# Equilibrium Effects of the Minimum Wage: The Role of Product Market Power

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[1]The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Bank of Italy.

# Motivation

- Minimum Wage (MW) prominent labor market policy.
- Traditional view: contrasts in-work poverty ($w \uparrow$) but increases unemployment ($u \uparrow$). [Brown et al. (1982); Neumark and Wascher (1992)]

  *Theory*: perfectly competitive labor market.
- Current consensus: boosts low wages ($w \uparrow$) with muted employment effects ($\bar{u}$). [Card and Krueger (1994); Cengiz et al. (2019)]

  *Theory*: labor market power.
- New empirical evidence: induces sizable price effects ($p \uparrow$). [Allegretto and Reich (2018); Link (2019); Harasztosi and Lindner (2019)]

  *Theory*: ?

## Research Question

What is the role of product mkt power in the equilibrium effects of MW?

# Preview of Quantitative Results

- **Hump-shaped response of the labor share.** labor share
  - { Small MW: reduction in monopsony power dominates $\Longrightarrow$ labor share $\uparrow$.
  - { Large MW: increase in monopoly power dominates $\Longrightarrow$ labor share $\downarrow$.
- MW=$15^{th}$ perc. $\Longrightarrow$ wage gains (**+9%**), modest unemployment surge (**+1pp**) but GDP rise (**+4%**), driven by **sizable productivity gains** from workers' reallocation.
  - { Larger welfare gains for low-skill workers (**+15%**).
- Factoring in **product market power is key** for a correct evaluation of MW reforms.
  1. Crucial for quantifying the aggregate impact: **GDP rises twice as much w/o prod mkt power.**
  2. Necessary for studying the distributional impact: **monotonic labor share response w/o endogenous markups.**

# Related Literature

- **Structural Models of the Equilibrium Effects of the MW**

  Engbom and Moser (2021), Berger et al. (2022), Drechsel-Grau (2021), Hurst et al. (2022), Ahlfeldt et al. (2022)

  *Contribution: Show the importance of product market power and endogenous markup response for the aggregate and distributional impact of the MW.*

- **Wage Posting Models**

  Burdett and Mortensen (1998), Bontemps et al. (1999, 2000), van den Berg and Ridder (1998), Manning (2003), Bilal and Lhuillier (2021), Engbom and Moser (2021), Flinn and Mullins (2021)

  *Contribution: Highlight the role of product market power for the equilibrium wage distribution.*

- **Oligopolistic Competition in Sectoral Markets**

  Atkeson and Burstein (2008), Grassi (2017), Burstein et al. (2021), De Loecker et al. (2021), Edmond et al. (2015, 2018), Deb et al. (2020), MacKenzie (2020)

  *Contribution: Discipline firms' labor market power by empirical wage distributions and worker transitions $\rightarrow$ markdowns separately identified from markups.*

# Stylized Model

# A simple monopsony model w/o product market power

Simple economy: 1 labor - 1 product market.

## Perfectly competitive product market

Continuum of rms w/ het. productivity $z \in [\underline{z}; \bar{z}]$.

Pro t maximization problem:

$$\max_{\ell} \; pz\ell - w(\ell)\ell$$

$$\text{s.t. } w(\ell) = \ell^{\frac{1}{\varepsilon}}$$

where $\varepsilon$ is the elasticity of labor supply.

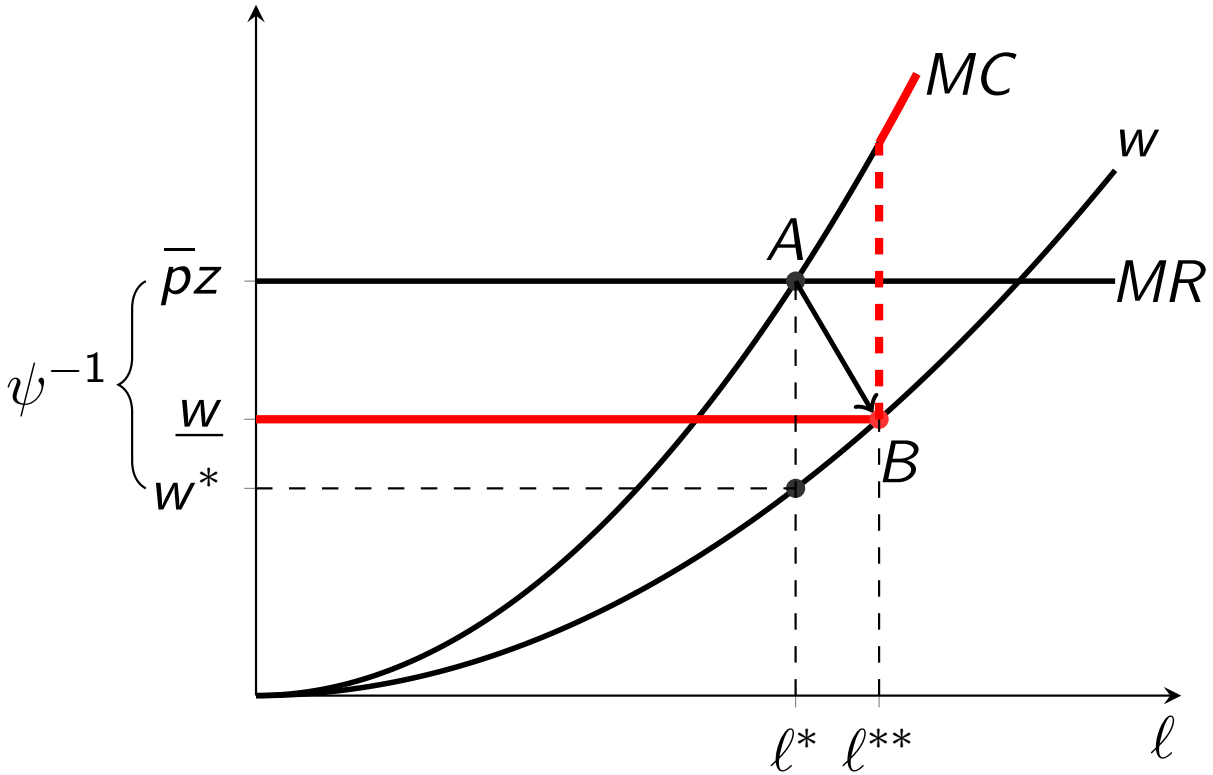
The FOC implies:

$$w(z) = \frac{1}{1 + \frac{1}{\varepsilon}} pz \Rightarrow LS(z) = \frac{w(z)}{pz} = \frac{1}{1 + \frac{1}{\varepsilon}} \equiv \mu$$

where $\mu$ is the equilibrium markdown, constant across rms.

# A simple monopsony model w/o product market power

- MW ↑ $\Longrightarrow$ exit ($z < \underline{w}/\overline{p}$) + monopsony power of low prod frms ↓.




## Proposition 1.

The introduction of a binding MW causes the aggregate labor share to increase: $\overline{LS}^{**}_{MW} > \overline{LS}^{*}$.

# A simple monopsony model w/ product market power

## Imperfectly competitive product market

- $N < \infty$ frms w/ het. productivity $z \in [\underline{z}, \overline{z}]$.
- Profit maximization problem:

$$\max_{\ell} \; p(\ell) z \ell - w(\ell)\ell - \kappa$$

$$\text{s.t.} \; p(\ell) = \left(\frac{z\ell}{Y}\right)^{-\frac{1}{\epsilon(N)}}$$

$$w(\ell) = \ell^{\frac{1}{\eta}}$$

where $\epsilon(N)$ is the elasticity of demand, with $\epsilon_N > 0$.

- Demand elasticity is a positive function of number of frms.

Intuition: $N \downarrow \Longrightarrow$ Market shares $\uparrow \Longrightarrow$ Demand elasticity $\downarrow$.

# A simple monopsony model w/ product market power

- The FOC implies

$$w^*(z) = \underbrace{\frac{\epsilon(N)-1}{\epsilon(N)}}_{\mu(N)^{-1}} \underbrace{\frac{\eta}{1+\eta}}_{\psi} p^*(z)z \implies LS^*(z) = \frac{\psi}{\mu(N)}$$

  where $\mu(N)$ is the equilibrium markup, constant across frms.

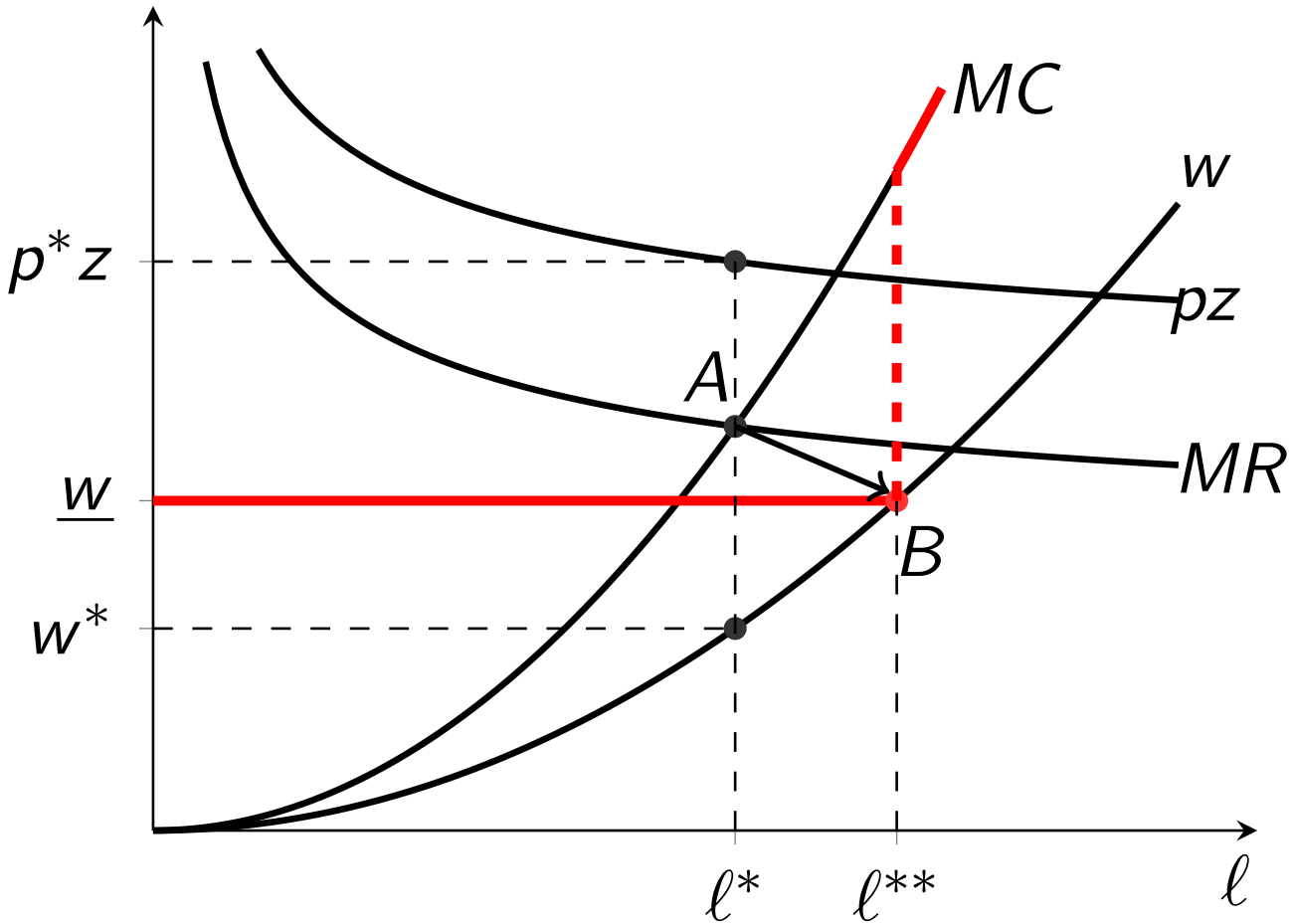
- In this economy there is a **double wedge** between wage $w^*$ and rev productivity $p^*z$.

  $\implies$ Firms make profts both on the output and the input market.

- **Labor share depends on both markup and markdown**.

# A simple monopsony model w/ product market power

MW $\uparrow$ $\Longrightarrow$ exit ($\Pi^{**}_{MW}(z) < 0$) + monopsony power of low prod frms $\downarrow$.



# A simple monopsony model w/ product market power

- But that's not it... some frms have left the market:

$$N' < N \implies \epsilon(N') < \epsilon(N)$$

- Hence, all frms increase their markups:

$$\mu(N') > \mu(N)$$

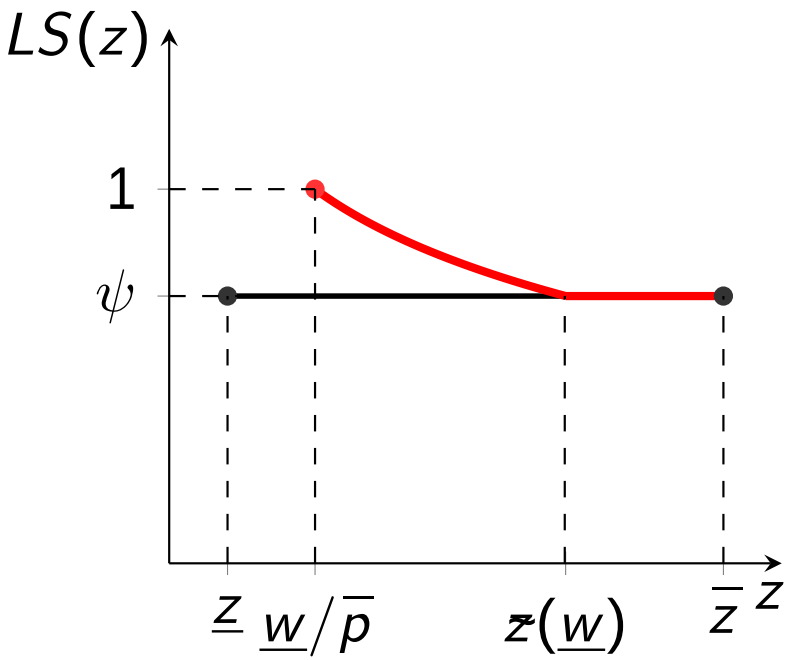
- What happens to the labor share, then? It depends on whether monopsony $\downarrow$ or monopoly $\uparrow$ dominates.

**Proposition 2.**

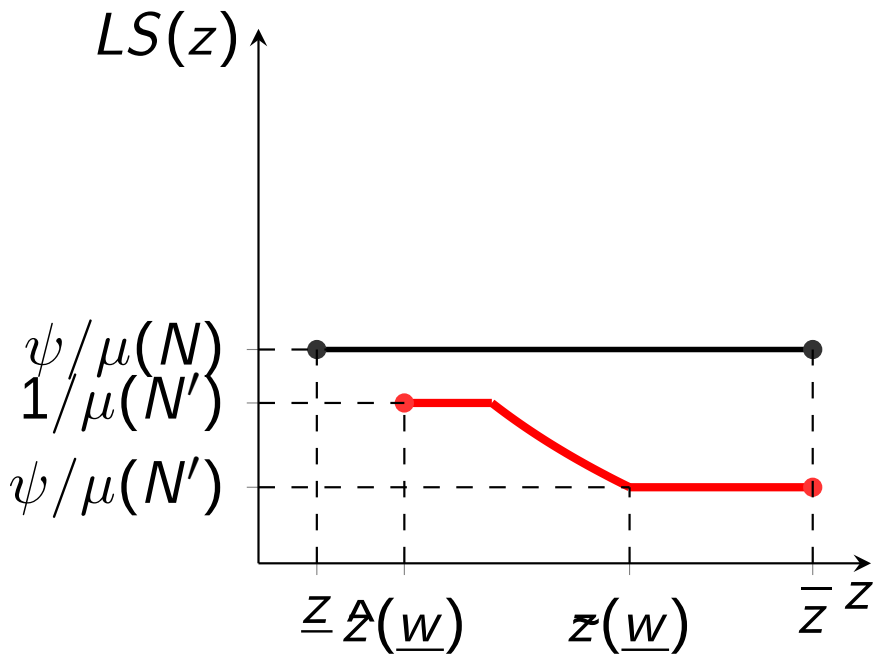
The introduction of a su f ciently large MW, i.e., such that $\mu(N') > \mu(N)/\psi$, causes the labor share to decrease: $\bar{LS}^{**}_{MW} < \bar{LS}^{*}$.

# Summing up

a) No product market power




b) Product market power




**Takeaway:** with product market power, the labor share may *shrink* in response to MW reforms $\Longrightarrow$ MW can backfire!

# Quantitative Model

# Model – Highlights

- **Goal**: Quantify the markup vs markdown response to the MW.
- **How**: Novel structural model w/ frictional labor markets (Engbom and Moser (2021)) and oligopolistically- competitive product markets (Atkeson and Burstein (2008)).
- SaM frictions + wage posting $\rightarrow$ varying elasticity of labor supply $\rightarrow$ **endogenous and heterogeneous markdowns**.
  - { Source of monopsony power: matching frictions (geographical distance, incomplete info).
- Oligopolistic competition $\rightarrow$ varying elasticity of demand $\rightarrow$ **endogenous and heterogeneous markups**.
  - { Source of monopoly power: consumers' preferences + granularity.

# Model – Environment

- Segmented labor markets by worker ability $a$. Workers
  - { Matching frictions: job finding rate $\lambda(\theta)$, job separation rate $\delta$, OTJ search intensity $s$, vacancy posting costs $c(v)$.
  - { Wage posting: employment wage dist $G(w)$, wage offer dist $F(w)$.
- Sectoral product markets with $N_k < \infty$ firms. Consumers
  - { Elasticity of subst across sectors $\rho > 1$.
  - { Elasticity of subst within sectors $\sigma > \rho$.
- For tractability, each firm is assigned to one product and one labor market.

# Model – Firm's Problem

- A frm w/ productivity $z$ hiring workers of ability $a$ and competing in product market $k$ solves:

$$\max_{w \geq \underline{w}/a, v, \ell} \quad p(\ell) \underbrace{az\ell}_{=y(\ell)} - aw\ell - c(v) - \kappa$$

$$\text{s.t.} \qquad \ell(w, v) = \frac{v}{V} \frac{\lambda(\theta)\left(u + seG(w)\right)}{\delta + s\lambda(\theta)\left(1 - F(w)\right)} \qquad \text{(Labor Supply)}$$

Derivation

$$p(\ell) = y(\ell)^{-\frac{1}{\sigma}} Y_k\left(\ell\right)^{\frac{1}{\sigma} - \frac{1}{\rho}} Y^{\frac{1}{\rho}} \qquad \text{(Inverse Demand)}$$

$$Y_k(\ell) = \left[ y(\ell)^{\frac{\sigma-1}{\sigma}} + \sum_{i \neq 1}^{N_k} y_{ki}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \qquad \text{(Sectoral Output)}$$

# Model – Firm's PMP – Cont'd

$$\text{FOC/w: } \ell(w,v) = \left[(1+\epsilon^{p,\ell})\, p\left(\ell(w,v)\right) z - w\right] \frac{\partial \ell(w,v)}{\partial w}.$$

- Can rewrite FOC/w as **optimal pricing rule**:

$$p\left(\ell(w,v)\right) = \underbrace{\frac{1}{1+\epsilon^{p,\ell}}}_{Markup \equiv \mu(\ell)} \underbrace{\frac{\epsilon^{\ell,w}+1}{\epsilon^{\ell,w}}}_{Markdown \equiv \Psi(\ell)^{-1}} \frac{w}{z}.$$

Markdown Solution System Graph

# Model – Equilibrium Characterization

- Markup and markdown are equilibrium outcomes:

$$\mu(z) = \frac{\sigma}{(\sigma-1)\left[1 - \frac{\sigma/\rho-1}{\sigma-1}s(z)\right]} > 1.$$

$$\psi(z) = \left(1 + \frac{1}{2f\left(w(z)\right)w}\left[\left(1 - F\left(w(z)\right)\right) + \frac{\delta}{s\lambda(\theta)}\right]\right)^{-1} < 1.$$

- Firm's total market power summarized by its **Market Power Index**:

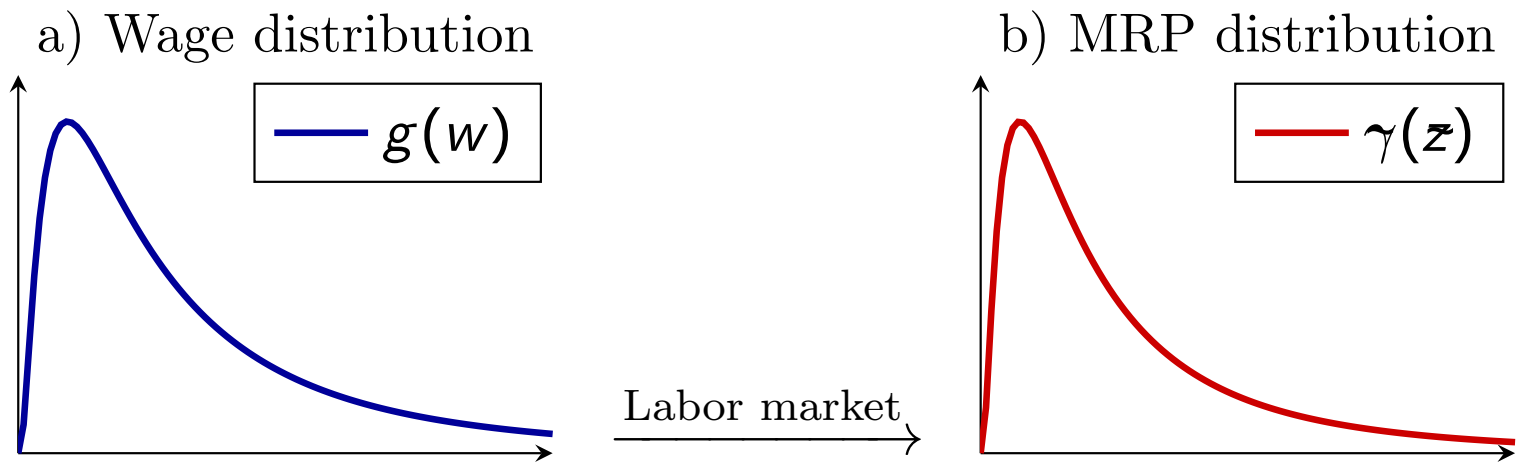
$$\mathcal{M}(z) = \frac{\mu(z)}{\psi(z)} > 1.$$

$\Longrightarrow$ Both product market power ($\mu > 1$) and labor market power ($\Psi < 1$) restrain optimal frm size (double wedge).

# Quantitative Analysis

# Estimation Strategy

- Estimate the model on Italian data, targeting empirical moments for the period 2016-18.
- Link worker ability types to **AKM worker fixed effects** ($J = 10$) and replicate actual workers' transitions (Engbom and Moser (2021)).
- For each worker type, two-step estimation of industry-specifc (1-digit) frms' physical prod dist's (Bontemps et al. (2000)):




details on estimation

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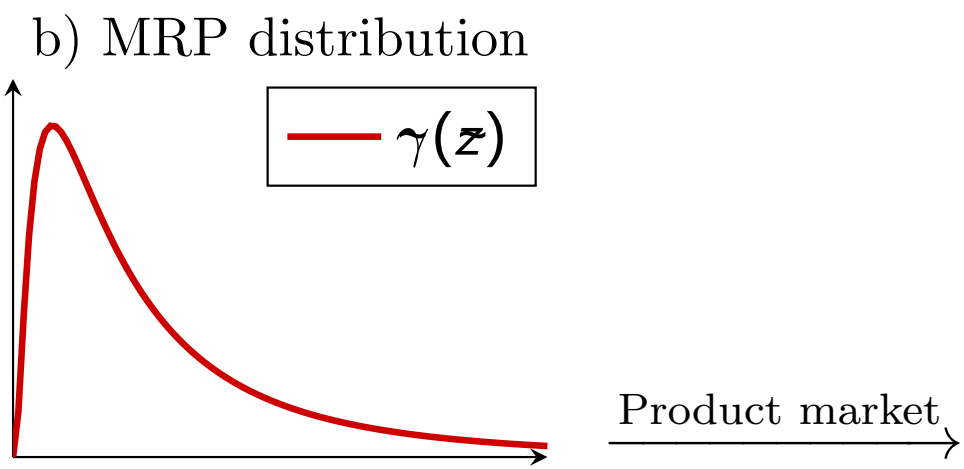


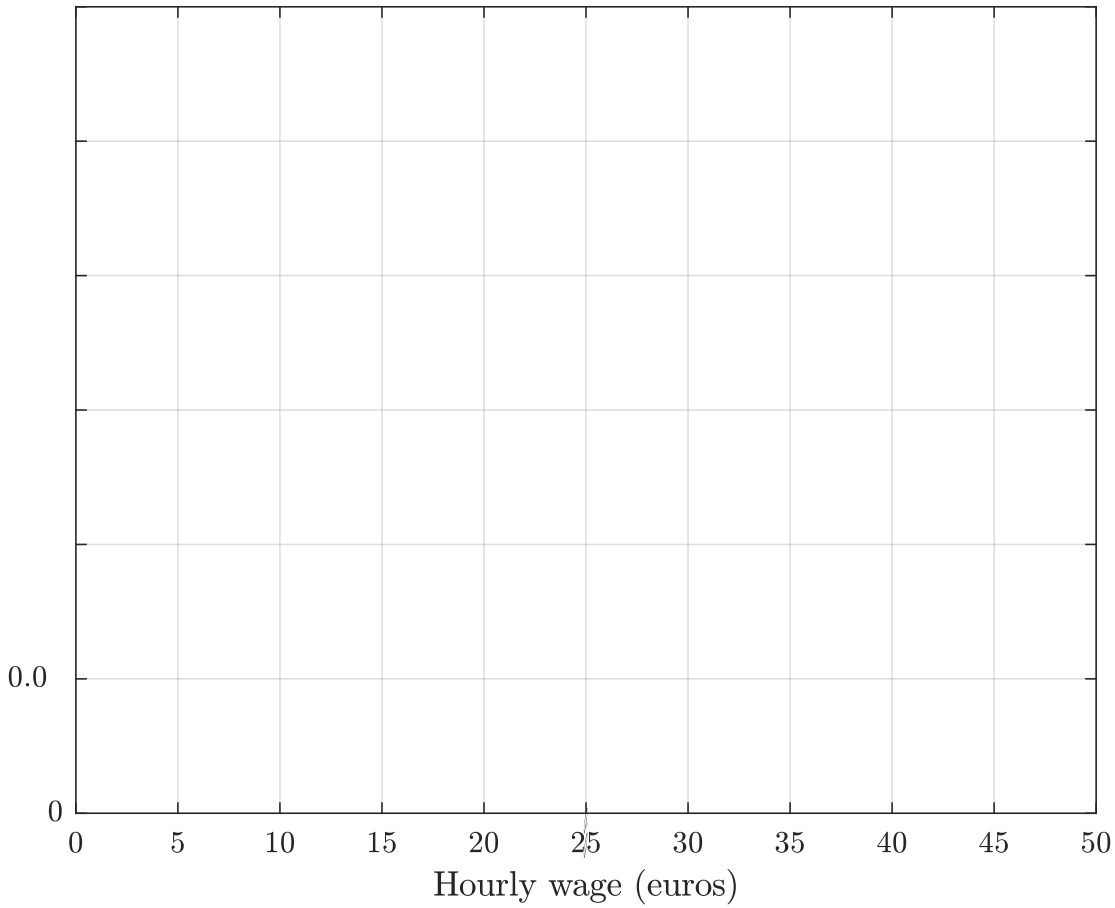

details on estimation

# Estimation Strategy – Cont'd

- Structural estimation allows **separately identifying markups and markdowns**:
  - { Observed wage dist's + observed workers' transitions $\Longrightarrow$ markdowns.
  - { Inferred MRP dist's + observed market structure of 4-digit sectors $\Longrightarrow$ markups.

Equilibrium eq's Calibration Table market power dist

# Model Fit – Wage Distribution

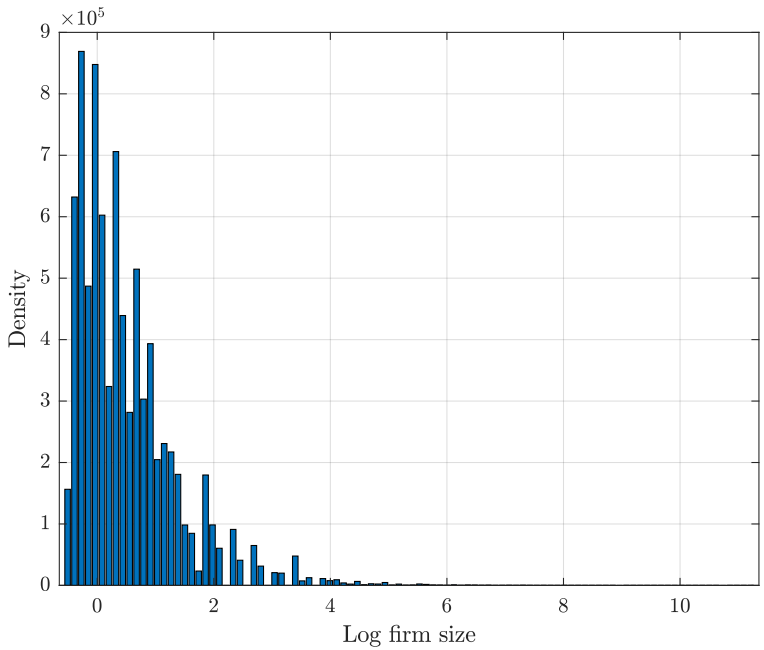



*Source*: INPS data (2016-2018) and model.

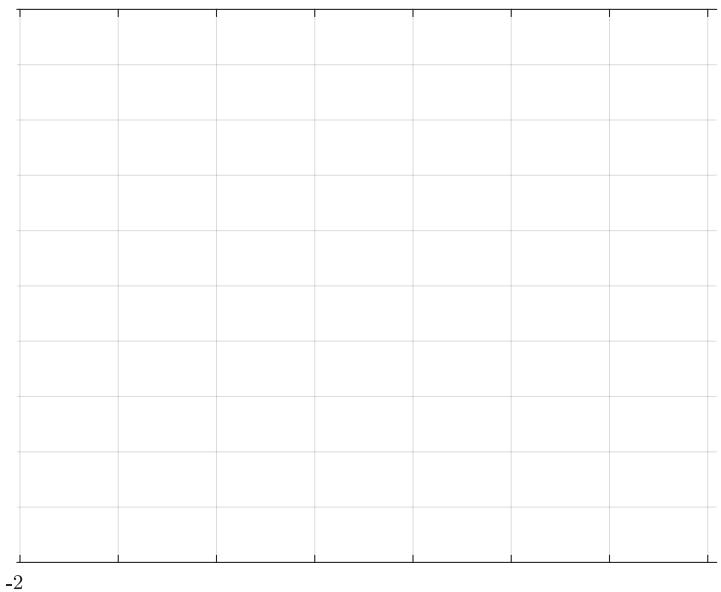
- Model replicates almost exactly the empirical wage dist.

# Estimated Model – Firm Size and Productivity Distribution

a) Firm size



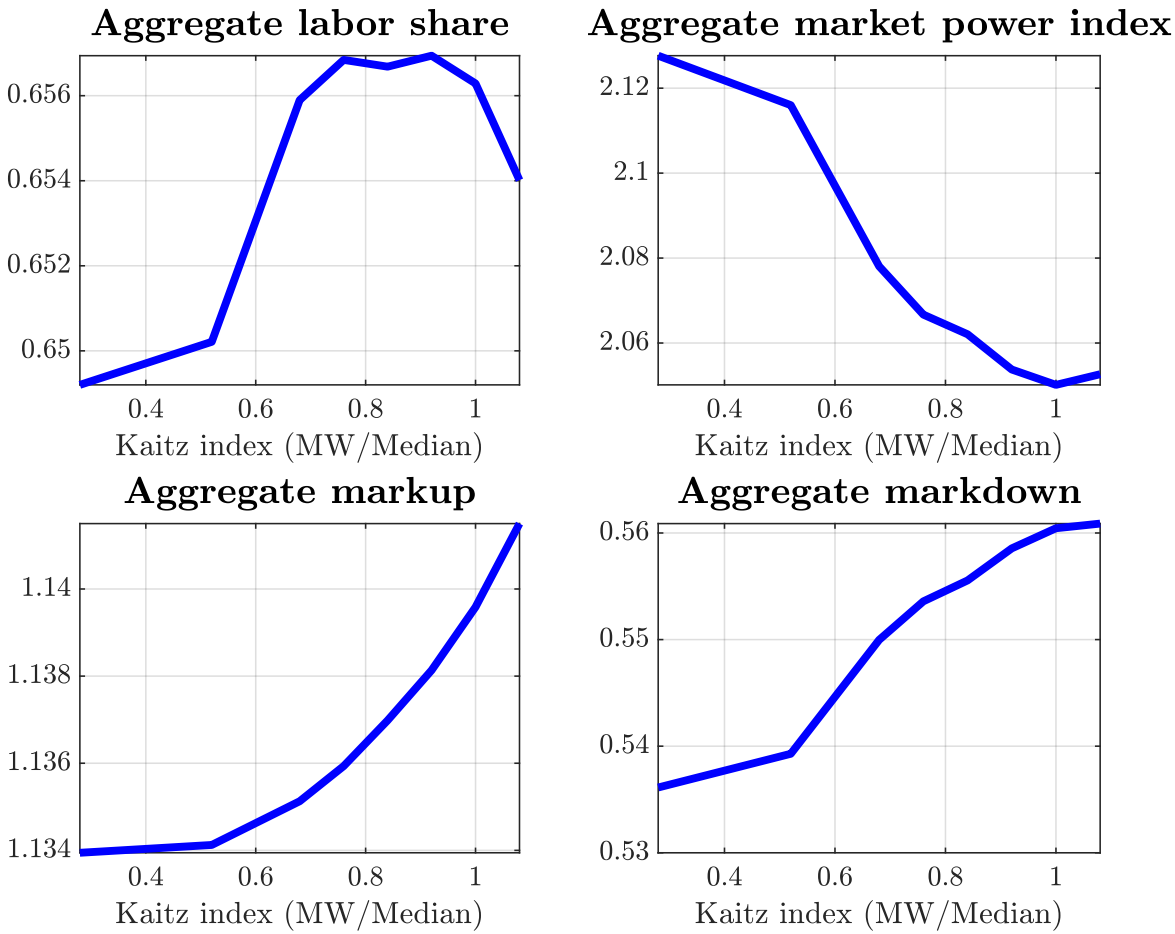

b) Physical productivity




- Right-skewed frm size dist, $\sim$ log-normal physical prod dist.

Labor Market Policies

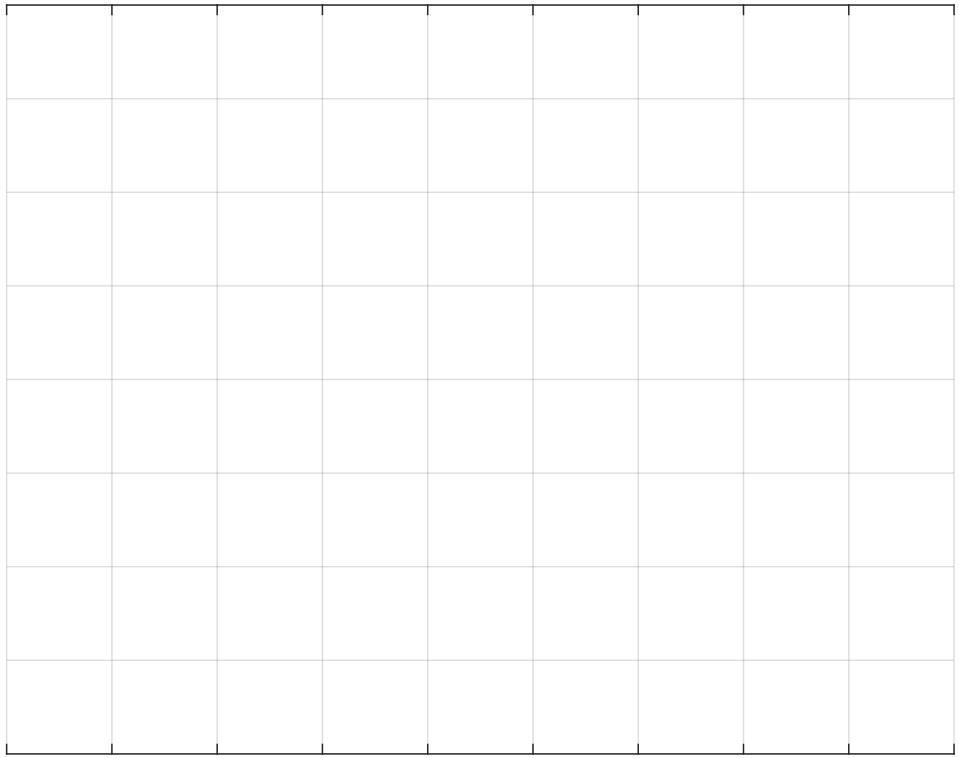
# Counterfactuals – Labor Share & Market Power




- Hump-shaped labor share response mirroring U-shaped MPI.
- $\Delta\psi$ dominates $\Delta\mu$ for low-to-middle MWs, opposite for large MWs.

impact of markups  factor shares

# Counterfactuals – Wage Distribution



**Takeaway:** Wage dist shifts rightward w/ higher MW due to pay rises (bottom half) and selection into higher-paying frms. CDF percentiles

# Counterfactuals – Equilibrium Effects

| Variable | Baseline | Small reform (68% Kaitz index) | Large reform (92% Kaitz index) |
|---|---|---|---|
| *Panel a. Aggregate statistics* | | | |
| GDP | **1.000** | **1.044** | **1.110** |
| Unemployment rate | **0.108** | **0.118** | **0.135** |
| Output per worker | 1.000 | 1.042 | 1.118 |
| Avg hourly wage (€) | 11.032 | 12.032 | 13.500 |
| Variance log wage | **0.132** | **0.091** | **0.074** |
| Avg firm size | 4.051 | 4.076 | 4.189 |
| *Panel b. Distributional Statistics* | | | |
| Labor share | **0.649** | **0.656** | **0.657** |
| Profit share | 0.351 | 0.344 | 0.343 |
| Profit share (product market) | **0.163** | **0.163** | **0.164** |
| Profit share (labor market) | 0.180 | 0.174 | 0.171 |

*Source*: Model. *Note*: the variables *GDP* and *Output per worker* are normalized to 1 in the Baseline.

**Takeaway:** MW ↑ → employment ↓ but GDP ↑ since productivity ↑; avg wage ↑ and wage inequality ↓; labor share ↑ since profts from lab mkt ↓ but profts from prod mkt ↑.

# Counterfactuals – Equilibrium Effects

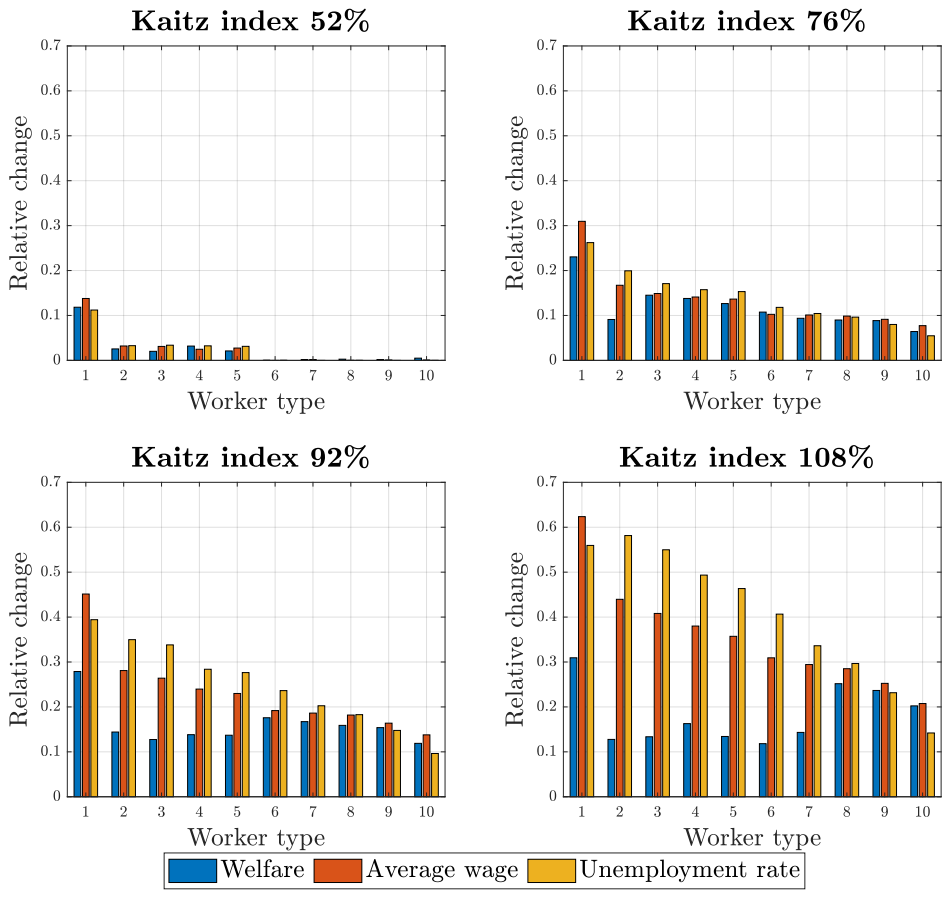
| Variable | Baseline | Small reform (68% Kaitz index) | Large reform (92% Kaitz index) |
|---|---|---|---|
| *Panel c. Market power statistics* | | | |
| Average markup | 1.134 | 1.135 | 1.138 |
| Average markdown | 0.536 | 0.550 | 0.559 |
| Average mpi | **2.128** | **2.078** | **2.054** |
| Misalloc index (mpi std dev) | **0.547** | **0.530** | **0.507** |
| *Panel d. Labor market transitions* | | | |
| Job-finding rate | 0.207 | 0.185 | 0.157 |
| Job-to-job flow rate | 0.013 | 0.013 | 0.012 |
| Job-separation rate | 0.025 | 0.025 | 0.025 |

*Source*: Model.

**Takeaway:** MW ↑ → avg MPI (aggregate distorsion) ↓ and MPI dispersion (misallocation) ↓.

Market Power Response  Beh vs Comp

# Counterfactuals – Distributional Impact




**Takeaway**: Wage gains and unemployment surge decrease w/ worker type; U-shaped welfare gains from large MWs (profts ↑).

profit dist

# The Role of Product Market Power

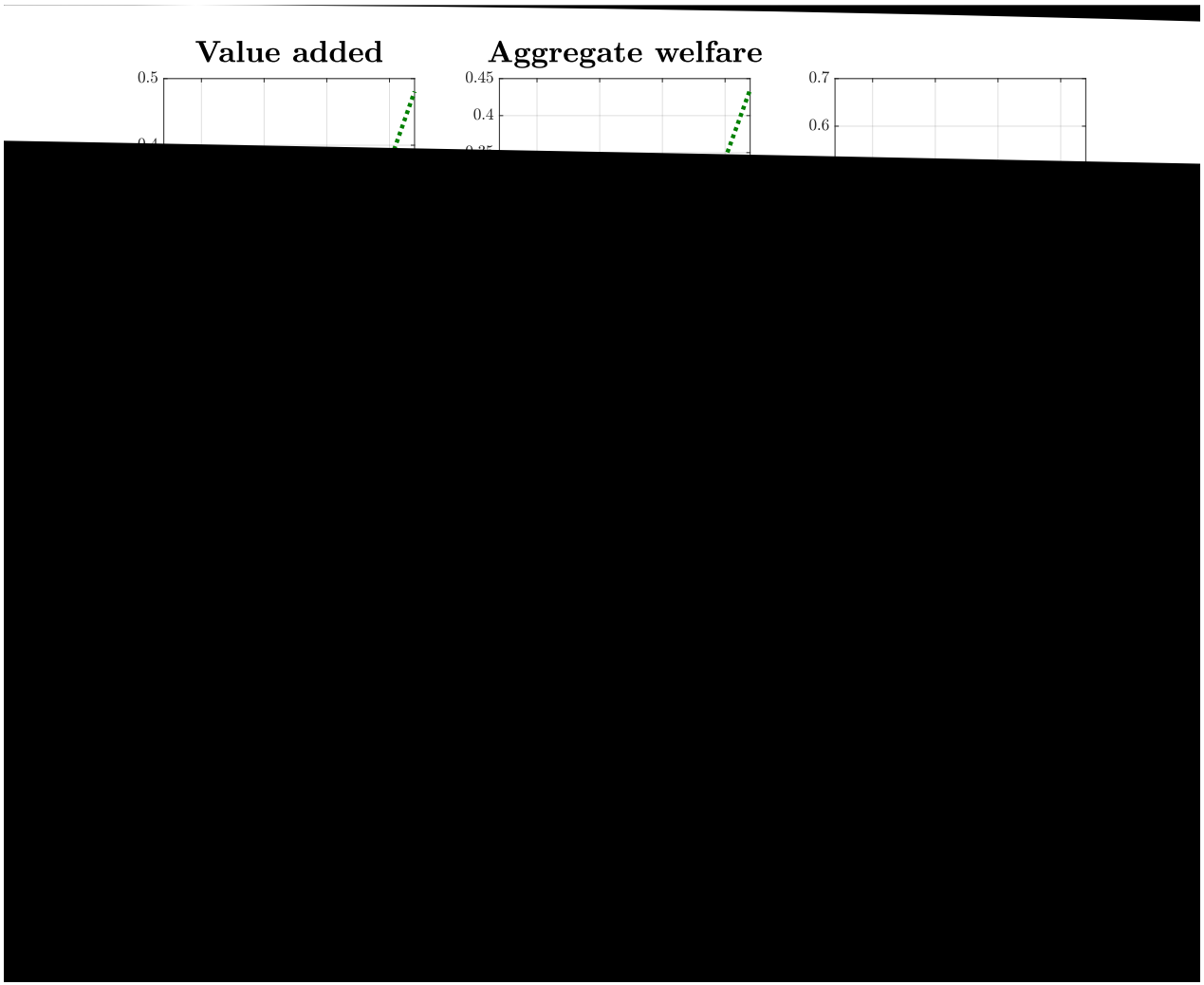
- **Goal**: Isolate the role of prod mkt power in the equilibrium effects of the MW.
- **How**: Replicate the same experiments in 2 alternative environments:
  1. *What if there was no prod mkt power at all?*

     *Markupless economy*: perfect competition on the prod mkt $\rightarrow$ no markups, identical prices. Markupless Economy Markupless vs Baseline
  2. *What if markups were constant?*

     *MP economy*: monopolistic competition in sectoral mkts $\rightarrow$ identical markups. MP Economy MP vs Baseline

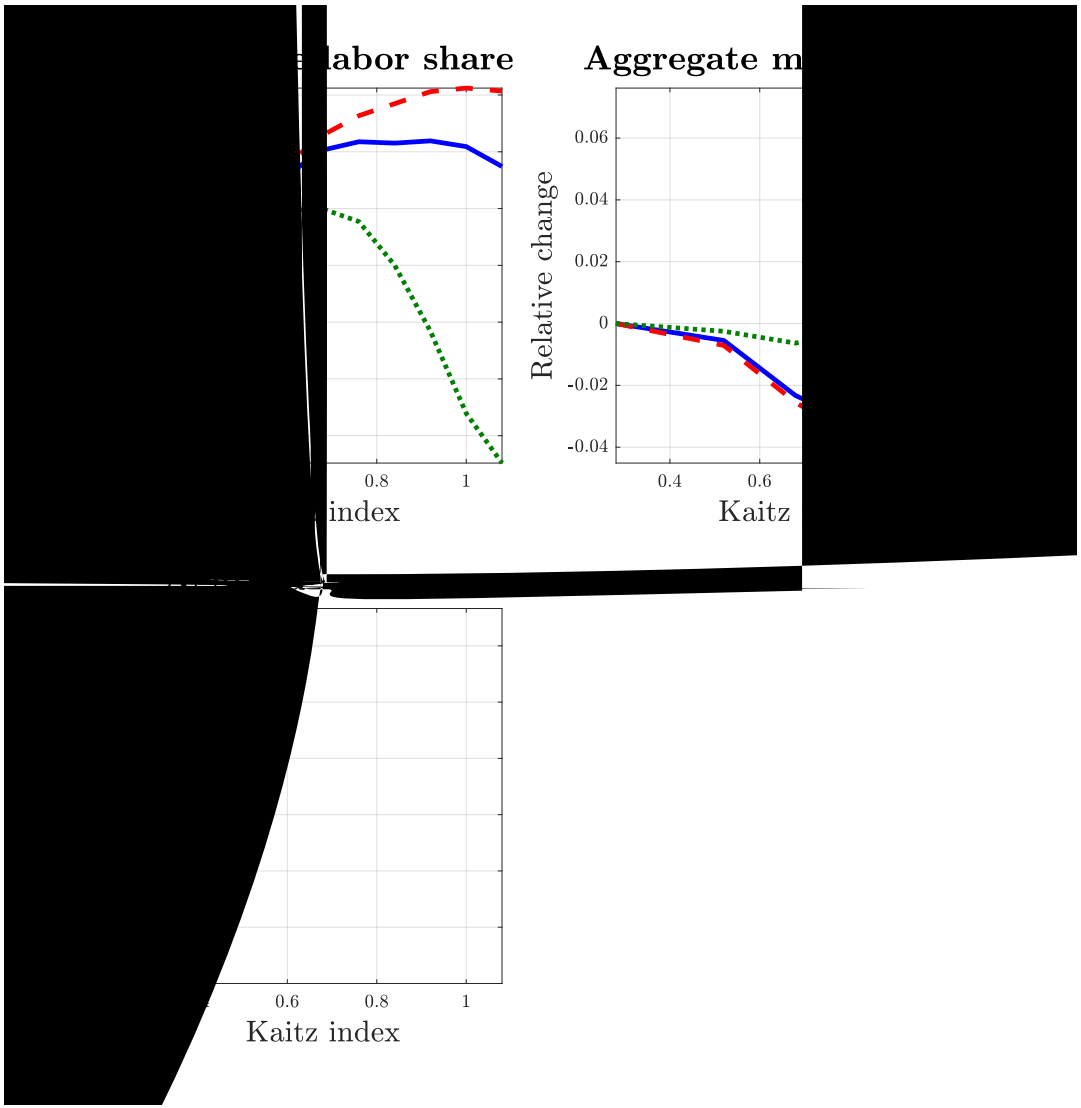
Exit Decisions

# The Role of Product Market Power – Aggregates




**Takeaway**: No prod mkt power $\rightarrow$ largely overstate unemp surge +50% and GDP rise (+200%) (excessive reallocation).

# The Role of Product Market Power – Distribution




**Takeaway**: Identical markups $\rightarrow$ monotonic labor share response.

Distr imp

# Conclusions

- Characterize theoretically a **novel concentration channel** of the MW.

  $\rightarrow$ Response of the labor share is qualitatively ambiguous: monopsony power $\downarrow$ but monopoly power $\uparrow$.

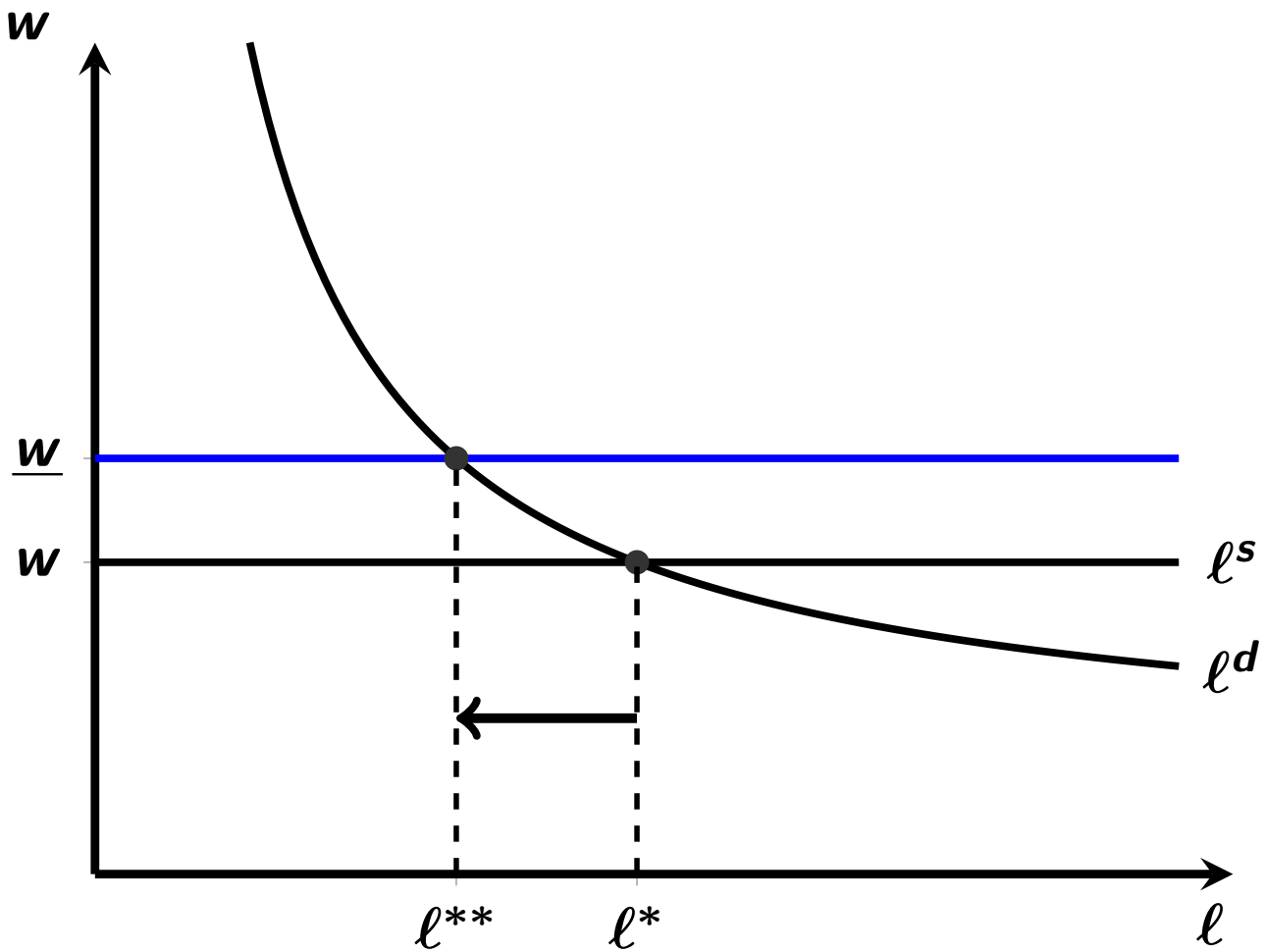
- Estimate a structural model to quantify both forces.

- Find hump-shaped response of the labor share $\Longrightarrow$ concentration channel increasingly relevant as MW gets higher.

- Neglecting prod mkt power leads to overestimate reallocation gains $\rightarrow$ **prod mkt power key for aggregate impact** of medium-to-large MW.

- Ignoring endogenous markups leads to underestimate the surge in profits from higher concentration $\rightarrow$ **strategic pricing crucial for distributional impact**.

# Appendix – Perfectly Competitive Labor Market

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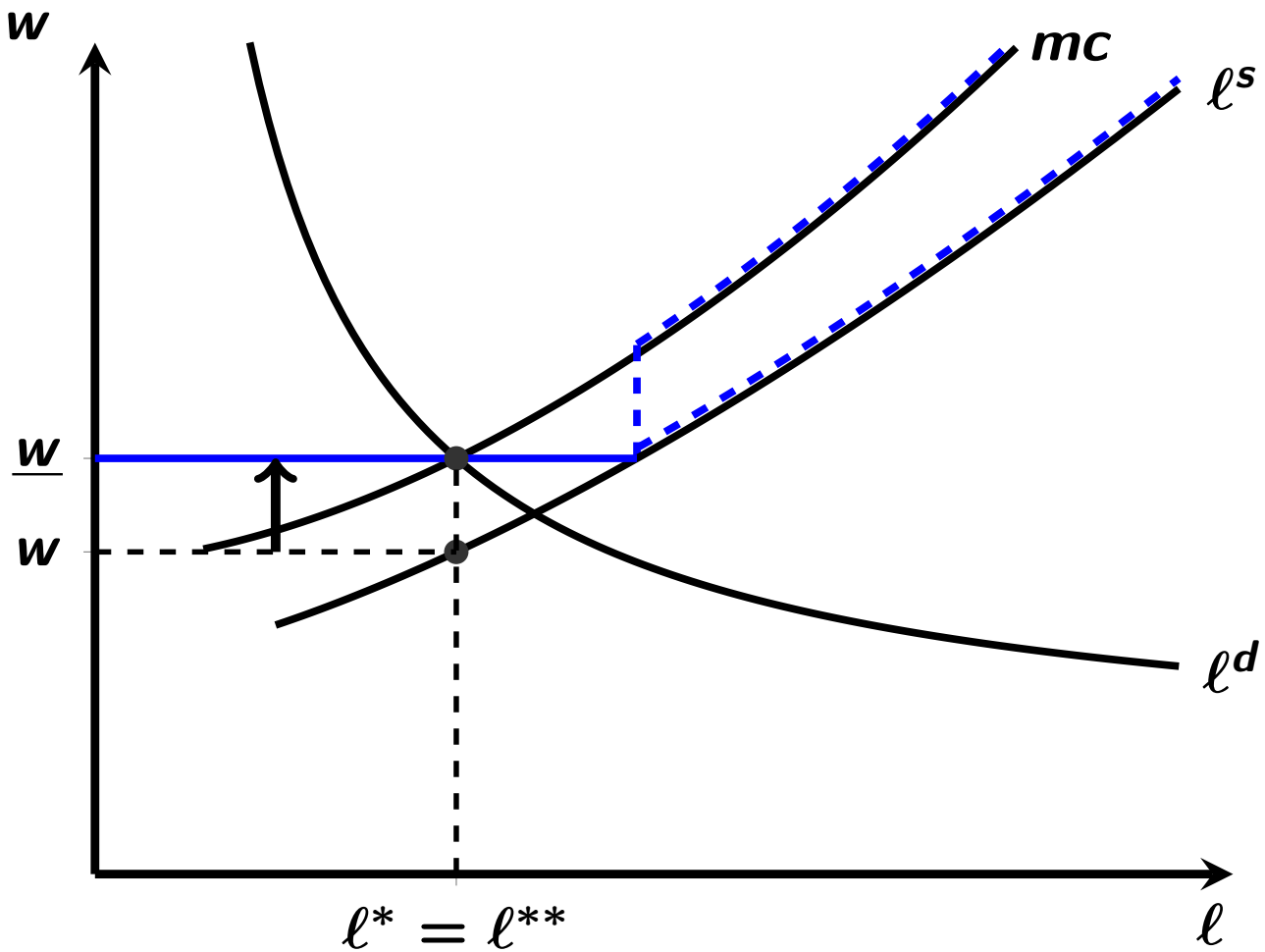
# Appendix – Labor Market Power

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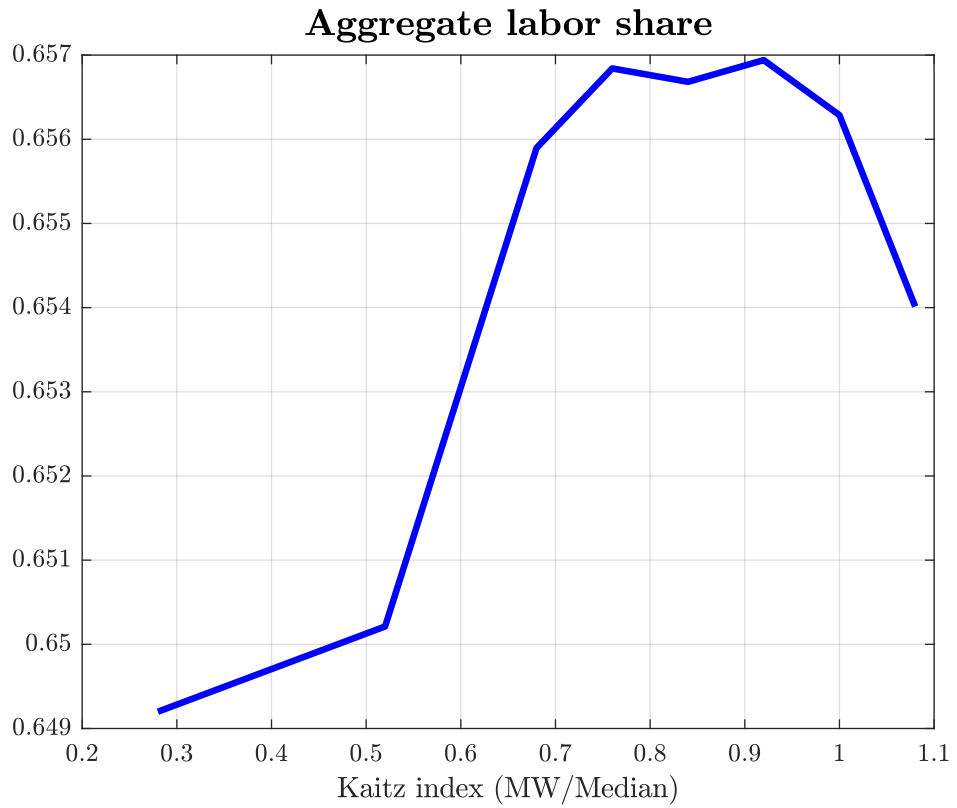
# Appendix – Labor Share Response

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# Model – Consumer's Problem

- Hand-to-Mouth consumers with risk-neutral intertemporal preferences and nested CES static preferences over sectoral goods:

$$\max_{c_{ik}} C = \left( \int_0^1 C_k^{\frac{\rho-1}{\rho}} \, dk \right)^{\frac{\rho}{\rho-1}}$$

$$\text{s.t.} \quad C_k = \left( \sum_{i=1}^{N_k} c_{ik}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

$$\int_0^1 \sum_{i=1}^{N_k} p_{ik} c_{ik} \, dk \leq PI$$

  where $\rho > 1$ and $\sigma > \rho$

- Preference-based sectoral oligopolistic competition

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# Model – Worker's Problem

- Workers can be either employed or unemployed in a labor market $j$

**Value of Unemp:** $$rU = a_j b_j + \lambda(\theta) \int_{\underline{w}}^{\bar{w}} [W(w) - U] \, dF_j(w)$$

**Value of Emp:** $$rW(w) = a_j w_j + \Pi_j + s_j \lambda(\theta_j) \int_{w}^{\bar{w}} [W(w') - W(w)] \, dF_j(w') + \delta_j (U - W(w))$$

where $r > 0$ is the instantaneous interest rate, $b$ flow value of leisure, $\lambda(\theta)$ job finding rate, $s \in (0, 1)$ OTJ search efficiency, $\delta$ job separation rate, and $F(w)$ the (endogenous) wage offer distribution

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# Appendix – Steady-State Labor Supply Curve

## LOM firm-level employment

$$\dot{\ell}(t) = -\left[\delta + s\lambda\left(\theta(t)\right)\left(1 - F(w(t))\right]\ell(t) + q\left(\theta(t)\right)\left[\frac{u(t)}{S(t)} + \frac{se(t)}{S(t)}G\left(w(t)\right)\right]v(t)$$

## Steady-state conditions

$$\begin{cases} G_j(w) = \dfrac{\lambda(\theta_j)F_j(w)}{\delta_j + s_j\lambda(\theta_j)(1 - F_j(w))} \\ u_j = \dfrac{\delta}{\delta + \lambda(\theta)} \\ \dot{\ell}(t) = 0 \implies \ell = \dfrac{v}{V_j}\dfrac{\lambda(\theta_j)\left(u_j + s_j e_j G_j(w)\right)}{\delta_j + s_j\lambda(\theta_j)\left(1 - F_j(w)\right)} = \dfrac{\delta\lambda(\theta)}{\theta\left[\delta + s\lambda(\theta)\left(1 - F(w)\right)\right]^2}v \end{cases}$$

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# Appendix – Labor Market Equilibrium

Defne the MRP as $\tilde{z} \equiv \frac{p}{\mu} z$.

**Equilibrium System of Differential Equations**:

$$\begin{cases} h'(\tilde{z}) = \frac{M}{V}\gamma(\tilde{z}) \left( \frac{[\tilde{z} - w(\tilde{z})]}{\overline{c}} \frac{\delta\lambda(\theta)}{\theta\left[\delta + s\lambda(\theta)\left(1 - h(\tilde{z})\right)\right]^2} \right)^{\frac{1}{\eta}} \\ w'(\tilde{z}) = [\tilde{z} - w(\tilde{z})] \frac{2s\lambda(\theta)h'(\tilde{z})}{\delta + s\lambda(\theta)\left(1 - h(\tilde{z})\right)} \end{cases}$$

**Boundary conditions**:

$$\lim_{\tilde{z} \to \underline{\tilde{z}}(a)} h(\tilde{z}|a) = 0$$

$$\lim_{\tilde{z} \to \underline{\tilde{z}}(a)} w(\tilde{z}|a) = \max\left\{ R(a), \frac{w^{min}}{a} \right\}$$

FOCs Estimation

# Appendix – Firm's PMP

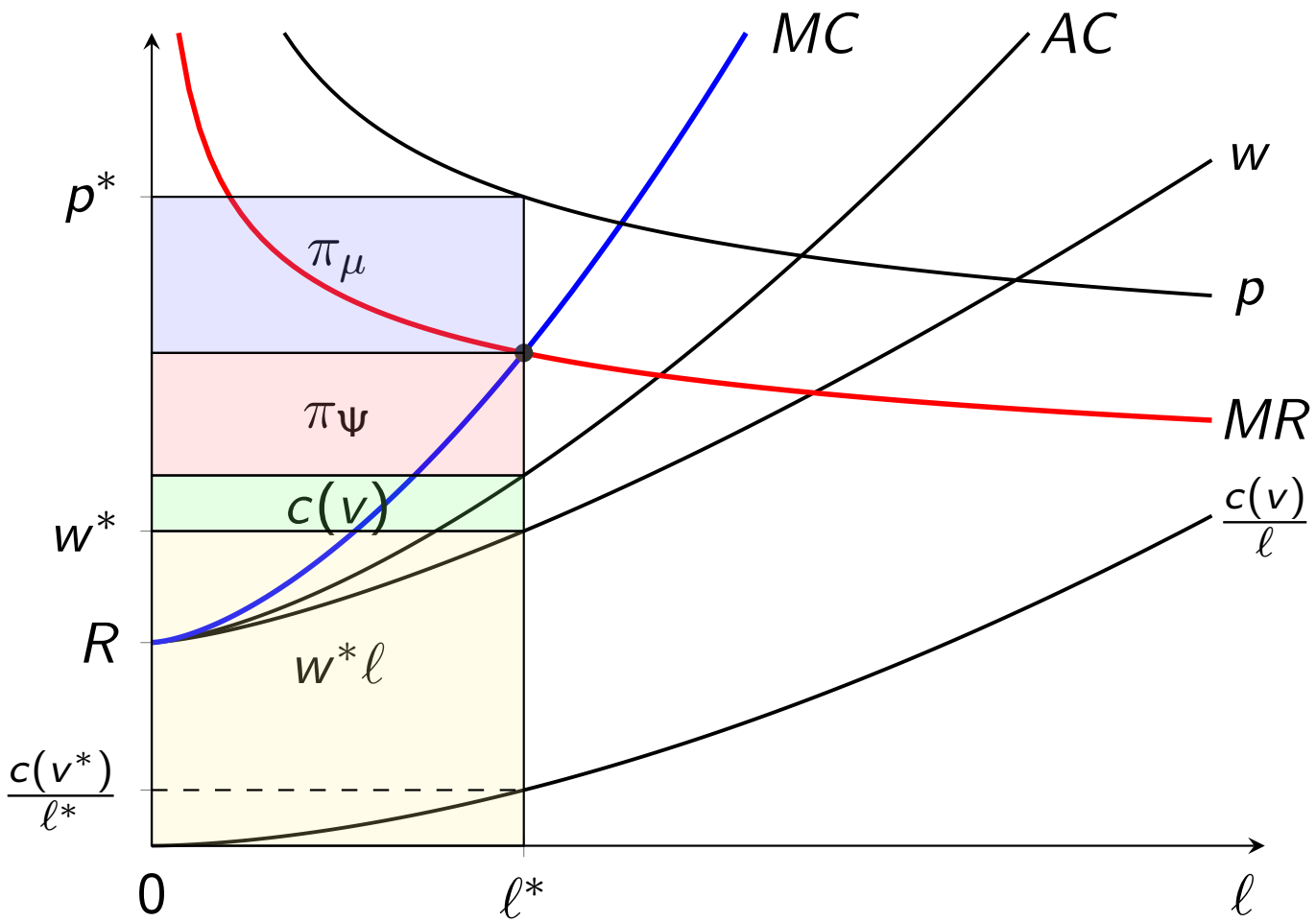


Figure: Static PMP with no MW.

FOCs Market power Product market power

# Model – Equilibrium Characterization

Equilibrium Definition

- In equilibrium, frms are indiferent between adjusting their size through vacancy (*visibility channel*) or wage policy (*wage channel*)

$$\frac{\overline{c}_j v_{jk}(z)^{\eta}}{\partial \ell_{jk}(z)/\partial v_{jk}(z)} = \frac{\ell_{jk}(z)}{\partial \ell_{jk}(z)/\partial w_{jk}(z)} \Longrightarrow \epsilon_{jk}^{\ell,w}(z) = \frac{w_{jk}(z)\ell_{jk}(z)}{(1+\eta)c_j\left(v_{jk}(z)\right)}$$

$\Longrightarrow$ **Elasticity of labor supply implied by labor market policies**

- Firms are granular in their product market $\rightarrow$ strategic choice of equilibrium size (*Cournot* game)

$$\epsilon_{jk}^{p,\ell}(z) = -\frac{1}{\rho}s_{jk}(z) - \frac{1}{\sigma}\left(1 - s_{jk}(z)\right)$$

where $s_{jk}(z) = \frac{p_{jk}(z)y_{jk}(z)}{\sum_{i=1}^{N_k} p_{jki}y_{jki}}$

$\Longrightarrow$ **Elasticity of inverse demand depends on firm's market share**

# Appendix – Equilibrium Definition

## Definition

A steady-state equilibrium of our model economy consists of:

- A set of reservation wages $\{\underline{w}_j^{R,U}, \underline{w}_j^{R,E}\}$ for both unemployed and employed workers, that solve the workers' problems;
- Consumption policy functions $\{c_{ikj}\}$ for the employed, that solve the consumers' problem;
- A set of wage, vacancy posting and price setting policies $\{w_{j,k}(z), v_{j,k}(z), p_{j,k}(z)\}$ that solve the firms' problem;
- A set of thresholds $\left\{\underline{z}_{j,k}\right\}$ that determine the marginal firm of each submarket $(j,k)$;
- Measures $\{G_j(w), e_j, u_j, V_j\}$ and matching rates $\{\lambda(\theta_j), q(\theta_j)\}$ that are consistent with firms' optimization, with the laws of motion in steady-state and with the matching technology;
- Goods market clearing conditions ensuring that quantities demanded and produced of each good coincide:

$$c_{ik} = \int_j e_j L_j \int_{\underline{w}_j}^{\bar{w}_j} c_{ik}(w, \Pi_j)\, dG_j(w)\, dj = y_{ik} - \bar{c}_j \frac{{v_{ik}}^{1+\eta}}{1+\eta} - \kappa_k \quad \forall\ i = 1, \ldots, N_k,\ \forall k.$$

where $L_j = L(a_j) = \omega(a)|_{a=a_j} L$.

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# Appendix – Markdown Derivation

$$
\begin{aligned}
mc(\ell) &= w(\ell) + w'(\ell)\ell + c'\left(v(\ell)\right) v'(\ell) \\
&= w(\ell)(1 + \epsilon_{w,\ell}) + \frac{cv(\ell)^{1+\eta}}{\ell(w,v)}\epsilon_{v,\ell} \\
&= w(\ell)\left(1 + \epsilon_{w,\ell} + \frac{\epsilon_{v,\ell}}{\epsilon_{\ell,w}}\right) \\
&= w(\ell)\left(1 + \frac{\epsilon_{w,\ell}\ \epsilon_{\ell,w} + \epsilon_{v,\ell}}{\epsilon_{\ell,w}}\right) \\
\Longrightarrow\ \Psi(\ell) &= \frac{\epsilon_{\ell,w}}{\epsilon_{\ell,w}(1 + \epsilon_{w,\ell}) + \epsilon_{v,\ell}}
\end{aligned}
$$

where $\dfrac{cv(\ell)^{1+\eta}}{\ell(w,v)} = \dfrac{\ell(w,v)}{\partial\ell(w,v)/\partial w} = \dfrac{w(\ell)}{\epsilon_{\ell,w}}$ (interior optimum)

$$
\ell = \ell(w,v) \ \Longrightarrow\ \epsilon_{w,\ell}\ \epsilon_{\ell,w} + \epsilon_{v,\ell} = 1
$$

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# Appendix – Calibration

Back

| Parameter | Description | Value | Target/Source | Data | Model |
|---|---|---|---|---|---|
| | | *Panel a. Externally set parameters* | | | |
| *Matching function* | | | | | |
| $\chi$ | TFP parameter | 1.000 | Normalization | - | - |
| $\xi$ | Elast. to search effort | 0.500 | Petrongolo and Pissarides (2001) | - | - |
| *Household preferences* | | | | | |
| $r$ | Discount rate | 0.004 | Annualized interest rate of 4 percent | - | - |
| *Other parameters* | | | | | |
| $J$ | Number of labor markets | 10 | Deciles of AKM worker fixed effects | - | - |
| $K$ | Number of product markets | 8211 | One firm in MRP level w/ lowest density | - | - |
| | | *Panel b. Directly inferred structural and auxiliary parameters* | | | |
| *Labor market parameters* | | | | | |
| $M$ | Firm-to-worker population ratio | 0.238 | Average firm size | 4.200 | 4.051 |
| $\{\Pi_j\}$ | Share of aggregate profits | | Distribution of non-labor income | Π | |
| $\{\delta_j\}$ | Separation rates | Values | EN rate | | |
| $\{s_j\}$ | On-the-job search intensity | Values | Job-to-job transition rate | | |
| *Productivity distributions and product markets* | | | | | |
| $\{\tilde{\Gamma}_{j,k}\}$ | Firm MRP distributions | | Wage distributions | | |
| $\{N_k\}$ | Number of competing firms | | Distribution of market structures, 4-digit Ateco | | |

# Appendix – Calibration – Cont'd

Back

| Parameter | Description | Value | Target/Source | Data | Model |
|---|---|---|---|---|---|
| | | *Panel c. Internally estimated parameters* | | | |
| *Search costs and labor market parameters* | | | | | |
| $\{\bar{c}_j\}$ | Vacancy posting cost (scale) | Values | Unemployment rate | 0.108 | 0.108 |
| $\eta$ | Vacancy posting cost (elasticity) | 0.530 | Share of employment in firms 50+ | 0.372 | 0.358 |
| $\{b_j\}$ | Flow value of leisure | Values | Smallest observed wage | | |
| $\{\kappa_j\}$ | Overhead costs | | Smallest operating profits | | |
| $\{a_j\}$ | Worker ability | - | Relative worker-firm AKM variance | 0.886 | 0.883 |
| *Demand elasticity and firms' assignment* | | | | | |
| $\rho$ | Elast. of subst. across sectors | 1.420 | Weighted CR4 | 0.250 | 0.235 |
| $\sigma$ | Elast. of subst. within sectors | 10.634 | Profit-to-labor share ratio | 0.539 | 0.554 |
| $\Theta$ | Sampling function (scale) | - | Standard deviation log value added | 1.490 | 1.437 |

*Source*: Model, INPS, Istat, Eurostat and SHIW data. *Note*: Labor market transition estimates and wage distributions are drawn from INPS matched employer-employee data (2016-2018). Statistics on average firm size and the share of employment in large firms are taken from Eurostat data. Finally, statistics on the number of firms in 4-digit Ateco sectors are drawn from the Structural Business Statistics dataset of Istat (2019).

# Appendix – Estimation Strategy

Three-step estimation of industry-specifc (1-digit) frm productivity dist's:

1. Structurally estimate the MRP ($r$) distributions by **inverting observed wage distributions** by worker type (Bontemps et al. (2000)):

$$r(w; G(w)) = w + \frac{u + s(1-u)G(w)}{2s(1-u)g(w)}\Delta w \implies r \sim H(r)$$

2. Each frm is assigned (i) a MRP drawn from the distribution $H(r)$ and (ii) a product market according to the empirical distribution of market structures across 4-digit sectors Market structure distribution

3. Solve for the equilibrium market shares in each sectoral market to back out frms' *physical* productivity $z$:

$$\begin{cases} z(r, s) = \mu(s)\dfrac{r}{p} \\ p = y(z, r)^{-\frac{1}{\sigma}} Y_k(z, r)^{\frac{1}{\sigma}-\frac{1}{\rho}} Y^{\frac{1}{\rho}} \end{cases} \implies z_k(r)$$

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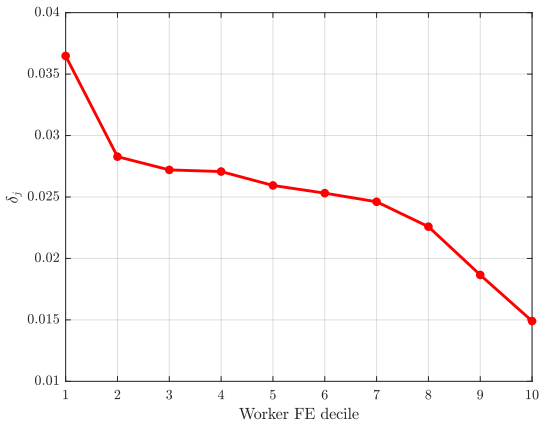
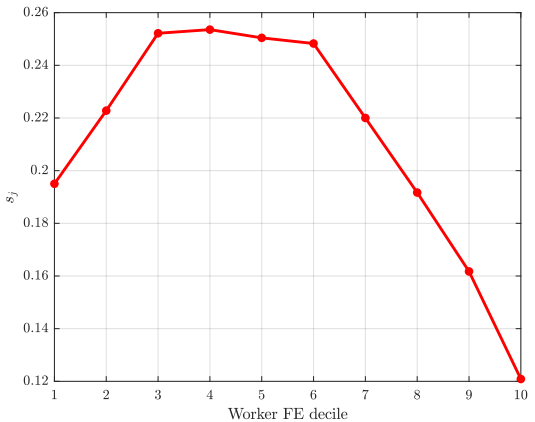
# Appendix – Labor Market Statistics by Worker Type

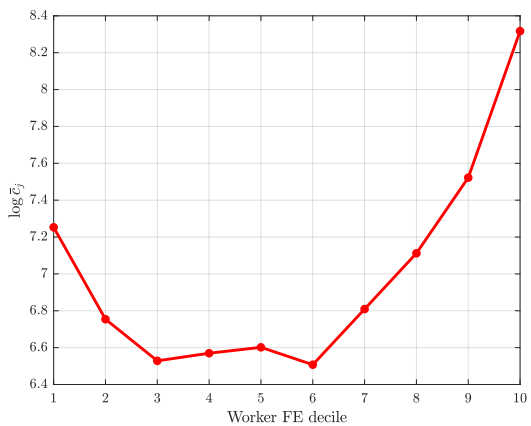
$\delta_j$




$s_j$




$\overline{c}_j$




$b_j$

*Source*: Model.

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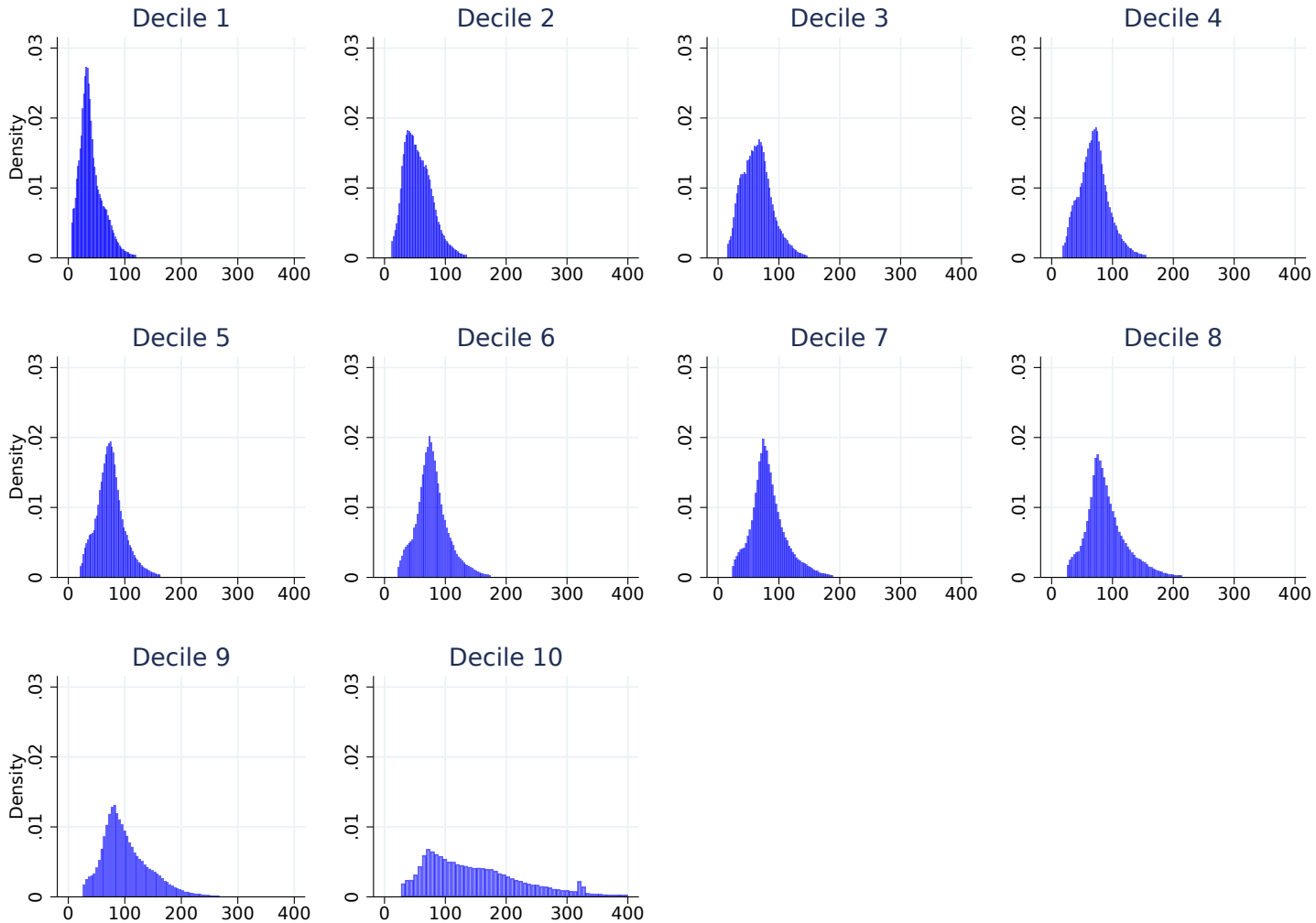
# Appendix – Wage Distribution by Worker Type




*Source*: INPS matched employer-employee data (2016-2018).

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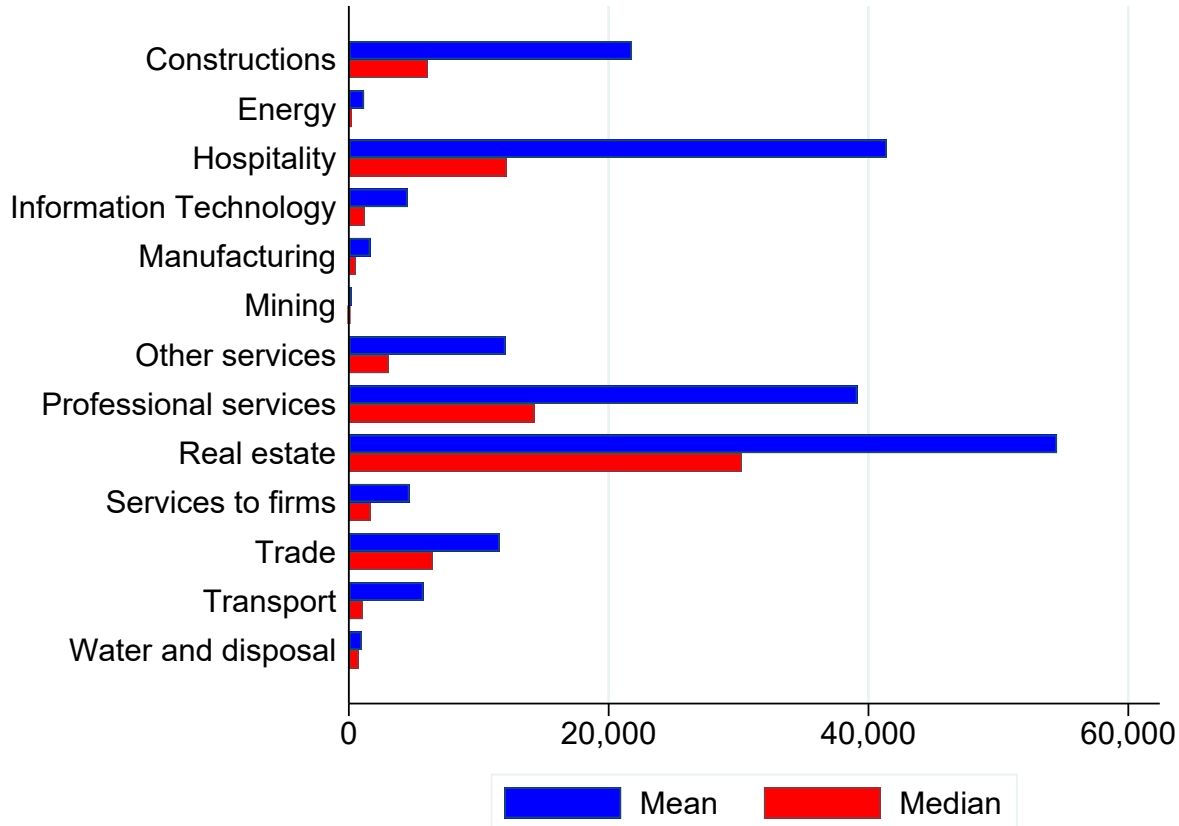
# Appendix – Distribution of Market Structure by Industry

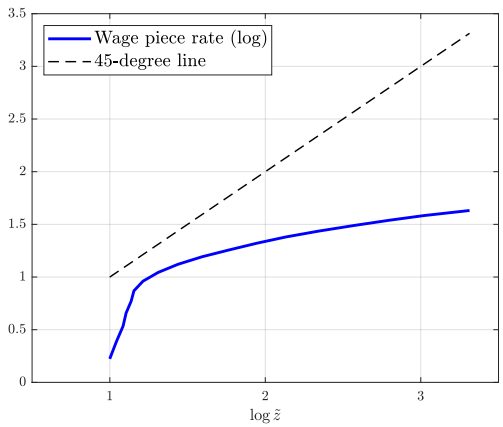



*Source*: Structural Business Statistics (Istat), 2019. *Note*: Sectors are defined according to the 4-digit Ateco classification.

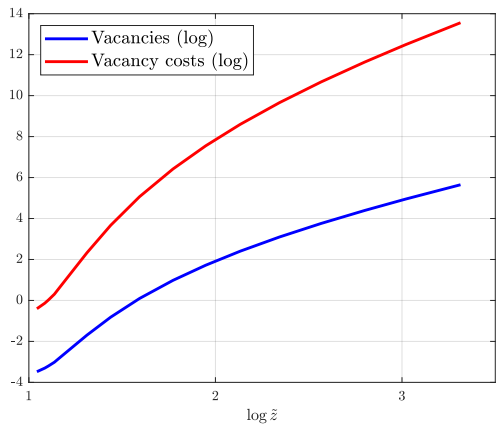
Estimation Calibration

# Appendix – Labor Market Policy Functions

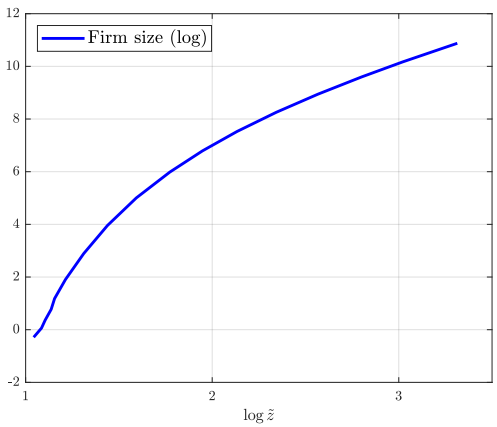
a) Wage piece rate




b) Vacancy posting




c) Equilibrium size




*Source*: Model. *Note*: the charts show the firms' policy functions in the $5^{th}$ decile labor market.

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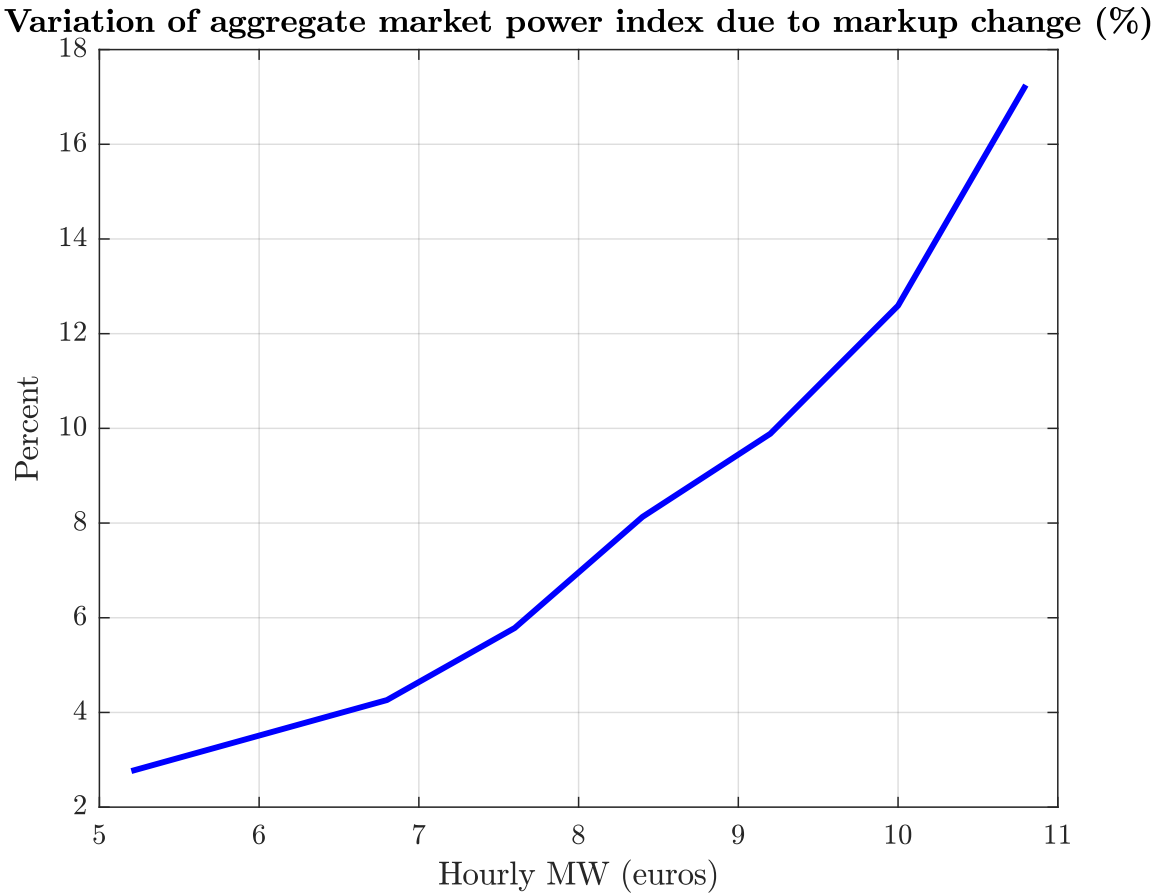
# Appendix – Markup Share in MPI variation




*Source*: Model.

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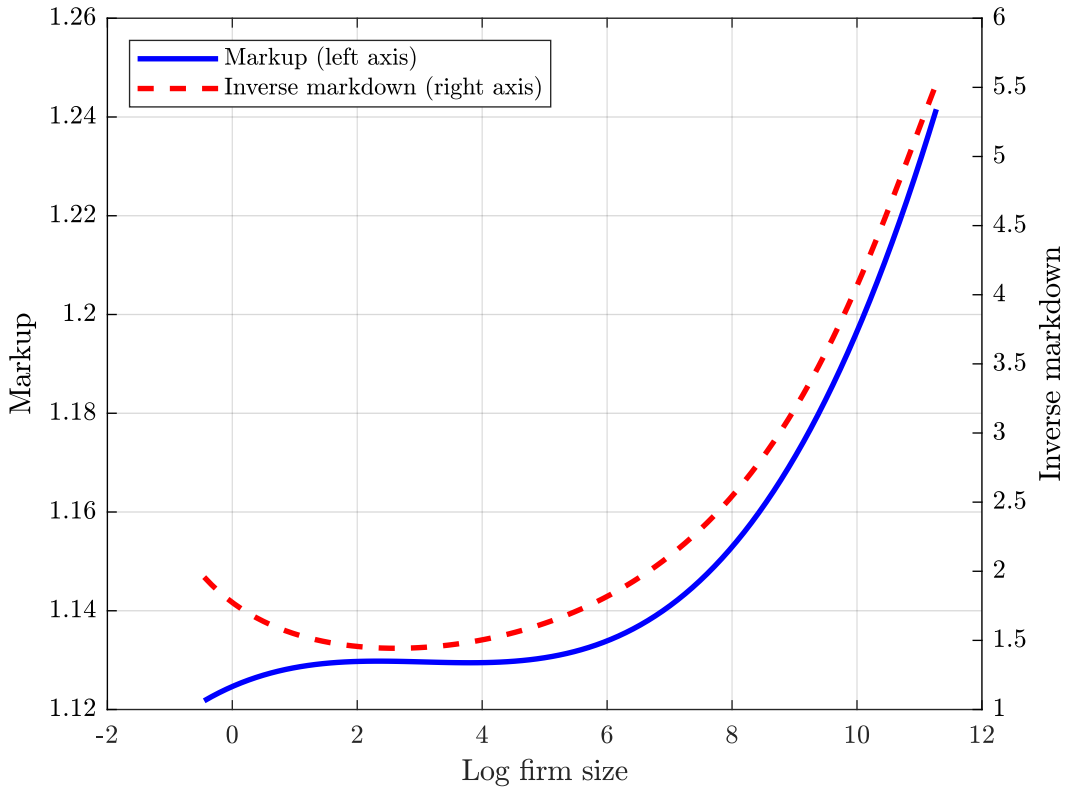
# Appendix – Markups vs Markdowns




*Source*: Model. *Note*: the lines represent the average markup and inverse markdown for different levels of firm size.

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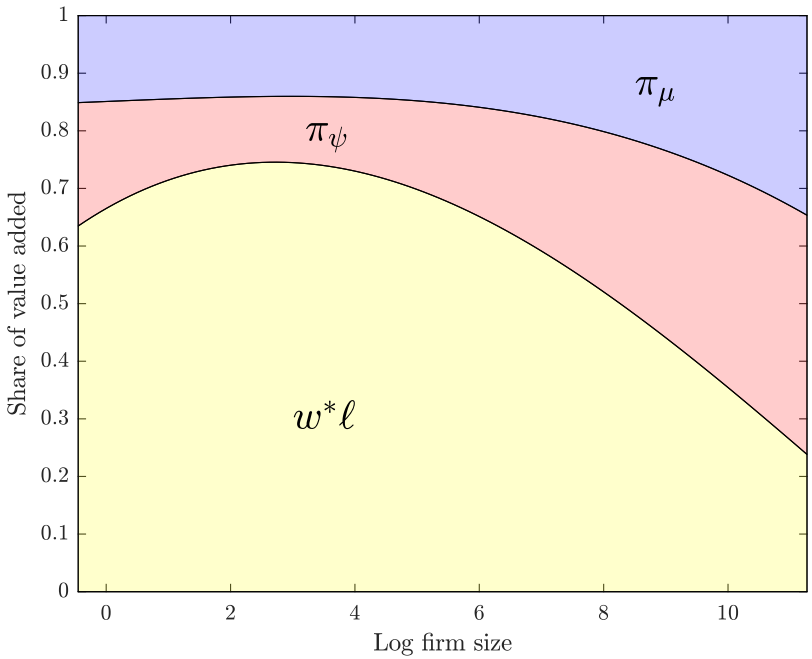
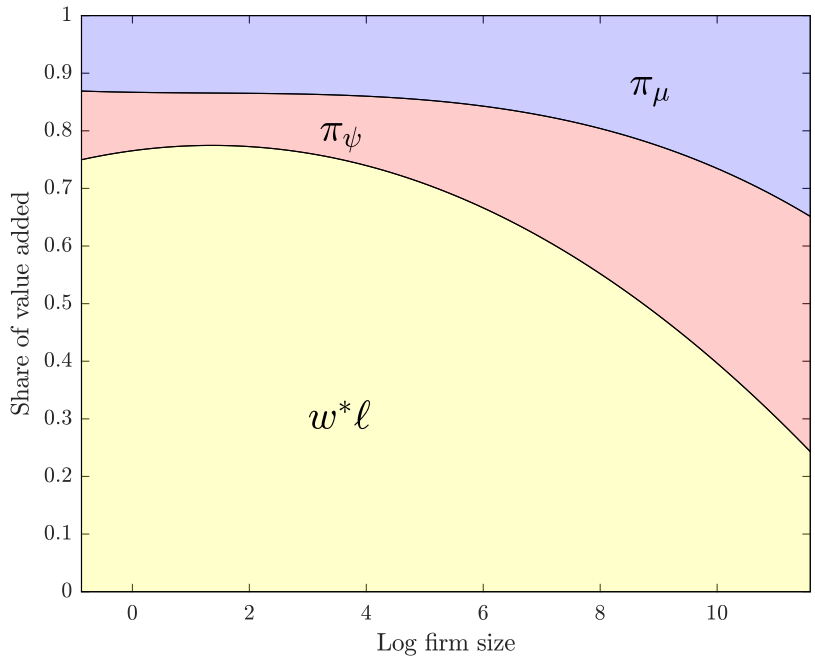
# Appendix – Factor Shares Response

a) Baseline equilibrium




b) After the reform




*Source*: Model.

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# Appendix – Market Power Response

- In our model, market power reduces GDP for two reasons:
  1. aggregate market power distortion $\iff \mathbb{E}[\mathcal{M}] > 1$
  2. misallocation of labor $\iff \mathbb{V}[\mathcal{M}] > 0$ (Hsieh and Klenow (2009))
- As long as $\mathbb{V}[\mathcal{M}] > 0$, labor is paid differently across firms:

$$\frac{w}{p} = \underbrace{\frac{\Psi}{\mu}}_{1/\mathcal{M}} z$$

- Small-to-medium MWs: $\mathbb{E}[\mathcal{M}] \downarrow$ and $\mathbb{V}[\mathcal{M}] \downarrow$
- Large MWs: $\mathbb{E}[\mathcal{M}] \uparrow$ but $\mathbb{V}[\mathcal{M}] \downarrow$

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# Appendix – Behavioral vs Compositional Effects

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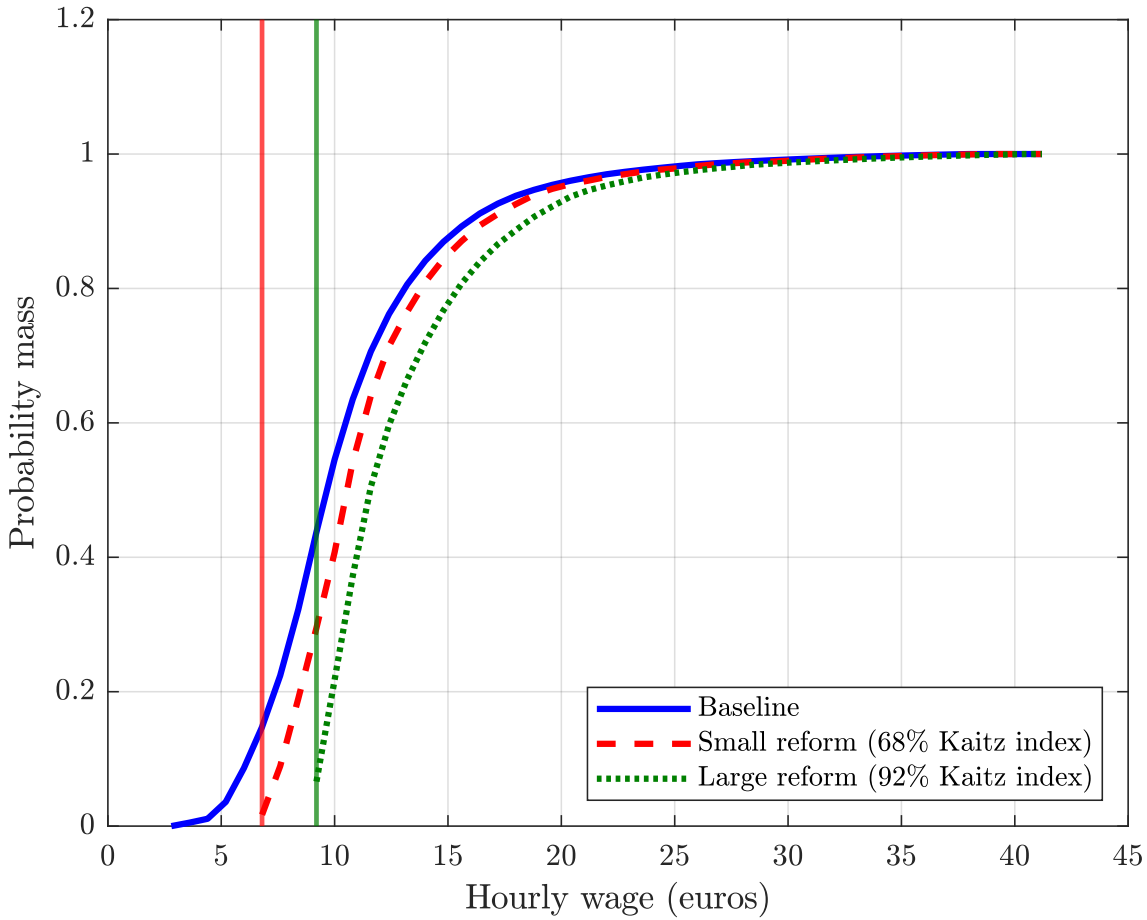
| Variable | Overall change (log points) | Due to policy change (perc.) | Due to reallocation (perc.) |
|---|---|---|---|
| *Panel a. Small reform (.68 Kaitz index)* | | | |
| Average wage | 10.610 | 64.5 % | 35.5 % |
| Average firm size | -10.626 | 116.2 % | -16.2 % |
| Average vacancies | -22.387 | 103.4 % | -3.4 % |
| Log wage variance | -37.509 | 82.6 % | 17.4 % |
| Labor share | 1.298 | 221.8 % | -121.8 % |
| Average markup | 0.101 | 33.3 % | 66.7 % |
| Average markdown | 3.077 | 165.3 % | -65.3 % |
| Average market power index | -2.976 | 169.8 % | -69.8 % |
| *Panel b. Large reform (.92 Kaitz index)* | | | |
| Average wage | 22.732 | 58.4 % | 41.6 % |
| Average firm size | -27.471 | 124.5 % | -24.5 % |
| Average vacancies | -57.411 | 104.1 % | -4.1 % |
| Log wage variance | -57.481 | 81.1 % | 18.9 % |
| Labor share | 1.607 | 398.5 % | -298.5 % |
| Average markup | 0.358 | 32.2 % | 67.8 % |
| Average markdown | 5.007 | 224.3 % | -124.3 % |
| Average market power index | -4.649 | 239.0 % | -139.0 % |

# Appendix – Wage CDF




*Source*: Model.

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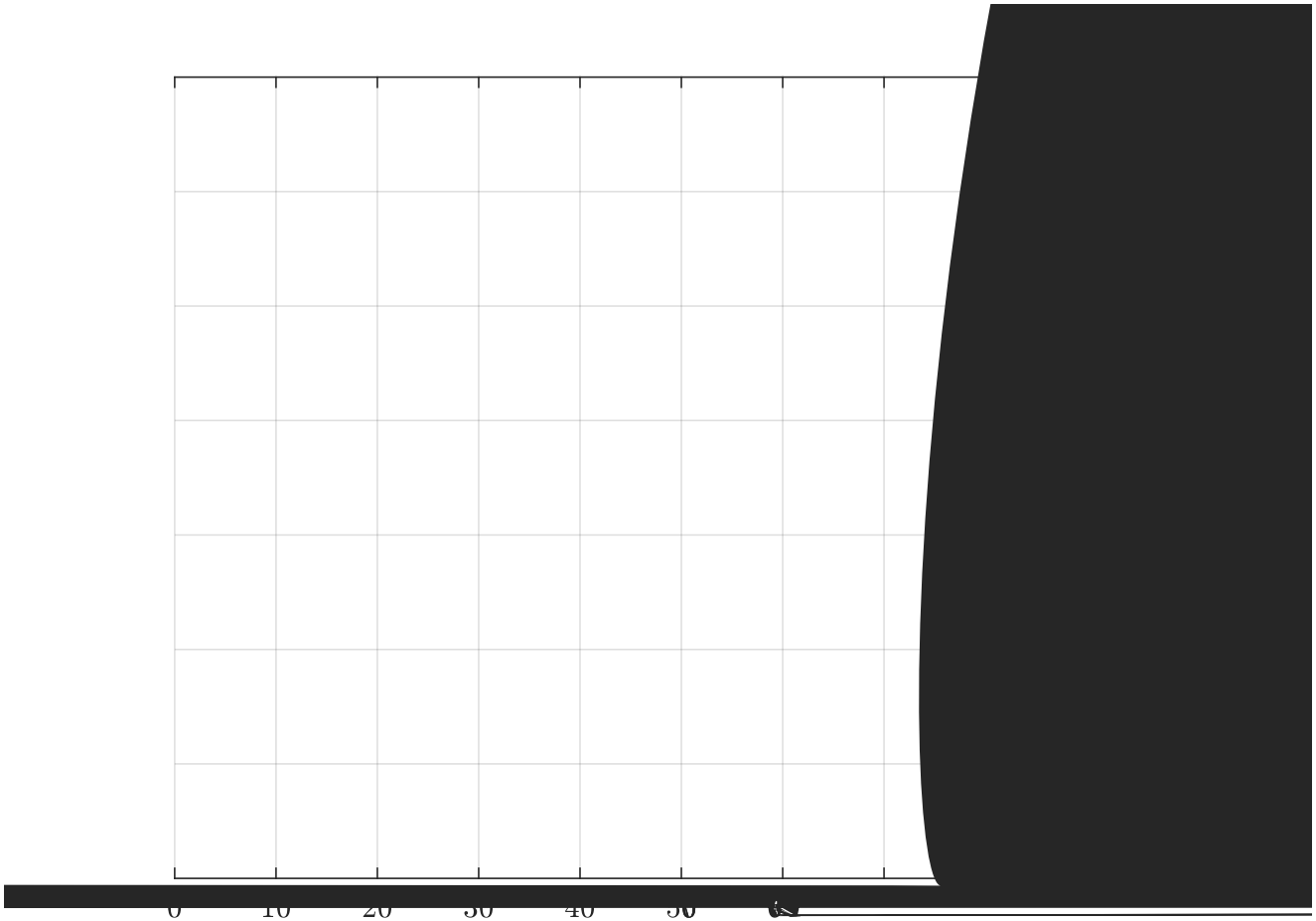
# Appendix – Wage Gains by Percentile




*Source*: Model.

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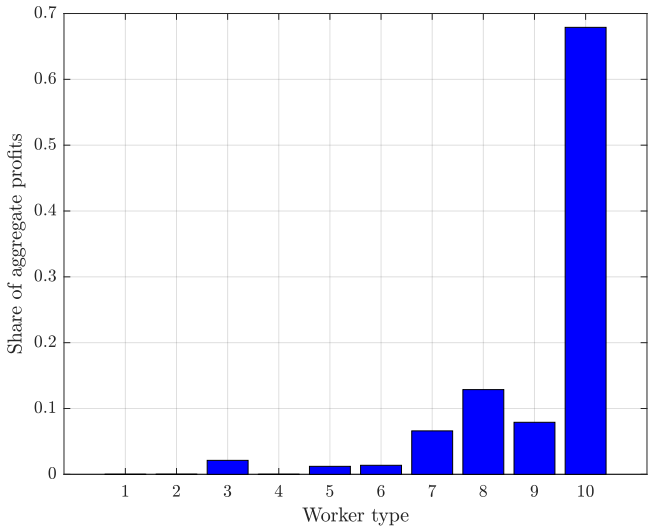
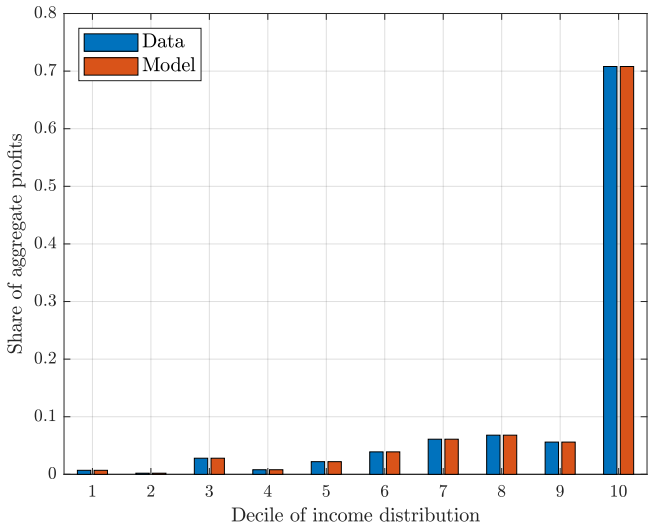
# Appendix – Distribution of Profits

a) Across worker types ($\Pi_j$)




b) Along the inc dist (model vs. data)




*Source*: Model. *Note*: panel a plots the estimates of the shares of aggregate profits accruing to each worker type; panel b plots the shares of aggregate profits accruing to each income decile (targets of the estimation), in the data and in the model.

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# Appendix – MW in PE: Unconstrained Firms

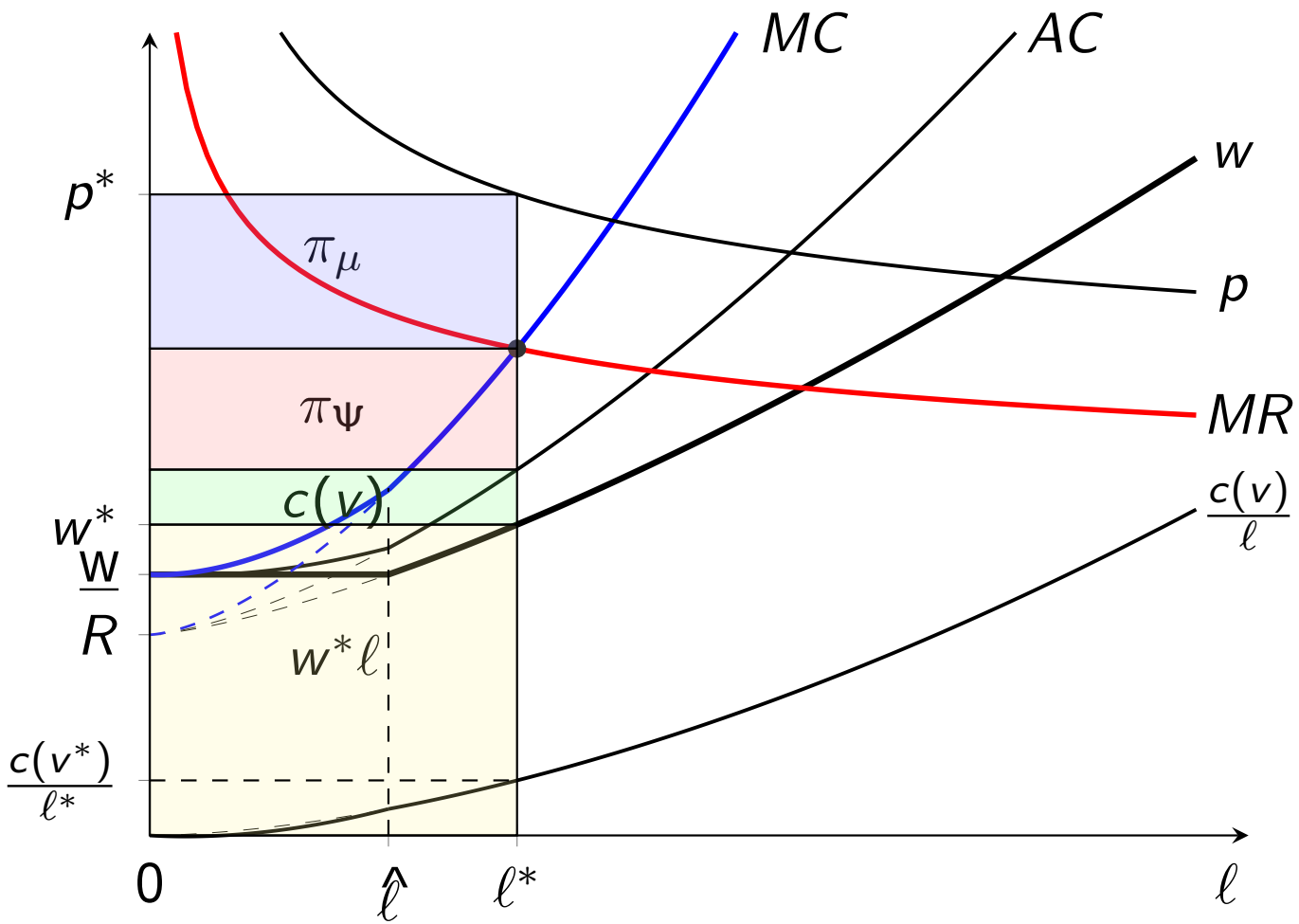


Figure: Non-binding MW.

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# Appendix – MW in PE: Constrained Firms

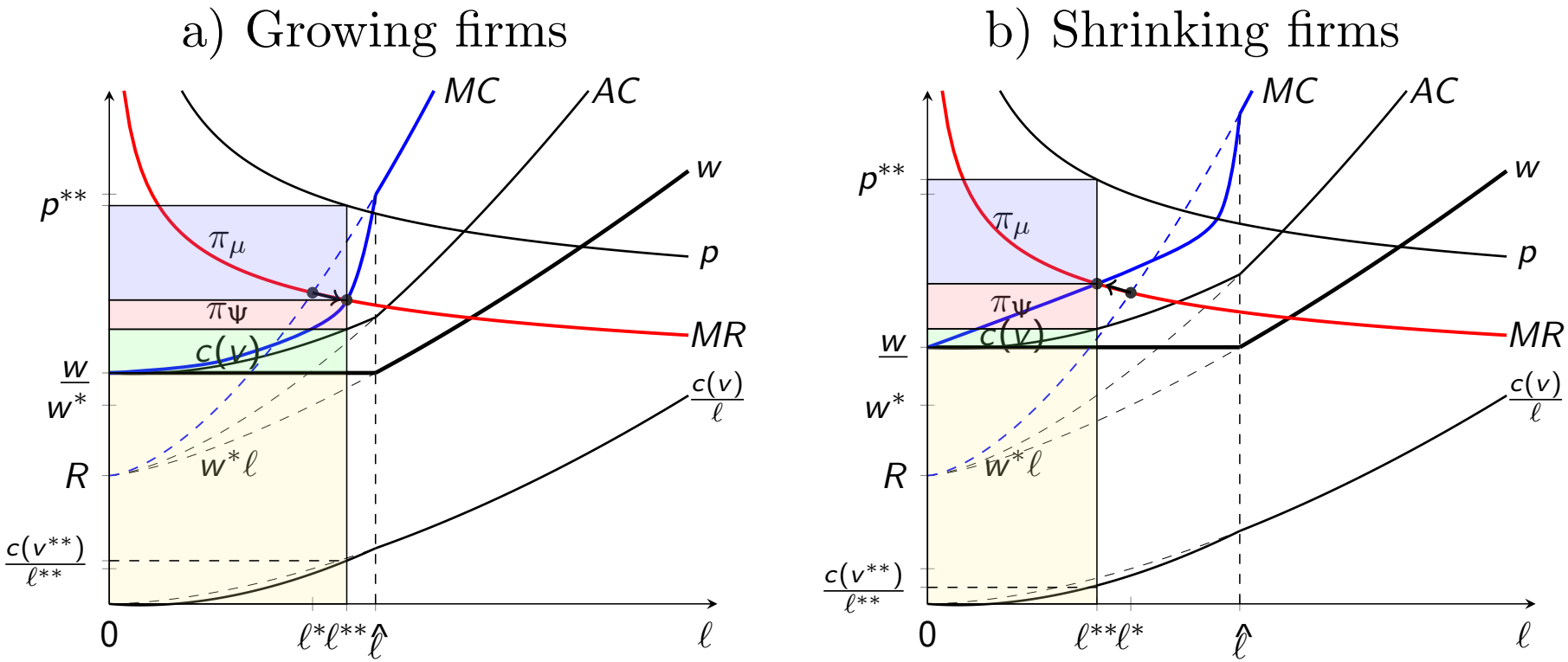


Figure: Binding MW.

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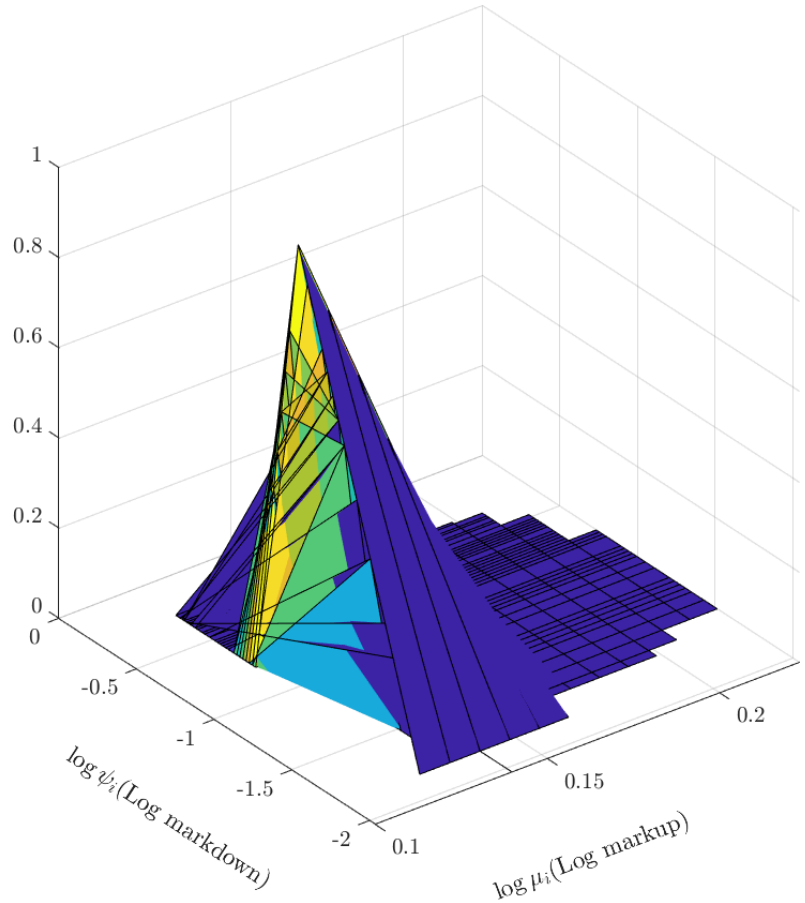
# Appendix – Exit Response after MW Reform




*Source*: Model.

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# Appendix – Baseline vs *Markupless* Economy

| Variable | Baseline Economy | | *Markupless* Economy | |
|---|---|---|---|---|
| | *Status quo* | *Large reform* | *Status quo* | *Large reform* |
| GDP | 1.000 | 1.110 | 1.000 | 1.246 |
| Unemployment rate | 0.108 | 0.135 | 0.108 | 0.148 |
| Avg firm size | 4.051 | 4.189 | 4.051 | 6.776 |
| Avg wage | 11.032 | 13.498 | 11.032 | 14.337 |
| | | | | |
| Labor share | 0.650 | 0.657 | 0.777 | 0.760 |
| Avg mpi | 2.127 | 2.054 | 1.865 | 1.922 |

*Source*: Model.

**Takeaway:** Product market power reins in reallocation and spillover effects and drives the distributional impact of high MWs

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# Appendix – Baseline vs *MP* Economy

| Variable | Baseline Economy | | *MP* Economy | |
|---|---|---|---|---|
| | *Status quo* | *Large reform* | *Status quo* | *Large reform* |
| GDP | 1.000 | 1.110 | 1.000 | 1.105 |
| Unemployment rate | 0.108 | 0.135 | 0.108 | 0.135 |
| Avg firm size | 4.051 | 4.189 | 4.051 | 4.190 |
| Avg wage | 11.032 | 13.500 | 11.032 | 13.498 |
| | | | | |
| Labor share | 0.650 | 0.657 | 0.650 | 0.663 |
| Avg mpi | 2.127 | 2.054 | 2.127 | 2.038 |

*Source*: Model.

**Takeaway:** Endogenous markups do not affect aggregate variables significantly, but influence the dynamics of factor shares

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# Appendix – *Markupless* Economy

| Variable | Baseline | Small reform (68% Kaitz index) | Large reform (92% Kaitz index) |
|---|---|---|---|
| *Panel a. Aggregate statistics* | | | |
| GDP | 1.000 | 1.078 | 1.246 |
| Unemployment rate | 0.108 | 0.120 | 0.148 |
| Output per worker | 1.000 | 1.087 | 1.315 |
| Avg hourly wage (€) | 11.032 | 12.165 | 14.337 |
| Variance log wage | 0.132 | 0.098 | 0.090 |
| Avg firm size | 4.051 | 4.422 | 6.776 |
| *Panel b. Distributional Statistics* | | | |
| Labor share | 0.777 | 0.777 | 0.760 |
| Profit share | 0.223 | 0.223 | 0.240 |
| Profit share (product market) | 0.000 | 0.000 | 0.000 |
| Profit share (labor market) | 0.223 | 0.223 | 0.240 |

*Source*: Model. *Note*: the variables *GDP* and *Output per worker* are normalized to 1 in the Baseline.

Product Market Power  Baseline Model

# Appendix – *Markupless* Economy – Cont'd

| Variable | Baseline | Small reform (68% Kaitz index) | Large reform (92% Kaitz index) |
|---|---|---|---|
| *Panel c. Market power statistics* | | | |
| Average markup | 1.000 | 1.000 | 1.000 |
| Average markdown | 0.536 | 0.540 | 0.520 |
| Average mpi | 1.865 | 1.853 | 1.922 |
| Misalloc index (mpi std dev) | 0.463 | 0.462 | 0.453 |
| *Panel d. Labor market transitions* | | | |
| Job-finding rate | 0.207 | 0.181 | 0.141 |
| Job-to-job flow rate | 0.013 | 0.012 | 0.010 |
| Job-separation rate | 0.025 | 0.025 | 0.025 |

*Source*: Model.

Product Market Power  Baseline Model

# Appendix – MP Economy

| Variable | Baseline | Small reform (68% Kaitz index) | Large reform (92% Kaitz index) |
|---|---|---|---|
| *Panel a. Aggregate statistics* | | | |
| GDP | 1.000 | 1.044 | 1.105 |
| Unemployment rate | 0.108 | 0.118 | 0.135 |
| Output per worker | 1.000 | 1.042 | 1.114 |
| Avg hourly wage (€) | 11.032 | 12.035 | 13.498 |
| Variance log wage | 0.132 | 0.091 | 0.074 |
| Avg firm size | 4.051 | 4.082 | 4.190 |
| *Panel b. Distributional Statistics* | | | |
| Labor share | 0.650 | 0.658 | 0.663 |
| Profit share | 0.350 | 0.342 | 0.337 |
| Profit share (product market) | 0.170 | 0.168 | 0.166 |
| Profit share (labor market) | 0.180 | 0.174 | 0.171 |

*Source*: Model. *Note*: the variables *GDP* and *Output per worker* are normalized to 1 in the Baseline.

Product Market Power  Baseline Model

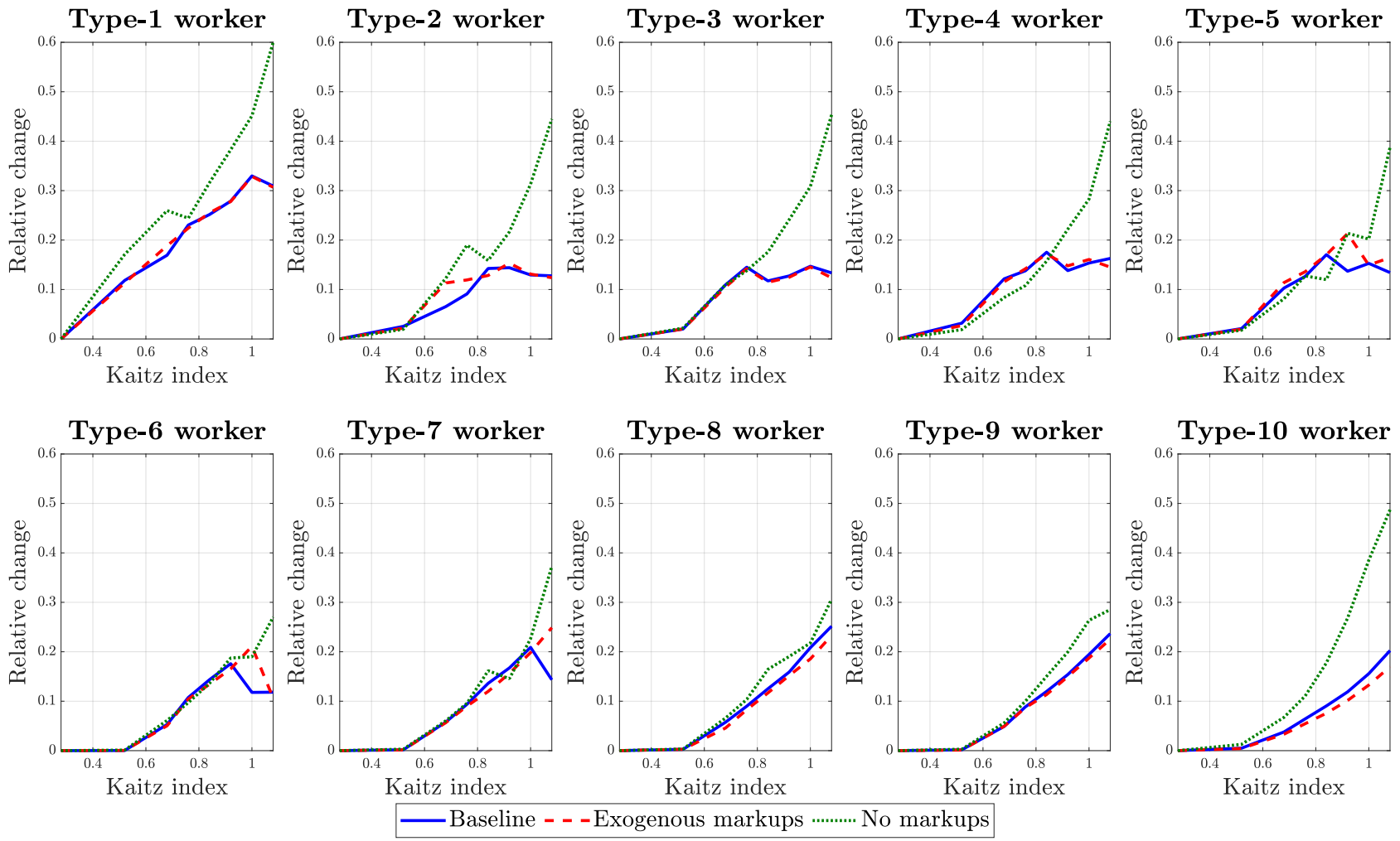
# Appendix – MP Economy – Cont'd

| Variable | Baseline | Small reform (68% Kaitz index) | Large reform (92% Kaitz index) |
|---|---|---|---|
| *Panel c. Market power statistics* | | | |
| Average markup | 1.140 | 1.140 | 1.140 |
| Average markdown | 0.536 | 0.550 | 0.560 |
| Average mpi | 2.127 | 2.073 | 2.038 |
| Misalloc index (mpi std dev) | 0.528 | 0.511 | 0.486 |
| *Panel d. Labor market transitions* | | | |
| Job-finding rate | 0.207 | 0.185 | 0.158 |
| Job-to-job flow rate | 0.013 | 0.013 | 0.012 |
| Job-separation rate | 0.025 | 0.025 | 0.025 |

*Source*: Model.

Product Market Power  Baseline Model

# Appendix – Distributional Impact Across Economies

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