

Exploitation: theory and empirics

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Overview

Is there a consistent and general definition of labour exploitation?
And is it empirically relevant?

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Contribution of this paper:

- We characterise a definition of labour exploitation based on three formally weak and normatively salient axioms.
- From this definition, we derive an individual-level ‘exploitation intensity index’– a measure of well-being and inequality, complementary to existing ones.
- First individual-level estimates of labour exploitation in the US (1975-2025) using CPS and GSS data.

The relevance of exploitation

The notion of labour exploitation is prominent in policy debates, in political discourse, and in the social sciences.

- Recent manifestos of the German SPD (2021), the Spanish PSOE (2021), and the UK Labour Party (2024) advocate the end of exploitation in labour relations.
- Excessive labour exploitation involving unfair compensation or excessive working hours is sometimes codified as a criminal offence (for example, Art.603-bis of the Italian Criminal Code).
- Extensively discussed in **political philosophy** (see Zwolinski et al 2022 for a survey); **political science**, (eg, Gerver 2022; Bryan 2023; Temin 2024; Chan 2024); and **sociology**, (eg, Desmond and Wilmers 2019; Sauer et al 2021).

Exploitation in philosophy/ethics

“To exploit someone is to take unfair advantage of them” (Zwolinski, Ferguson & Wertheimer, Stanford Encyclopedia of Philosophy, 2022 ed.).

- Can be *transactional* (property of a discrete direct interaction) or *structural* (property of institutions or systems).
- Can be *harmful* (to the exploited) or *mutually beneficial*.
- Power & distribution: “exploitation involves inequality on both ends of exchange: inequality defining the context of the exchange . . . and inequality defining the outcome” (Warren 1997, p.63).
- But besides these generic traits, there is little agreement on what exactly constitutes exploitation
 - “There is no widespread agreement about what, precisely, exploitation is . . . Philosophers disagree about substantive features of exploitation” (Stanford Encyclopedia of Philosophy).

Exploitation in economics

In economics, the concept of exploitation receives less attention and is often viewed with suspicion — if not dismissed as logically incoherent or metaphysical.

Marx, of course, but it rested on the discredited Labour Theory of Value, and Marxian approaches are not central today anyway.

Important exception: ‘Robinsonian/Pigouvian’ exploitation in labor economics (Machin & Manning 1994; Azar, Marinescu & Steinbaum 2022, Kline 2025, Dube 2026, ...)

- Monopsonistic labour market.
- Exploitation = wage markdown = $(MRPL - w) / w$
- Recent estimates suggest substantial wage markdowns (eg, Bassier, Dube & Naidu 2021; Yeh, Macaluso, and Hershbein 2022).
- Important but does not amount to a comprehensive, general account or theory of exploitation: it focuses on a specific source of exploitation, when there might be others.

A more general notion: Exploitation as the unequal exchange of labour.

Exploitative relations are characterised by systematic differences between the labour individuals 'contribute', in some relevant sense, and the labour they 'receive', in some relevant sense.

- **Long history:** traces back to Aristotle's proportional justice; consistent with Marx, but not dependent on the Labour Theory of Value.
- **Broad:** encompasses wage markdowns as one form of non-proportionality between contribution and income, but also non-proportionality due to *unequal asset ownership* (e.g.: Belle Époque rentiers living off passive capital income).
- **But which formal definition?** Several proposals – Morishima (1974, 1989), Roemer (1982, 1988, 1992), Duménil (1980, 1982), Foley (1982), Flaschel (1983, 2010) – with different positive and normative implications. *How to adjudicate among them?*

Adjudicating among definitions of labour exploitation

- We take an axiomatic approach
- Setting: standard neoclassical GE (generalisation of Roemer 1980).
- Domain condition **LE**: identifies the domain of definitions of labour exploitation
- Three axioms identify properties that a definition should satisfy.
 1. Relational exploitation (**RE**)
 2. Scale invariance (**SI**)
 3. Independence (**IND**)
- These axioms pin down a unique definition: *An individual is exploited if and only if her share of total labour contribution exceeds her share of total income.* (as in Duménil 1980; Foley 1982)
- These shares can be measured empirically.

Production

- Standard neoclassical framework.
- There are m goods produced, used as inputs, and consumed.
- All agents have access to production set Y , which elements (*activities*) have the form $y = (x, -k, -\ell)$ where
 - $\ell \in \mathbb{R}_+$: the (effective) labour input;
 - $k \in \mathbb{R}_+^m$: the inputs of the m produced goods;
 - $x \in \mathbb{R}_+^m$: the outputs of the m goods.
- Constant returns to scale (Y is a closed convex cone with $\mathbf{0} \in Y$).
- The net output vector arising from y is denoted as $\hat{y} \equiv x - k$.

The model

Agents

- A set of agents $N = \{1, \dots, n\}$, with n large.
- Each agent $\nu \in N$ is endowed with physical and human capital.
 - s^ν is agent ν 's skill level.
 - ω^ν is a vector of productive assets (ie, commodities) inherited by ν .
- Agents can sell their labour or hire workers to work on their capital.
 - $y^\nu \in Y$ is the activity that ν operates by hiring (effective) labour ℓ^ν
 - $\lambda^\nu = s^\nu \gamma^\nu$: (effective) labour supply, with $0 \leq \gamma^\nu \leq 1$ labour time.
- Utility u^ν is increasing in consumption c^ν and decreasing in labour time γ^ν , continuous and quasi-concave.
- Given prices (p, w) , each agent chooses a plan $\xi^\nu \equiv (y^\nu, \lambda^\nu, c^\nu)$ to maximise u^ν subject to (1) net income being sufficient for consumption plans; and (2) wealth being sufficient to purchase the inputs necessary for production plans (no credit market).

The model

Equilibrium

We assume that the economy is in a *stationary competitive equilibrium*.

Let $\mathbf{e} = \langle Y, N, (u^\nu, s^\nu, \omega^\nu)_{\nu \in N} \rangle$ be an economy, and E be the set of all such economies.

A *stationary competitive equilibrium* (SCE) for $\mathbf{e} \in E$ is a price vector (p, w) and an associated profile of actions $(\xi^\nu)_{\nu \in N} = (y^\nu, \lambda^\nu, c^\nu)_{\nu \in N}$ such that:

- (i) ξ^ν solves ν 's optimisation problem, for all ν (every agent optimises);
- (ii) $\sum_{\nu \in N} k^\nu \leq \sum_{\nu \in N} \omega^\nu$ (feasibility);
- (iii) $\sum_{\nu \in N} \ell^\nu = \sum_{\nu \in N} \lambda^\nu$ (labour market equilibrium);
- (iv) $\sum_{\nu \in N} \hat{y}^\nu \geq \sum_{\nu \in N} c^\nu \geq \mathbf{0}$ (aggregate net outputs at least suffice for consumption, so endowments are not depleted over time).

Defining exploitation

A definition of exploitation d is a rule that, at any given equilibrium allocation of any economy, identifies the exploitation status of all agents.

- Formally, a mapping $d : E \times SCE \longrightarrow \mathcal{P}_N$ such that for each $\mathbf{e} \in E$ and $((p, w), (\xi^\nu)_{\nu \in N}) \in SCE_{\mathbf{e}}$,

$$d(\mathbf{e}, ((p, w), (\xi^\nu)_{\nu \in N})) = \{N^{ter}, N^{ted}, N^{ne}\} \in \mathcal{P}_N$$

- N^{ter} is the set of exploiters
- N^{ted} is the set of exploited agents
- N^{ne} is the set of agents who are neither.

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Let $\mathcal{D}$ denote the set of conceivable definitions of exploitation.

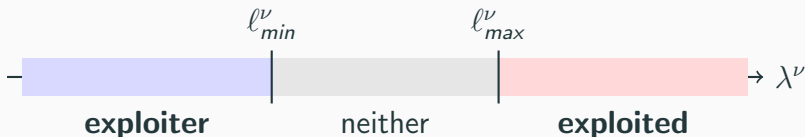
- There are many of them — ie, many ways of identifying the subsets $\{N^{ter}, N^{ted}, N^{ne}\}$ at any given equilibrium allocation.
- All views on exploitation could be formalised as part of $\mathcal{D}$.

LE Domain Condition

Within $\mathcal{D}$, the **LE** domain condition identifies *labour-based* definitions.

At any equilibrium, the sets N^{ter} and N^{ted} are determined by comparing:

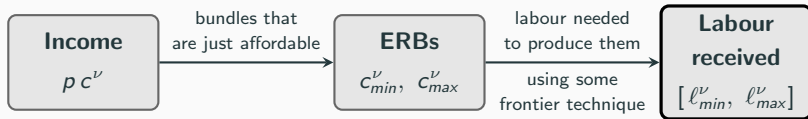
- **Labour contribution** λ^ν
- **Labour received:** a min and max amount of labour that the agent can 'receive' through their income: ℓ_{min}^ν & ℓ_{max}^ν



- But how to convert the agent income into their (range of) labour received?

LE: The Exploitation Reference Bundles (ERBs)

- **Labour received** by an agent $[\ell_{min}^\nu, \ell_{max}^\nu]$ is the labour associated with two (possibly identical) consumption bundles: the ERBs.
- ℓ_{min}^ν & ℓ_{max}^ν are the amounts of labour required to produce the two ERBs using some frontier technique, actual or counterfactual.
- (Weak) restrictions on ERBs and the associated labour received:
 - **Just affordable:** labour received must be linked to income.
 - **Anonymity:** identical agents (same endowments, preferences & choices) must have the same ERBs and labour received.



LE encompasses existing definitions

LE restricts the focus to definitions of *labour exploitation*. Within those, it is appropriately general: all main definitions in the literature satisfy it.

ERBs	Labour content of the ERBs		
	min. labour, <i>any technique</i>	min. labour, <i>profit-max. techniques</i>	techniques <i>actually in use</i>
Actual (optimal) consumption	Morishima (1974)	Roemer (1981, 1982)	Flaschel (1983)
Affordable bundles with most & least labour	Roemer (1982)	Roemer (1982)	—
Agent's share of net output ($\tau^\nu \hat{y}$)	—	—	New Interpretation (Duménil 1980; Foley 1982)

New Interpretation: exploited iff labour share $>$ income share.

► New Interpretation

Three axioms

Within D_{LE} , we look for definitions with three mild properties.

- **Relational Exploitation (RE):** someone is exploited *if and only if* someone is an exploiter.

► RE formalization

- **Scale Invariance (SI):** scaling an agent's endowments and actions by χ^ν (prices, technology, aggregates fixed) scales their labour received by χ^ν .

► SI formalization

- Status depends on *proportions*, not size: twice the endowments, hours worked, consumption of each good $\Rightarrow$ same status.

- **Independence (IND):** labour received is unchanged if (i) preferences change but consumption does not or (ii) only the arbitrary pick among equally optimal bundles changes.

► IND formalization

Main theoretical result: Theorem 1

Theorem 1

A definition of labour exploitation $d \in D_{LE}$ satisfies **RE**, **SI** and **IND** if and only if, at every equilibrium with positive profits, for every agent ν :

$$\ell_{min}^{\nu} = \ell_{max}^{\nu} = \frac{p c^{\nu}}{p \hat{y}^{p,w}} \ell^{p,w},$$

where $p c^{\nu} / p \hat{y}$ is ν 's share of national income and ℓ is total labour performed.

- Pins down a unique definition of labour exploitation.
- *An individual is exploited if and only if her share of total labour contribution exceeds her share of total income.*
- Matches the 'New Interpretation' (Duménil 1980, 1984; Foley 1982, 1986).
- **Measurable:** depends only on labour and income shares.

Which definitions from the literature satisfy the axioms?

	RE	SI	IND
Morishima (1974)	×	✓	✓
Roemer (1981, 1982) – three definitions	×	✓	✓
New Interpretation (Duménil 1980; Foley 1982)	✓	✓	✓

- SI and IND are satisfied by all the classic definitions.
- The mild axiom **RE** is what rules them out:
 - with counterfactual, labour-minimising techniques, total labour *received* can fall short of labour actually *performed* $\Rightarrow$ everyone can be exploited at once;
 - under the New Interpretation, labour received adds up to total labour, so if someone receives less than they contribute, someone else receives more.

Exploitation Intensity Index

Log distance from the exploitation-neutral point:

$$\begin{aligned}\varepsilon_t^\nu &= \ln\left(\frac{\lambda_t^\nu}{\ell_t}\right) - \ln\left(\frac{l_t^\nu}{l_t}\right) \\ &= \ln\left(\frac{\lambda_t^\nu}{l_t^\nu}\right) - \ln\left(\frac{\ell_t}{l_t}\right)\end{aligned}$$

l_t^ν , l_t : agent and total income;

λ_t^ν , ℓ_t : agent and total effective labour.

- $\varepsilon_t^\nu > 0$: exploited; $\varepsilon_t^\nu < 0$: exploiter
- $\varepsilon = 0.1$: labour share $\approx 1.1 \times$ income share
- Deviation of the individual *labour–income ratio* from the economy-wide ratio
- Benchmark: income *proportional to contribution* (vs. equal income in standard inequality indices)

Measuring effective labour λ^ν

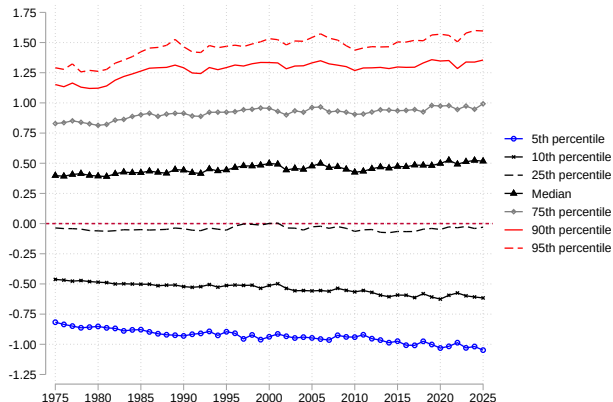
- **Main: hours worked** $\Rightarrow$ *upper bound*; transparent, only requires hours
- **Earned income**: wages fully reflect productivity $\Rightarrow$ *lower bound*
- **Mincer**: wage predicted by education and experience $\times$ hours

Data

[Details](#)

- CPS–ASEC (IPUMS), 1975–2025
- *Market* income (pre-tax & transfers)
- ≈ 4.2 million observations
- GSS (1973–2023) to relate exploitation intensity with socio-economic outcomes.

Exploitation intensity by percentile



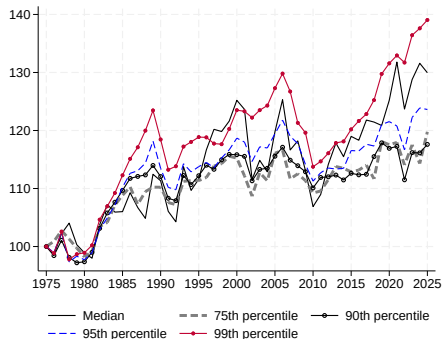
Most people are exploited: just below **75%** have $\varepsilon > 0$, with no clear trend

Median American: $\varepsilon \approx 0.52$ in 2025
 $\Rightarrow$ her labour share is $\approx$ **68% higher** than her income share ($e^{0.52} \approx 1.68$)

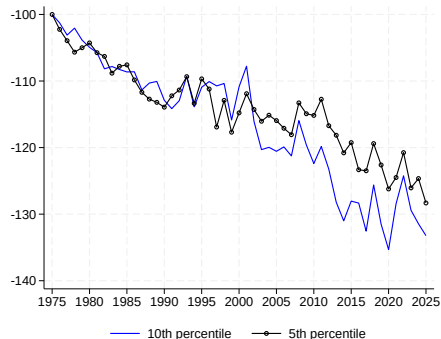
The gap between top and bottom percentiles **widened** over time

Diverging dynamics: the exploited vs. the exploiters

50% most exploited (1975 = 100)

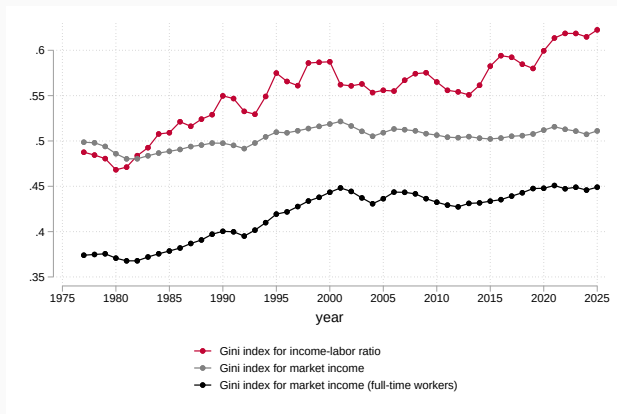


10% least exploited (exploiters) (1975 = -100)



Exploitation intensity rose by almost **30%** for the median, almost **18%** at the 90th and almost **40%** at the 99th percentile; it became around **30%** more *negative* for the least exploited 10%.

Inequality in exploitation grew more than income inequality



Gini index, 1975–77 to 2023–25

(3-year moving averages)

- Income–labour ratios:
+0.13 points (+28%)
- Market income, whole sample:
+2.5%
- Market income, full-time workers:
+20%

Inequality in income–labour ratios is not shown for full-time workers only: with similar hours, variation would come mostly from income.

Who is most exploited?

	(1) Full Sample	(2) 1975-1989	(3) 1990-2004	(4) 2005-2025
female	0.21*** (0.00)	0.28*** (0.00)	0.22*** (0.00)	0.18*** (0.00)
rentier	-0.45*** (0.00)	-0.38*** (0.00)	-0.45*** (0.00)	-0.48*** (0.00)
entrepreneur	-0.63*** (0.00)	-0.54*** (0.00)	-0.63*** (0.00)	-0.68*** (0.00)
retired	-0.15*** (0.00)	-0.14*** (0.01)	-0.11*** (0.01)	-0.17*** (0.01)
unemployed	0.06*** (0.00)	0.10*** (0.01)	0.07*** (0.00)	0.04*** (0.00)
black	0.10*** (0.00)	0.12*** (0.00)	0.08*** (0.00)	0.11*** (0.00)
<i>N</i>	4234870	1131051	1245995	1857824

Standard errors in parentheses

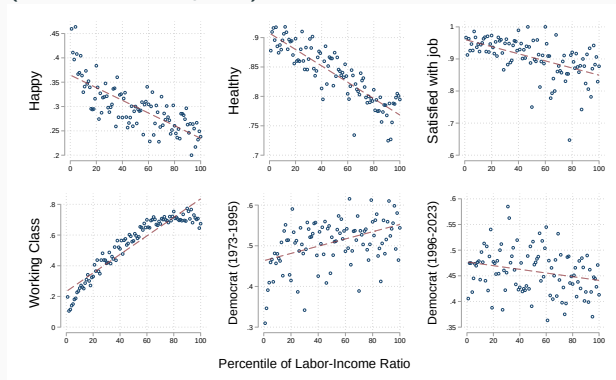
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

OLS, dep. var.: ε_t^V . Age-by-year fixed effects. CPS.

- **Women:** $\approx 21\%$ more exploited; the gap falls from 28% (1975–89) to 18% (2005–25)
- **Black people:** $\approx 10\%$ more exploited, with no clear trend
- **Rentiers** (any interest, dividend or rental income) and **entrepreneurs** (any business or farm income) are much less exploited than those living on wages only
- **Workers with an unemployment spell:** $\approx 6\%$ more exploited

Does exploitation matter? Well-being, class and politics

Outcomes by percentile of exploitation intensity (binned scatterplots)



GSS: outcomes by percentile of exploitation intensity

- More exploited $\Rightarrow$ **less happy, less healthy, less satisfied with their job, more likely to identify as working class**
- +10 percentiles of exploitation:
 - 1.3 pp prob. “very happy”; +6 pp prob. working-class identification
- Robust to controlling for income percentile (except job satisfaction): smaller but still significant

Does exploitation matter? Regression results (GSS)

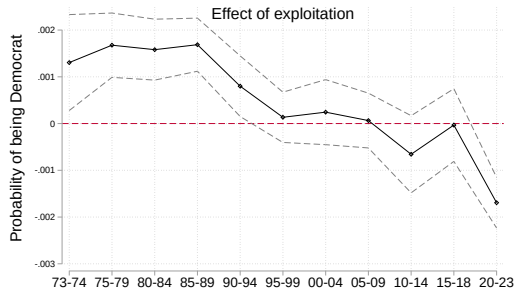
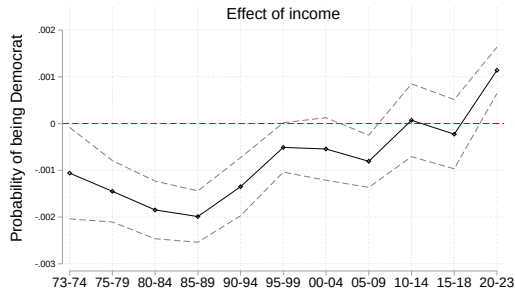
Effect in **percentage points** of a **10-percentile** increase in exploitation (or income).

	(1) Happy	(2) Happy	(3) Healthy	(4) Healthy	(5) Job Satisfied	(6) Job Satisfied
Exploitation	-1.29*** (0.09)	-0.52** (0.18)	-1.68*** (0.08)	-0.61*** (0.16)	-0.90*** (0.13)	-0.03 (0.25)
Income		0.98*** (0.20)		1.36*** (0.17)		1.12*** (0.27)
<i>N</i>	31,901	31,901	26,028	26,028	6,942	6,942
Adj <i>R</i> ²	0.015	0.016	0.027	0.029	0.020	0.022

	(1) Working Class	(2) Working Class	(3) Democrat 1973–1995	(4) Democrat 1973–1995	(5) Democrat 1996–2023	(6) Democrat 1996–2023
Exploitation	6.12*** (0.09)	3.16*** (0.18)	1.28*** (0.15)	0.16 (0.27)	-0.39** (0.14)	-1.62*** (0.27)
Income		-3.77*** (0.20)		-1.44*** (0.30)		-1.55*** (0.30)
<i>N</i>	32,988	32,988	15,472	15,472	17,986	17,986
Adj <i>R</i> ²	0.127	0.137	0.018	0.020	0.004	0.005

Standard errors in parentheses (same units). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Exploitation and Income: within-year percentiles of exploitation intensity and of income. Year and age fixed effects. Years are income years.

Exploitation, income and support for the Democratic Party



Effect of a one-percentile increase in exploitation intensity (left) or income (right) on the probability of supporting the Democratic Party; separate regressions by period, age and year FE; dashed lines: 95% CI. GSS, income years.

More exploited individuals were more likely to support the Democrats until the mid-1990s. The link then faded and in **2020–23 reversed**: the more exploited are now *less* likely, the higher-income *more* likely, to support them (cf. Gethin, Martínez-Toledano & Piketty 2022).

Alternative measurements of labour contribution

Main analysis: labour performed = hours worked.

- In some relevant sense, everyone's time is equally valuable.
- Yields an index with a straightforward interpretation: hours worked per \$ of total income.

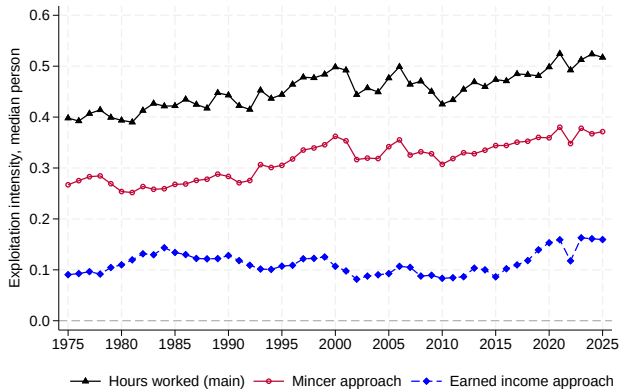
But ability and effort clearly matter.

Two alternative approaches to measuring labour contribution λ^ν :

1. **Earned income approach:** perfect competition $\rightarrow$ labour performed = earned income.
 - Only unearned capital income creates exploitation (Marxian reading)
2. **Mincer-regression approach:** we observe determinants of productivity & their effect on wages $\rightarrow$ labour performed = hours worked $\times$ predicted wage.

Main insights are preserved: Inequality in exploitation increased over time also according to these two alternative approaches.

Median exploitation intensity under the three measures of labour contribution



- The median person is **increasingly exploited under all three measures**: +0.12, +0.10, +0.07 since 1975
- Median ε in 2025: **0.52** (hours), **0.37** (Mincer), **0.16** (earned income) $\Rightarrow$ labour share **68%**, **45%**, **17%** above income share
- Hours: upper bound; earned income: lower bound (only capital income creates exploitation)

Median of the exploitation intensity index by year, CPS 1975–2025. Mincer: hours $\times$ wage predicted by education and experience. Earned income: labour = earned income (perfect competition).

Conclusions

- **The notion of labour exploitation is not logically incoherent:** contrary to the received view, there is a logically consistent definition of exploitation, *uniquely* characterised, among labour-based definitions, by a small set of weak, normatively appealing axioms.
- **And can be taken to the data:** it yields an individual-level index that can be estimated empirically.
- **A new well-being and inequality measure** that combines income and working time, and measures deviations from a benchmark of proportionality between income and contribution.
- **US evidence, 1975–2025:**
 - inequality in exploitation increased substantially since 1980, *more* than income inequality;
 - the largest increases: the most exploited and the middle of the distribution;
 - gender gap declining but still $\approx 18\%$; racial gap $\approx 10\%$, no trend;
 - exploitation predicts well-being, health and class identification, over and above income; its link with Democratic support was positive until the mid-1990s and has reversed since 2020;
 - main results are robust to the three measures of labour contribution.

Appendix

Appendix: the LE domain condition

For any $p, c \in \mathbb{R}_+^m$, let $B(p, c) \equiv \{z \in \mathbb{R}_+^m \mid pz = pc\}$ be the set of bundles that cost exactly as much as c at prices p ; let $\phi(c) \equiv \{y \in Y \mid \hat{y} \geq c\}$ be the set of activities that produce at least c as net output; and let ∂Y denote the frontier of Y .

Labour Exploitation (LE): *For every $e \in E$ and $((p, w), (\xi^\nu)_{\nu \in N}) \in SCE_e$, there exists a profile $(c_{max}^\nu, c_{min}^\nu)_{\nu \in N}$ such that for each $\nu \in N$, $c_{max}^\nu, c_{min}^\nu \in B(p, c^\nu)$ and there exist $y_{max}^\nu \in \phi(c_{max}^\nu) \cap \partial Y$ and $y_{min}^\nu \in \phi(c_{min}^\nu) \cap \partial Y$ such that $\ell_{max}^\nu \geq \ell_{min}^\nu$ and*

$$\nu \in N^{ter} \Leftrightarrow \lambda^\nu < \ell_{min}^\nu;$$

$$\nu \in N^{ted} \Leftrightarrow \lambda^\nu > \ell_{max}^\nu.$$

Furthermore, if $(u^\nu, \omega^\nu, s^\nu, \xi^\nu) = (u^\mu, \omega^\mu, s^\mu, \xi^\mu)$ for all $\nu, \mu \in N$, then $(c_{max}^\nu, c_{min}^\nu, \ell_{max}^\nu, \ell_{min}^\nu) = (c_{max}^\mu, c_{min}^\mu, \ell_{max}^\mu, \ell_{min}^\mu)$ for all $\nu, \mu \in N$.

Appendix: the New Interpretation's ERB

The ERB is a **miniature copy of the economy's net output**: the same mix of goods, scaled down to cost exactly the agent's income.

- **Net output** $\hat{y}$: goods produced minus inputs used up; $p\hat{y}$ = national income.
- **Income share**: $\tau^\nu = pc^\nu / p\hat{y}$.
- **ERB**: $c_{min}^\nu = c_{max}^\nu = \tau^\nu \hat{y}$: costs pc^ν , but generally *not* what ν buys.
- **Labour content**: same slice of actual production $\Rightarrow \ell_{min}^\nu = \ell_{max}^\nu = \tau^\nu \ell^{p,w}$.
- $\Rightarrow$ exploited iff $\lambda^\nu / \ell^{p,w} > \tau^\nu$ ($\ell^{p,w}$ = total labour): **labour share** > **income share**.

Example: net output = 100 loaves + 50 coats, made with 1,000 hours. With 1% of national income: ERB = 1 loaf + $\frac{1}{2}$ coat $\Rightarrow$ 10 hours received; exploited if working 15 hours, an exploiter if 5.

Intuition: every dollar of income commands the same labour, $\ell^{p,w} / p\hat{y}$, whatever it buys.

Appendix: Relational Exploitation (RE)

Relational Exploitation (RE): For every $\mathbf{e} \in E$ and $((p, w), (\xi^\nu)_{\nu \in N}) \in SCE_{\mathbf{e}}$,

$$N^{ter} \neq \emptyset \quad \Leftrightarrow \quad N^{ted} \neq \emptyset.$$

- Captures the *relational* nature of exploitation: whenever some agent is exploited, someone else is exploiting, and vice versa.
- Formally a weak restriction: it says nothing about *who* is exploited, only that the two sets are either both empty or both non-empty.

Appendix: Scale Invariance (SI)

Let $E[(Y, N); (\bar{s}, \bar{\omega})] \subset E$ be the set of economies with the same production set Y , set of agents N , and aggregate endowments of labour $\bar{s} = \sum_{\nu} s^{\nu}$ and of commodities $\bar{\omega} = \sum_{\nu} \omega^{\nu}$. At any equilibrium, $y^{p,w} \equiv \sum_{\nu \in N} y^{\nu}$ is the aggregate production activity.

Scale Invariance (SI): Consider any $e, e' \in E[(Y, N); (\bar{s}, \bar{\omega})]$ and any $((p, w), (\xi^{\nu})_{\nu \in N}) \in SCE_e$ and $((p, w), (\xi'^{\nu})_{\nu \in N}) \in SCE_{e'}$ such that $y^{p,w} = y'^{p,w}$ and, for all $\nu \in N$, there exists $\chi^{\nu} > 0$ such that $s^{\nu} = \chi^{\nu} s'^{\nu}$, $\omega^{\nu} = \chi^{\nu} \omega'^{\nu}$ and $\xi^{\nu} = \chi^{\nu} \xi'^{\nu}$. Let $(c_{max}^{\nu}, c_{min}^{\nu})_{\nu \in N}$ and $(c_{max}'^{\nu}, c_{min}'^{\nu})_{\nu \in N}$ be the corresponding ERBs. Then

$$(\ell_{max}^{\nu}, \ell_{min}^{\nu}) = \chi^{\nu} (\ell_{max}'^{\nu}, \ell_{min}'^{\nu}) \quad \text{for all } \nu \in N.$$

With prices, technology, aggregate endowments and aggregate production fixed, proportional changes in an agent's endowments and activities yield equiproportional changes in their labour received. Given LE, exploitation status is therefore invariant to such changes. Analogous to scale invariance conditions in social choice.

Appendix: Independence (IND)

Let $E[(Y, N); (\bar{s}, \bar{\omega})] \subset E$ be the set of economies with the same production set Y , set of agents N , and aggregate endowments of labour $\bar{s} = \sum_{\nu} s^{\nu}$ and of commodities $\bar{\omega} = \sum_{\nu} \omega^{\nu}$. At any equilibrium, $y^{p,w} \equiv \sum_{\nu \in N} y^{\nu}$ is the aggregate production activity.

Independence (IND): Consider any $\mathbf{e}, \mathbf{e}' \in E[(Y, N); (\bar{s}, \bar{\omega})]$ and any $((p, w), (\xi^{\nu})_{\nu \in N}) \in SCE_{\mathbf{e}}$ and $((p, w), (\xi'^{\nu})_{\nu \in N}) \in SCE_{\mathbf{e}'}$ such that $y^{p,w} = y'^{p,w}$. Let $(c_{\max}^{\nu}, c_{\min}^{\nu})_{\nu \in N}$ and $(c'_{\max}^{\nu}, c'_{\min}^{\nu})_{\nu \in N}$ be the corresponding ERBs. If either

- (i) $\mathbf{e} \neq \mathbf{e}'$ and $c^{\nu} = c'^{\nu}$ for all $\nu \in N$, or
- (ii) $\mathbf{e} = \mathbf{e}'$ and $(\lambda^{\nu}, y^{\nu}) = (\lambda'^{\nu}, y'^{\nu})$ for all $\nu \in N$,

then $(\ell_{\max}^{\nu}, \ell_{\min}^{\nu}) = (\ell'_{\max}^{\nu}, \ell'_{\min}^{\nu})$ for all $\nu \in N$.

Labour received should not depend on (i) preferences, when they do not affect consumption choices, nor on (ii) the arbitrary selection of one bundle among equally optimal ones. Part (ii) also guarantees that labour received is uniquely determined at any allocation.

Appendix: constructing hours and income

Hours and income

- **Hours** λ^v : weeks worked $\times$ usual weekly hours (unpaid care work not included)
- **Income** I^v : wages + business/farm + rental + interest + dividends (a “minimal” market income)

Adjustments

- **Capital income under-reporting**: scaled up with Rothbaum (2015) ratios, as in Hoffmann, Lee & Lemieux (2020): business $\times \frac{1}{0.356}$, interest $\times \frac{1}{0.675}$, dividends $\times \frac{1}{0.695}$, rent $\times \frac{1}{0.274}$
- **Top-coding**: revised top-code files and rank-proximity swapping applied to all years

Sample restrictions

- **Dropped** (likely reporting errors):
 - zero market income (status undefined)
 - implied hourly earnings $< \frac{2}{3}$ of federal minimum wage
 - employees earning $> \$50,000/\text{hour}$ (1999 \$)
 - zero hours but positive wages
- **Zero hours, positive non-wage income** (exploiters, but ε undefined):
 - not working because retired, at home, in school, ill/disabled, unemployed or in the armed forces: dropped
 - others with income $\geq \$7,000$ (1999 \$): assigned 1 hour ($\approx 0.05\%$ of sample; results unchanged)
- **Unpaid family workers**: they and their family members get the household labour–income ratio