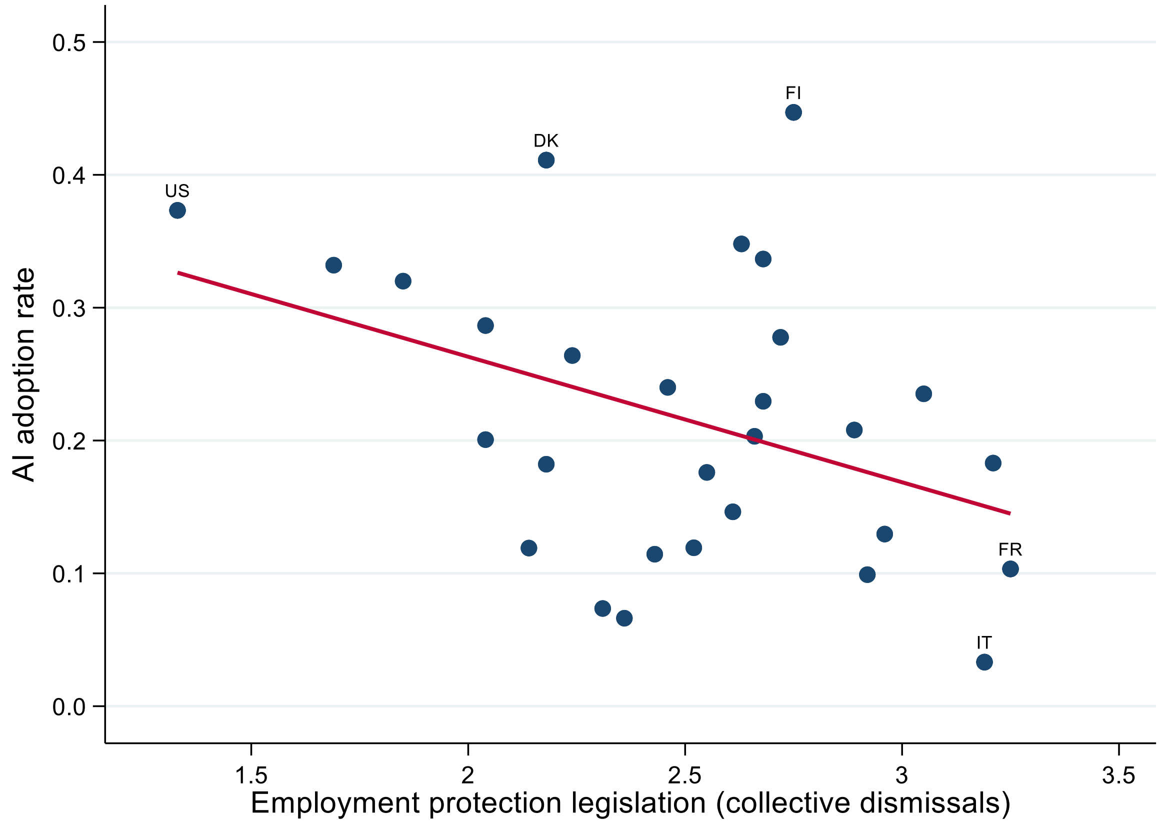
AI adoption varies widely, and US outperforming most EU countries



EPL indicator for collective dismissals

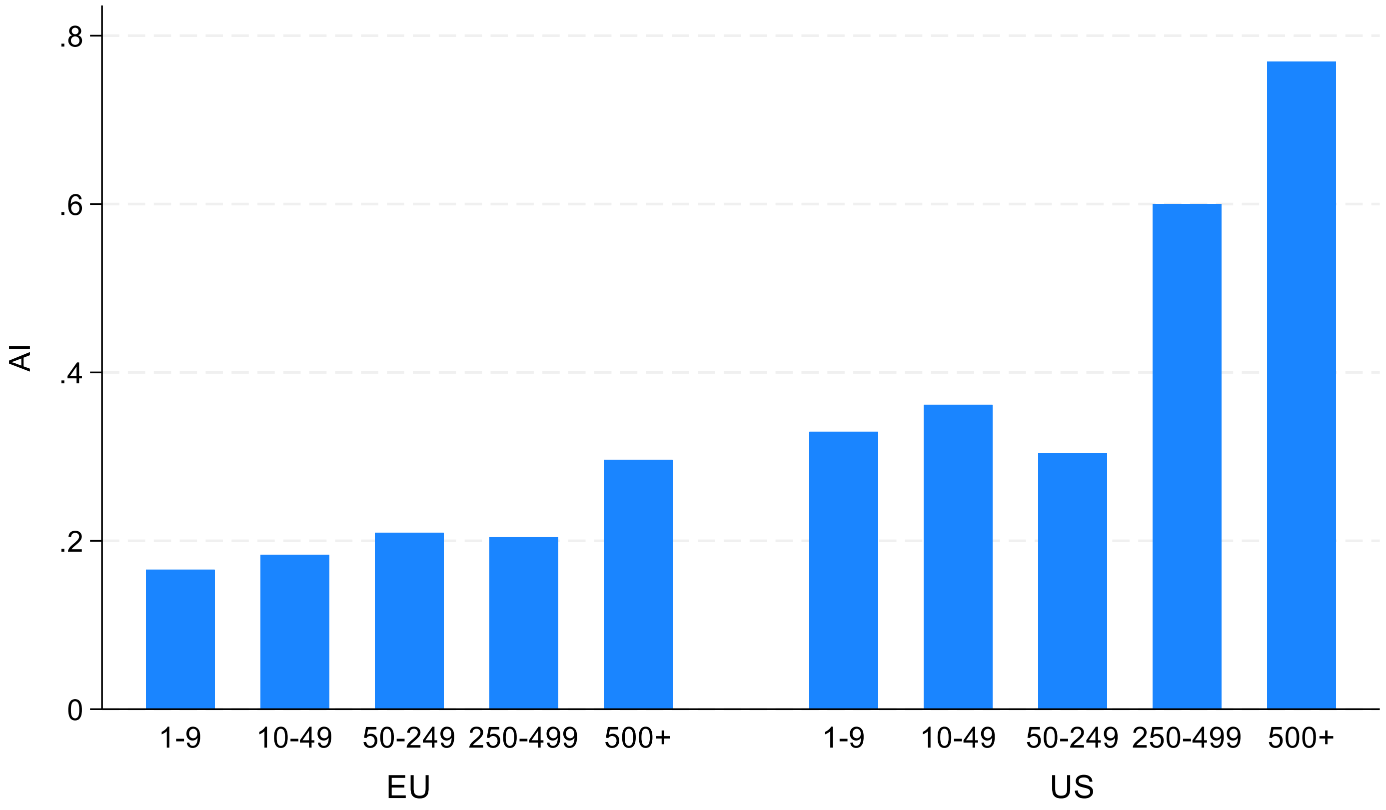


Stylized Fact 1: EPL is selectively associated with the adoption of advanced technologies



Negative correlation for AI and digital security, no correlation for other advanced technologies such as cloud computing and IoT

Stylized Fact 2: The negative association between EPL and AI adoption is primarily driven by large firms



AI adoption rises sharply with firm size - particularly in the United States

firm-size gradient is considerably steeper for artificial intelligence than for cloud computing

Stylized Fact 3: Startups and scaleups play a disproportionate role in technology adoption

- Startup and scaleups important for tech adoption, though not for all technologies

- Firms with lower legacy costs and greater organizational flexibility - often younger and fast-growing firms - play a disproportionate role in the diffusion of new technologies (Haltiwanger et al. 2013; Brynjolfsson et al. 2021)

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General equilibrium model of tech adoption

Production function under technology $j \in \{O, N\}$:

$Y_j = T_j z l_j^{\alpha_j}$, $\quad 0 < \alpha_j < 1$

with heterogeneous productivity z across firms

Firm's static problem:

$$\pi_j(z, w_j) = \max_{l_j \geq 0} [T_j z l_j^{\alpha_j} - w_j l_j]$$

Workers have an outside option b and bargaining weight $\beta \in (0,1)$.

Right-to-manage Nash bargaining:

$$w_j^{NB} = b\left[1 + \beta\left(\frac{1}{\alpha_j} - 1\right)\right]$$

Technology adoption if:

$$\pi_N(z, w_N) - \pi_O(z, w_O) \geq R(z, w_O, w_N, EPL)$$

where $R(.)$ denotes restructuring costs, which depend on EPL

Restructuring costs

(1) Fixed restructuring costs

$R_{\text{fixed}} = \kappa\phi(EPL), \qquad \phi(EPL) = 1 + \eta_\phi EPL$

(2) Severance costs

$R_{\text{sev}} = \psi(EPL) w_O D(z), \qquad \psi(EPL) = S + \eta_\psi EPL$

(3) Retraining costs

$R_{\text{train}} = \tau w_N (1 - \rho) L_r(z)$

So:

$R(z, w_O, w_N, EPL) = R_{\text{fixed}} + R_{\text{sev}} + R_{\text{train}}$

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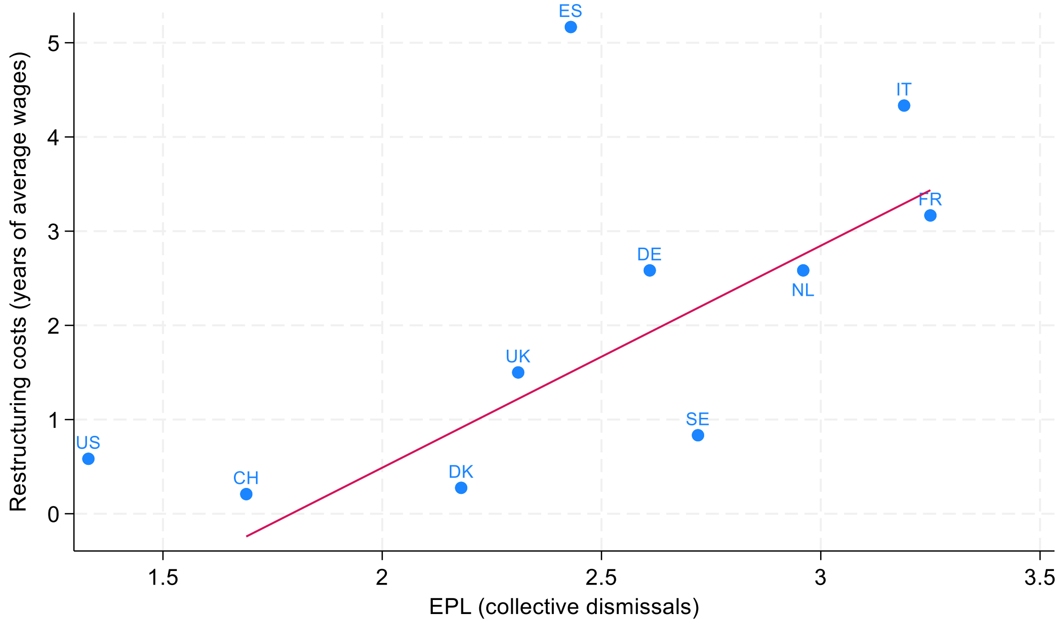
Baseline

Numbers loosely based on reality

Special attention for severance pay

$$\frac{R_{\text{sev}}}{w_O D(z)} = \psi(EPL) = S + \eta_\psi EPL$$

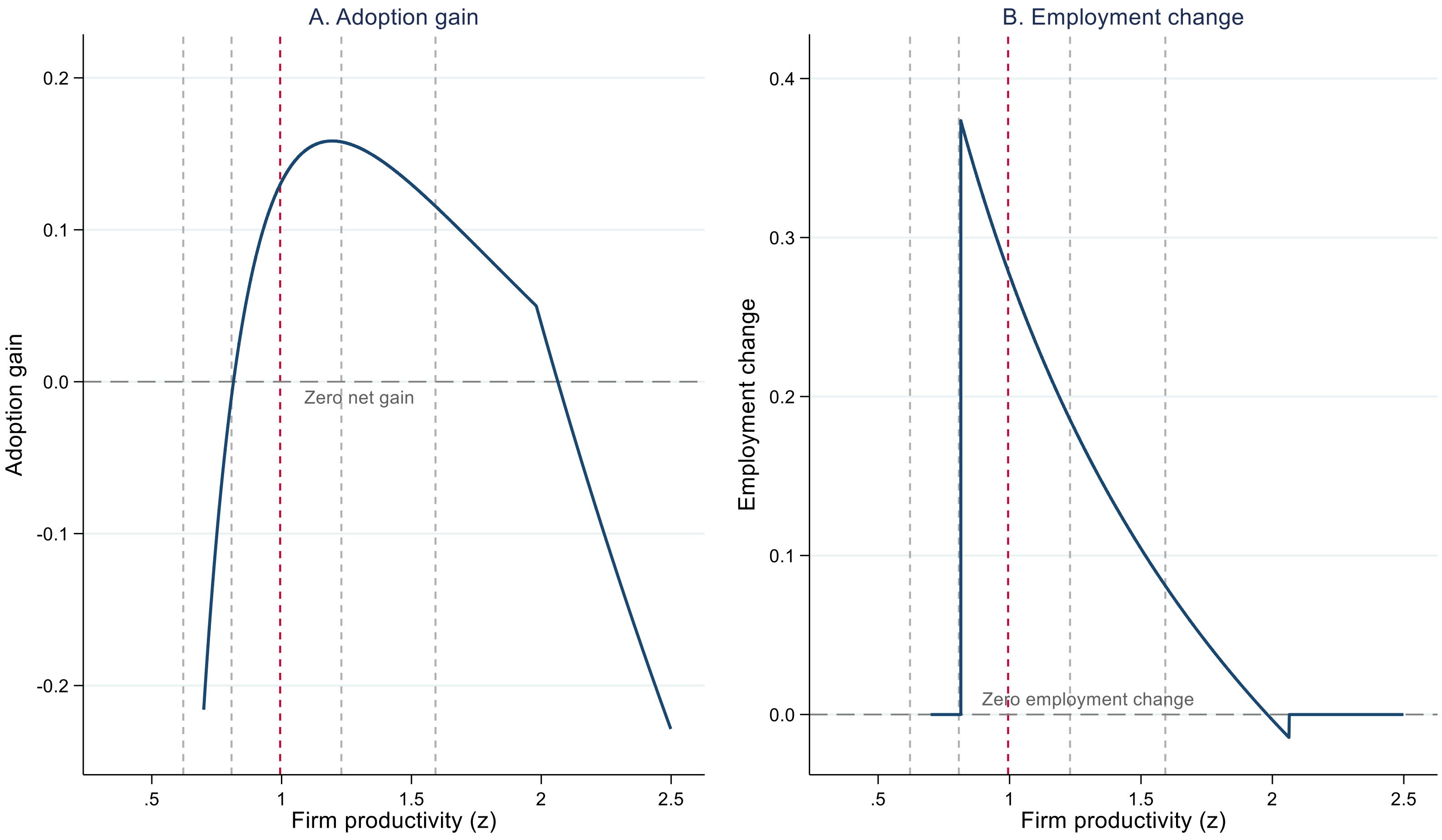
Coatanlem and Coste (2025) provide country-level estimates of the “cost of failure” for firms



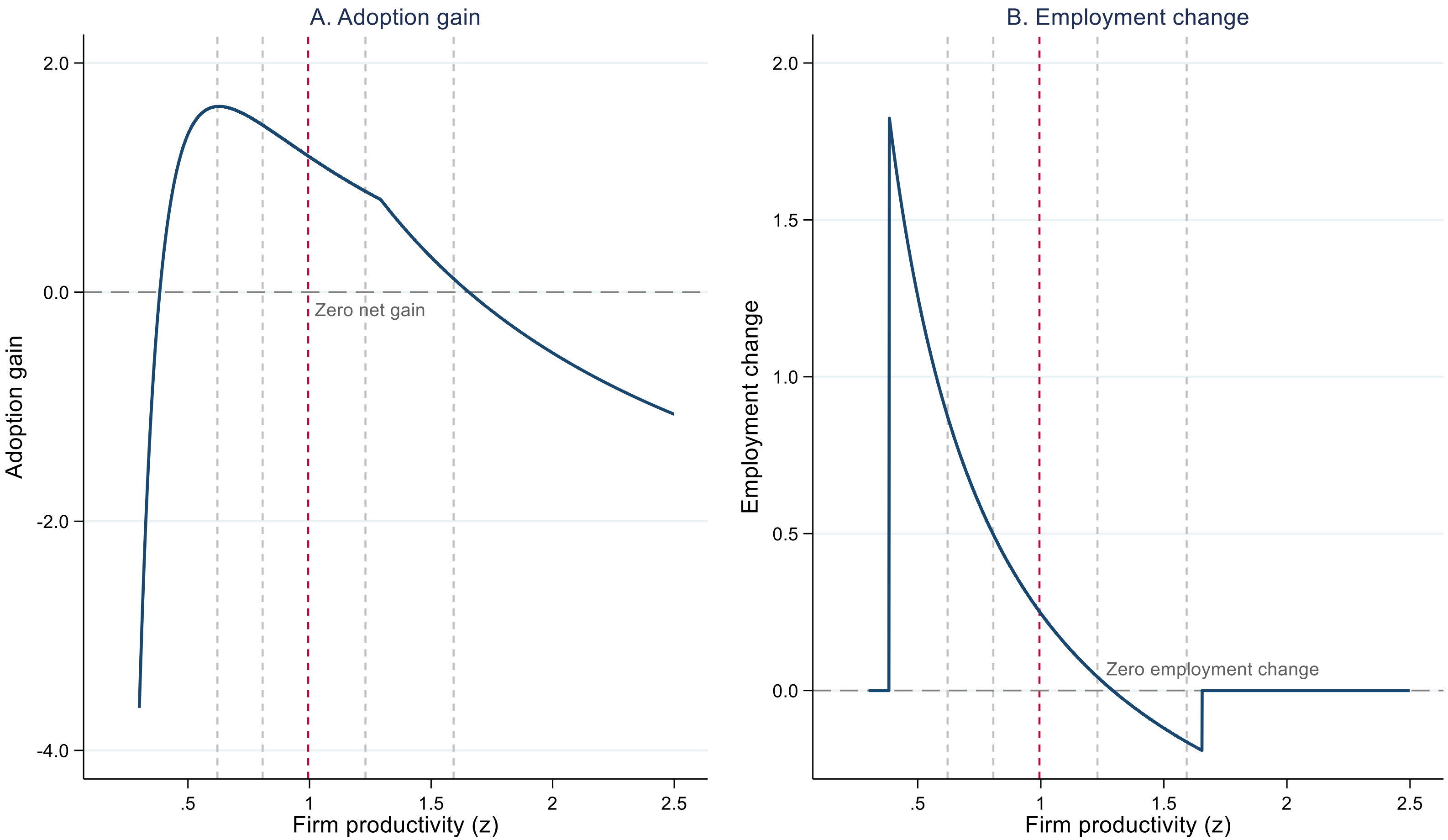
Technology trajectories and retraining costs

Trajectory	Parameterization	Description
AI-P	$T_N = 1.2$; $\alpha_N = 0.6$; $\tau = 0.3$; $\rho = 0.65$	Process-augmenting AI: AI technologies that raise productivity while largely complementing existing tasks. Adoption requires meaningful organizational adjustment and retraining but involves limited displacement of labor.
AI-T	$T_N = 1.5$; $\alpha_N = 0.5$; $\tau = 0.3$; $\rho = 0.65$	Transformational AI: Technologies that generate a large productivity gain and substantially alter task composition, reducing labor intensity. Adoption entails major workforce reorganization and is highly sensitive to employment protection.
MDT	$T_N = 1.04$; $\alpha_N = 0.65$; $\tau = 0.1$; $\rho = 0.9$	Modular digital and automation technologies: Incremental digital and automation technologies that can be adopted in a modular fashion. Productivity gains are modest and largely Hicks-neutral, with limited organizational disruption and weak sensitivity to EPL.

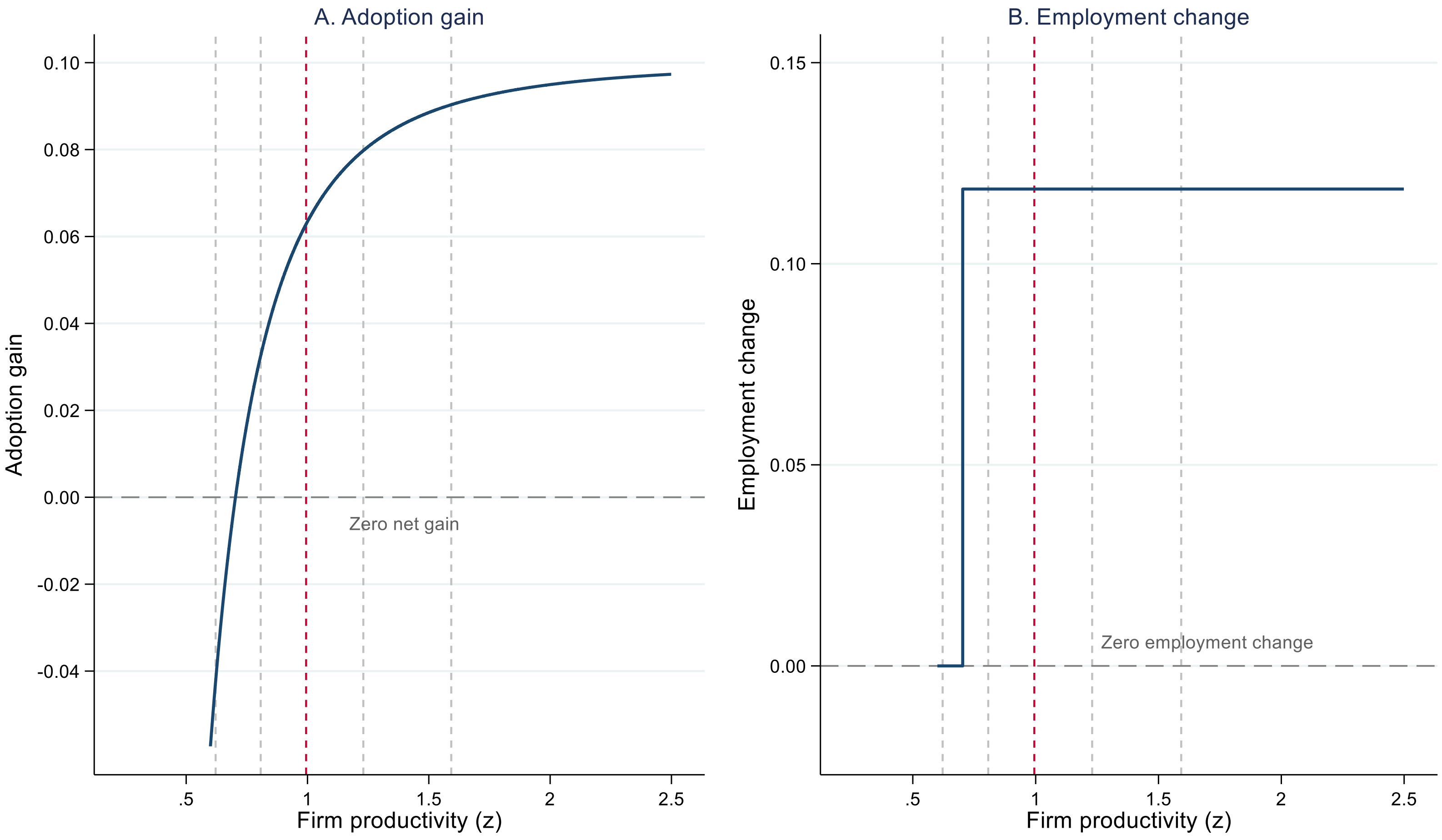
Process-augmenting AI



Transformational AI



Modular digital and automation technologies



Firm types

- **Zombies**: Firms with negative adoption surplus located at the bottom of the productivity distribution. These firms neither adopt nor restructure and remain locked into low-productivity technologies.
- **Marginal non-adopters**
- **Low-productivity adopters**
- **Expanding adopters**
- **Frontier stars**
- **Downsizing adopters**: High-productivity firms that adopt the new technology but reduce employment following adoption, consistent with adoption of labor-saving technologies that entail substantial reorganization.
- **Very high-productivity holdouts**: Firms at the top of the productivity distribution with negative adoption surplus. Despite their high productivity, these firms optimally refrain from adoption because EPL-related restructuring costs dominate adoption gains.

Comparison of model-predicted and observed firm types, AI

		Model economy	
Firm type	Data	AI-P	AI-T
Zombies	0.163	0.167	0.022
Marginal non-adopters	0.178	0.174	0
Low-productive adopters	0.208	0.160	0.478
Expanding adopters	0.088	0.333	0.204
Frontier stars	0.045	0.090	0
Downsizing adopters	0.016	0.014	0.148
Highly productive holdouts	0.077	0.063	0.147
Other:			
Stable adopters	0.045		
Productive holdouts	0.181		

Comparison of model-predicted and observed firm types, MDT

		Model economy
Firm type	Data	MDT
Zombies	0.114	0.167
Marginal non-adopters	0.124	0.071
Low-productive adopters	0.310	0.262
Expanding adopters	0.131	0.333
Frontier stars	0.069	0.167
Downsizing adopters	0.025	0
Highly productive holdouts	0.047	0
Other:		
Stable adopters	0.066	
Productive holdouts	0.114	

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Endogenous innovation

Arrival probability of an innovation depends on investment:

$p(I) = 1 - e^{-\nu I}, \qquad \nu > 0,\ p'(I) > 0,\ p''(I) < 0,$

The innovator solves:

$\max_{I \geq 0} p(I) V^{\text{innov}}(T_N, \alpha_N, P_L, w, EPL) - I$

where V^{innov} is the revenue from selling the new technology (T_N, α_N) to adopting firms through a license fee P_L and I is the total R&D investment

The first-order condition yields
$\nu e^{-\nu I^*} V^{\text{innov}} = 1$

Menu from which the innovation sector can choose:

- AI-P
- AI-T
- MDT

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Social planner

The social planner's problem over R&D is given by:

$$\max_{I^S} p(I^S)W_1 + \left(1 - p(I^S)\right)W_0 - I^S$$

W_0 stands for social welfare when the new technology has not arrived, and W_1 represents social welfare when the new technology has arrived and firms decide whether to adopt or not

The FOC for the socially optimal R&D level I^S is:

$$p'(I^S)\Delta W = 1$$

where $\Delta W \equiv W_1 - W_0$

Social welfare depends on aggregate output and unemployment

$$W(I^S) = p(I^S)\{Y_1 - R_1 - \xi U_1\} + (1 - p(I^S))(Y_0 - \xi U_0) - I^S$$

where ξ measures the planner's concern for unemployment

Market and social planner solution under different technology trajectories

	Technology trajectory		
	AI-P	AI-T	MDT
Private R&D (I/Y_1)	0.6%	0.6%	0.1%
Exp. profits innovation sector	30.1	27.6	25.6
Socially optimal R&D (I^S/Y_1)	2.3%	2.4%	2.6%
R&D multiplier	5.0	7.1	5.8
Unemployment rate ($U_1/\bar{L}$)	4.2%	6.8%	0.4%
Net welfare gain	13.0%	22.4%	16.5%

R&D investment under alternative labor market regimes

	High EPL			Flexicurity		
	AI-P	AI-T	MDT	AI-P	AI-T	MDT
Private R&D / Y_1	0.5%	0.5%	0.1%	0.6%	0.6%	0.1%
Exp. profits innovation sector	22.0	18.9	24.5	41.5	21.3	27.5
Socially optimal R&D / Y_1	2.2%	2.5%	2.5%	2.3%	2.5%	2.6%
R&D multiplier	4.8	6.9	5.8	5.3	7.1	5.8
Unemployment rate ($U_1/\bar{L}$)	4.5%	5.6%	0.4%	3.7%	5.5%	0.3%
Net welfare gain	12.2%	21.6%	16.4%	14.1%	22.6%	16.6%

Policy implications

- Employment protection legislation affects innovation primarily through its impact on adoption incentives, rather than through a direct effect on R&D technology
- Private R&D is systematically biased away from technologies with large social payoffs but high adjustment requirements - most notably transformational AI - and toward technologies that are easier to adopt but deliver smaller productivity gains
- Flexicurity mitigates innovation distortions not by eliminating worker protection, but by shifting it from ex ante constraints on firms toward ex post insurance for workers

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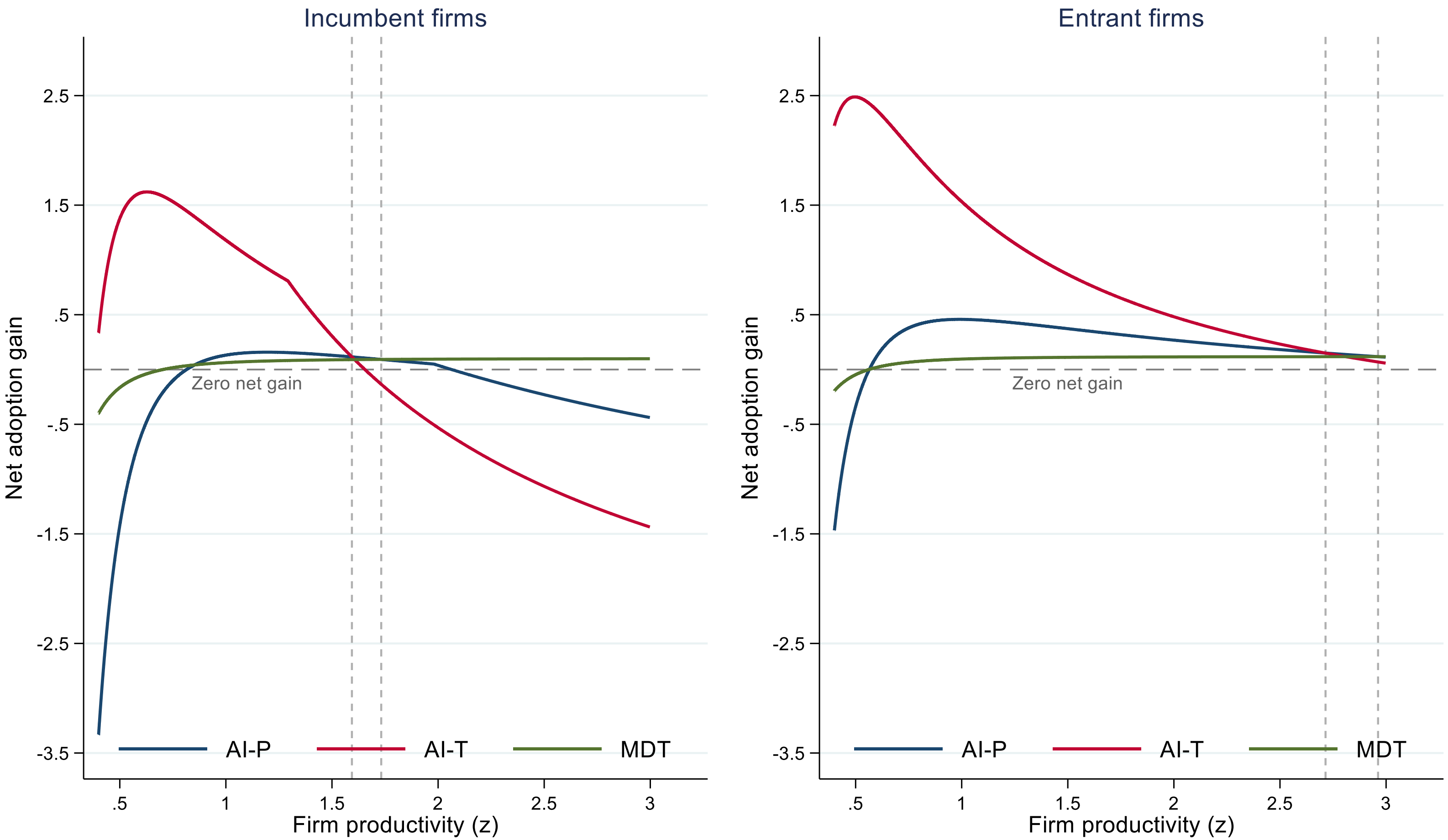
- Labor market institutions shape the creation and diffusion of advanced technologies

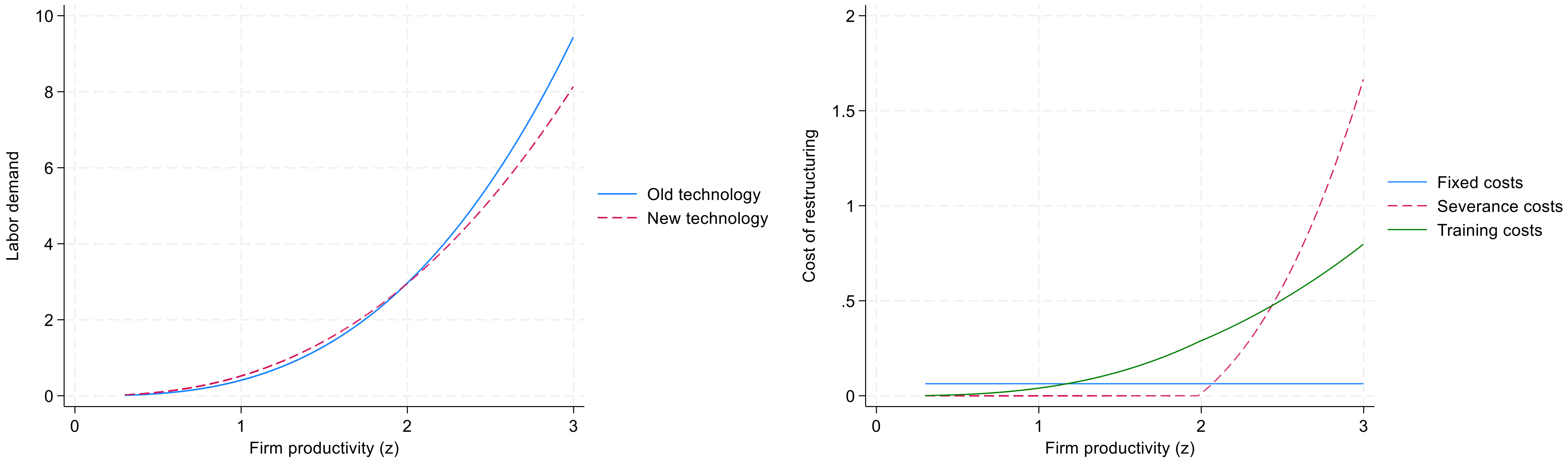
- The employment effects of technology adoption are inherently heterogeneous

- The results highlight that technology policy and labor market policy are complements rather than substitutes in fostering productivity growth and employment reallocation at the technological frontier

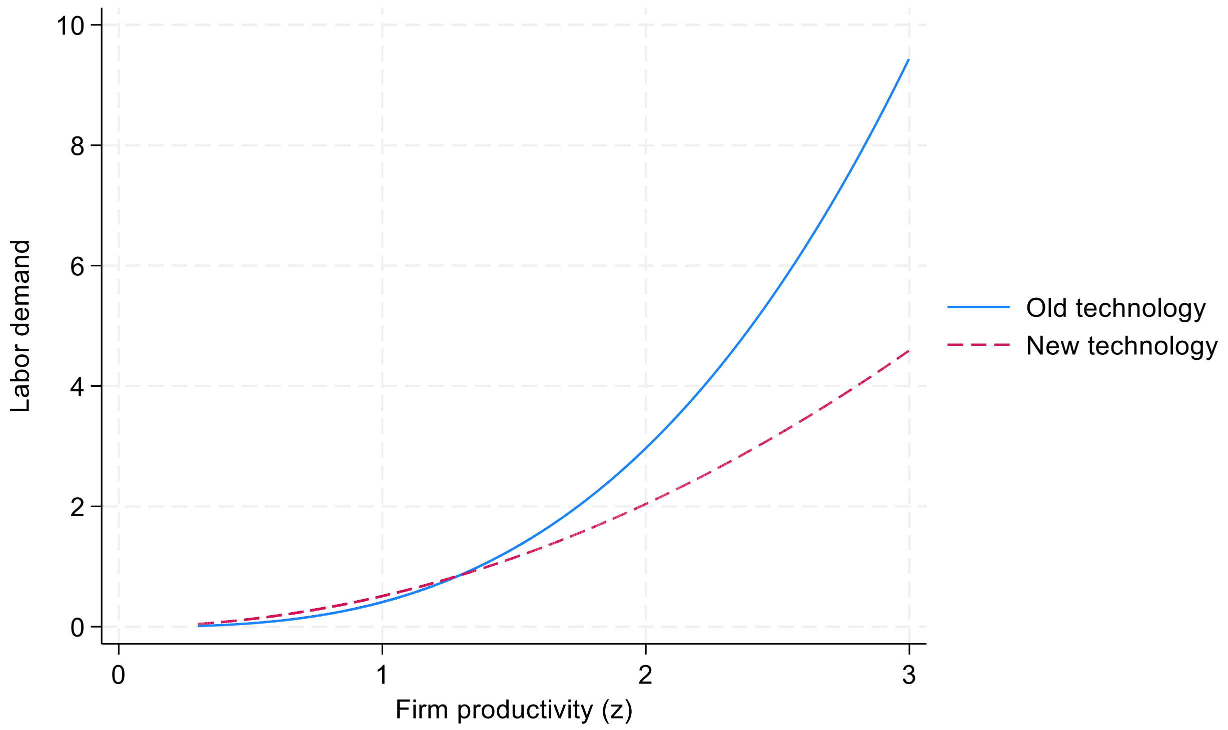
Technology adoption gains across firm productivity: incumbents and entrants

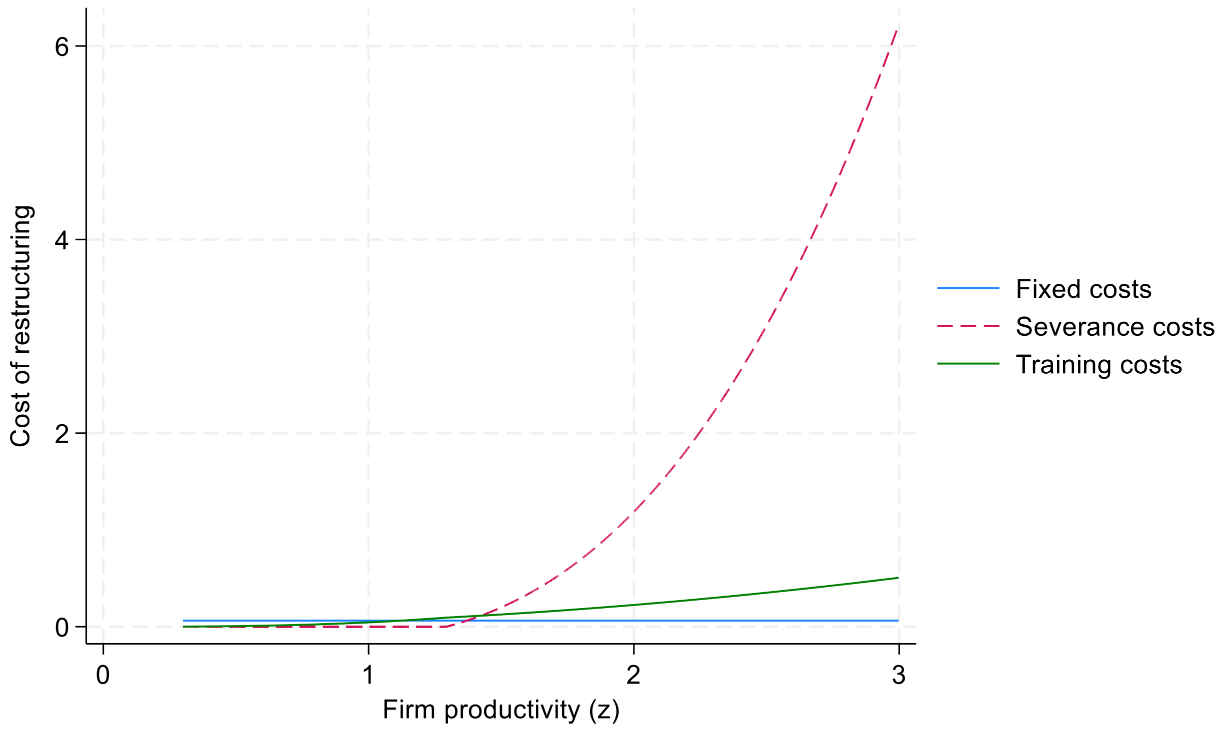


Auxiliary figures, process-augmenting AI



Auxiliary figures, transformational AI





Auxiliary figures, modular technologies