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Labour productivity as panacea for ageing?

WRSA's 53rd annual meeting, Paradise Point Resort and Spa, San Diego, California, February 16–19, 2014

Lourens Broersma
Inge Noback
Jouke van Dijk
Department of Economic Geography, Faculty of Spatial Sciences, University of Groningen, The Netherlands

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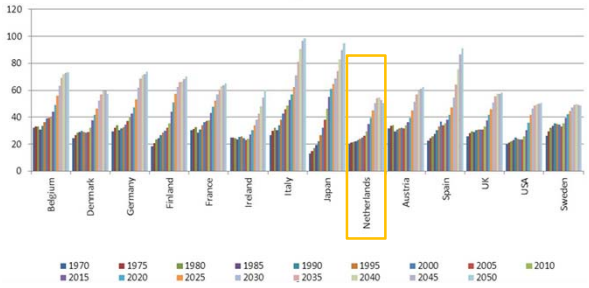
Ageing, i.e. persons of 65 and older as percentage of persons of 15-64 in various countries, 1970-2050



Source: Statistics Netherlands, Eurostat and ILO

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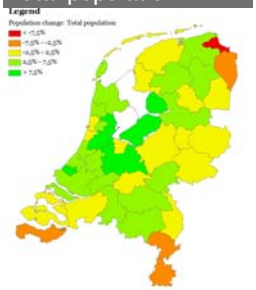
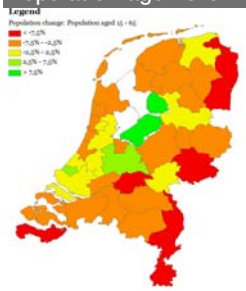
Regional Population Development 2010-2025

Total population



Population age 15-64



Aging problem!!

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Motivation: keep up the welfare level

- Wealth per cap = Labor productivity * hours per worker * net labor participation * population of working age

$$\frac{Y}{P} = \frac{Y}{H} \cdot \frac{H}{E} \cdot \frac{E}{P_{15-64}} \cdot \frac{P_{15-64}}{P},$$

- Y = GDP, P = total population, H = hours worked, E = employed persons, P_{15-64} = population of working age

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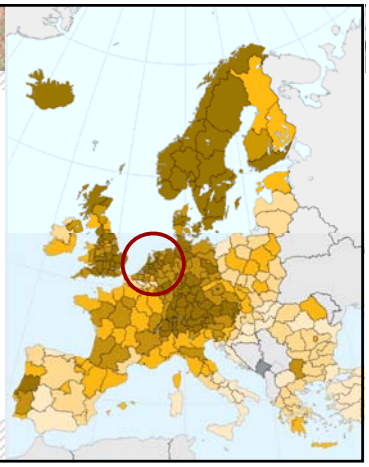
Employment rate 2010: dark is better (jobs per inhabitants 20-64 years)



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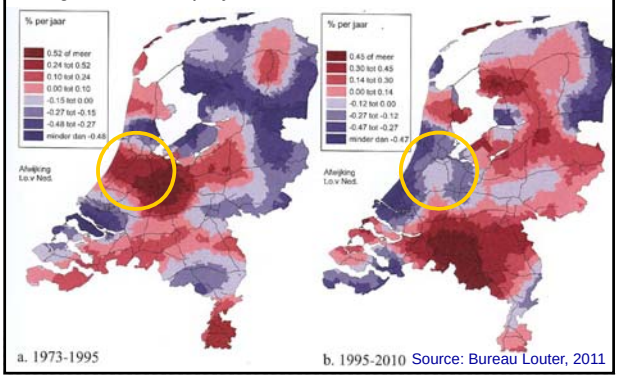
Changes in the employment rates 1973-1995 vs 1995-2010



a. 1973-1995 b. 1995-2010 Source: Bureau Louter, 2011

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Demarcation in economic core, intermediate zone and periphery

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Share of part time workers: dark is more parttime work

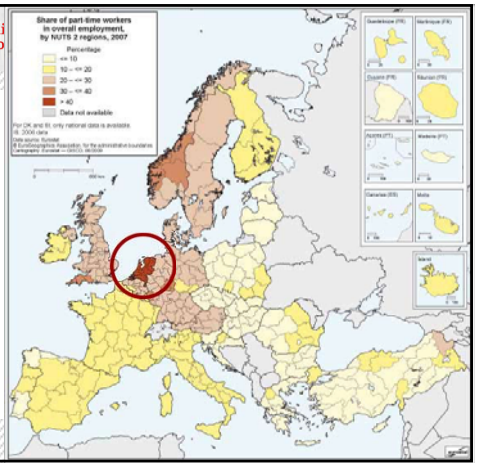

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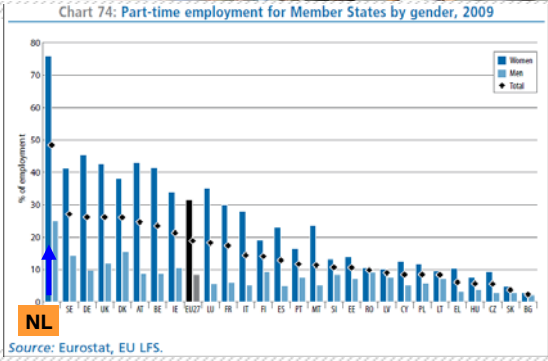
Chart 74: Part-time employment for Member States by gender, 2009



Source: Eurostat, EU LFS.

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Working hours OECD countries (hours per year per person in employment)

Korea 2390
Poland 1984
United States 1777
Spain 1745
Italy 1523
Germany 1362
Netherlands 1309

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Possible solutions

- Increase retirement age: popular policy measure, now gradually from 65 → 67
- Increase participation: already high in the Netherlands
- Increase work hours: Noback et al. (2013) Dutch are world champion part-time work
- OR: → Increase in labour productivity
- Interactions productivity with age, participation and working hours?
- Regional specific approach?

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Demarcation in economic core, intermediate zone and periphery

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Labour productivity levels in The Netherlands, EU-15 and the USA

Table 1. Levels of labour productivity in Netherlands, EU-15 and USA, between 1970-2011 (index 1995=100)

	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-10
Netherlands	59,1	76,3	83,9	92,0	97,4	102,6	110,6	119,7
EU-15	56,4	65,6	73,8	83,4	93,3	102,9	111,1	118,1
USA	75,1	81,5	83,8	91,1	97,2	103,9	116,0	127,6

Source: EUKLEMS data base, Statistics Netherlands, Eurostat and US Bureau of Labor Statistics

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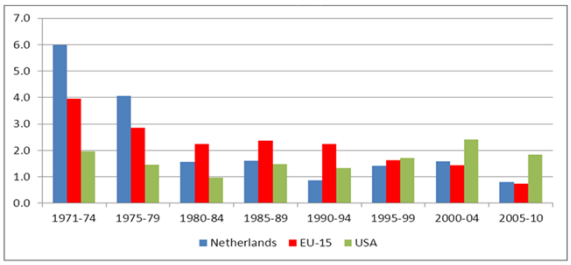
Five-year average labour productivity growth in Netherlands, EU-15 and USA, between 1970-2011 (%)



Source: EUKLEMS data base, Statistics Netherlands, Eurostat and US Bureau of Labor Statistics

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Data

- Matched employer-employee database
- Register data Statistics Netherlands on all employee jobs (SSB-jobs) build from different sources (social premium registers, tax register, surveys, etc)
- Period 1999-2005
- Employer: survey information production statistics, wage costs, investment statistics, NACE code
- Employee: in part survey data (work hours and wages)

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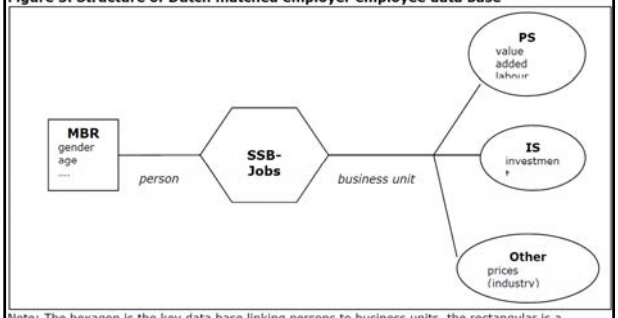
Figure 3. Structure of Dutch matched employer employee data base



Note: The hexagon is the key data base linking persons to business units, the rectangular is a census, ovals are surveys.

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Model specification

derived from **firm level** production function

› **Level** of labour productivity

$$\log\left(\frac{y}{n}\right) = \omega + \sum_m \alpha\eta_m \log x_m + \beta \log\left(\frac{k_{IT}}{n}\right) + \gamma \log\left(\frac{k_{non-IT}}{n}\right) + \xi \log n$$

› Labour productivity **growth**

$$\Delta\log\left(\frac{y}{n}\right) = \Delta\omega + \sum_m \alpha\eta_m \Delta\log x_m + \beta\Delta\log\left(\frac{k_{IT}}{n}\right) + \gamma\Delta\log\left(\frac{k_{non-IT}}{n}\right) + \xi\Delta\log n$$

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Estimation results **level** of labour productivity

Variable name	Symbol in (10)	Estimation and test results of model (a)	model (b)	model (c)
Intercept	α_0	-6.098 (-110.5)	-6.127 (-152.0)	-4.713 (-83.33)
Lagged IT-capital-labour ratio	$\log\left(\frac{k_{IT,-1}}{h_{-1}}\right)$	0.094 (31.86)	0.094 (31.86)	0.072 (25.61)
Lagged Non-IT-capital-labour ratio	$\log\left(\frac{k_{non-IT,-1}}{h_{-1}}\right)$	0.043 (6.97)	0.042 (6.96)	0.033 (5.75)
Lagged hours worked	$\log h_{-1}$	-0.002 (-0.76)		
Lagged hours worked per employee	$\log\left(\frac{h_{-1}}{e_{-1}}\right)$			0.012 (4.72)
Lagged net labour participation	$\log\left(\frac{e_{-1}}{p_{-1,15-64}}\right)$			-0.519 (-61.12)

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Estimation results **level** of labour productivity (part 2)

Variable name	Symbol in (10)	Estimation and test results of model (a)	model (b)	model (c)
Worker characteristics				
Gender				
Absolute difference share male and female workers	$\log\lvert S_m - S_f \rvert$	0.004 (1.87)	0.004 (1.89)	0.000 (0.19)
Age group				
Share age group 15-24	$\log S_{age1}$	0.017 (4.38)	0.019 (4.38)	0.005 (1.42)
Share age group 25-34	$\log S_{age2}$	0.115 (17.61)	0.115 (17.60)	0.109 (17.52)
Share age group 35-44	$\log S_{age3}$	0.050 (6.47)	0.050 (6.47)	0.052 (7.11)
Share age group 45-54	$\log S_{age4}$	0.023 (4.21)	0.023 (4.19)	0.017 (3.31)
Reference 55+				
Skill				
Share skilled workers	$\log S_{skill}$	1.885 (121.0)	1.885 (121.0)	1.998 (134.6)

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Variable name	Symbol in (10)	Estimation and test results of model (a)	model (b)	model (c)
Establishment characteristics				
Province				
Groningen		0.002 (0.103)	0.001 (0.104)	-0.007 (-0.493)
Friesland		-0.051 (-3.58)	-0.051 (-3.58)	-0.053 (-3.96)
Drenthe		0.010 (0.56)	0.010 (0.57)	-0.003 (-0.19)
Overijssel		-0.003 (-0.29)	-0.003 (0.30)	0.009 (0.89)
Gelderland		-0.020 (-2.37)	-0.020 (-2.37)	-0.012 (-1.48)
Flevoland		-0.084 (-4.57)	-0.085 (-4.58)	-0.064 (-3.66)
Reference Zuid-Holland				
Utrecht		0.001 (0.06)	0.000 (0.05)	0.008 (0.84)
Noord-Holland		-0.012 (-1.46)	-0.012 (-1.47)	-0.001 (-0.08)
Zeeland		0.052 (2.83)	0.052 (2.83)	0.040 (2.30)
Noord-Brabant		-0.014 (-1.82)	-0.014 (-1.82)	-0.013 (-1.71)
Limburg		-0.042 (-3.87)	-0.042 (-3.87)	-0.032 (-3.07)
Adjusted R^2		0.612	0.612	0.653
Observations		34,921	34,922	34,920

Controlling for industries and size classes

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Estimation results of labour productivity **growth** (part 1)

Variable name	Symbol in (11a)	Estimation and test results of model with districts	with regions
Intercept	β_0	-0.163 (-6.24)	-0.170 (-6.47)
Lagged growth rate of IT-capital-labour ratio	$\Delta\log\left(\frac{k_{IT,-1}}{h_{-1}}\right)$	0.047 (2.19)	0.047 (2.16)
Lagged growth rate of non-IT-capital-labour ratio	$\Delta\log\left(\frac{k_{non-IT,-1}}{h_{-1}}\right)$	0.044 (1.89)	0.042 (1.80)
Lagged growth rate of hours worked per employee	$\Delta\log\left(\frac{h_{-1}}{e_{-1}}\right)$	0.006 (2.23)	0.006 (3.18)
Lagged growth rate of net labour participation	$\Delta\log\left(\frac{e_{-1}}{p_{-1,15-64}}\right)$	-0.865 (-36.42)	-0.867 (-36.37)

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Estimation results of labour productivity **growth** (part 2)

Variable name	Symbol in (11a)	Estimation and test results of model with districts	with regions
Level of worker characteristics			
Absolute difference in share male and female workers	$\log\lvert S_m - S_f \rvert$	0.000 (0.09)	0.000 (0.19)
Share age group 15-24	$\log S_{age1}$	0.050 (13.47)	0.049 (13.22)
Share age group 25-34	$\log S_{age2}$	-0.013 (-2.11)	-0.014 (-2.17)
Share age group 35-44	$\log S_{age3}$	-0.011 (-1.39)	-0.011 (-1.50)
Share age group 45-54	$\log S_{age4}$	-0.012 (-2.28)	-0.013 (-2.44)
Reference 55+			
Share skilled workers	$\log S_{skill}$	0.395 (26.11)	0.396 (26.04))

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Estimation results of labour productivity **growth** (part 3)

Variable name	Symbol in (11a)	Estimation and test results of model with districts	with regions
District: Reference: West			
North		0.032 (3.48)	
East		0.019 (3.05)	
South		0.022 (3.73)	
Economic region: Reference: Core (Randstad)			
Intermediate			0.021 (3.75)
Periphery			0.028 (4.35)
Adjusted R^2		0.216	0.216
Observations		28,816	28,430

Controlling for industries and size classes

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Conclusions

- A rise in the capital-labour ratio will raise productivity ratio for both IT and non-IT capital, but more for IT-capital
- A rise in work hours slightly raises labour productivity (note: many people work part time!)
- A rise in the number of employees leads to a fall in productivity
- No differences in productivity by gender, certainly not after correcting for working hours

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Conclusions

› Better skilled → higher productivity
› Larger firms → higher productivity
› **Age: 25-44 year old show higher productivity levels, but lower growth rates than 15-24 and 55+**
› Taking industry, firm size and differences in worker characteristics into account, productivity growth in the periphery exceeds that of the core

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Discussion

Maintain the welfare level in times of aging by:
› Increase productivity + more working hours
› Invest in education and training
› More hours work of especially females
› Increase participation and keep older workers at work in combination with improving and maintaining skills → life long learning
› Agglomeration effects are limited: consider investing outside core region: Place Based Smart Specialization

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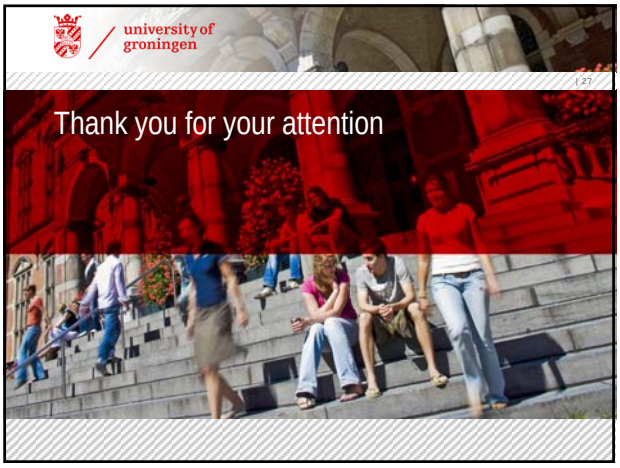

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Operational form for model of labor productivity level

$$\log\left(\frac{y}{h_{-1}}\right) = \alpha_0 + \alpha_1 \log\left(\frac{k_{IT,-1}}{h_{-1}}\right) + \alpha_2 \log\left(\frac{k_{non-IT,-1}}{h_{-1}}\right) + \alpha_3 \log h_{-1} + \alpha_4 \log\left|S_m - S_i\right| +$$
$$+ \alpha_5 \log S_{age1} + \alpha_6 \log S_{age2} + \alpha_7 \log S_{age3} + \alpha_8 \log S_{age4} + \alpha_9 \log S_{age5} + \quad (10)$$
$$+ \alpha_{11} \log S_{skill} + \alpha_{12} \log\left(\frac{h_{-1}}{e_{-1}}\right) + \alpha_{13} \log\left(\frac{e_{-1}}{p_{-1,15-64}}\right) + controls$$

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Operational form for model of real labor productivity growth

$$\Delta\log\left(\frac{y}{h_{-1}}\right) = \beta_0 + \beta_1 \Delta\log\left(\frac{k_{IT,-1}}{h_{-1}}\right) + \beta_2 \Delta\log\left(\frac{k_{non-IT,-1}}{h_{-1}}\right) + \beta_3 \Delta\log h_{-1} +$$
$$+ \beta_4 \Delta\log\left|S_m - S_i\right| + \beta_5 \Delta\log S_{age1} + \beta_6 \Delta\log S_{age2} + \beta_7 \Delta\log S_{age3} +$$
$$(11)$$
$$+ \beta_8 \Delta\log S_{age4} + \beta_9 \Delta\log S_{age5} + \beta_{11} \Delta\log S_{skill} +$$
$$+ \beta_{12} \Delta\log\left(\frac{h_{-1}}{e_{-1}}\right) + \beta_{13} \Delta\log\left(\frac{e_{-1}}{p_{-1,15-64}}\right) + controls$$

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Descriptives

Variable	Unit	Frequency	Mean	St.dev.
Value added (current prices)	1000 euro	45612	10274.4	59270.6
Labour costs (current prices)	1000 euro	45612	5451.7	23755.1
Depreciation (current prices)	1000 euro	45612	1259.5	8535.4
Total investments (current prices)	1000 euro	45612	1269.5	8260.9
IT investments (current prices)	1000 euro	45612	99.9	687.5
Total capital stock (current prices)	1000 euro	45612	20763.0	147903
IT capital stock (current prices)	1000 euro	45612	720.8	4188.7
Different plants per firm	1	45612	3.5	15.0
Number of employees	1	45612	225	1330.2
Fraction males	%	45611	74.6	21.6
Fraction foreign employees	%	45611	16.1	13.1
Average age	years	45612	37.9	4.8
Fraction 15-24 years of age	%	45612	13.1	14.1
Fraction 25-34 years of age	%	45612	27.8	11.6
Fraction 35-44 years of age	%	45612	28.4	9.7
Fraction 45-54 years of age	%	45612	20.0	9.6
Fraction 55 years and above	%	45612	10.6	8.0
Share of skilled workers per firm relative to those per industry	1+(firm wage)/(industry wage)	45364	2.0	313.1