

Lecture 10

Revision Lecture & Overview of Macroeconomic Trends

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EC417

This term

Part I: Shocking theory of the business cycle

- Introduction to business cycles ✓
- Real Business Cycle (RBC) Model ✓
- New Keynesian DSGE Models ✓

Part II: Perspectives on business cycles and steady states

- Heterogeneity versus homogeneity and the effect of policy ✓
- Endogenous growth and persistent effects of recessions ✓
- Aggregate shocks? Firm-heterogeneity and the business cycle ✓

DSGE Paradigm

Key features:

1. **Representative** household makes optimal intertemporal decisions ✓
2. Business cycles are **transitory** deviations from the long-term trend ✓
3. Macroeconomic fluctuations are driven by **aggregate** shocks ✓
4. We study aggregate fluctuations through **shocks**

Today

- **Recent trends:** firm dynamics, market power, growth, interest rates
- Mainly ask questions, not give many answers ☺
- Different way of thinking about macro: **interesting steady states**
- Alternative way to model macro dynamics: **MIT shocks**

Today

- **Trends: firm dynamics, market power, growth, interest rates**
- Different way of thinking about macro: interesting steady states
- Alternative way to model macro dynamics: MIT shocks

Trends

Medium-term trends across advanced economies:

1. Slowdown of productivity growth
2. Decline in business dynamism
3. Decline in real interest rates
4. Rise of market power and firm concentration
5. Aging

Trends

Medium-term trends across advanced economies:

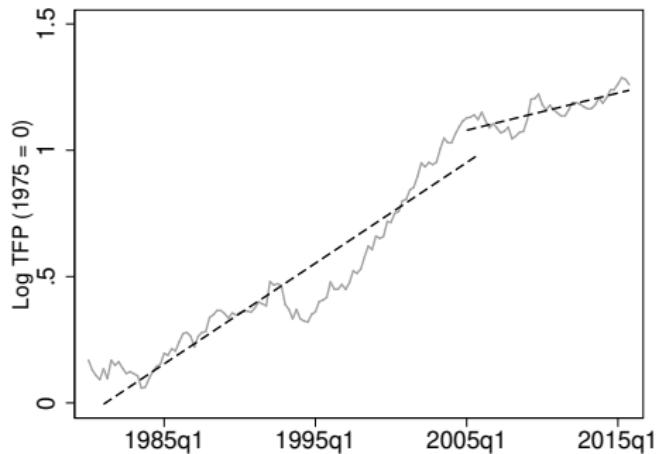
1. **Slowdown of productivity growth**
2. Decline in business dynamism
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Productivity

Final trend: a **slowdown of productivity growth**

- Productivity is the purified Solow residual (see next slide)
- Responsible for 80% of post-war growth in output per hour (U.S.)
- Across advanced economies, TFP growth slowed since mid 2000s

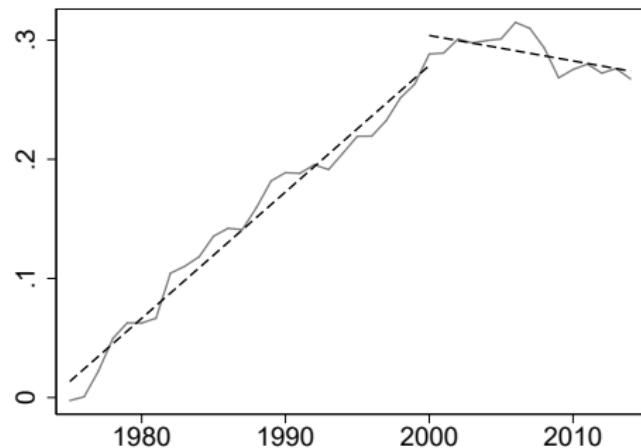
Productivity growth



Total Factor Productivity between 1975 and 2016.

Data: Fernald/FRSF

Productivity growth (France)

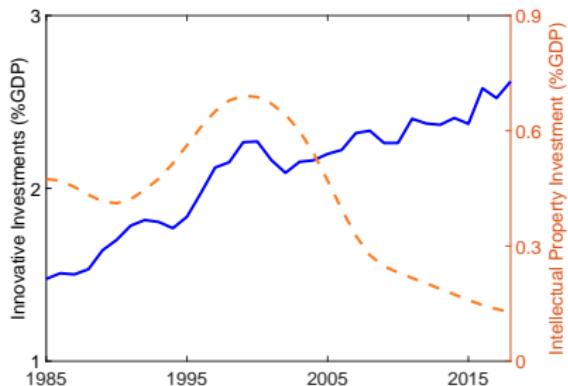


Total Factor Productivity between 1975 and 2016.

Data: Penn World Tables

Research and Development

- R&D intensity increased 62%.
- Ideas are getting harder to find (Bloom et al. 2017)



U.S. Investments in Intellectual Property excluding Software

Source: BEA, Fernald (FRBSF)

Longer Trend

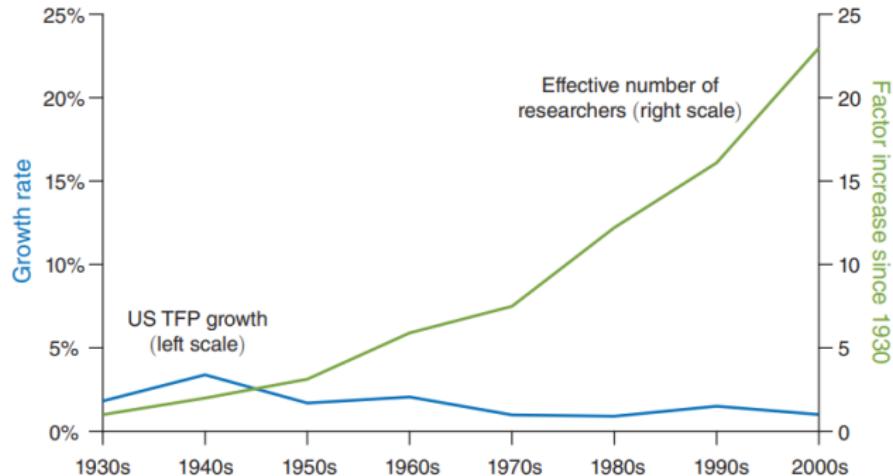
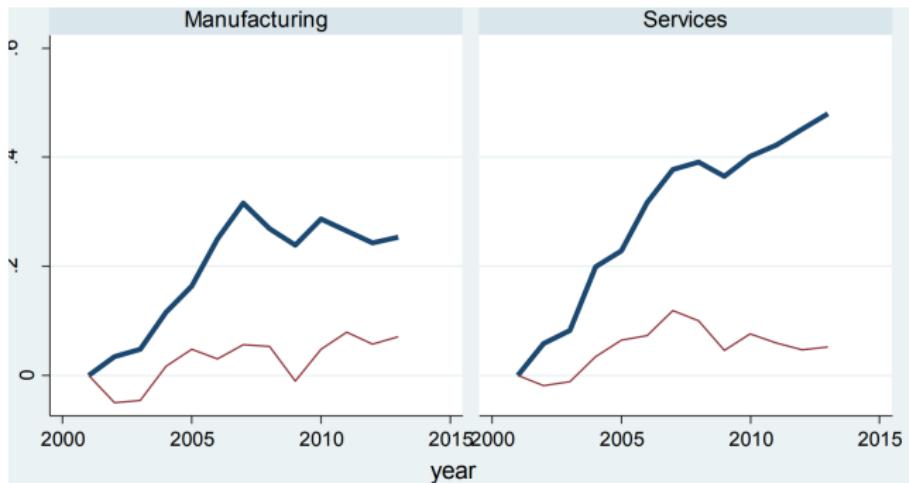


FIGURE 1. AGGREGATE DATA ON GROWTH AND RESEARCH EFFORT

TFP growth versus effective number of researchers – measured through IIP investment, indexed to 1 in 1930. Source: 'Are Ideas Getting Harder to Find', Bloom et al. (2019).

Best versus the rest



MFP Development at Leaders (blue) vs Laggards (red).

Source: Andrews et al. (2016) based on BvD ORBIS

Trends

Medium-term trends across advanced economies:

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Business dynamism

Businesses are not **static**: they grow, shrink, enter, exit

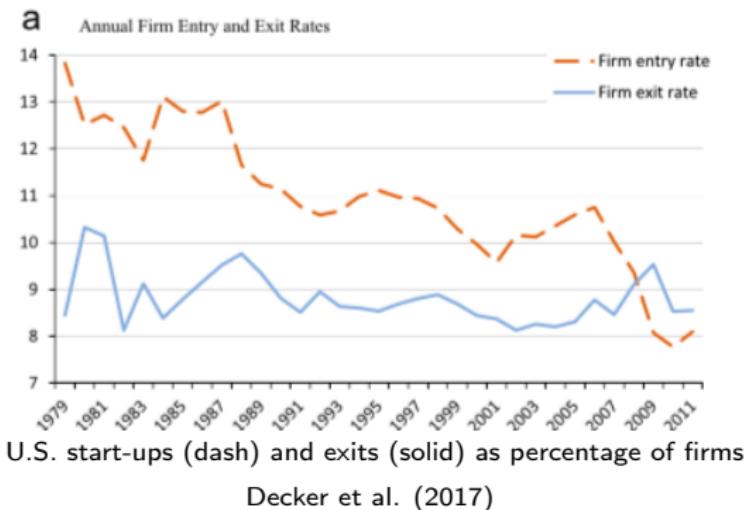
- That process is known as **business dynamism**
- Models of firm-heterogeneity typically have dynamism in steady state
- Last three decades: many countries have a **decline** in Dynamism

Measuring business dynamism

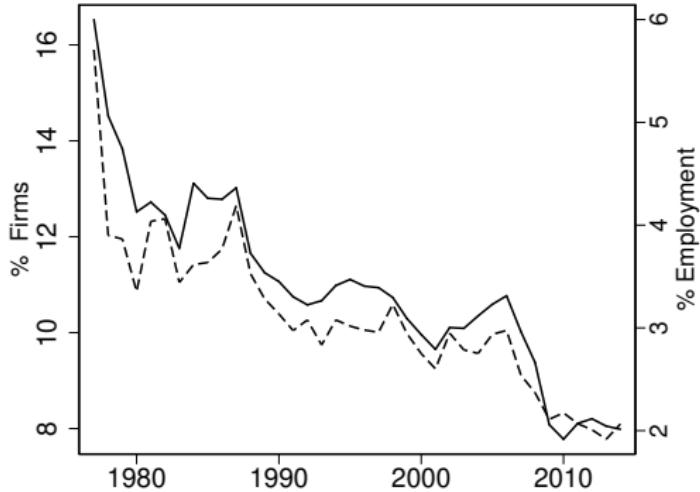
Common measures:

- Entry rate
 - Either measured through (%) of firms that's new, or
 - Percentage of employees working at new firms
- Reallocation of workers to different firms
- Distribution of growth rates across firms

Business dynamism: entry and exit



Business dynamism: % employment versus % firms

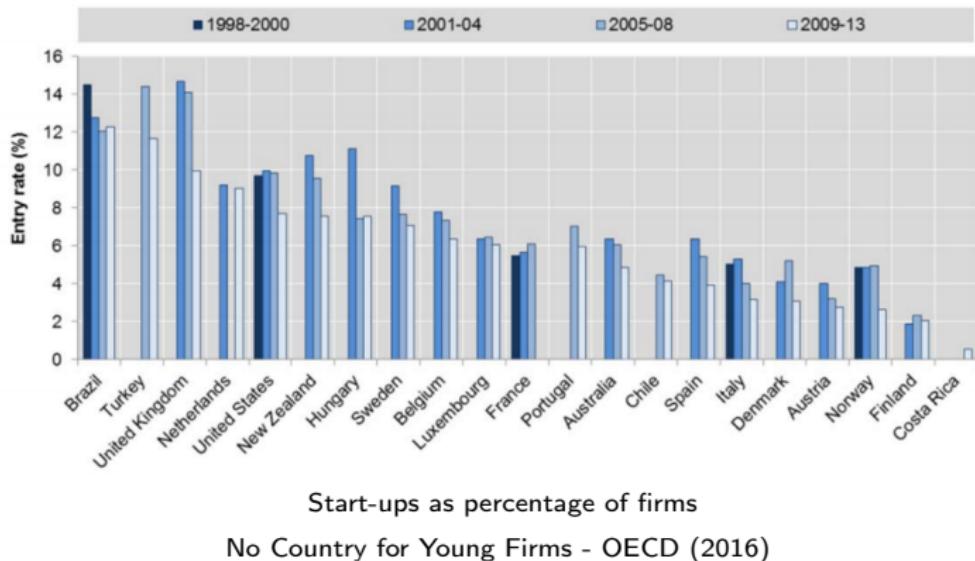


Start-ups as percentage of firms (solid) and employment (dash)

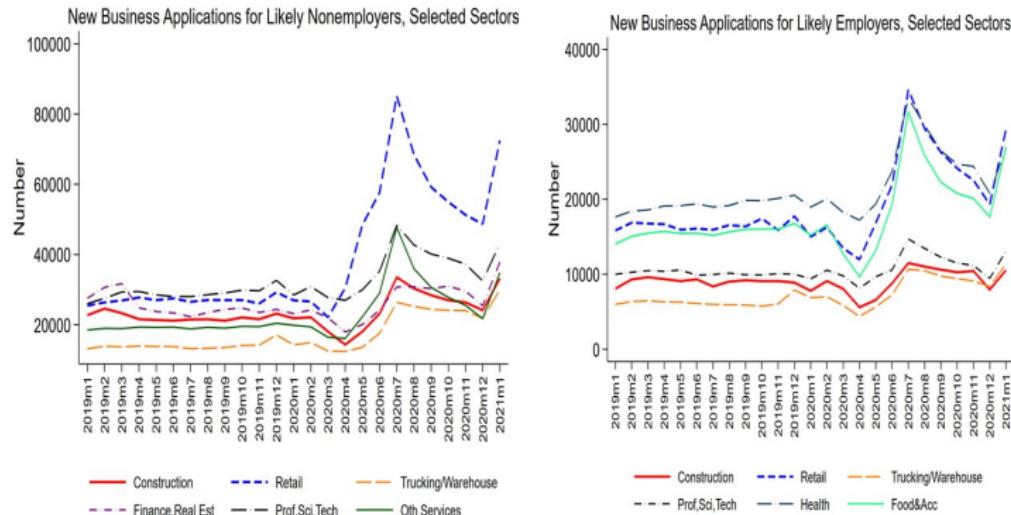
Data: Business Dynamics Statistics, U.S. Census

Business dynamism: entry

Figure 3. The start-up rate is decreasing in most OECD countries



Note: boom of entry during Covid

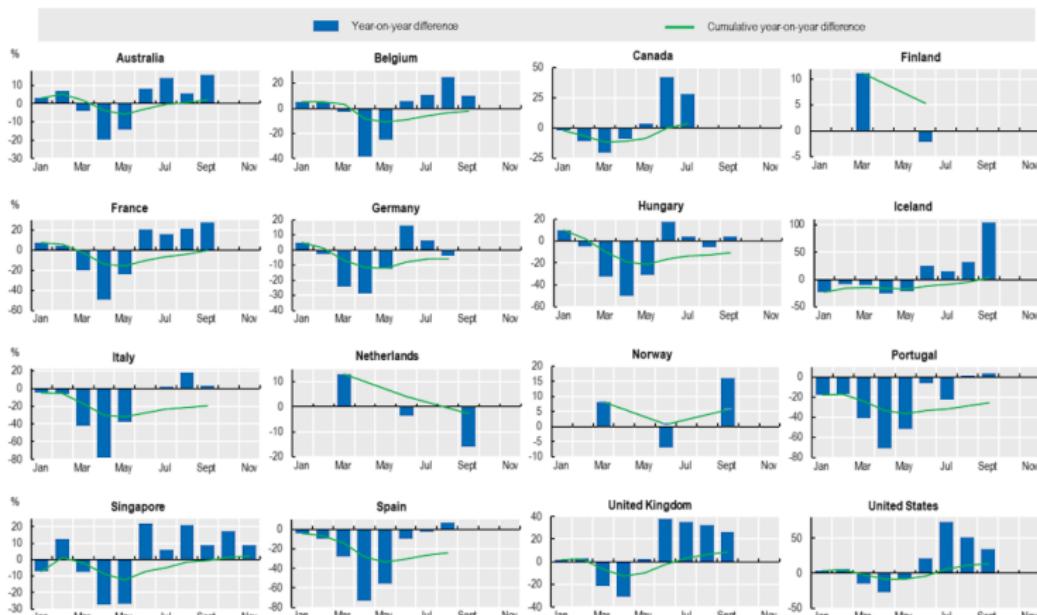


Source: Census Monthly Business Formation Statistics

Entry of firms increased during Covid

Note: boom of entry during Covid

Figure 1. Aggregate business registration: differences 2020 vs. 2019



Year-on-year differences in firm registrations, monthly. OECD (2021)

Business dynamism: job flows

Alternative measure of business dynamism: **job flows**

- Consider an establishment i
(e.g. physical address where a business operates)
- Gross job creation: total addition to employment by expanding i

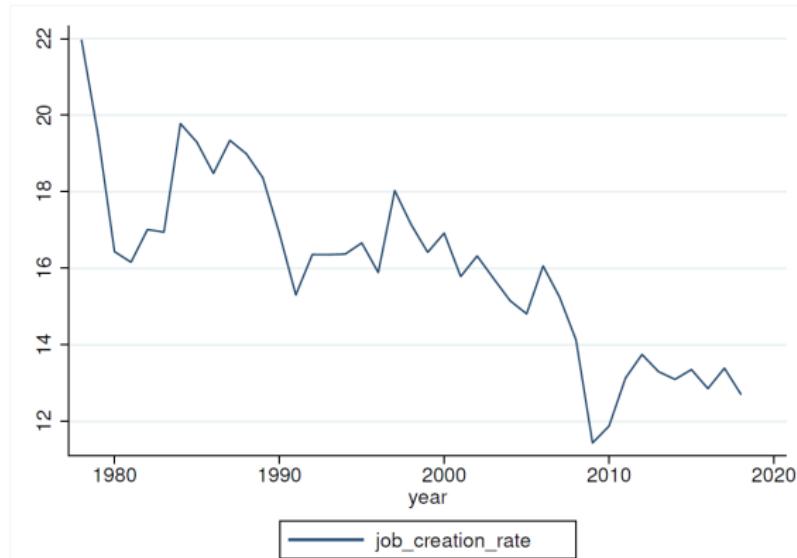
$$JC_t = \sum_{i:E_{i,t} > E_{i,t-1}} (E_{i,t} - E_{i,t-1})$$

where for new establishments, lagged employment is 0

- **Job creation rate** is JC divided by empl. of *all* establishments
- Conversely, **job destruction rate** is calculated from:

$$JD_t = \sum_{i:E_{i,t} < E_{i,t-1}} (E_{i,t} - E_{i,t-1})$$

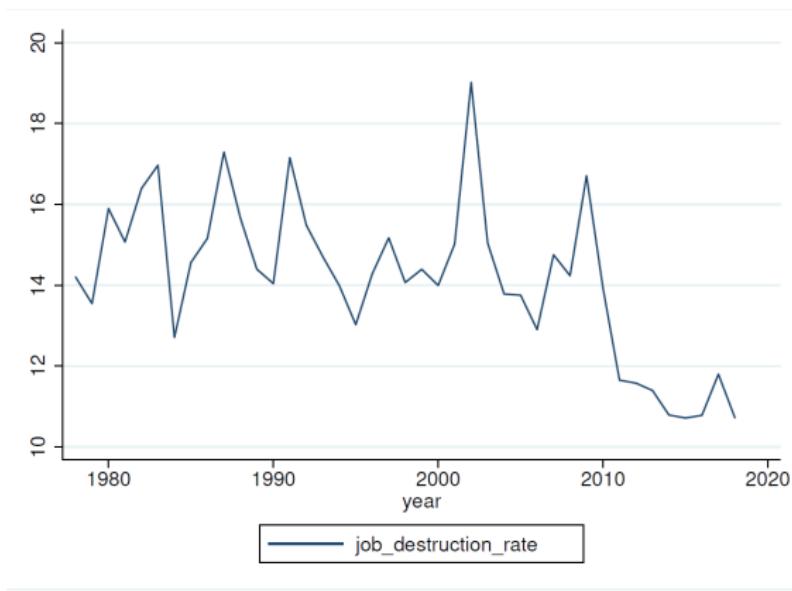
Business dynamism: job creation



Gross job creation as a percentage of total employment.

Source: U.S. Census

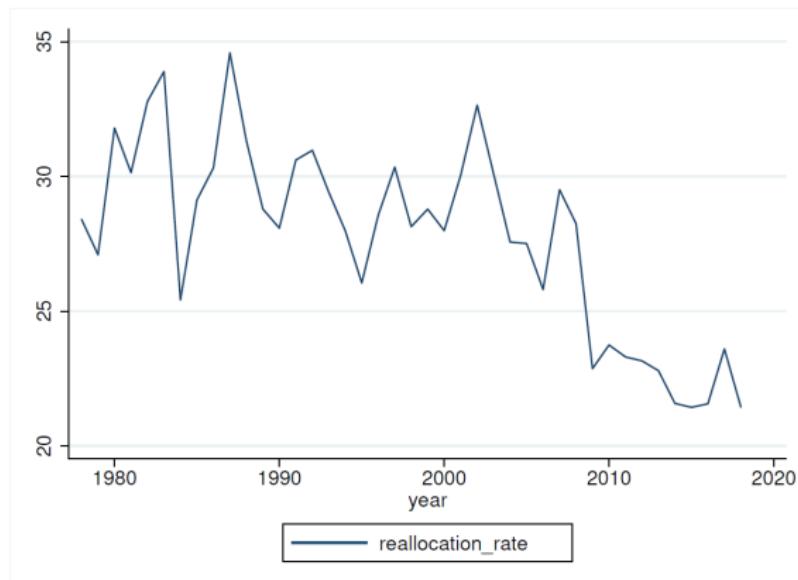
Business dynamism: job destruction



Gross job destruction as a percentage of total employment.

Source: U.S. Census

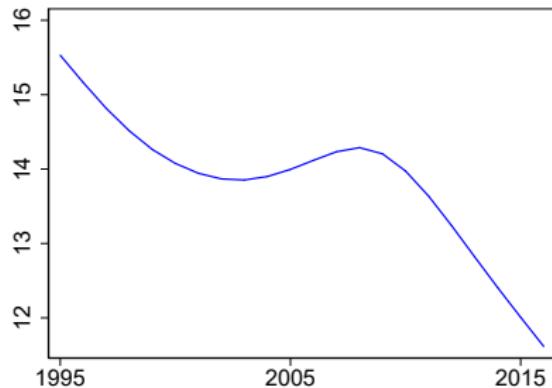
Business dynamism: reallocation rate



Reallocation rate: sum of job destruction and job creation rates

Source: U.S. Census

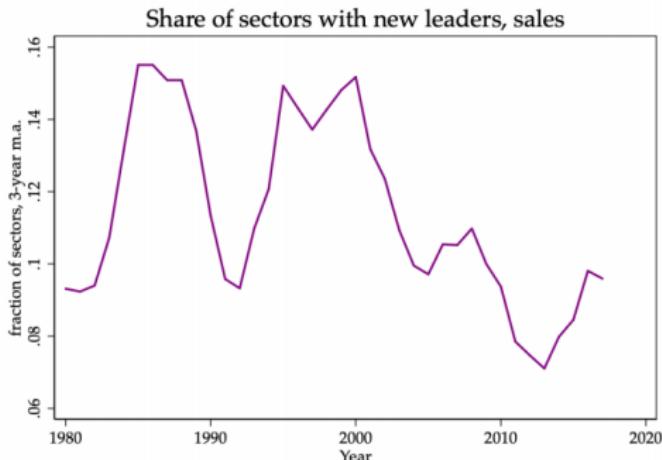
Business dynamism: reallocation rate (France)



Reallocation rate: sum of job destruction and job creation rates, HP-filtered

Source: De Ridder (2020)

Business dynamism: topple rates



Share of 4-digit industries where, compared to last year, a new firm has become the industry leader in terms of sales. Data from Compustat.

Source: Olmstead-Rumsey (2020)

Note: be careful with Compustat

It's very easy to start doing research using Compustat

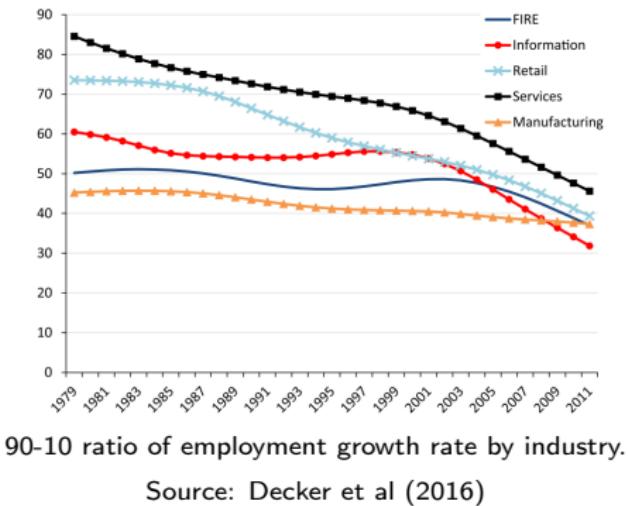
- Universe of U.S. publicly listed firms from 1955
- For the U.S. that's quite a lot of firms (about 3,000 now)
- But for research there are serious issues
 - Data on e.g. sales are consolidated: can represent international sales
 - Strong selection into listed status, and selection changes over time
- However: stock prices, consolidated accounts can be useful
- LSE: ask library for a **WRDS** account, clean data ready for use

Business dynamism: skewness of growth rates

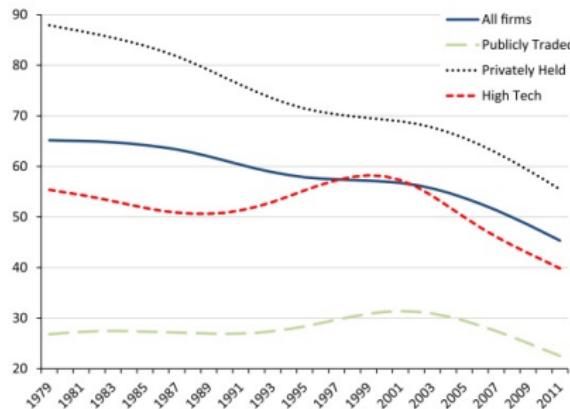
- Recall that historically, young firms are responsible for disproportionate share of employment growth
- These firms create high **skewness** in the firm-growth distribution
 - 1980: firm at 90th percentile of employment growth, grew 65 percentage points after than firm at the 10th percentile
 - 2010: 90-10 differential of firm growth rates fallen to 45 perc. points

Business dynamism: skewness of growth rates

R.A. Decker et al. / European Economic Review 86 (2016) 4–23



Business dynamism: skewness of growth rates



90-10 ratio of employment growth rate by firm type.

Source: Decker et al (2016)

Trends

Medium-term trends across advanced economies:

1. Slowdown of productivity growth
2. Decline in business dynamism
3. **Rise of market power and firm concentration**
4. Decline in real interest rates
5. Aging

Market power

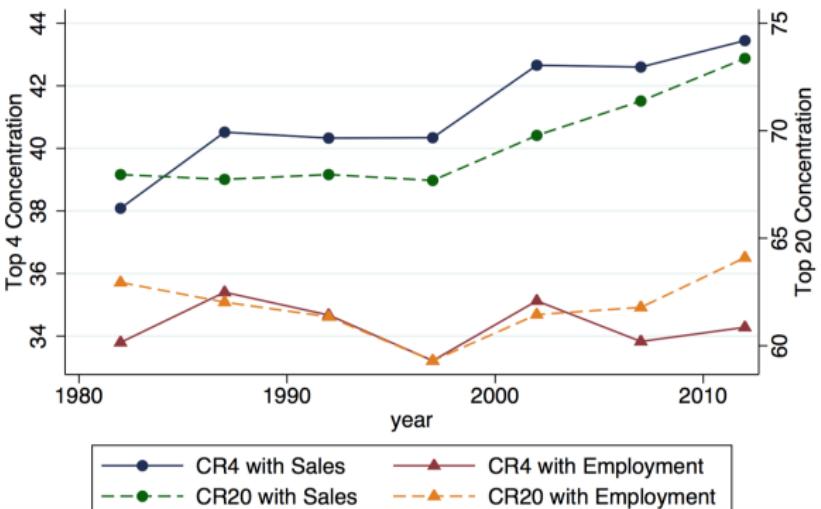
Definition: ability of firms to raise prices above marginal costs

Three pieces of evidence that market power is increasing

- Firm concentration is increasing
- Measures of the **markup** have increased
- The share of **labor** in national income has fallen

Firm concentration

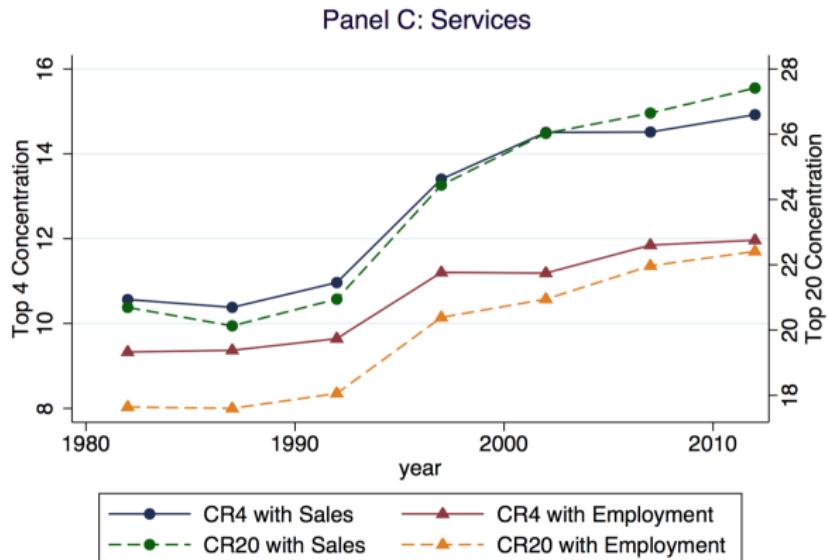
Panel A: Manufacturing



Fraction of sales and employment by top 4 or 20 firms.

Source: Autor et al (2017) based on U.S. Census

Firm concentration



Fraction of sales and employment by top 4 or 20 firms.

Source: Autor et al (2017) based on U.S. Census

Firm concentration

Evidence outside of the United States:

- Complication: what is the market? EU-level or country level?
- Ownership structure can be hard to track, esp. cross-country
- Availability of firm-level data differs by country, changes **over time**
- Particularly hard to obtain **long time series** of data

Until 2018: dominant view that rise of concentration was a 'US' problem

Firm concentration

Chart 9

Herfindahls: EU and US

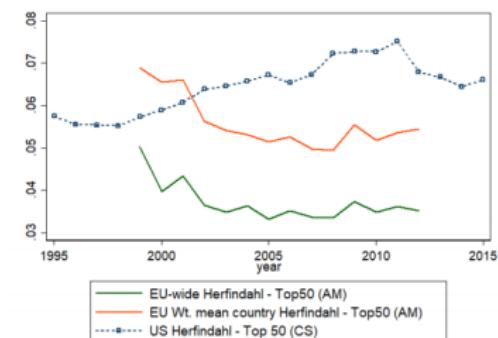
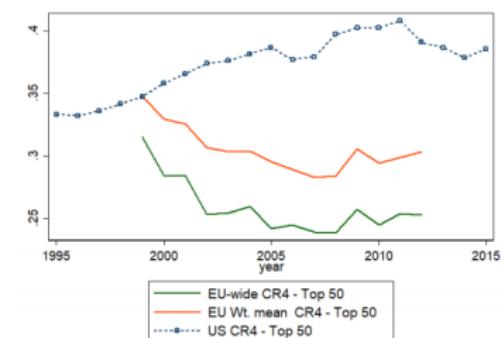


Chart 10

Top 4 firm market share: EU and US

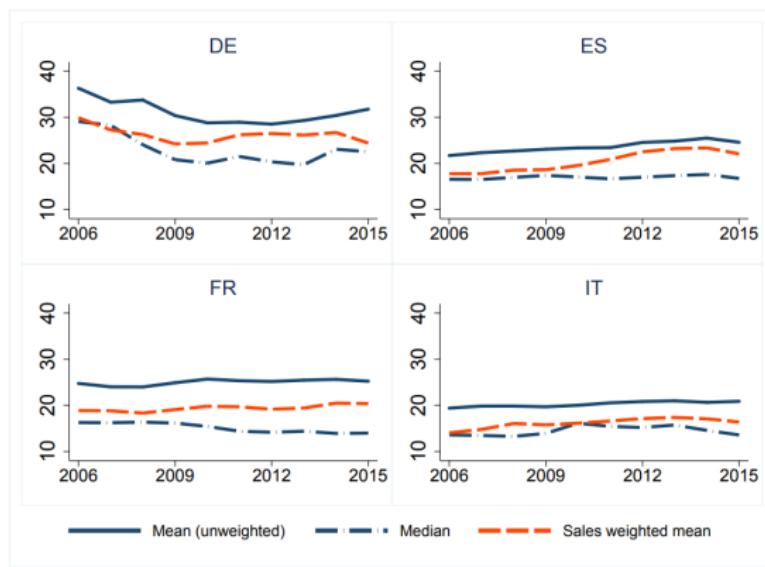


Market concentration in Europe versus the U.S. based on Orbis and Compustat

Source: Dottling, Gutierrez, Philippon (2017, ECB Forum on Central Banking)

Firm concentration

Figure 2: CR_4 evolution over the period 2006-2015 by country



Market concentration in Europe from iBach

Source: Cavalleri et al (2019, European Central Bank)

Firm concentration

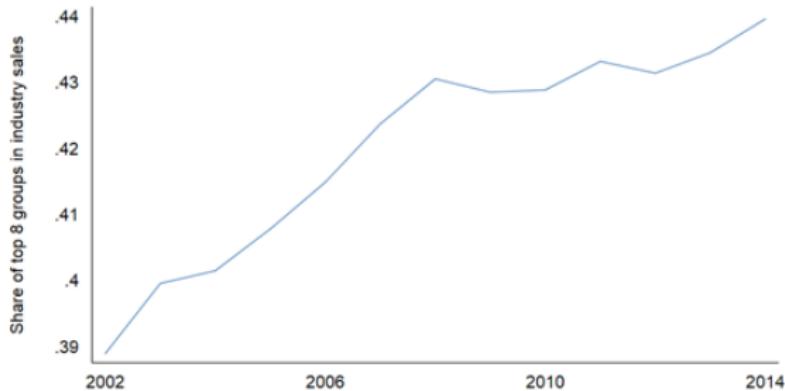
Recent work by OECD Science, Technology and Innovation Directorate
(Chiara Criscuolo - CEP):

- Use data on **ultimate ownership structure** in Orbis
- Define firm's revenue as total within-sector revenue by all in group
- Restrict analysis to countries where Orbis sample is high quality
- Calculate share of top firms' domestic sales in total industry sales

$$CR_x = \sum_{g=1}^x \frac{S_{gcit}}{S_{ct}}$$

Key: denominator is based on **national accounts data**

Firm concentration



Share of top 8 groups in industry sales.

Data for Belgium, Germany, Spain, Finland, France, UK, Japan, Sweden,

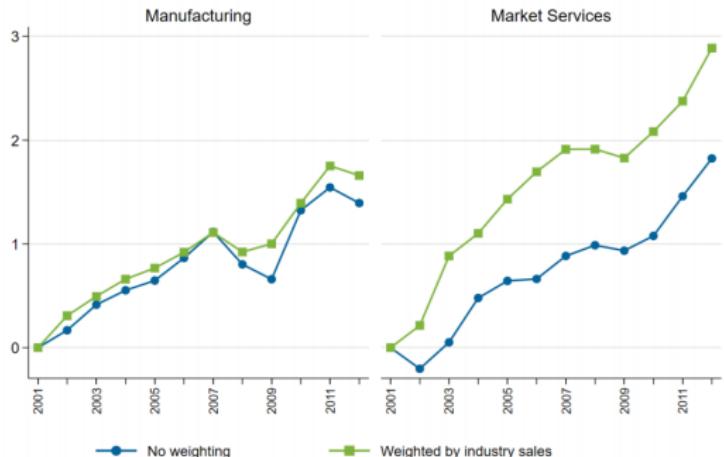
Source: Bajgar et al. (2020, OECD)

Three in four industry-country pairs have increase in concentration

Firm concentration

Figure 5. Share of gross output accounted for by largest firms in select European countries

Top-10% firms in terms of sales, year effects from weighted regression



Note: Countries included are AUT, BEL, DEU, DNK, FIN, FRA, HUN, NOR, PRT, SWE

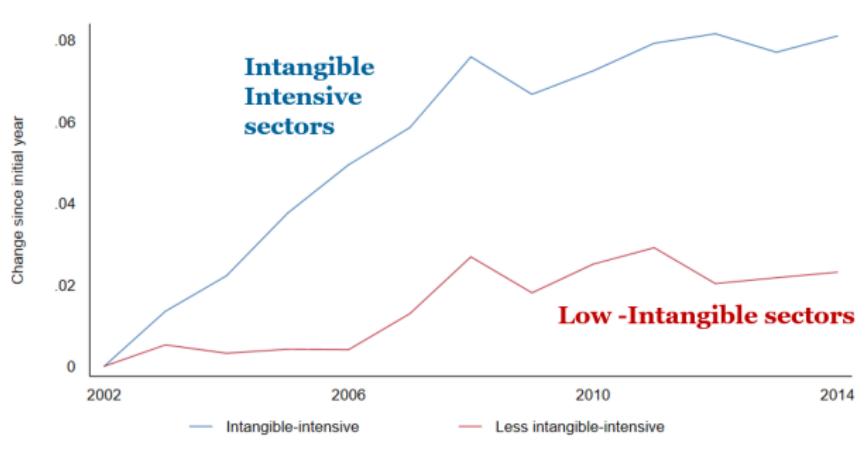
Growth in firm concentration in various OECD countries

Source: Bajgar et al. (2019, OECD)

Firm concentration

- Consensus seems to be building that concentration is increasing in most advanced economies
- But there is heterogeneity: increase is larger in the U.S. than Europe
- Why does this matter so much?
 - Regulation: country-specific. Could lax U.S. antitrust be the cause? (See Philippon's book, *The Great Reversal*)
 - Technological changes: would emerge (to some extent) everywhere

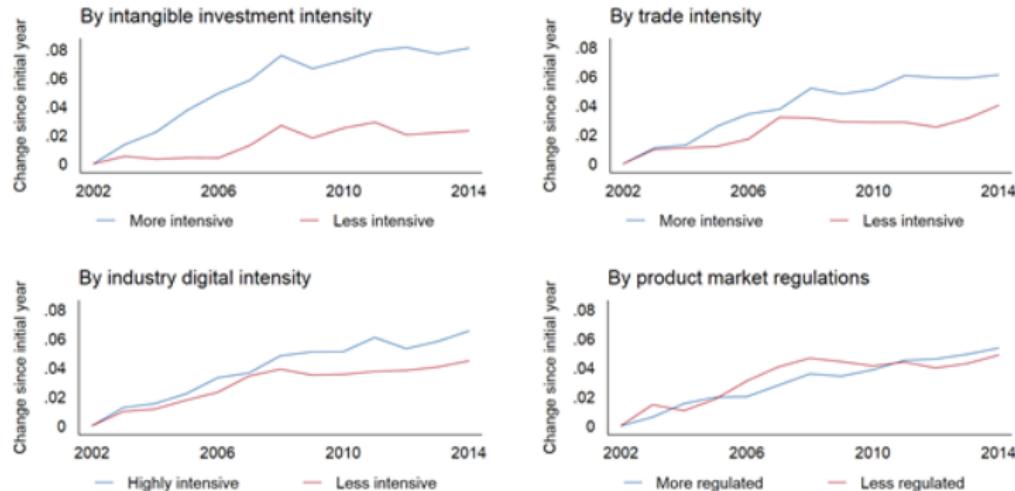
Firm concentration: technology



Change in top 8 firm sales share in various OECD countries

Source: Bajgar et al. (2020, OECD)

Firm concentration: technology



Change in top 8 firm sales share in various OECD countries

Source: Bajgar et al. (2020, OECD)

Market power

Classic measure of market power is the markup:

$$\mu_{it} = \frac{p_{it}}{mc_{it}}$$

You can show that the markup equals:

$$\mu_{it} = \alpha_{it}^m \frac{p_{it} y_{it}}{p_t^m m_{it}}$$

where m is an input that firms can set without adjustment costs (e.g. materials) and where α_m is:

$$\frac{\partial \log y_{it}}{\partial \log m_{it}} = \alpha_{it}^m$$

Hall (1988)

Assume that firms minimize costs with **variable** input V_{it}

- No intertemporal considerations (adjustment costs, time to build)
- Competitive factor market for V_{it} (no monopsony power)

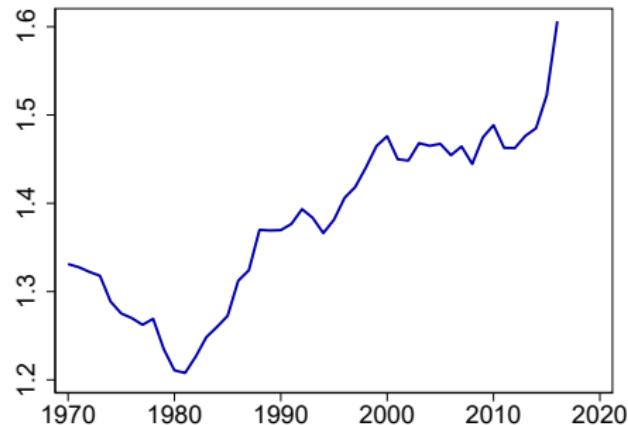
Constrained cost-minimization problem for V_{it}

$$\mathcal{L} = \textcolor{red}{V_{it}} P_t^\nu + \dots + \lambda_{it} [Y_{it} - Y(\textcolor{red}{V_{it}}, \dots)]$$

First order condition gives the **markup**:

$$\frac{1}{\lambda_{it}} = \frac{\partial Y_{it}}{\partial V_{it}} \frac{1}{P_t^\nu} \rightarrow \underbrace{\frac{P_{it}}{\lambda_{it}}}_{\alpha_{it}^\nu} = \left(\frac{\partial Y_{it}}{\partial V_{it}} \frac{V_{it}}{Y_{it}} \right) \frac{P_{it} Y_{it}}{P_t^\nu V_{it}}$$

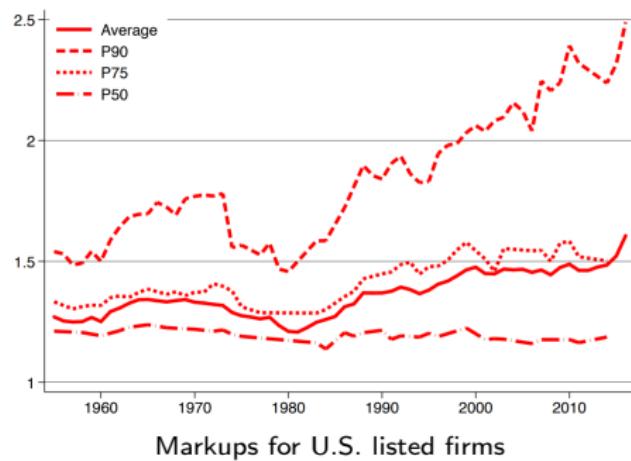
Markups



Sales-weighted average for U.S. listed firms

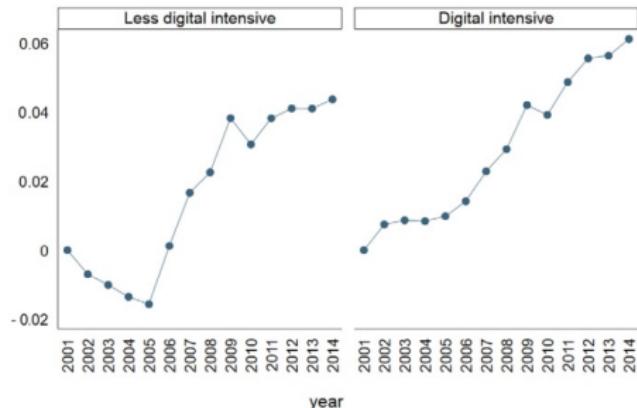
(Compustat data, estimates from De Loecker, Eeckhout, Unger 2020)

Markups



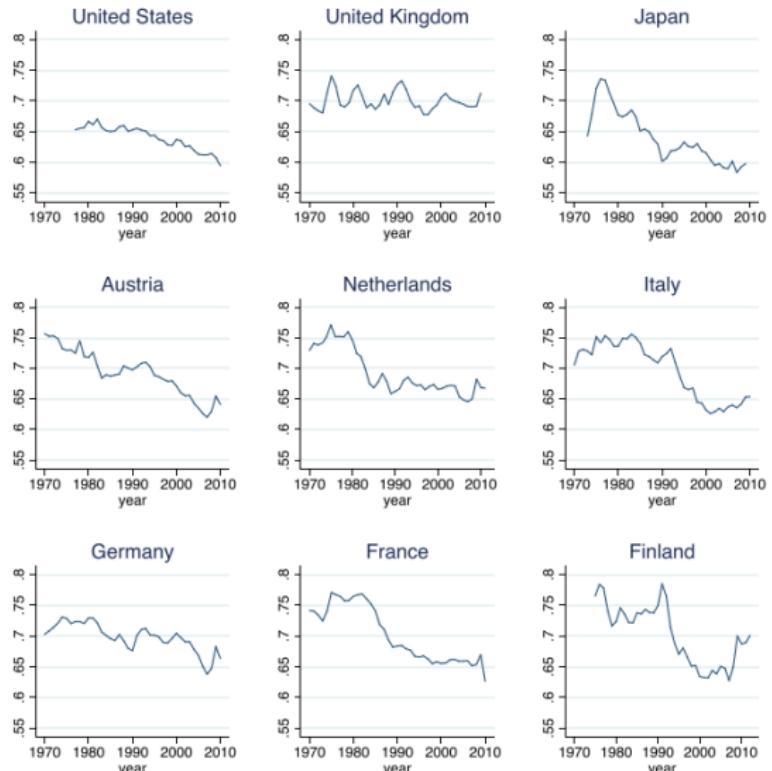
(Compustat data, estimates from De Loecker, Eeckhout, Unger 2020)

Markups



Average markups for large sample of OECD firm, ditigal versus non digital sectors
(Orbis data, estimates from Calligaris, Criscuolo, Marcolin 2018)

Labor share



Ratio of labor compensation to private sector value added.

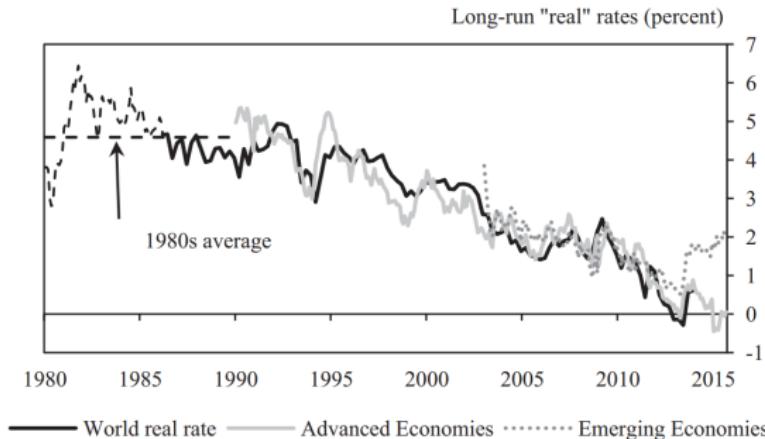
(Source: Autor et al 2020, EU-KLEMS data)

Trends

Medium-term trends across advanced economies:

1. Slowdown of productivity growth
2. Decline in business dynamism
3. Rise of market power and firm concentration
4. **Decline in real interest rates**
5. Aging

Interest rates over time



Notes: The “world” real rate (solid black line) is taken from King and Low (2014) and shows the average ten-year yield of inflation-linked bonds in the G7 countries (excluding Italy) over the period 1985–2013.

(Source: Rachel and Smith, 2017)

Trends

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Aging

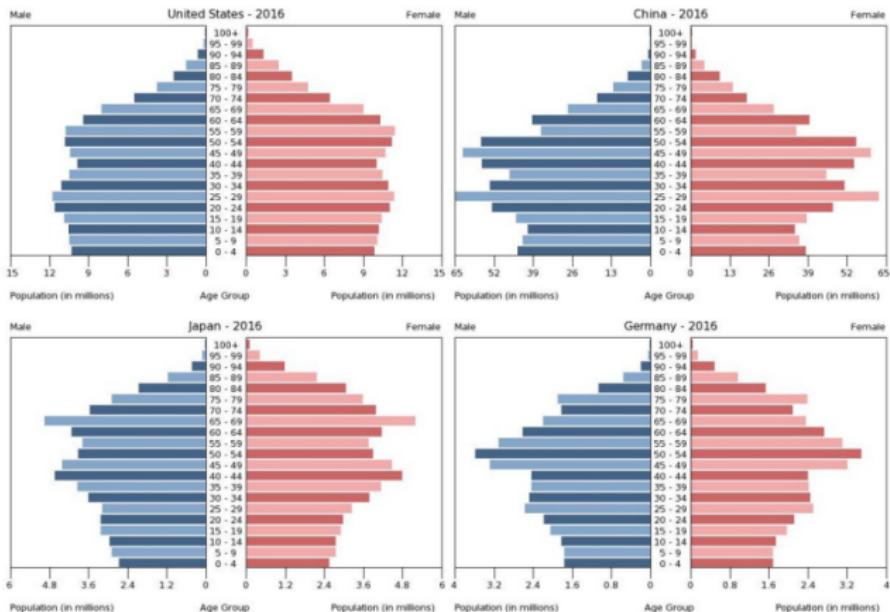


Figure 1: Age pyramids of the world's four largest economies.

(Source: Lu and Teulings, 2017)

Aging Firms



(Source: Hopenhayn et al. 2021)

Today

- Trends: firm dynamics, market power, growth, interest rates
- **Different way of thinking about macro: steady states**
- Alternative way to model macro dynamics: MIT shocks

Interesting steady states

These trends are not well-modeled in a business cycle model

- Perturbations around a steady state: the steady state dominates!!
- Increasingly: focus on **structural** macro
- Larger models, detailed micro foundations, sectors/linkages, etc.
- Also facilitated by improved computing powers

MIT shocks

In structural (large) models: can you still analyze dynamics? Yes!

Shocks in these models are usually **MIT shock**

- A shock to the parameters that happens at some T
- Exercise: endogenous response of economy to the shock
- Agents don't realize these types of shocks happen
- Path from old to new steady state is **deterministic**

MIT shocks: transitional dynamics

Solution algorithm:

1. Assume new steady state is reached at some finite (but far-away) \bar{T}
2. Initial guess for path of factor prices (for example)
3. Calculate all endogenous objects for given factor prices each period
4. Update: endogenous object imply a new path for factor prices
5. Iterate until all parts of the model are consistent

Course Overview/Revision

Part I: Shocking theory of the business cycle

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- Real Business Cycle (RBC) Model
- New Keynesian DSGE Models

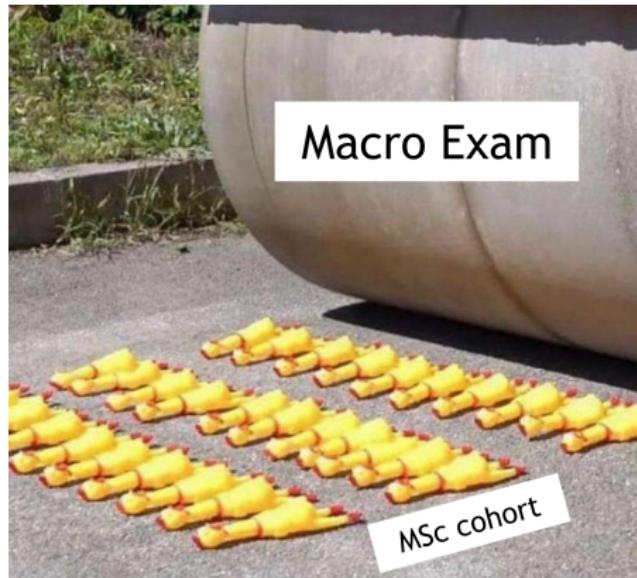
Part II: Perspectives on business cycles and steady states

- Heterogeneity versus homogeneity and the effect of policy
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Exam

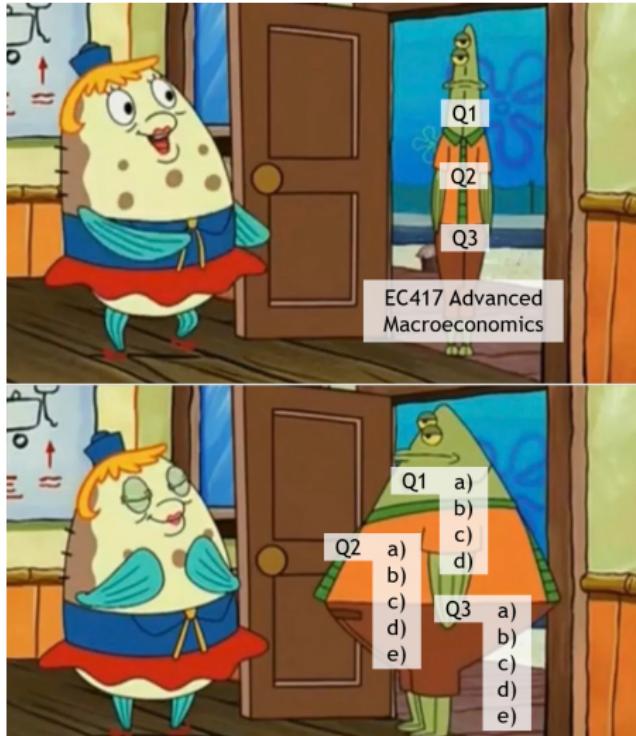
- 2 hours, and 15 minute reading time
- 3 questions: 25 points, 25 points, 50 points
- Problem sets are excellent preparation, see Moodle
- Last year's paper (shortened) is on Moodle (ST week 1: class)
- Based on material covered in lectures and classes

Exam (not true!!)



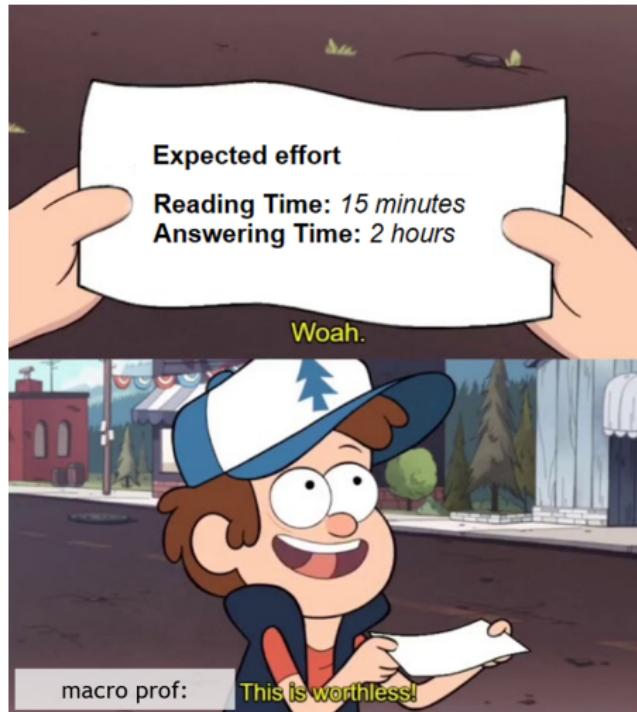
Source: Borui Zhu (MSc EME 2021)

Exam (true)



Source: Borui Zhu (MSc EME 2021)

Exam



Source: Borui Zhu (MSc EME 2021)

Lecture 1: introduction to business cycles

Knowledge:

- Properties: irregularity, comovements, relative volatility, persistence
- Hodrick-Prescott filter
- DSGE models: characteristics, RBC versus New Keynesian

Skills:

- Use the HP filter, understand results
- Solve the static firm's problem
- Solve the dynamic household's problem (Euler, labor supply, ..); either with Lagrangian, substitution or recursive formulation
- Define population

Lecture 2: Solving RBC models

Knowledge:

- Blanchard-Kahn conditions (how to check / what conditions are)
- How perturbation works (how are policy functions approximated)
- Solution techniques and limitations

Skills:

- Finding the deterministic steady state of the model
- Log-linearizing the system of eq. equations by hand
- Solving the linearized model by hand with guess and verify

Lecture 3: analyzing RBC model

Knowledge:

- Mechanisms in the RBC model
- Approaches to calibration
- Performance of the model, criticisms

Skills:

- Interpret Dynare output: impulse responses, policy functions
- Solving various extended versions of the model
(e.g. introduction of alternative preferences, new taxes, frictions, etc) and interpretation of results

Lecture 4/5: introduction to the NK-DSGE model

Knowledge:

- Empirical evidence on monetary non-neutrality
- Empirical evidence on nominal rigidity (wage/prices)
- Taylor rule

Skills:

- Derive demand function under the CES aggregator
- Derive competitive equilibrium with flexible prices
- Solve firm problem with sticky prices (Calvo)
- Derive the DIS curve and New Keynesian Philips Curve

Lecture 6: analyzing the NK-DSGE model

Knowledge:

- Mechanisms in the New Keynesian model
- Approaches to calibration: important parameters (e.g. θ)
- Criticisms (e.g. transmission mechanism: countercyclical markups)
- Difference between nominal and real shocks, prod. shocks in NK

Skills:

- Interpret Dynare output: impulse responses, policy functions
- Solving various extended versions of the model
- Solve the model with Guess and Verify
- Check conditions for determinacy/stability of equilibrium

Lecture 7: heterogeneity in the NK-DSGE model

Knowledge:

- Difference between complete market and incomplete market models
- Mechanisms: real effect of nominal shocks under wage rigidity
- (Lack of) Keynesian cross in the New Keynesian model
- Mechanism: intertemporal substitution versus multiplier effect of monetary policy
- Evidence on marginal propensities to consume, contrast with theory
- Understand how higher MPCs can be generated

Skills:

- Interpret impulse responses and equilibrium equations TANK model

Lecture 8: persistent effects of recessions

Knowledge:

- Drivers of transitory effects of shocks in DSGE models
- Assumptions behind Lucas cost of business cycle results
- Mechanisms behind permanent effect of transitory shock in AK model and the Comin-Gertler model

Skills:

- Solve FOCs and log-linearize the AK model (+interpretation)
- Solve for equilibrium growth in the Romer model (+interpretation)

Lecture 9: firms and business cycles

Knowledge:

- Firm-size distribution is well-approximated by a Pareto distribution
- Properties of the pareto distribution
- Hulten's theorem

Skills:

- Derive (generalized) diversification result
- Work with models with heterogeneous firms (e.g. problem set)
- Derive effect of micro shocks on macroeconomy

Congratulations!

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- New Keynesian DSGE Models ✓

Part II: Perspectives on business cycles and steady states

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- Endogenous growth and persistent effects of recessions ✓
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