Inequality and Institutions: **Global Inequality**

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Empirical insights on accumulation dynamics

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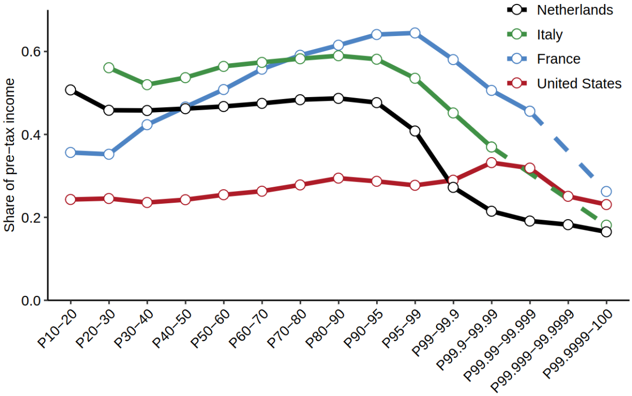
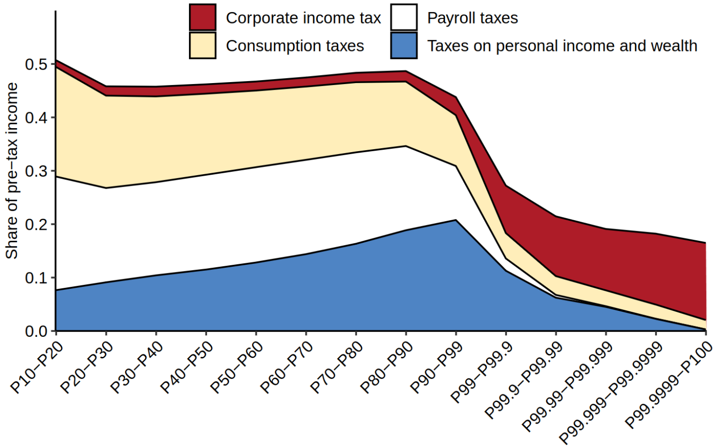
Taxes and redistribution

Regressive tax systems in Europe



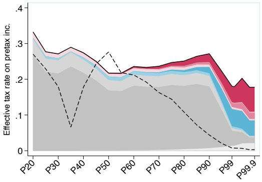
- **Notes.** Effective tax rates, divide all taxes paid (incl, PIT, CIT, Indirect taxation) and divide it by total income (incl. personal incomes and incomes retained in corporations). The often increase from the middle to the middle-high incomes, until they drop at the very top of the distribution. Source: Bruil et al., 2022

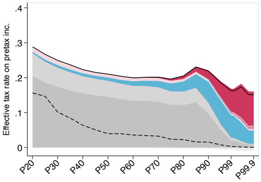
Zoom on the Netherlands 2016



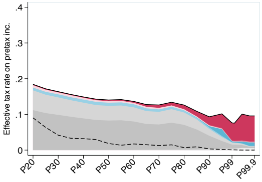
- **Notes.** Consumption taxes are more important for those with lower saving rates. Progressive taxation on personal income and the corporate income tax combined are not enough to render the system progressive. Source: Bruil et al., 2022

Similar patterns in the global south





(d) Chile 2017

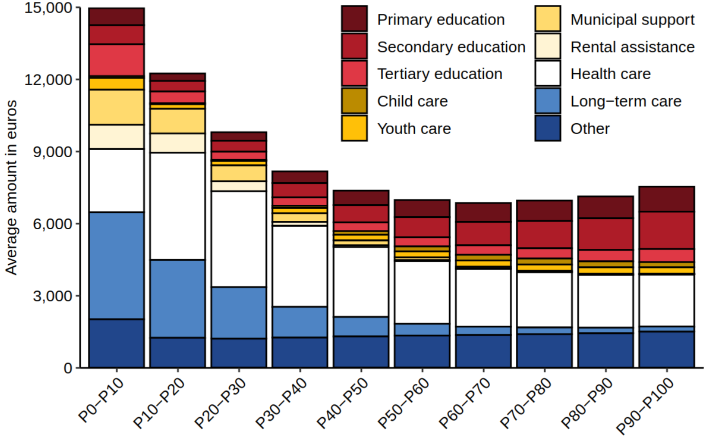


(e) Mexico 2018

(f)

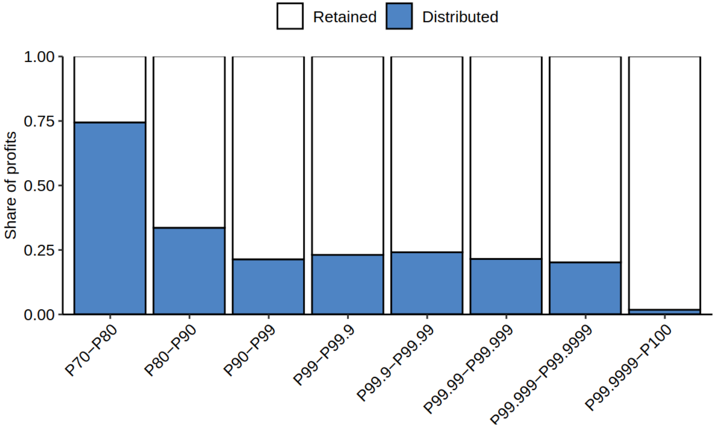
- **Notes.** Although tax levels are lower, the large reliance on indirect taxation in Latin America and tax exemptions result in regressive systems. Source: De Rosa, Flores, and Morgan (2022)

Zoom on in kind spending, Netherlands 2016



- **Notes.** Linked administrative sources allow for a careful incidence analysis of in kind spending. Here, it is mostly targeted to lower deciles. Source: Bruil et al., 2022

Retained vs. distributed profits



- **Notes.** Retained profits, as opposed to distributed profits, have become increasingly relevant worldwide. Profit retention is also more present in top rankings, likely for tax purposes. This also complicates wealth inequality estimates, such as those based on the capitalization method, which relies on distributed profits. Source: Bruil et al., 2022

Financial assets and pensions

Return rates differ substantially across households

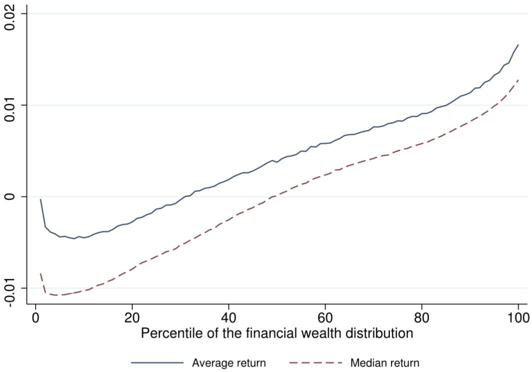


Figure: Fagereng et al., 2020 (Norwegian data)

- Positive correlation with wealth, differences can compound in time
- Gradient confirmed in other contexts (Smith, Zidar, and Zwick, 2023 for the US; Bach, Calvet, and Sodini, 2020 for Sweden)

Why might richer households earn higher returns?

The gradient is well documented, but what are the mechanisms?

Candidates:

- **Risk:** riskier portfolios earn higher expected returns.
- **Access:** reduced participation costs to high-yielding assets.
- **Skill/information:** some make better investment choices.
- **Entrepreneurship:** business can yield high returns.

Interpretation depends on modeling choices

Figure: Fagereng et al., 2020

- Fagereng et al. (2020) emphasize persistent heterogeneity in realized gains after controlling for risk, favoring skill/information
- Bach, Calvet, and Sodini (2020) uses risk modeling to argue that most of the gradient reflects *systemic* risk exposure ($\neq$ idiosyncratic)

Implications for inequality

For inequality dynamics

Faster wealth reproduction at the top accelerates wealth concentration.

- "*returns explain most of the historical increase in top wealth shares*" (Bach, Calvet, and Sodini, 2020)

For inequality measurement

- Wealth is often inferred by capitalizing income: $\widehat{W_i} = \frac{Y_i^K}{r}$.
- Return r is common within asset classes, so positive gradient overstates top wealth (Smith, Zidar, and Zwick, 2023).
- Yet, this do not eliminate the rise in US top wealth shares.

Pension funds and "augmented wealth"

Only privately owned pension funds are counted as private wealth in standard definitions. So depending on institutions, pension funds can be (*or not be*) part of the total

- Individual capitalization funds are tractable
- But entitlements in pay-as-you-go systems don't have a sock-counterpart
- This has distributional consequences and blurs comparisons

So should we include the capitalized present value of pension entitlements in household wealth?

Pension funds and rights matter quantitatively

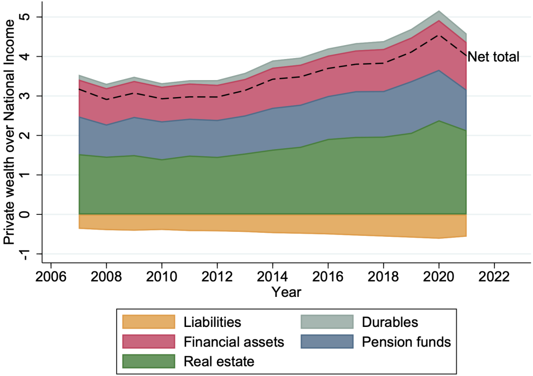
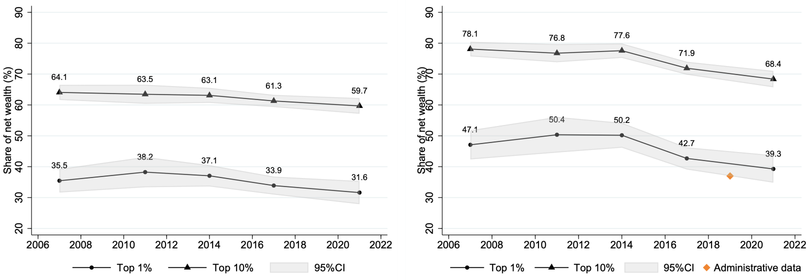


Figure: From Nofal, Flores, and Cubillos, 2026

- In Chile (fully privatized system), pension funds ≈ 1/4 of national assets, nearly as much as other financial assets.

Wealth inequality with and without pensions



(a) Including pension funds (b) Excluding pension funds

Figure: Nofal, Flores, and Cubillos, 2026 (Chilean data)

- Including pensions funds from top means a difference in the top 10% wealth share of 18 points in the latest year

Distributional consequences of augmented wealth

- Pension wealth is usually more equally distributed than marketable wealth, reducing measured wealth inequality.
- Augmented wealth adjustments –including health and pension– typically lower measured inequality (Feldstein, 1976; Wolff, 1996; Davies and Shorrocks, 2000)

Change in wealth Gini (2013)

Country	Net wealth	Augmented wealth	Difference
United States	0.892	0.701	-0.191
Germany	0.765	0.511	-0.254

Source: Bönke et al., 2020, augmented wealth includes the present value of pension entitlements in this case

Augmented measurement challenges

Estimating the present value of future benefits requires assumptions about:

- retirement age;
- survival probabilities (mortality heterogeneity);
- real discount rates (very sensitive);
- future earnings and contribution histories;
- pension rules;

Also, should we count entitlements accumulated so far, or expected entitlements too?

Consequences for inequality

For inequality measurement

- Institutional choices matter for measurement
- Conceptual distinctions are not always sharp
- International comparisons must be done with attention to detail
- Pension systems are generally great equalizers

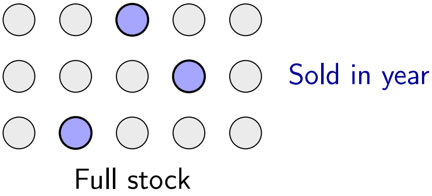
For conceptual debates

-

Non-financial assets

The problem of stock valuation at market prices

- We want to **value the entire stock of assets** (e.g. housing, unlisted firms).
- But market prices are only directly observed when assets are sold.
- In any period, **sales are only a fraction** of the universe.
- Moreover, sales are not representative of the full stock.



Hedonic pricing as the bridge

- Goods are bundles of characteristics. For housing, for example:

$$z_i = (\text{size}_i, \text{location}_i, \text{amenities}_i, \ldots)$$

- The market maps each bundle of characteristics into a price:

$$p_i = p(z_i)$$

- So the price is not only the price of the house as a unit; it embeds the market valuation of its attributes (Rosen, 1974)

Implicit prices and the hedonic gradient

- The marginal implicit price of characteristic z_k is the derivative of the hedonic price function:

$$p_k(z) = \frac{\partial p(z)}{\partial z_k}$$

  which is the market price of a marginal increase in characteristic k, holding other characteristics fixed.
- The hedonic function is an **equilibrium price schedule**.
- The slope of the hedonic price function equals the marginal willingness to pay of the marginal household (Rosen, 1974).
- So the hedonic price function is not simply a statistical association. It aims to measure the observed equilibrium.

Empirical implementation

- A typical empirical hedonic specification is:

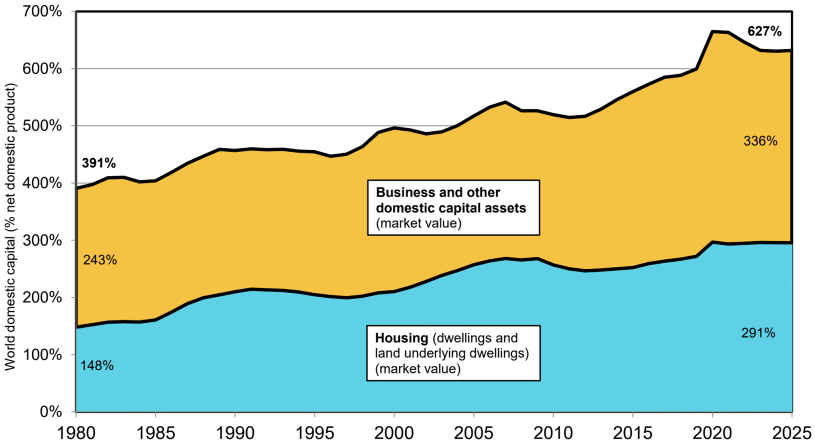
  $$\log p_i = \alpha + \beta_1 \log(\text{size}_i) + \beta_2 \text{pollution}_i + \beta_3 \text{distance}_i + X_i' \gamma + \varepsilon_i$$

- X_i includes other housing, and location controls, for example:

  $$X_i = (\text{rooms}_i, \text{age}_i, \text{floor}_i, \text{school quality}_i, \text{municipality}, \text{year})$$

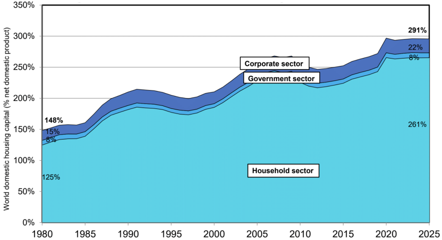
- Implementation decisions matter: functional form, controls, interactions, fixed effects, and omitted variables

The world capital stock 1980-2025

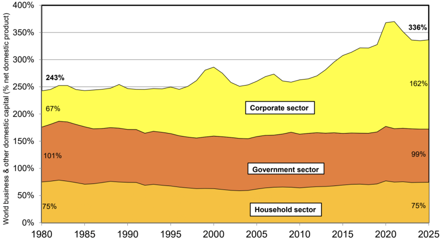


- Despite measurement challenges and assumptions, the global wealth to income ratio seems to rise remarkably between 1980-2025, from 391% to 627% (Bauluz et al., 2025).

Both housing and business assets increased



(a) Domestic housing capital



(b) Business and other domestic

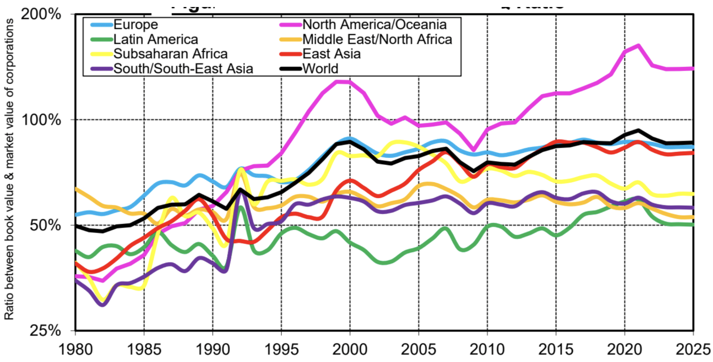
- Both asset types contributed to the increase (Bauluz et al., 2025). But can we disentangle saving-led accumulation from price effects at this level?

Savings vs. price effects in Bauluz et al., 2025

- Accumulated wealth grew faster (4%) than income flows (2.8%)
- From an accounting perspective, savings could only explain up to 2.1% of that growth
- The rest (1.9%) must come from variations in prices

Roughly, the trend is half savings, half asset-price revaluation.

The evolution of business assets

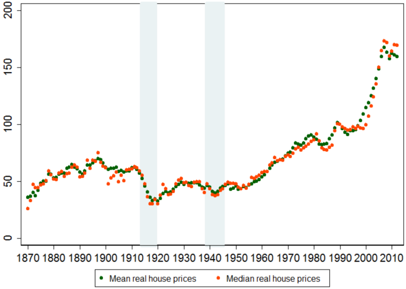


- A large revaluation of business assets is measured by Tobin's Q (market / book-value of firms) in most regions.

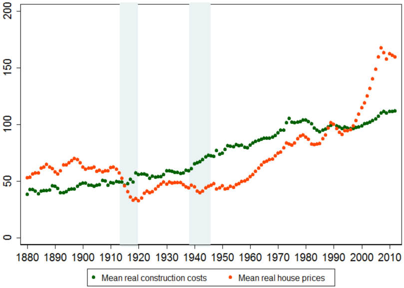
Housing is an important part of the story

- Housing capital: 148% $\rightarrow$ 291% of world NDP (Bauluz et al., 2025)
- The housing share of domestic capital also rose: 38% $\rightarrow$ 46%
- Other studies confirm this trend over an even longer period (Knoll, Schularick, and Steger, 2017)
- The key driver seems to be the value of land: scarcity, location, amenities, and urban demand.

A focus on housing: rising land prices



(a) Mean and median house prices



(b) Costs vs house prices

- Knoll, Schularick, and Steger, 2017 show that construction costs cannot explain the historical rise of housing prices, pointing to an increase in the value of underlying land. Source: Data is aggregated for 14 countries. Index base 100 in 1990. WW1 and WW2 are shaded.

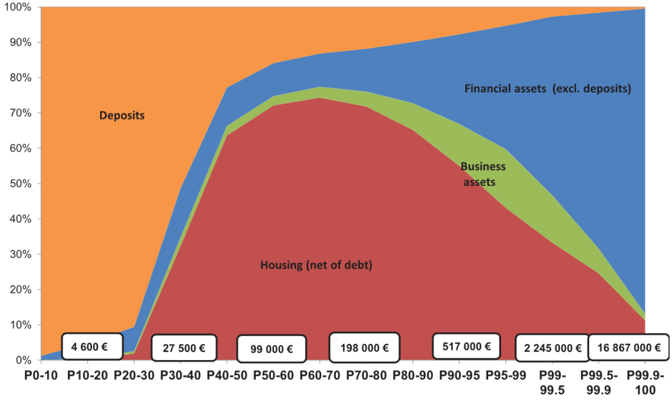
Consequences for inequality: are housing assets equalizing?

- Housing is the single largest component of household wealth in most OECD countries (Causa, Woloszko, and Leite, 2019)
- The middle class holds a disproportionate share of its wealth in owner-occupied housing

Distributional implication:

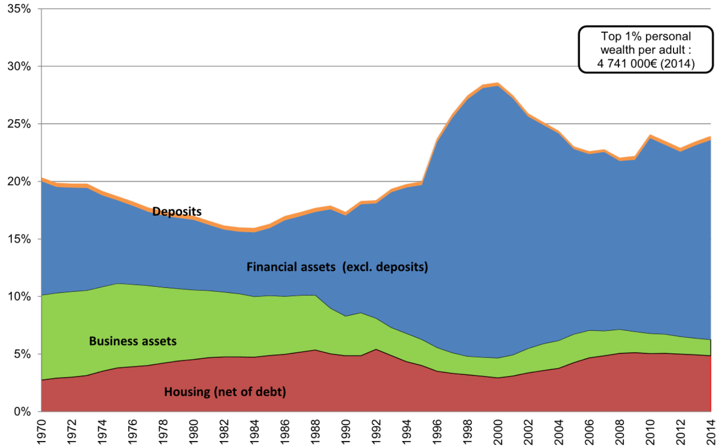
- High homeownership $\rightarrow$ tends to compress wealth inequality.
- Rising house prices with limited access $\rightarrow$ amplifies inequality between owners and non-owners.

Wealth types by percentile: France



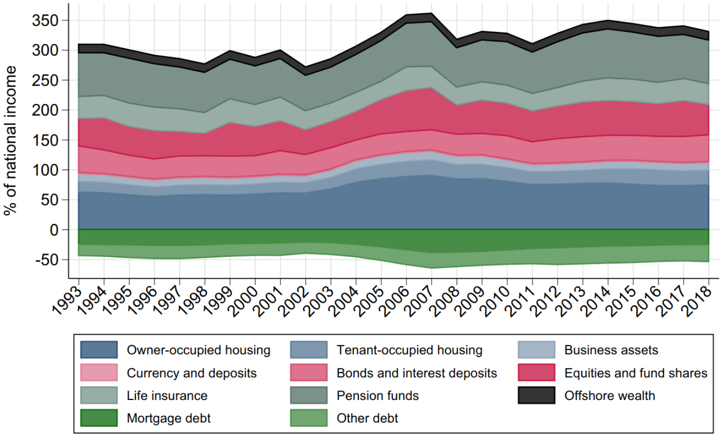
- **Notes.** Large heterogeneity in composition across the wealth distribution. Lower ranking households mostly keep wealth as cash and bank deposits. The middle classes mainly hold wealth through housing assets, while richer households mainly hold financial assets. Source: Garbinti, Goupille-Lebret, and Piketty, 2021

Top 1% composition across time: France



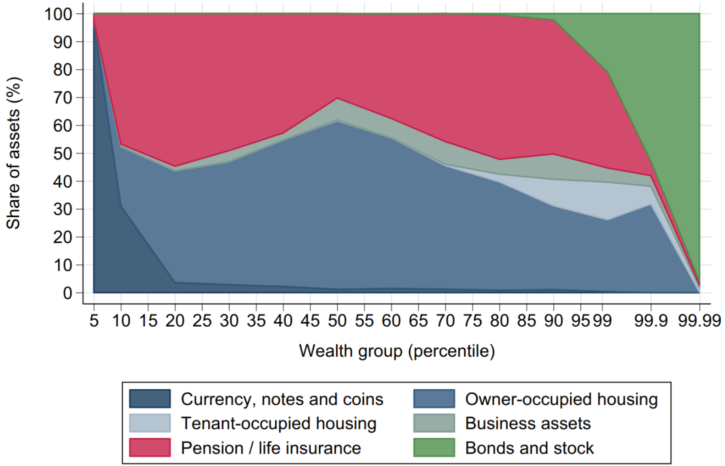
- **Notes.** The composition of wealth within the top 1% varies, especially since the 1990s, financial assets are now largely the dominant asset-type. Source: Garbinti, Goupille-Lebret, and Piketty, 2021

Wealth composition in South Africa



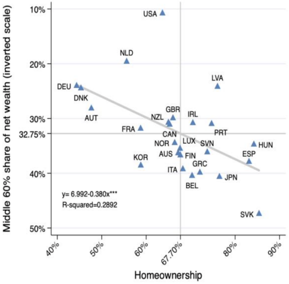
- **Notes.** Similar patterns are observed in –the few– developing countries with data, yet for shorter time-spans. Source: Chatterjee, Czajka, and Gethin, 2022

Similar patterns across countries: South Africa

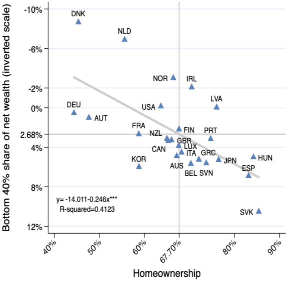


- **Notes.** Similar to France, both ends of the distribution hold diametrically different forms of wealth. In countries with more privatized pension systems, pension funds are also an important part of the wealth of the middle class. Source: Chatterjee, Czajka, and Gethin, 2022

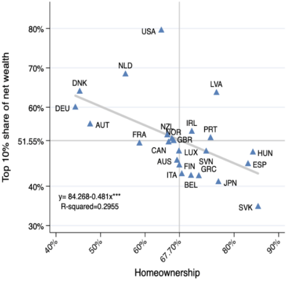
Home-ownership % tends to lower wealth inequality



(a) Middle 60%



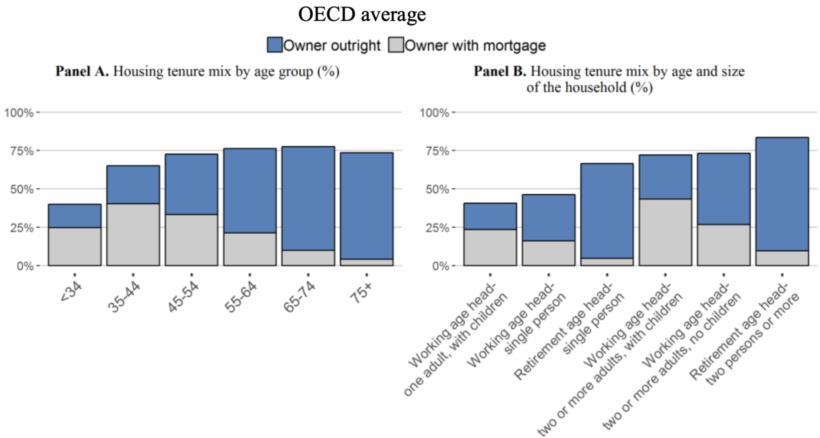
(b) Bottom 40%



(c) Top 10%

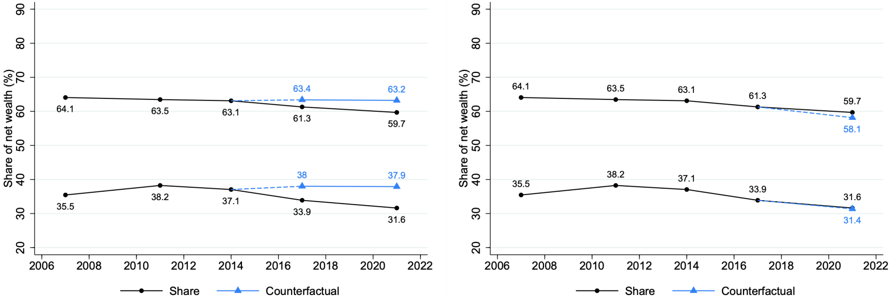
- Using the OECD Wealth Distribution Database, Causa, Woloszko, and Leite, 2019 Find a cross-country (-) correlation between top 10% shares and homeownership, and a (+) correlation with middle and bottom shares (inverted y-axis in figures).

Household characteristics and household tenure



- The same source finds that ownership follows a clear demographic profiling.

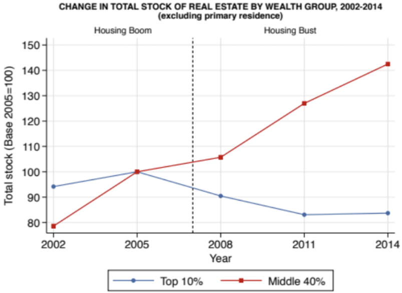
The equalizing effect of housing in Chile



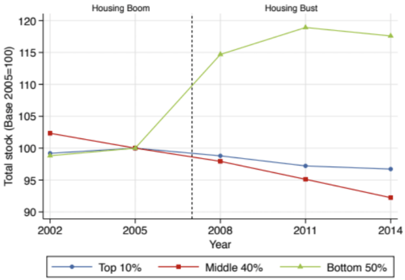
(a) Only real estate (b) Only pension funds

- The housing VAT introduced in 2016, provoked a soaring increase in housing prices. The counterfactual analysis suggests that top shares would have remained stable or even increased without it. (see Nofal, Flores, and Cubillos, 2026)

Housing bursts are also redistributive



(a) Change in total housing stock (excl. 1ry residence)



(b) Change in stock of owner occupied residences

- Martínez-Toledano, 2020 Finds evidence of portfolio reshuffling with housing booms and bursts (Spain). The richer dis-save renal investmnts, while the bottom 50% can benefit from lower prices in access.

Housing booms: equalization and exclusion

Equalizing channel

- Middle-class holds housing.
- Mortgage leverages gains.
- Prices raise net worth.

Exclusion channel

- Prices raise entry costs.
- Down-payment constraints.
- Renters/young fall behind.

Housing is a democratic asset only for who can enter the market.

From wealth inequality to ownership inequality

A central divide is increasingly:

- owners versus renters
- older owners versus younger entrants
- high-demand locations versus peripheral

Homeownership rates determine which force dominates through:

- Credit access
- Housing supply
- Taxation (on property, capital gains, inheritance)

A flavor of current research

A defining feature of economic development

Economic growth has paired with the *consolidation of agricultural production* worldwide

- Productivity gains have met the demands of a fastly growing population over the XXth century (Borlaug, 2007)
- But productivity has stagnated at the frontier for decades
- The same production model has come a great ecological expense and now faces climate change first in line (Ortiz-Bobea et al., 2021)

We ask: Does the same model that boosted agricultural productivity come with a hidden cost? Does it also increase vulnerability to heat-shocks?

Mostly uncharted territory

Little evidence connecting agricultural inequality to productivity:

- Negative relation at the international cross-sectional level (Vollrath, 2007)

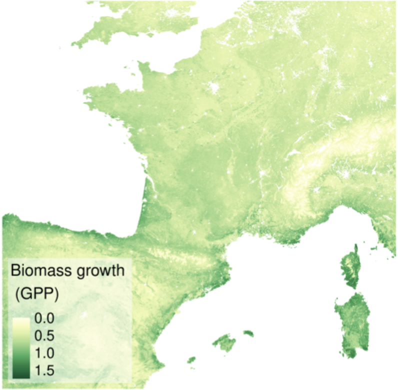
The climate-adaptation literature:

- Part of the literature focuses of quantifying the damage of climate change, and agriculture is expected to suffer great losses (Bilal and Känzig, 2024)
- 20% of damages have been avoided by crop-level technological adaptation since 1960 in the US (Moscona and Sastry, 2023; Moscona and Sastry, 2025)

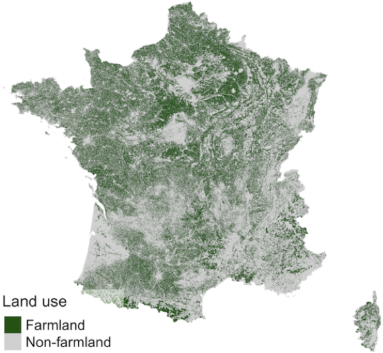
Many studies analyze productivity levels, but less so their variance

- The century-old puzzle of the inverse relation between farm size and productivity is related but inconclusive
- With increasing farm size labor and land productivity go in opposite directions (Foster and Rosenzweig, 2022)

France as unique data opportunity



(a) Yearly land productivity, 2021



(b) Exhaustive farm information

- We combine satellite spectrometry for productivity with within plot-level cadastral data

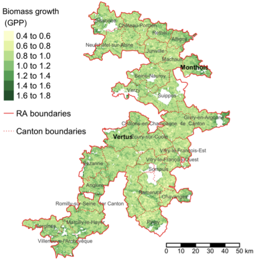
GPP: a biologically-grounded measure of productivity

Gross Primary Productivity (GPP)

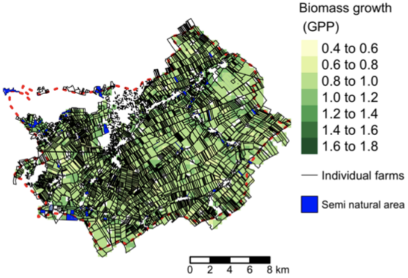
- Captures the biological base of agricultural production rather than revenue or profit.
- Measures the growth of biomass every 8-days in C.kg /m2
- Based on fluorescence from photosynthesis
- Resolution: 0.5km pixels
- Credits to Running and Zhao (2019)

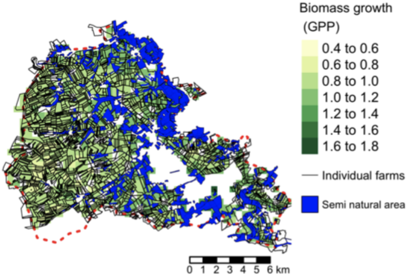
Data snapshots

(a) Champagne-Crayeuse (Agricultural region)

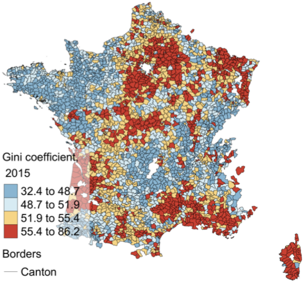


(b) Yearly production in 31 cantons

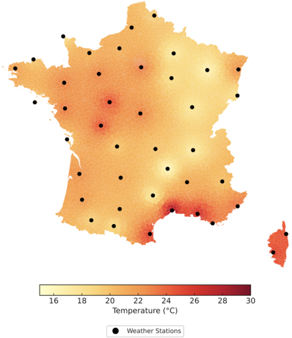




Building the panel



(c) Land Gini coefficient



(d) Midsummer temperatures, 2021 (ºC)

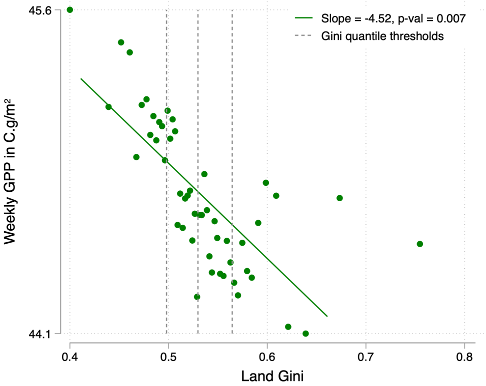
- The full panel is comprised of 2,485 cantons observed over seven years with each year nesting 45 quasi-weeks. They are nested in $\approx$ 400 agricultural regions
- Temperatures are observed several times a day, but exposure is summarized at the weekly level

Two margins of agricultural production

Total output combines two margins:

- Inequality is associated with lower intensive margins but larger cropped areas
- The net effect on totals can be positive even as per-hectare crop performance declines.

More unequal farmland has lower GPP per hectare



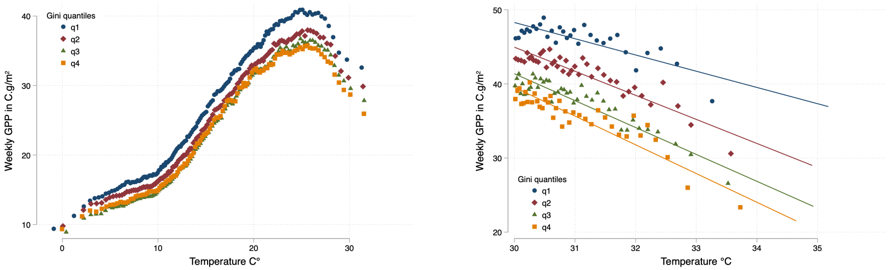
- At the intensive margin, higher land inequality is associated with lower crop biomass production per square meter during the main growing season.

Different plants have different needs

Crop	Max. temp (ºC)	Land share	Cumulative	Reference
Winter wheat	32	34.5	34.5	Gammans et al. (2017)
Corn/Maize	32	17.4	51.9	Hawkins et al. (2013)
Winter barley	33	7.4	59.3	Gammans et al. (2017)
Rapeseed	27	6.1	65.4	Pollowick and Sawhney (1988)
Sunflower	35	4.3	69.8	Rondanini et al. (2003)
Grapevine	30	3.6	73.3	Imputed
Spring barley	32	3.3	76.6	Gammans et al. (2017)
Alfalfa	30	2.8	79.5	Murata et al. (1965)
Beetroot	30	2.6	82.1	Imputed
Potato	30	1.1	83.2	Imputed
Soybean	30	1.0	84.1	Schlenker and Roberts (2009)
Spring wheat	33	0.2	84.3	Gammans et al. (2017)
Other (<1%)	30	15.6	100.0	Imputed

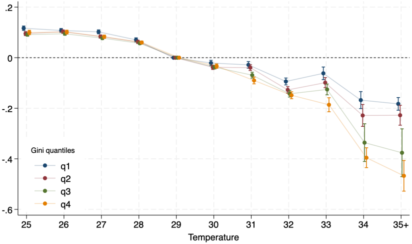
Notes. Compiled by the authors based on Cadastral data and references.

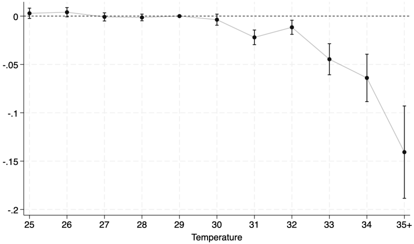
Inequality matters most in the tail



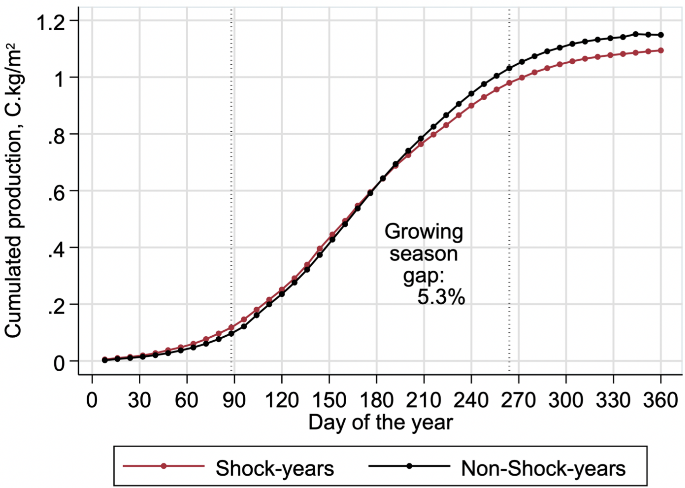
- Across ordinary temperatures, the gradient is modest; above roughly 30°C, high-Gini places exhibit steeper biological losses.

Heat losses are larger where land is concentrated





The average heatshock



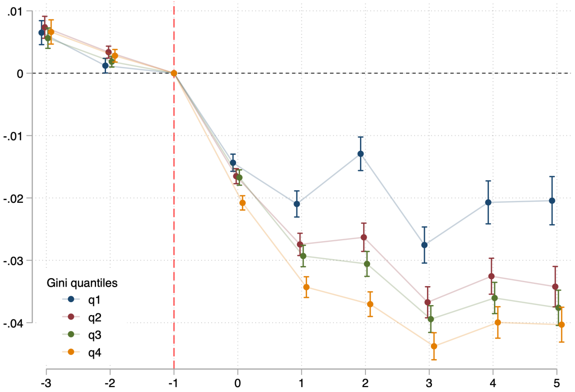
TWFE Regression results

Table 4: Generalized heat shock TWFE impact estimates

Dep. Variable: logGPP	(1)	(2)	(3)	No post-shock weeks (4)	Absorbing shock (5)
Panel (a): ATE and linear Gini					
Shock	-0.196***	-0.183***	-0.187***	-0.184***	-0.088***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Shock x Ginist	-0.021***	-0.018***	-0.019***	-0.030***	-0.015***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.002)
Panel (b): ATE by Gini quantile					
q1	-0.167***	-0.164***	-0.167***	-0.134***	-0.044***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.007)
q2	-0.188***	-0.180***	-0.182***	-0.182***	-0.092***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
q3	-0.199***	-0.181***	-0.186***	-0.189***	-0.102***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.004)
q4	-0.227***	-0.208***	-0.215***	-0.226***	-0.104***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.004)
p-val equal	0.0000	0.0000	0.0000	0.0000	0.0000
R-sq.	0.723	0.812	0.825	0.819	0.824
N	355024	355024	355024	330067	355024
Canton x Year FEs	✓	✓	✓	✓	✓
Gini x Week FEs	✓				
Gini x AR x Week FEs		✓			
Canton x Week FEs			✓	✓	✓

Notes. Estimated heat shock effects and inequality heterogeneity by log of land Gini (a) and by quantile of the land Gini (b) from baseline models B.4 and B.5, respectively. (1-3) include all weeks in prime season in which shock indicator can turn on and off. (4) drops shocked cantons post initial shock week. (5) Absorbing shock. Standard errors are clustered at the canton. * $p < .1$, ** $p < .05$, *** $p < .01$.

Losses accumulate into persistent production losses



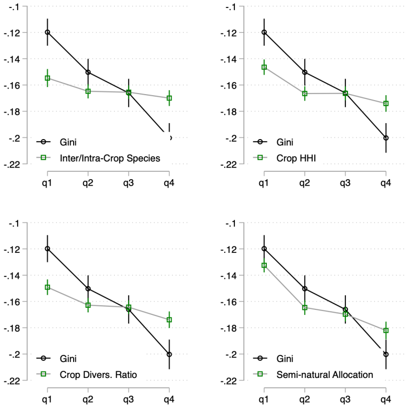
- Cumulative GPP effects map onto year-end agricultural yield outcomes.

Land-use decisions as mechanisms

Leading candidates:

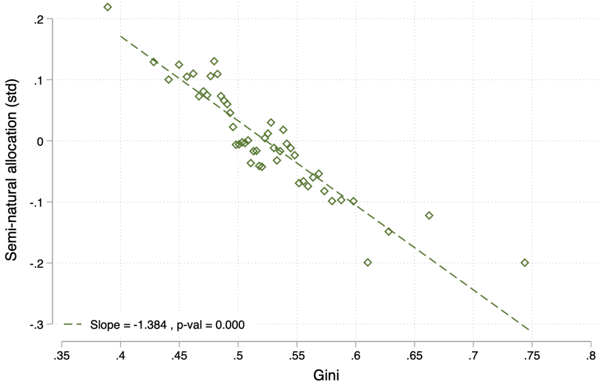
- Crop diversification strategies (Abson et al., 2013; Renard and Tilman, 2019)
- Seminatural ecosystem integration within farmland (Altieri et al., 2015; Rolo et al., 2023; Burgess et al., 2022).

Testing potential predictors



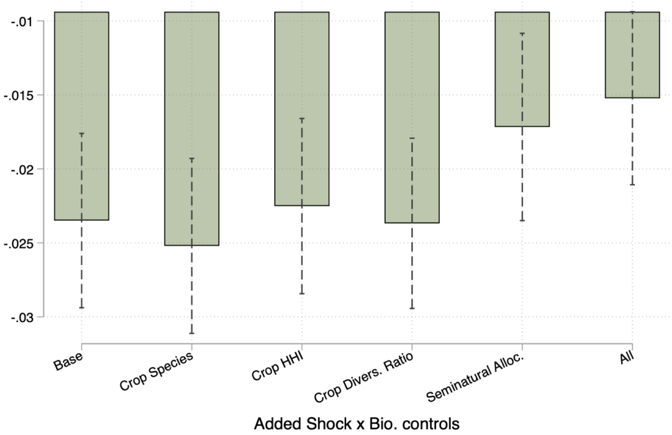
- Crop diversification matters less for the inequality gradient than protective seminatural ecosystems embedded in agricultural landscapes.

Tight correlation with ecological buffers



- High-Gini places allocate less to seminatural area.
- Crop diversification matters less for the inequality gradient than protective seminatural ecosystems embedded in agricultural landscapes.

Controlling for bio-moderators



Comparing with actual aggregate yields

	Yearly log(Crop Yield (C.t/ha.))						log(Cum. GPP (C.t/ha.))		
	Department-level ATE			Dosage ATE per nested canton			Week 6 of exposure Het. Rob. ATE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shock	-0.0637***	-0.0519***	-0.0523***	-0.0121***	-0.0124***	-0.0126***	-0.0350***	-0.0350***	-0.0351***
	[0.0076]	[0.0065]	[0.0065]	[0.0016]	[0.0017]	[0.0015]	(0.0008)	(0.0008)	(0.0008)
Shock x Ginist	-0.0162***		-0.0142***	-0.0018**		-0.0012*	-0.0042***		-0.0030***
	[0.0060]		[0.0050]	[0.0009]		[0.0006]	(0.0008)		(0.0009)
Shock x Seminaturalst		0.0347***	0.0333***		0.0044***	0.0041***		0.0032***	0.0018**
		[0.0079]	[0.0084]		[0.0015]	[0.0016]		(0.0007)	(0.0008)
N	22183	22183	22183	22183	22183	22183	355024	355024	355024
Canton FEs	✓	✓	✓	✓	✓	✓			
Year FEs	✓	✓	✓	✓	✓	✓			

Notes. (1-3) Crop yields correspond to marketable food crops transformed as the log of metric tons per hectare for each French *département* for years 2015-2021 by the French Agricultural Ministry. (4-6) Yield canton dosage effects per *département* by scaling (1-3) by the proportion of shocked cantons for each year. (7-9) Dynamic heterogeneity robust event study estimates on (log) cumulative GPP at treatment week six (w+5) using our preferred specification (model 3 of Table 5. Model (7) estimates correspond to the last bars in Figure 7b. Standard errors in brackets indicate clustering at the *département* while those in parentheses indicate clustering at the canton. * $p < .1$, ** $p < .05$, *** $p < .01$..

Modeling our findings

In the paper, we write a simple production technology showing:

- Scale economies raise the opportunity cost of maintaining non-yield-producing ecological buffers.
- The result is systematic under-provision of ecological protection in high-inequality landscapes.
- Uniform per-hectare subsidies are not equally effective across landscapes (Protection among small and mid-sized farms, but may fail among large farms)

Concluding remarks

Global income and wealth

- Are extremely concentrated and connected through foreign investment
- Recent literature has improved our understanding of historical processes but warrants better data and measurement
- Macroeconomic consistency is key to base discussions in growth distribution into solid empirical ground