

Quantitative Macroeconomics

Motivation: Household Heterogeneity

Tomás R. Martinez

UnB

Motivation

Why should we model household heterogeneity:

- (i) Because that is the way the world is. ×
- (ii) Because it matters for policy. ✓
- (iii) Because it matters for the aggregate macroeconomic variables. ✓

Inequality: Earnings, Income and Wealth

Concentration and skewness of the distributions

	Earnings	Income	Wealth
Coefficient of variation	3.69	4.19	6.81
Variance of logs	1.50	0.99	4.80
Gini indexes	0.67	0.58	0.85
Location of mean	70	74	83
99–50 ratio	17.46	14.78	96.81
90–50 ratio	4.15	3.33	11.56
Mean-to-median ratio	1.96	1.85	6.49
50–30 ratio	3.21	1.64	5.50

United States, 2013 (Survey of Consumer Finances). **Source:** Kuhn and Ríos-Rull (2016).

Inequality: Earnings, Income and Wealth

United States, 2013 (Survey of Consumer Finances).

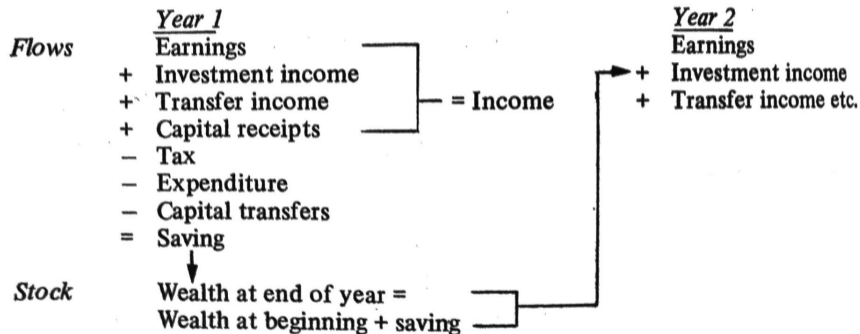
Quantiles of the 2013 earnings, income, and wealth distributions

	0	1	5	10	20	40	50	60	80	90	95	99	100
Earnings	-962.1	0	0	0	0	21.3	32.6	46.7	89.3	134.9	194.2	568.3	137,458.4
Income	-247.5	4.3	10.1	13.5	20.3	36.5	46.7	59.9	102.0	155.2	232.3	689.9	156,126.2
Wealth	-227,019.0	-78.9	-18.5	-2.0	4.3	38.2	81.4	147.6	427.8	941.0	1,871.6	7,880.4	1,324,417.5

Note: Values are 2013 thousands of dollars.

Source: Kuhn and Ríos-Rull (2016).

Budget Constraint



Source: Atkinson (1975, *The Economics of Inequality*).

US: Earnings Inequality over Time

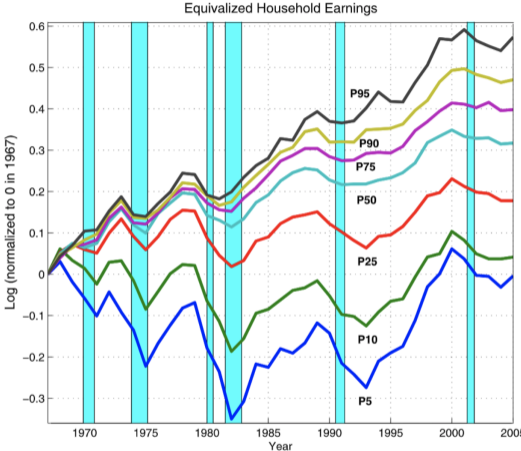
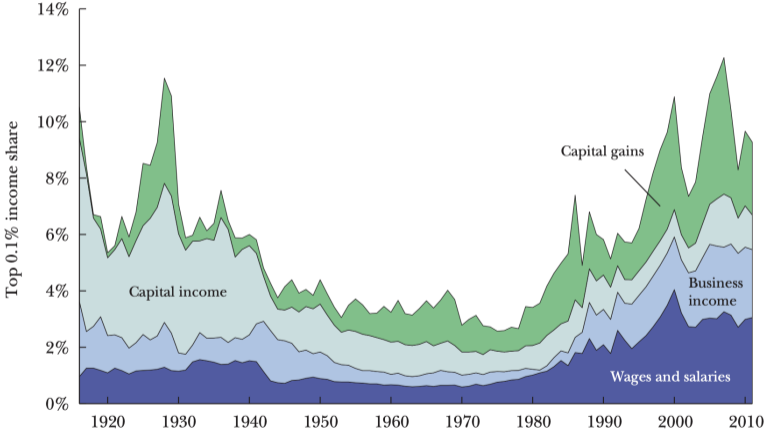


Fig. 9. Percentiles of the household earnings distribution (CPS). Shaded areas are NBER recessions.

Source: Heathcote, Perri and Violante (2010, RED).

US: Top 0.1%

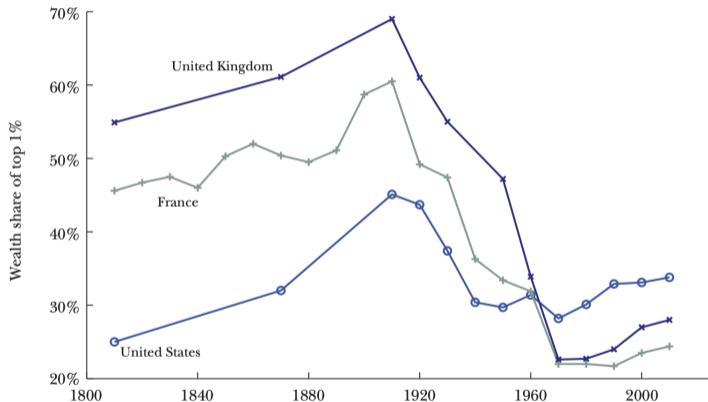
The Top 0.1 Percent Income Share and Its Composition, 1916–2011



Source: Jones (2015, JEP).

Wealth: Top 1%

Wealth Shares of the Top 1% in Three Countries, 1800 to 2010



Source: Supplementary Table S10.1 for chapter 10 of Piketty (2014), available at: <http://piketty.pse.ens.fr/capital21c>.

Source: Jones (2015, JEP).

Opening the Household Portfolio

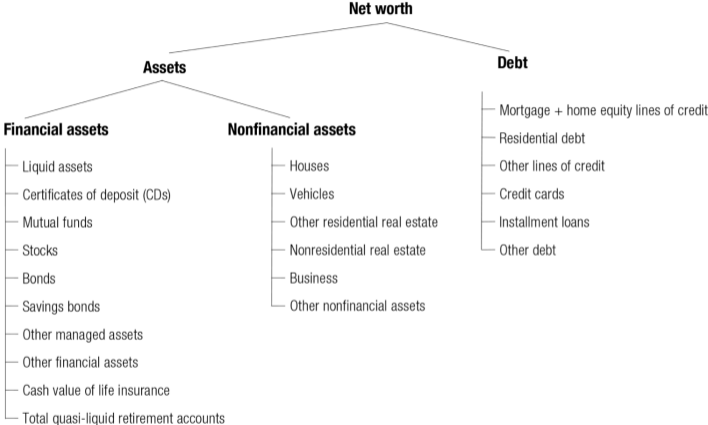
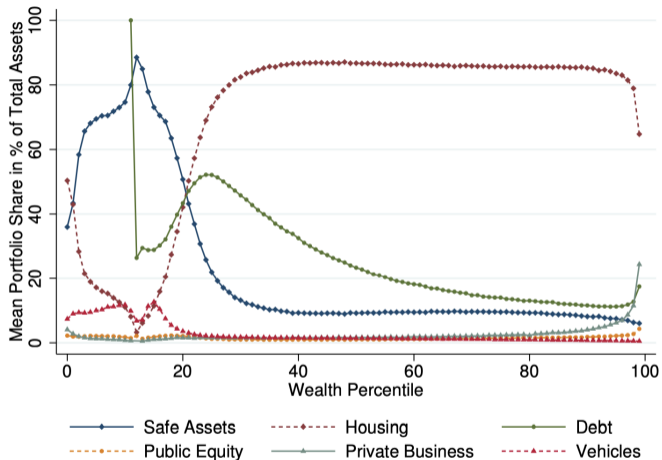


Figure 7. **SCF household portfolio.**

Source: Kuhn and Ríos-Rull (2016).

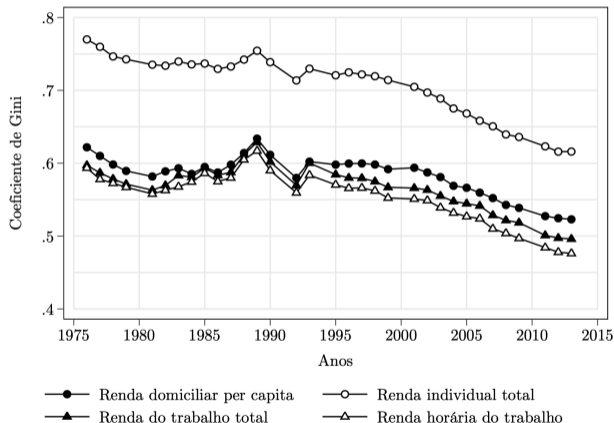
Norway: Portfolio Shares



Notes: 15th pctlile = 0 net worth. Safe assets = deposits + bonds + informal loans. **Source:** Fagereng et al (2021).

Brazil: Earnings Inequality Over Time

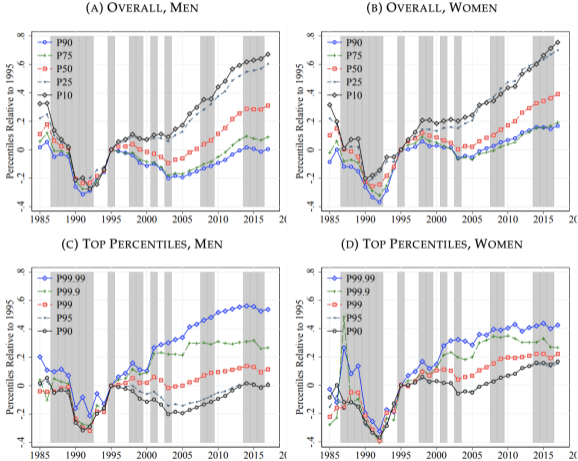
Figura 8. Coeficientes de Gini para a renda domiciliar *per capita*, renda individual total, renda total do trabalho e renda horária do trabalho principal – Brasil, 1976–2013



Notes: PNAD. **Source:** Pedro de Souza (2016, Tese de Doutorado UnB).

Brazil: Formal Earnings Inequality Over Time

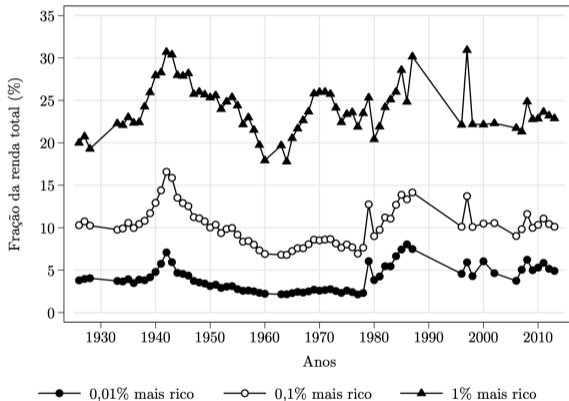
FIGURE 2. EVOLUTION OF EARNINGS PERCENTILES, BY GENDER



Note: Workers aged 25–55. Percentiles of the distribution of log real annual earnings, normalized to 1995. Source: RAIS 1985–2017.

Brazil: Earnings Inequality Over Time

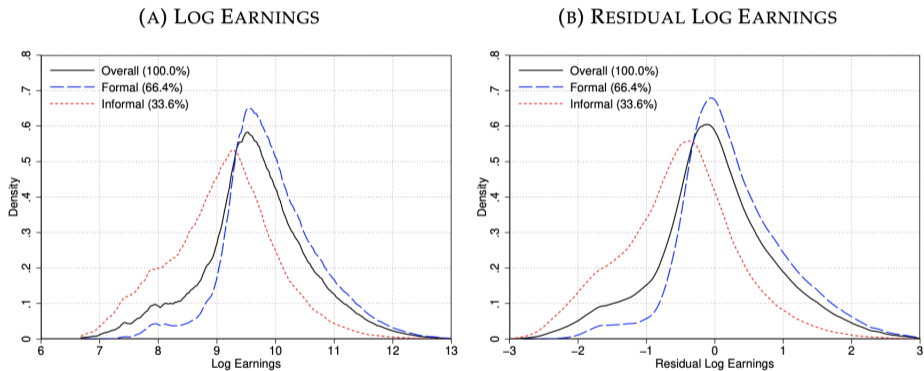
Figura 30. Fração da renda recebida pelos 0,01%, 0,1% e 1% mais ricos – Brasil, 1926–2013 (%)



Fonte: elaboração própria a partir de tabulações de dados tributários e das Contas Nacionais; ver capítulo 4.

Brazil: Formal and Informal Earnings

FIGURE 14. DENSITIES OF (RESIDUAL) LOG EARNINGS, BY SECTOR

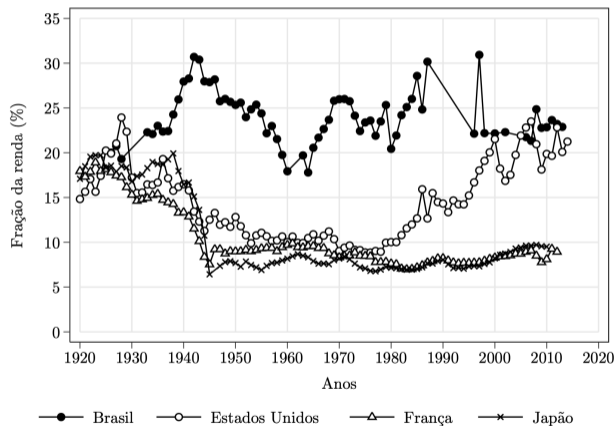


Note: Workers aged 25–55. Kernel densities of log earnings (Panel A) and residual log earnings (Panel B) in each sector. Residual log earnings are calculated controlling for age and survey wave fixed effects, separately by gender and year. Formal sector includes all employees with a work permit. Informal sector includes all employees without a work permit and the self-employed. *Source:* PME, 2002–2015.

Source: Engbom et al (2021).

Cross-Country Comparison

Figura 44. Fração recebida pelo 1% mais rico no Brasil e em países desenvolvidos selecionados, 1920–2013



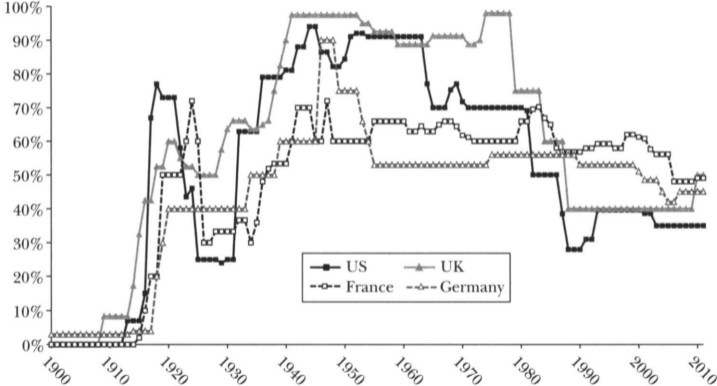
Source: Pedro de Souza (2016, Tese de Doutorado UnB).

Should we do something?

- Redistributive policies have strong welfare effects for the poor.
- What are the trade-offs? Do transfers induce behavioral responses?
 - ▶ Do people stop working? Do they adjust their savings?
- How should we finance them?
 - ▶ Consumption tax? Income tax? Wealth tax? What is the optimal level of progressivity?

Policy: Top Taxes

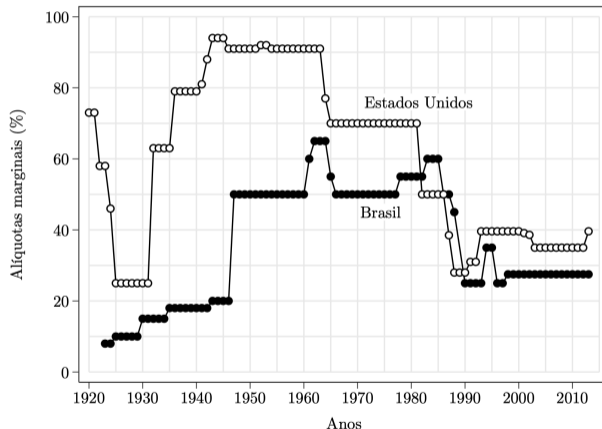
Figure 3
Top Marginal Income Tax Rates, 1900–2011



Source: Alvaredo et al (2013, JEP).

Policy: Top Taxes

Figura 16. Alíquotas marginais máximas do IRPF no Brasil e nos Estados Unidos, 1920–2013



Source: Pedro de Souza (2016, Tese de Doutorado UnB).

Policy: Cash Transfers

(a) Number of PBF beneficiaries as a share of the population in 2008



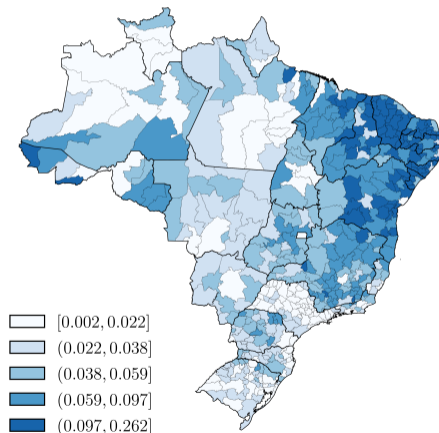
Source: Gerard, Naritomi and Silva (2021).

Policy: Minimum Wage

- **Gap:** measure of exposure to increases in MW in a region.

$$GAP_r = \frac{\sum_{i \in r} \max\{0, MW_{2010} - w_i^f\}}{\sum_{i \in r} w_i^f + \sum_{i \in r} w_i^i},$$

- ▶ w_i^f and w_i^i is the wage of formal and informall worker in 2000 in region r
 - ▶ MW_{2010} is the real minimum wage in 2010;
- **Source:** Own research.



Macro Aggregates

- Does inequality matter for the aggregate variables?
- **Benchmark:** Representative Agent or homothetic preferences with complete markets (such that Gorman's theorem holds).
- **Gorman's Aggregation Theorem:** Consider an economy with N goods with price vector p and H agents with wealth w^h . Suppose the preferences of h are represented by the indirect utility: $v^h(p, w^h) = a^h(p) + b(p)w^h$. Then, aggregate preferences can be represented by:

$$v(p, w) = a(p) + b(p)w$$

where $a(p) = \int_{h \in H} a^h(p) dh$ and $w = \int_{h \in H} w^h dh$.

Macro Aggregates

Gorman's Aggregation Theorem:

- **Intuition:** Linear relationship between demand and wealth. All agents have the **SAME** marginal propensity to consume;
- Rich is a just scaled version of the poor...
 - ▶ ...they spend the same share of their income in good c^1 , save the same share, etc.
- What matters is the **aggregate income**.
 - ▶ If we reallocate the wealth from the rich to the poor, aggregate demand does not change.
- Similar versions of the theorem also hold in dynamic models (consumption-savings problem, neoclassical growth, etc) as long there are homothetic preferences and complete markets.
 - ▶ See Rubinstein (1974), Chatterjee (1994), Caselli and Ventura (2000).

Macro Aggregates

- Does inequality matter for the aggregate variables?
- **Benchmark:** Representative Agent or homothetic preferences with complete markets (such that Gorman's theorem holds).
- ...No!
- Is this consistent with the reality? Take a look at the MPCs...

Heterogeneity in Marginal Propensity to Consume

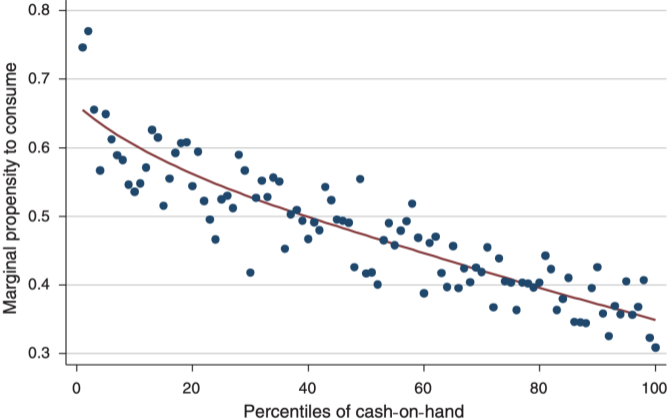


FIGURE 2. AVERAGE MPC BY CASH-ON-HAND PERCENTILES

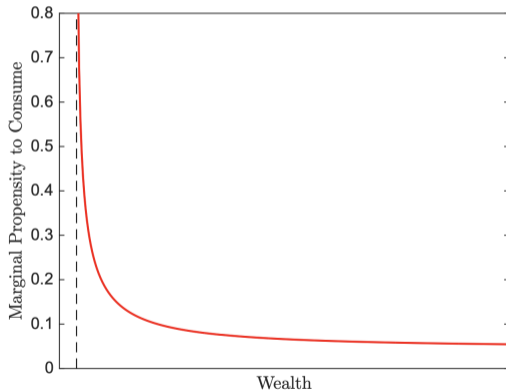
Source: Jappelli and Pistaferri (2014, AEJ:Macro).

Macro Aggregates

- Does inequality matter for the aggregate variables?
- **Early Models of Heterogeneous Agents:** small effects on consumption and savings.
 - ▶ “Quasi- Aggregation” \Rightarrow same behavior for the rich, middle class, and poor (scaled by income).
 - ▶ Only the very poor change their behavior, but they are very small to matter.
- Still, policies can have large effects on welfare (social security, progressive taxation, etc).
- Macro(-policies) affects inequality, but inequality has little effect on macro.

Heterogeneity in MPC

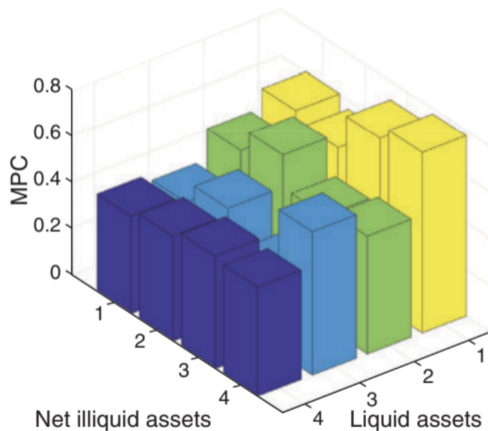
Figure: Heterogeneity in MPC in Early Heterogeneous Agents Model



Macro Aggregates

- Does inequality matter for the aggregate variables?
- **Modern Models:** Inequality matters.
 - ▶ Households hold different assets with different liquidity (housing, bonds, stocks) and different MPC.
- Strong feedback from the distribution of income and wealth to aggregate variables: “Macro \Leftrightarrow Inequality”.
- Policies affect that distribution **and** the distribution reinforces (or attenuate) the effect of the policy on the aggregates.

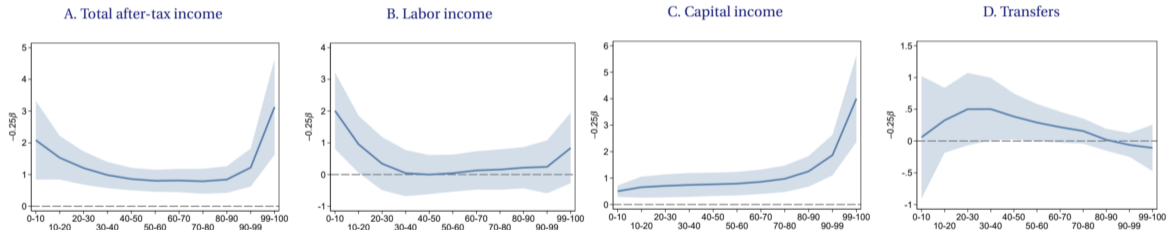
Heterogeneity in Marginal Propensity to Consume



Source: Fagereng, Holm and Natvik (2021, AEJ:Macro).

Heterogeneity in the Effects of Monetary Policy

Figure: The effects of a -25bp shock on total after-tax income across the income distribution (Sweden)



Source: Amberg et al (2022, AER: Insights). See also Almgren et al (2022, AEJ: Macro).

How we got here

- **Methodological and computational advances:** Solving these models is hard. Better computers help.
- **Better data:** distribution is important, high-quality micro data uncover new facts. credibility revolution on-going in applied micro.
- **Policy debate:** inequality is high and it is rising in many parts of the world. There is increasing interest from policymakers and economists in the topic.

History of Economic Thought

A little bit of the **History of Economic Thought** from this part of Macro:

- **Blog post by Beatrice Cherrier:** [here](#).
- **Paper by Beatrice Cherrier, Pedro Duarte, and Aurélien Saïdi:** [here](#).
- **Lecture notes by Ben Moll:** [here](#).