

Geographical Economics

Course 4: Productivity and competitiveness

Rosella Nicolini

UAB

January 2013

What did we learn ?

- ▶ Clustering (agglomerating) activities triggers productivity
- ▶ Higher productivity implies higher returns to labor factor

What are we learning today ?

- ▶ Does higher productivity entails also competitiveness ?

Fundamentals

- ▶ Competitiveness: being able to export and gaining market share in the international market
- ▶ *Labour productivity vs unit labor costs*

Fundamentals

- ▶ Competitiveness: being able to export and gaining market share in the international market
- ▶ *Labour productivity vs unit labor costs*
- ▶ *Total factor productivity (TFP)*

Fundamentals

- ▶ **Total factor productivity (TFP)**: it is the part of output not explained by the amount of inputs used in the production.

Fundamentals

- ▶ **Total factor productivity (TFP)**: it is the part of output not explained by the amount of inputs used in the production.
- ▶ Its level is proportional to the efficient use of the inputs in the production process.

Fundamentals

- ▶ **Total factor productivity (TFP)**: it is the part of output not explained by the amount of inputs used in the production.
- ▶ Its level is proportional to the efficient use of the inputs in the production process.
- ▶ TFP growth is usually measured by the Solow residual.

Fundamentals: TFP

- ▶ Let us consider a standard Cobb-Douglas function using labor and capital as inputs.

Fundamentals: TFP

- ▶ Let us consider a standard Cobb-Douglas function using labor and capital as inputs.
- ▶ Let g_Y denote the growth rate of output, g_K the growth rate of capital, g_L the growth rate of labor, and α the capital share.

Fundamentals: TFP

- ▶ Let us consider a standard Cobb-Douglas function using labor and capital as inputs.
- ▶ Let g_Y denote the growth rate of output, g_K the growth rate of capital, g_L the growth rate of labor, and α the capital share.
- ▶ The Solow residual is defined as

$$TFP = g_Y - \alpha g_K - (1 - \alpha) g_L$$

Fundamentals: TFP

- ▶ TFP (growth) is rightly estimated according to the previous strategy if

Fundamentals: TFP

- ▶ TFP (growth) is rightly estimated according to the previous strategy if
 - ▶ (i) the production function is neoclassical,

Fundamentals: TFP

- ▶ TFP (growth) is rightly estimated according to the previous strategy if
 - ▶ (i) the production function is neoclassical,
 - ▶ (ii) there is perfect competition in factor markets,

Fundamentals: TFP

- ▶ TFP (growth) is rightly estimated according to the previous strategy if
 - ▶ (i) the production function is neoclassical,
 - ▶ (ii) there is perfect competition in factor markets,
 - ▶ (iii) the growth rates of the inputs are measured accurately.

Fundamentals: TFP

- ▶ TFP (growth) is rightly estimated according to the previous strategy if
 - ▶ (i) the production function is neoclassical,
 - ▶ (ii) there is perfect competition in factor markets,
 - ▶ (iii) the growth rates of the inputs are measured accurately.
- ▶ Problem: empirically it is very complicated to get an accurate measure of the capital. See alternative strategies as those introduced by Levinsohn and Petrin (2003).

Labor productivity

Labor productivity measures the capacity of one unit of labor (in one unit of time) to produce output:

$$\frac{Y}{L}$$

when working time varies, we compute the labor productivity per-hour worked:

$$\frac{Y}{L * H}$$

Labor productivity

In the growth analysis labor productivity is important because of the following relationship:

GDP per-capita =

Productivity per hour worked x

Total hours worked x Participation rate x Share of adult population to be able to work

Fundamentals: unit labor costs

The unit labor costs are the costs of one unit of production and their change is inversely proportional to that of productivity.
There are several way to compute them: the most natural one is:

$$ULC = \frac{\text{Compensation}}{Y}$$

Fundamentals: productivity and competitiveness

1. Productivity is a measure of the efficiency in production

Fundamentals: productivity and competitiveness

1. Productivity is a measure of the efficiency in production
2. That efficiency drives competitiveness either on international and national markets (see Helpman, Melitz, Yeats, 2004 or Melitz and Redding (2012))

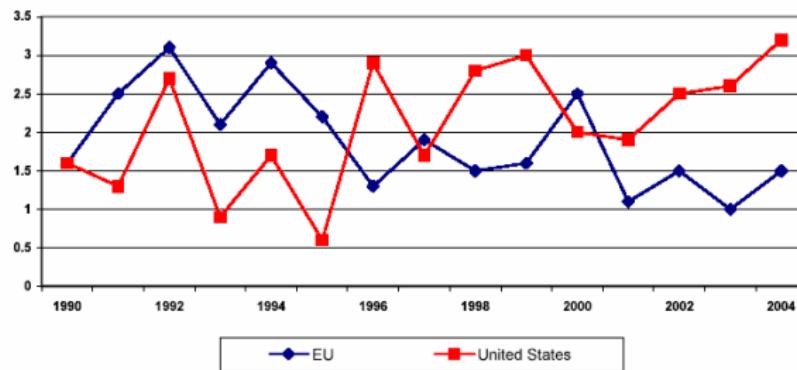
Fundamentals: productivity and competitiveness

1. Productivity is a measure of the efficiency in production
2. That efficiency drives competitiveness either on international and national markets (see Helpman, Melitz, Yeats, 2004 or Melitz and Redding (2012))
3. What's happens to Europe ?

Productivity: evidence

How does productivity changed in the EU and US in time ?

Figure 1: Annual labor productivity growth (%) in the European Union (13 countries) and the United States, 1990-2004. (Source: OECD)



Productivity: evidence

D. Jorgenson et al. (2008)

Table 1

Sources of U.S. Output and Productivity Growth 1959–2006
(average annual growth rates)

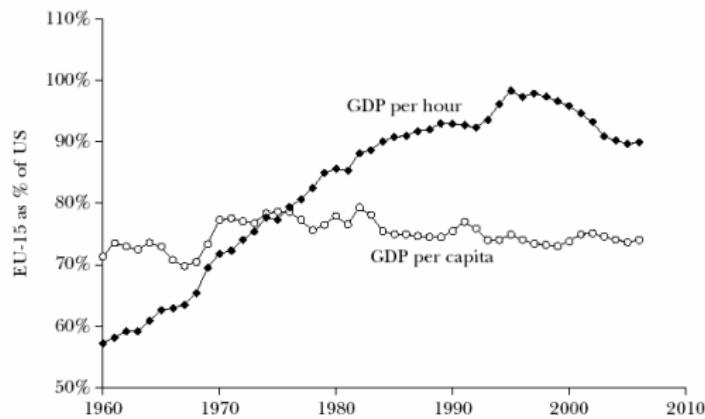
	1959– 2006	1959– 1973	1973– 1995	1995– 2000	2000– 2006
Private output	3.58	4.18	3.08	4.77	3.01
Hours worked	1.44	1.36	1.59	2.07	0.51
Average labor productivity	2.14	2.82	1.49	2.70	2.50
Contribution of capital deepening	1.14	1.40	0.85	1.51	1.26
Information technology	0.43	0.21	0.40	1.01	0.58
Non-information technology	0.70	1.19	0.45	0.49	0.69
Contribution of labor quality	0.26	0.28	0.25	0.19	0.31
Total factor productivity	0.75	1.14	0.39	1.00	0.92
Information technology	0.25	0.09	0.25	0.58	0.38
Non-information technology	0.49	1.05	0.14	0.42	0.54
Share attributed to information technology	0.32	0.11	0.43	0.59	0.38

Productivity: evidence

van Ark et al. (2008)

Figure 1

Total Economy GDP per Hour Worked and GDP per Capita in EU-15, 1960–2006
(relative to the United States)



Productivity: evidence

Inklaar et al. (2008)

Table 1. Growth rates of GDP per hour worked in European countries and the US, 1980–2006 (average annual growth in %)

	1980–1995	1995–2006
EU-15	2.3	1.4
United States	1.3	2.2
Austria	2.4	2.3
Belgium	2.0	1.4
Denmark	2.5	1.2
Finland	3.0	2.5
France	2.5	1.8
Germany	2.4	1.7
Greece	0.9	2.5
Ireland	3.6	4.2
Italy	2.1	0.4
Luxembourg	2.6	1.9
Netherlands	1.7	1.5
Portugal	2.1	1.7
Spain	3.0	-0.2
Sweden	1.3	2.5
United Kingdom	2.6	2.0
Average of 15 EU countries	2.3	1.8
Standard deviation	0.7	1.0

Productivity: evidence

Inklaar et al. (2008)

Table 1. Growth rates of GDP per hour worked in European countries and the US, 1980–2006 (average annual growth in %)

	1980–1995	1995–2006
EU-15	2.3	1.4
United States	1.3	2.2
Austria	2.4	2.3
Belgium	2.0	1.4
Denmark	2.5	1.2
Finland	3.0	2.5
France	2.5	1.8
Germany	2.4	1.7
Greece	0.9	2.5
Ireland	3.6	4.2
Italy	2.1	0.4
Luxembourg	2.6	1.9
Netherlands	1.7	1.5
Portugal	2.1	1.7
Spain	3.0	-0.2
Sweden	1.3	2.5
United Kingdom	2.6	2.0
Average of 15 EU countries	2.3	1.8
Standard deviation	0.7	1.0

Productivity: evidence

Inklaar et al. (2008)

Table 2. Share in GDP and average annual labor productivity growth in European countries and the US, market services, 1980–2004 (%)

	Share of market services in GDP (%)			Growth of value added per hour worked	
	1980	1995	2004	1980–1995	1995–2004
Austria	37	40	43	2.1	0.7
Belgium	32	40	44	1.4	1.2
Denmark	34	38	40	3.0	0.9
Finland	30	34	36	2.5	1.7
France	36	38	41	1.9	1.3
Germany	32	38	40	2.3	0.8
Italy	36	40	42	0.6	0.3
Netherlands	34	42	46	0.3	2.4
Spain	31	38	41	1.0	0.4
UK	33	41	49	1.9	2.5
US	37	41	44	1.4	3.3
Average	34	39	42	1.7	1.4
Standard deviation	2.4	2.2	3.3	0.8	1.0

Productivity: evidence

Inklaar et al. (2008)

Table 5. The share of high-skilled workers in market services employment (%)

	1980	1995	2004
Austria	3.3	7.6	10.9
Belgium	6.7	12.0	15.5
Denmark	2.7	5.8	8.5
Finland	14.6	29.8	30.7
France	6.3	11.9	16.1
Germany	3.7	6.6	8.0
Italy	4.7	7.4	14.1
Netherlands	3.8	8.6	11.2
Spain	5.3	12.1	19.4
UK	8.0	12.8	18.0
US	19.4	26.9	30.6
Average	7.1	12.9	16.6
Standard deviation	5.2	8.1	7.8

Productivity: Spanish case

- ▶ The Spanish case is well known in economic literature because it is the case of economic growth without productivity growth

Productivity: Spanish case

- ▶ The Spanish case is well known in economic literature because it is the case of economic growth without productivity growth
- ▶ Economic growth has been supported with increasing labor.

Productivity: Spanish case

- The Spanish case is well known in economic literature because it is the case of economic growth without productivity growth

Productivity: Spanish case

- ▶ The Spanish case is well known in economic literature because it is the case of economic growth without productivity growth
- ▶ Economic growth has been supported with increasing labor.

Productivity: Spanish case

- ▶ The Spanish case is well known in economic literature because it is the case of economic growth without productivity growth
- ▶ Economic growth has been supported with increasing labor.
- ▶ Remark: remember data in class 1 (Spain lost part of their international competitiveness)

Productivity: Spanish case

Table 3. Average annual growth rate in employment by sector (%)

	Industry		Services	
	1990–1995	1995–2001	1990–1995	1995–2001
Spain	−2.9	5.4	1.2	5.0

Source: EUROSTAT – calculus: author.

Productivity: Spanish case

Table 9. Correlation between labour productivity and share of employment in industry and services

Industry	pi7786	pi8693	pi9502
ei7786	-0.2420		
	0.3494		
ei8693		-0.7868***	
		0.0002	
ei9502			-0.7706***
			0.0003

Correlations

Productivity: Management practices

Evidence: Bloom and van Reenen (2007, QJE)

- ▶ Persistent evidence of differences in productivity across countries (and forms). It is argued it is due to differences in management.

Productivity: Management practices

Evidence: Bloom and van Reenen (2007, QJE)

- ▶ Persistent evidence of differences in productivity across countries (and forms). It is argued it is due to differences in management.
- ▶ They develop a measure on management performance for a sample of US and European firms

Productivity: Management practices

Evidence: Bloom and van Reenen (2007, QJE)

- ▶ Persistent evidence of differences in productivity across countries (and firms). It is argued it is due to differences in management.
- ▶ They develop a measure on management performance for a sample of US and European firms
- ▶ They take care details about characteristics of the firms: market competition and firm ownership are important differences in management practices (here ownership matters because they are referring to medium size firms)

Productivity: Management practices

Labour Productivity



Sales Growth, (% pa)



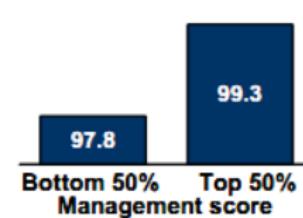
Profit Rate, (%)



Stock Market Value



Survival Rates, (%)



(source: ERS, Lectures)

Productivity: Management practices

Dependent variable	Sales (in Ln)	Sales (in Ln)	Sales (in Ln)
Estimation ¹	OLS	OLS	OLS
Firms	All	All	All
Management _{it}	0.085 (0.025)	0.034 (0.011)	0.042 (0.012)
Ln(Labor) _{it}	0.999 (0.014)	0.539 (0.021)	0.540 (0.021)
Ln(Capital) _{it}		0.103 (0.013)	0.104 (0.013)
Ln(Materials) _{it}		0.362 (0.020)	0.354 (0.020)
Controls ¹	No	Yes	Yes
Noise controls	No	No	Yes
Observations	6,267	5,350	5,350
Firms	732	709	709

(source: ERS, Lectures)

Productivity: Management practices

COUNTRY LEVEL MANAGEMENT SCORES*



(source: ERS, Lectures)

Productivity: Management practices

US FIRMS ARE ALSO BETTER IN EUROPE

Average management score by firm type
in UK, France and Germany*



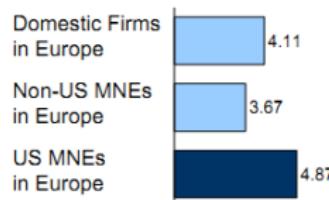
(source: ERS, Lectures)

Productivity: Management practices

Organizational devolution



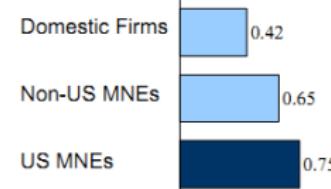
Organizational devolution
(firms located in Europe)



Organizational change
(UK establishments, 1981-1990)



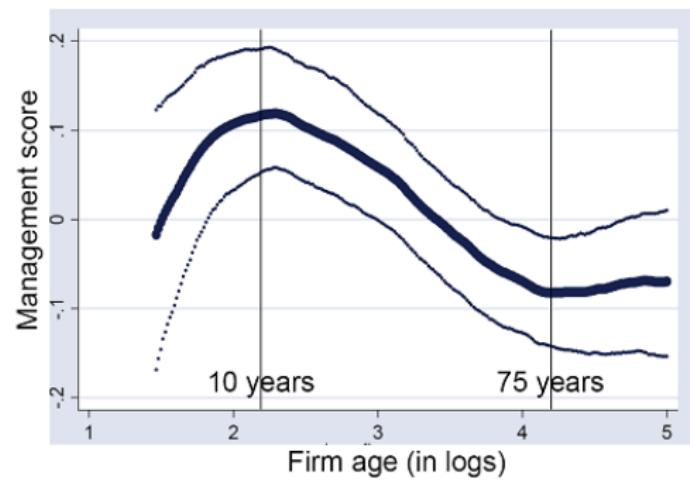
Organizational change
(UK establishments, 1998-2000)



(source: ERS, Lectures)

Productivity: Management practices

AGE AND MANAGEMENT PRACTICES (KERNEL¹)



(source: ERS, Lectures)

Productivity: Organization of tasks

Referring to Caliendo and Rossi-Hansberg (2012, QJE)

- ▶ Empirical studies identify that the good management practices are useful to increase firms' productivity and sales

Productivity: Organization of tasks

Referring to Caliendo and Rossi-Hansberg (2012, QJE)

- ▶ Empirical studies identify that the good management practices are useful to increase firms' productivity and sales
- ▶ This factor is as much important as we are considering large firms

Productivity: Organization of tasks

Referring to Caliendo and Rossi-Hansberg (2012, QJE)

- ▶ Empirical studies identify that the good management practices are useful to increase firms' productivity and sales
- ▶ This factor is as much important as we are considering large firms
- ▶ The capacity to well organize the production within a firm may impact on firms' productivity and trade.

Productivity: Organization of tasks

- ▶ They propose an theoretical framework (whose empirical application is "in-progress" for French data, Manufacturing firms 2002-2007)

Productivity: Organization of tasks

- ▶ They propose an theoretical framework (whose empirical application is "in-progress" for French data, Manufacturing firms 2002-2007)
- ▶ Intuition about the basic idea: production is obtained by using "labour" and "knowledge"

Productivity: Organization of tasks

- ▶ They propose an theoretical framework (whose empirical application is "in-progress" for French data, Manufacturing firms 2002-2007)
- ▶ Intuition about the basic idea: production is obtained by using "labour" and "knowledge"
- ▶ Here for each unit of output a worker has to solve a problem. Each worker learns "knowledge" in a given interval.

Productivity: Organization of tasks

- ▶ They propose an theoretical framework (whose empirical application is "in-progress" for French data, Manufacturing firms 2002-2007)
- ▶ Intuition about the basic idea: production is obtained by using "labour" and "knowledge"
- ▶ Here for each unit of output a worker has to solve a problem. Each worker learns "knowledge" in a given interval.
- ▶ **There is a ladder of problem solving: higher skill workers solve more complicated problems.**

Productivity: Organization of tasks

- ▶ They propose an theoretical framework (whose empirical application is "in-progress" for French data, Manufacturing firms 2002-2007)
- ▶ Intuition about the basic idea: production is obtained by using "labour" and "knowledge"
- ▶ Here for each unit of output a worker has to solve a problem. Each worker learns "knowledge" in a given interval.
- ▶ There is a ladder of problem solving: higher skill workers solve more complicated problems.
- ▶ Managers specialized in solving problems

Productivity: Organization of tasks

- ▶ Equilibrium solutions: it is optimal and incentive compatible a situation in which each worker solves problems compatible with his/her learning intervals

Productivity: Organization of tasks

- ▶ Equilibrium solutions: it is optimal and incentive compatible a situation in which each worker solves problems compatible with his/her learning intervals
- ▶ (International) competition pushes a firm to better its internal organization matching workers to tasks.

Productivity: Organization of tasks

- ▶ Equilibrium solutions: it is optimal and incentive compatible a situation in which each worker solves problems compatible with his/her learning intervals
- ▶ (International) competition pushes a firm to better its internal organization matching workers to tasks.
- ▶ In an open economy situation: non-exporters loses efficiency and the quantity they produce decreases

Productivity: Organization of tasks

- ▶ The number of management layers decreases in the non-exporters and increases in exporters

Productivity: Organization of tasks

- ▶ The number of management layers decreases in the non-exporters and increases in exporters
- ▶ If changes in quantity are quite important, productivity of exporters increases.

Productivity: Organization of tasks

- ▶ The number of management layers decreases in the non-exporters and increases in exporters
- ▶ If changes in quantity are quite important, productivity of exporters increases.
- ▶ Calibration of the model: the task organization grants productivity but trade option has a double effect (big novelty).

Productivity: Organization of tasks

- ▶ The number of management layers decreases in the non-exporters and increases in exporters
- ▶ If changes in quantity are quite important, productivity of exporters increases.
- ▶ Calibration of the model: the task organization grants productivity but trade option has a double effect (big novelty).
- ▶ Selection made not only by the competition effect, but also on the internal capacity to organize tasks.

Productivity: Organization of tasks

Evidence from the French case (C-M-RH, 2012)

Table 1: Distribution of average hourly wage by occupation in 2005 euros

	CEO, directors	Senior staff	Supervisors	Clerks	Blue collars
Mean	75.60	47.91	26.30	19.06	20.83
p5	22.33	19.56	13.14	9.74	9.67
p10	26.99	23.07	15.01	11.00	10.94
p25	38.86	28.93	18.14	13.03	12.88
p50	54.62	35.96	21.87	15.63	15.24
p75	75.07	44.62	26.44	19.01	18.34
p90	106.04	56.95	32.76	23.73	22.58
p95	132.17	69.01	38.94	28.33	26.94

Productivity: Organization of tasks

Table 13: Change in firm-level outcomes

	All	Increase L	No change in L	Decrease L
$d \ln \text{total hours}$	-0.014***	0.056***	-0.011***	-0.093***
- detrended	-	0.070***	0.003***	-0.079***
$d \ln \sum_{\ell=0}^L n_L^\ell$	-0.011***	1.366***	0.012***	-1.408***
- detrended	-	1.377***	0.023***	-1.396***
$d \ln VA$	-0.008***	0.032***	-0.007***	-0.049***
- detrended	-	0.039***	0.001	-0.040***
$d \ln \text{avg wage}$	0.018***	-0.001	0.018***	0.038***
- detrended	-	-0.020***	-0.000	0.020***
- common layers	0.020***	-0.117***	0.018***	0.156***
- - detrended	-	-0.137***	-0.002***	0.136***
% firms	100	12.75	73.48	13.78
% VA change	100	39.21	65.65	-4.87

*** significant at 1%.

Productivity: Organization of tasks

Table 17: Description of exporters

	Average			
	VA	Hours	Wage	# of layers
Non-exporters	800	29,026	23.03	1.23
Exporters	5,343	141,615	23.39	1.96

See the footnote in Table 2. The difference in wages is significant at 1%.

Productivity: Organization of tasks

Table 21: Behavior of firms that enter the export market

	All	Increase L	No change in L
$d \ln \text{total hours}$	0.021***	0.126***	0.015***
- detrended	0.035***	0.141***	0.029***
$d \ln \sum_{\ell=0}^L n_L^\ell$	0.008	1.237***	0.024***
- detrended	0.019**	1.248***	0.035***
$d \ln VA$	0.038***	0.116***	0.033***
- detrended	0.046***	0.125***	0.041***
$d \ln \text{avg wage}$	0.018***	0.000	0.021***
- detrended	-0.000	-0.018**	0.003
- common layers	0.018***	-0.119***	0.021***
-- detrended	-0.002	-0.139***	0.001
% firms	100	14.62	70.61
% VA change	100	18.62	73.66

Productivity: Organization of tasks

Results:

- ▶ Firms that expand (also increase competitiveness) are those that add layers and pay lower average wages to existing layers.

Productivity: Organization of tasks

Results:

- ▶ Firms that expand (also increase competitiveness) are those that add layers and pay lower average wages to existing layers.
- ▶ Less performing firms do not reorganize their production (do not hire new layers) and pay higher wages to existing layers.