3.7. Les consequences de la compression salariale:

- ✓ Les travailleurs peu diplômés sont-ils trop coûteux au regard de leur productivité?
- ✓ Faut-il régionaliser la formation des salaires pour stimuler l'emploi?

Les travailleurs peu diplômés sont-ils trop coûteux au regard de leur productivité?

IZA Journal of Labor Economics, 2018
(Kampelmann, Saks, Rycx & Tojerow)

Motivation

- ✓ Vast literature examining the **impact of education on wages** (Ashenfelter et al., 1999; Card, 1999).
- ✓ Large wage gap between high- and low-educated workers, that **has been increasing over the last few decades** (Harmon et al., 2003; Picketty and Saez, 2003).
- ✓ Still quite **substantial educational wage premium after controlling for observable heterogeneity and other econometric issues** (Chevalier, 2011; Devereux and Fan, 2011; Dickson and Harmon, 2011).

Motivation

How can this educational wage premium be interpreted?

- ✓ **Human capital theory** (Becker, 1964):
  a) Education develops skills that make workers more productive.
  b) Wage differentials reflect differences in productivity.

  ⇒ Highly educated workers earn higher wages *ceteris paribus* simply because they are more productive than their less educated counterparts.

  ⇒ **Education raises productivity and wages equally**.

- ✓ This interpretation has been **challenged by various labour market theories** emphasizing sources of inequality other than labour productivity (Kalleberg and Sørensen, 1979; Berg, 1981; Lazear and Shaw, 2007).

Motivation: some theory

Low-educated workers are paid:	**At their marginal products** **(Profits = with % low-educated)**	**Below their marginal products** **(Profits ↑ with % low-educated)**	**Above their marginal products** **(Profits ↓ with % low-educated)**
Human capital (Becker, 1964)	**X**		
Bargaining power and internal decision-making process within organisations (Osterman, 2009)		**X**	
Tournaments (Lazear and Rosen, 1981)		**X**	
Fair wages (Akerlof and Yellen, 1988)			**X**
Labour market regulations, e.g. collective bargaining, minimum wages (Boeri and van Ours, 2013)	**X** (if monopsony)		**X**
Hysterisis in social norms (Skott, 2005)			**X**

Motivation: empirical evidence

- ✓ **Very few studies** examined how the educational composition of the labour force affects firm productivity* (Galindo-Rueda and Haskel, 2005; Haegeland and Klette, 1999; Haltiwanger et al., 1999; Moretti, 2004).
- ✓ **Evidence** on whether education raises productivity and wages equally is even thinner, **inconclusive and often subject to various potential econometric biases** (Hellerstein and Neumark, 2004; Ilmakunnas and Maliranta, 2005 ; Van Biesebroeck, 2011; Lebedenski and Vandenberghe, 2014; .
- ✓ To our knowledge, **no study has tried to assess whether the education-productivity-wage nexus varies across working environments**.

* At macro-level, some studies suggest education fosters output per worker and income per capita (Krueger and Lindahl, 2001; Mankiw et al., 1992). However, use of cross-country panel data makes identification of causal relationship difficult, i.e. fast growing countries invest more in education (Sianesi and Van Reenen, 2003).

Aim of paper

- ✓ **Provide robust estimates of the impact of the educational composition of the workforce on firm productivity**

  Use of detailed Belgian linked panel data for 1999-2010. Enable to address important econometric issues (e.g. firm fixed effects, endogeneity of education and state dependence of productivity)

- ✓ **Examine whether education increases productivity and wage costs equally**, i.e. extend the analysis to productivity-wage gaps (i.e. profits)

- ✓ Bring **first evidence on whether the alignment** between productivity and wage costs across educational levels **depends on workers' age, gender and sectoral affiliation**

Policy relevance

- ✓ **Labour market situation of low-educated people is very critical in most advanced economies (especially when they are young and female), and this is also the case in Belgium (Eurostat, 2015).**

  In Belgium:

  - Unemployment rate among low-educated more than 3 times bigger than among tertiary educated ones.
  - Employment rate below 40% among low educated and above 80% among high educated.

- ✓ **Policies aiming to increase the employability of low-educated people in the OECD area either try to foster the latter's' productivity (e.g. through specific training programmes) and/or to decrease their wage cost (e.g. through reduced payroll taxes).**

  Belgium is no exception:

  - Among highest spenders for ALM policies in Europe (Eurostat, 2010).
  - Reductions in SS contributions (notably for low-skilled) > 1.5 % of GDP (BFG, 2012).

Policy relevance

- ✓ **Effectiveness of these policies remains highly controversial** (Burggraeve and du Caju, 2003; Heckman et al., 1999; Kluwe and Schmidt, 2002; Konings and Vanormelingen, 2014; Huttunen et al., 2013).

- ✓ This is notably **due to the fact that**:
  - Relationship between education, wage costs and productivity is still not well understood.
  - **Remains unclear whether education-induced productivity gains are well aligned with corresponding wage cost differentials**.

⇒ **Aim** = improve our understanding of these issues with a specific focus on workers' age, gender and sectoral affiliation.

Methodology

- ✓ **Empirical set-up pioneered by Hellerstein, Neumark and Troske (1999)** and refined by Aubert and Crépon (2003) and van Ours and Stoeldraijer (2011).

- ✓ Based on the **estimation of a value added , a wage cost and a productivity-wage gap (i.e. profit) equation at the firm level**.

  - The value added function yields parameter estimates for the average marginal products of workers with different educational levels.

  - The wage equation estimates the respective impact of each educational group on the average wage bill paid by the firm.

  - The gap (i.e. profit) equation produces coefficients for the educational variables directly measuring the size and significance of educational-induced productivity-wage gaps.

Methodology

Benchmark equations:

$$\ln(Value\ \ Added\ /Hours)_{i,t} = \alpha + \sum_{j-\{0\}}^{J} \beta_j Education_{\ j,i,t} + \lambda\, X_{i,t} + \varepsilon_{i,t} \qquad (1)$$

$$\ln(Wage\ \ Cost/Hours)_{i,t} = \alpha^{*} + \sum_{j-\{0\}}^{J} \beta_j^{*} Education_{\ j,i,t} + \lambda^{*}\ X_{i,t} + \varepsilon_{i,t}^{*} \qquad (2)$$

$$\mathrm{Pr}oductivity - Wage\ \ Gap = \alpha^{**} + \sum_{j-\{0\}}^{J} \beta_j^{**} Education_{\ j,i,t} + \lambda^{**}\ X_{i,t} + \varepsilon_{i,t}^{**} \qquad (3)$$

where the dependent variable in:

- **Eq. (1)** is the hourly value added in firm *i* at time *t*, obtained by dividing the total value added (at factor costs) in firm *i* at time *t* by the total number of working hours (including paid overtime).
- **Eq. (2)** is the hourly wage cost in firm *i* at time *t*, including basic and variable pay components, in kind benefits, employer-funded extra-legal advantages (related to e.g. health, early retirement or pension) and payroll taxes (net of social security payroll tax *cuts*).
- **Eq. (3)** is :
  a)
  b) $\ln(Value\ \ Added\ /Hours)_{i,t} - \ln(Wage\ \ Cost/Hours)_{i,t}$
     $\ln(\mathrm{Pr}ofits/Hours)_{i,t} = \ln(Value\ \ Added\ /Hours - Wage\ \ Cost/Hours)_{i,t}$

Methodology (Cont.)

$$\ln(Value\ Added/Hours)_{i,t} = \alpha + \sum_{j-\{0\}}^{J} \beta_j Education_{j,i,t} + \lambda X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\ln(Wage\ Cost/Hours)_{i,t} = \alpha^{*} + \sum_{j-\{0\}}^{J} \beta_j^{*} Education_{j,i,t} + \lambda^{*} X_{i,t} + \varepsilon_{i,t}^{*} \quad (2)$$

$$\text{Pr}oductivity - Wage\ Gap = \alpha^{**} + \sum_{j-\{0\}}^{J} \beta_j^{**} Education_{j,i,t} + \lambda^{**} X_{i,t} + \varepsilon_{i,t}^{**} \quad (3)$$

With:

- ***Education*$_{j,i,t}$** shares of hours worked respectively by the different educational categories in total work hours of firm *i* at time *t*.

- Employees are split into **3 educational groups**: i) low-educated (i.e. at most lower secondary education), ii) middle-educated (i.e. at most higher secondary education) and iii) high-educated (i.e. tertiary education).

Robustness tests with up to 7 categories

Methodology (Cont.)

$$\ln(Value\ Added/Hours)_{i,t} = \alpha + \sum_{j-\{0\}}^{J} \beta_j Education_{j,i,t} + \lambda X_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\ln(Wage\ Cost/Hours)_{i,t} = \alpha^{*} + \sum_{j-\{0\}}^{J} \beta_j^{*} Education_{j,i,t} + \lambda^{*} X_{i,t} + \varepsilon_{i,t}^{*} \quad (2)$$

$$\text{Pr}oductivity - Wage\ Gap = \alpha^{**} + \sum_{j-\{0\}}^{J} \beta_j^{**} Education_{j,i,t} + \lambda^{**} X_{i,t} + \varepsilon_{i,t}^{**} \quad (3)$$

With $\boldsymbol{X_{i,t}}$ the share of the workforce within a firm that :

– has at least 10 years of tenure,

– is younger than 30 and older than 49 years, respectively,

– is female, works part-time,

– occupies a blue-collar job,

– has a fixed-term employment contract,

– is apprentice or under contract with a temporary employment agency.

& ln of firm size (# full-time equivalent workers), ln of capital stock per worker, level of collective wage bargaining (1 dummy), industry (8 dummies), region where firm is located (2 dummies), and 11 year dummies.

Estimation techniques

OLS and FE estimators

- ✓ **Neither addresses potential endogeneity** of educational variables.
- ✓ Yet, "employers might exploit cyclical downturns to improve the average skill level of their work force" (Gautier et al., 2002: 523).

There might be some **cyclical 'crowding out'**, namely a process by which during recessions, because of excess labour supply, highly educated workers take the jobs that could be occupied by less educated ones.

This assumption supported for certain countries including Belgium (Cockx and Dejemeppe, 2002; Dolado et al., 2000), suggests that the **share of more educated workers within firms may increase as a result of a lower labour productivity** (and vice versa).

Estimation techniques

GMM-SYS (Blundell and Bond, 1998) and Levinsohn and Petrin (2003) estimators

- ✓ **GMM-SYS** approach boils down to simultaneously estimating a system of two equations (respectively in level and in first differences) and relying on **internal instruments** to control for endogeneity.

- ✓ **LP estimator**, particularly well-suited for panels with small *t* and big *N*, **controls for endogeneity using firm's intermediate inputs** (namely, inputs such as energy , raw material, semi-finished goods and services that are typically subtracted from gross output to obtain value added) as a proxy for productivity shocks.

  Intuition: firms respond to time-varying productivity shocks observed by managers (and not by econometricians) through the adjustment of their intermediate inputs. Profit-maximizing firms react to positive productivity shocks by increasing their output, which requires more intermediate inputs (and vice versa).

Data set

Combination of two large data sets for 1999-2010:

- ✓ **'Structure of Earnings Survey'** (SES): information, provided by the management of firms, both on:
  - Firm-level characteristics (e.g. sector of activity, size of the firm, level of wage bargaining),
  - Individual and job characteristics (e.g. age of the worker, level of education, years of tenure, sex, occupation, working time, employment contract).
- ✓ **'Structure of Business Survey'** (SBS): firm-level survey providing annual information on financial variables (e.g. hourly value added and gross operating surplus).

Data set

Information in the SES refers to the month of October of each year, while data in the SBS are measured over entire calendar years.

To avoid running a regression where information on the dependent variable precedes (to a large extent) that on explanatory variables, all explanatory variables are lagged by one year $\Rightarrow$ information on educational variables relative to the month of October of year *t* used to explain firm-level productivity in year *t+1*.

This restricts our sample to firms that are observed at least two consecutive years $\Rightarrow$ over-representation of medium-sized and large firms given that sampling percentages of firms in our data increase with the size of the latter.

Final sample consists of an unbalanced panel of **6,714 firm-year-observations from 1,844 firms**.

It is representative of **all medium-sized and large firms in the Belgian private sector**, with the exception of large parts of the financial sector and the electricity, gas and water supply industry.

Selected Firm-level Descriptive Statistics

Variables:	Mean	Std. Dev.
Value added per hour (€[1])	66.19	526.00
Wage cost per hour (€[1])	33.34	19.62
Gross profit per hour (€[1])	32.85	524.56
Share of workers:	20.35	22.08
- Low-educated (i.e. at most lower secondary education):	**0.298**	0.295
Primary education	0.073	0.155
Lower secondary education	0.225	0.262
- Middle-educated (i.e. at most upper secondary education):	**0.426**	0.268
Upper general secondary education	0.208	0.242
Upper technical or professional secondary education	0.219	0.251
- High-educated (i.e. tertiary education):	**0.276**	0.251
Bachelor's or equivalent level	0.157	0.157
Master's or equivalent level	0.112	0.147
Post-Master's education or PhD	0.006	0.031
Workers with 10 years of tenure or more (%)	0.40	0.23
Women (%)	0.26	0.23
Share of workers < 30 years	0.21	0.13
Share of workers > 49 years	0.17	0.12
Blue-collar workers (%)	0.53	0.33
Part-time (less than 30 hours per week, %)	0.11	0.13
Fixed-term employment contracts (%)	0.03	0.08
Flanders	0.57	0.48
Wallonia	0.28	0.43
Firm-level collective agreements	0.32	0.46
Number of observations	6,714	
Number of firms	1,844	

[1] At 2004 constant prices.

Estimates for the entire sample, 3 educational categories

	GMM-SYS				LP
Dependent variable:	Value added per hour worked (ln)	Wage cost per hour worked (ln)	Value added-wage cost gap	Profit per hour worked (ln)	Value added per hour worked (ln)
	(1)	(2)	(3)	(4)	(5)
Low-educated (E12)	Reference	Reference	Reference	Reference	Reference
Middle-educated (E34)	**0.106****	**0.027****	0.027	0.084	**0.019****
	(0.053)	(0.013)	(0.021)	(0.074)	(0.009)
High-educated (E567)	**0.258*****	**0.145*****	**0.055***	**0.341*****	**0.128*****
	(0.092)	(0.047)	(0.031)	(0.130)	(0.026)
Hansen over-identification test, p-value	0,175	0.132	0.619	0.616	
Arellano-Bond test for AR(2), p-value	0.384	0.342	0.219	0.192	
Number of observations	6,714	6,714	6,714	6,714	6,691
Number of firms	1,844	1,844	1,844	1,844	1,844
χ^2 test **H_0: E34 = E567**	**2,85***	**6.24****	1.15	**5.24****	**17.83*****
	$\Rightarrow$ **Edu ↑ VA**	$\Rightarrow$ **Edu ↑ W**	$\Rightarrow$ **Edu ↑ Π**	$\Rightarrow$ **Edu ↑ Π**	$\Rightarrow$ **Edu ↑ VA**

Notes: ***/**/* significant at the 1, 5 and 10% level, respectively. Robust standard errors between parentheses. Regressions also control for: a) the lagged dependent variable; b) worker, job and firm characteristics; and c) year dummies (cf. Methodology).

Estimates for the entire sample, 7 educational categories

Dependent variable:	GMM-SYS				LP
	Value added per hour worked (ln)	Wage cost per hour worked (ln)	Value added-wage cost gap	Profit per hour worked (ln)	Value added per hour worked (ln)
	(1)	(2)	(3)	(4)	(5)
Primary education (E1)	Reference	Reference	Reference	Reference	Reference
Lower secondary (E2)	0.018	-0.015	0.030	0.150	0.004
	(0.028)	(0.023)	(0.025)	(0.098)	(0.018)
General upper secondary education (E3)	**0.068****	0.001	**0.064****	**0.220****	**0.037****
	(0.030)	(0.022)	(0.026)	(0.105)	(0.017)
Technical and professional upper secondary education (E4)	**0.068****	0.023	**0.041***	**0.177***	0.014
	(0.030)	(0.023)	(0.023)	(0.104)	(0.015)
Bachelor's or equivalent level (E5)	**0.122*****	0.056	**0.085****	**0.409****	**0.071*****
	(0.047)	(0.040)	(0.035)	(0.169)	(0.022)
Master's or equivalent level (E6)	**0.199*****	**0.243*****	**0.082***	**0.558*****	**0.205*****
	(0.061)	(0.074)	(0.042)	(0.165)	(0.055)
Post-Master's level or PhD (E7)	**0.366****	**0.295***	**0.235***	**1.071*****	**0.392*****
	(0.161)	(0.163)	(0.141)	(0.383)	(0.142)
Hansen over-identification test, p-value	0.487	0.154	0.686	0.707	
Arellano-Bond test for AR(2), p-value	0.129	0.284	0.217	0.163	
Number of observations	6,714	6,714	6,714	6,714	6,691
Number of firms	1,844	1,844	1,844	1,844	1,844
χ^2 test for equality of regression coefficients:	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**

Notes: ***/**/* significant at the 1, 5 and 10% level, respectively. Robust standard errors between parentheses. Regressions also control for: a) the lagged dependent variable; b) worker, job and firm characteristics; and c) year dummies (cf. Methodology).

Results from benchmark specification:

- ✓ **Upward-sloping profile between:**
  - Education end wage costs,
  - Education and productivity.

- ✓ **Education has stronger impact on productivity that wage costs**.
  →
  Profits rise when lower educated workers are substituted by higher-educated ones (and vice versa) .
  →
  'Wage-compression effect', i.e. relative over- (under-) payment of low-(high)-educated workers.

Estimates by age (threshold = 40 years), 3 educational categories

Dependent variables:	GMM-SYS				LP
	Value added per hour worked (ln)	Wage cost per hour worked (ln)	Value added-wage cost gap	Profit per hour worked (ln)	Value added per hour worked (ln)
	(1)	(2)	(3)	(4)	(5)
Young low-educated	Reference	Reference	Reference	Reference	Reference
Older low-educated	-0.028	-0.010	-0.034	0.038	-0.026
	(0.055)	(0.039)	(0.046)	(0.172)	(0.032)
Young middle-educated	0.046	0.004	0.040	0.002	-0.017
	(0.044)	(0.022)	(0.043)	(0.124)	(0.022)
Older middle-educated	0.039	**0.059***	-0.033	0.229	0.035
	(0.047)	(0.034)	(0.043)	(0.159)	(0.022)
Young high-educated	**0.158*****	**0.096****	**0.093****	**0.466*****	**0.120*****
	(0.058)	(0.048)	(0.045)	(0.178)	(0.033)
Older high-educated	0.080	**0.235*****	-0.029	0.152	**0.106*****
	(0.069)	(0.080)	(0.056)	(0.211)	(0.036)
Hansen over-identification test, p-value	0.451	0.238	0.799	0.663	
Arellano-Bond test for AR(2), p-value	0.132	0.306	0.224	0.219	
Number of observations	6,714	6,714	6,714	6,714	6,691
Number of firms	1,844	1,844	1,844	1,844	1,844
χ^2 test for equality of regression coefficients:					
a) Among **young workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**
b) Among **older workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu = Π**	**Edu = Π**	**Edu ↑ VA**

Notes: ***/**/* significant at the 1, 5 and 10% level, respectively. Robust standard errors between parentheses. Regressions also control for: a) the lagged dependent variable; b) worker, job and firm characteristics; and c) year dummies (cf. Methodology).

Estimates by age, 4 educational categories

			GMM-SYS			LP
Dependent variable:	Value added per hour worked (ln) 40 years threshold	Wage cost per hour worked (ln) 40 years threshold	Value added-wage cost gap 40 years threshold	Profit per hour worked (ln) 40 years threshold	Profit per hour worked (ln) 50 years threshold	Value added per hour worked (ln) 40 years threshold
	(1)	(2)	(3)	(4)	(5)	(6)
Young & primary education	**-0.165*** **	-0.060	**-0.096** **	**-0.384***	-0.150	-0.021
	(0.062)	(0.042)	(0.044)	(0.210)	(0.122)	(0.030)
Older & primary education	0.044	0.054	-0.025	0.260	0.195	-0.038
	(0.060)	(0.042)	(0.052)	(0.188)	(0.332)	(0.033)
Young & lower or upper secondary education	Reference	Reference	Reference	Reference	Reference	Reference
Older & lower or upper secondary education	-0.027	0.006	-0.050	0.128	0.079	-0.029
	(0.047)	(0.032)	(0.042)	(0.144)	(0.195)	(0.027)
Young & Bachelor's or equivalent degree	**0.130** **	0.057	**0.074***	**0.476** **	**0.275***	**0.060***
	(0.063)	(0.047)	(0.045)	(0.198)	(0.167)	(0.032)
Older & Bachelor's or equivalent degree	-0.045	0.073	-0.050	-0.013	0.200	-0.003
	(0.081)	(0.071)	(0.061)	(0.248)	(0.438)	(0.036)
Young & Masters's or equivalent degree or beyond	0.124	**0.132***	0.072	**0.463** **	**0.343** **	**0.201*** **
	(0.078)	(0.075)	(0.049)	(0.192)	(0.158)	(0.046)
Older & Masters's or equivalent degree or beyond	**0.188** **	**0.421*** **	-0.006	**0.568** **	**0.813***	**0.137** **
	(0.087)	(0.123)	(0.071)	(0.250)	(0.441)	(0.061)
Hansen over-identification test, p-value	0.474	0.402	0.606	0.704	0.567	
Arellano-Bond test for AR(2), p-value	0.124	0.287	0.217	0.192	0.233	
Number of observations	6,714	6,714	6,714	6,714	6,714	6,691
Number of firms	1,844	1,844	1,844	1,844	1,844	1,844
χ^2 test for equality of regression coefficients:						
a) Among **young workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**
b) Among **older workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu = Π**	**Edu ↑ Π (but not clear-cut)**	**Edu = Π**	**Edu ↑ VA**

Notes: ***/**/* significant at the 1, 5 and 10% level, respectively. Robust standard errors between parentheses. Regressions also control for: a) the lagged dependent variable; b) worker, job and firm characteristics; and c) year dummies (cf. Methodology).

Results by workers' age:

- ✓ **Among both young and older worker, upward-sloping profile between:**
  - Education and wage costs,
  - Education and productivity.

- ✓ Over-payment (under-payment) of low-educated (high-educated) workers disappears among older cohorts of workers.

  →

  Existence of '**wage-compression effect' essentially verified among young workers**.

  For older workers, distribution of wage costs across educational groups well aligned with workers' educational profile.

Estimates by gender, 3 educational categories

Dependent variable:	GMM-SYS				LP
	Value added per hour worked (ln)	Wage cost per hour worked (ln)	Value added-wage cost gap[c]	Profit per hour worked (ln)[d]	Value added per hour worked (ln)
	(1)	(2)	(3)	(4)	(5)
Male low-educated	Reference	Reference	Reference	Reference	Reference
Female low-educated	-0.029	-0.060	0.007	-0.225	-0.034
	(0.060)	(0.049)	(0.046)	(0.206)	(0.026)
Male middle-educated	**0.058****	**0.031****	0.029	0.093	0.009
	(0.025)	(0.016)	(0.024)	(0.090)	(0.013)
Female middle-educated	0.014	-0.035	0.019	-0.184	0.025
	(0.060)	(0.041)	(0.043)	(0.169)	(0.020)
Male high-educated	**0.101***	**0.150*****	0.009	0.238	**0.119*****
	(0.054)	(0.050)	(0.045)	(0.176)	(0.032)
Female high-educated	**0.151***	0.082	**0.125****	0.231	**0.128*****
	(0.077)	(0.069)	(0.051)	(0.203)	(0.039)
Hansen over-identification test, p-value	0.319	0.138	0.737	0.740	
Arellano-Bond test for AR(2), p-value	0.129	0.338	0.215	0.177	
Number of observations	6,714	6,714	6,714	6,714	6,691
Number of firms	1,844	1,844	1,844	1,844	1,844
χ^2 test for equality of regression coefficients:					
a) Among **male workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu = Π**	**Edu = Π**	**Edu ↑ VA**
b) Among **female workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**

Estimates by gender, 4 educational categories

Dependent variable:	Value added per hour worked (ln) (1)	Wage cost per hour worked (ln) (2)	Value added-wage cost gap (3)	Profit per hour worked (ln) (4)	Value added per hour worked (ln) (5)
Female & primary education	**-0.131***	-0.093	-0.031	-0.301	**-0.081*****
	(0.070)	(0.058)	(0.048)	(0.231)	(0.030)
Male & primary education	0.028	**0.076***	**-0.129***	0.159	0.005
	(0.054)	(0.043)	(0.072)	(0.173)	(0.020)
Female & lower or upper secondary education	Reference	Reference	Reference	Reference	Reference
Male & lower or upper secondary education	0.037	0.062	-0.104	0.213	0.003
	(0.053)	(0.039)	(0.065)	(0.150)	(0.016)
Female & Bachelor's or equivalent degree	**0.141***	0.069	**0.125***	**0.404***	**0.069***
	(0.073)	(0.071)	(0.064)	(0.234)	(0.036)
Male & Bachelor's or equivalent degree	0.048	**0.107***	**-0.138***	0.241	0.037
	(0.069)	(0.055)	(0.079)	(0.209)	(0.032)
Female & Masters's or equivalent degree or beyond	0.156	0.182	0.087	0.452	**0.212****
	(0.121)	(0.121)	(0.075)	(0.286)	(0.090)
Male & Masters's or equivalent degree or beyond	**0.172****	**0.339*****	-0.093	**0.576*****	**0.184*****
	(0.074)	(0.092)	(0.081)	(0.202)	(0.035)
Hansen over-identification test, p-value	0.373	0.297	0.209	0.541	
Arellano-Bond test for AR(2), p-value	0.125	0.289	0.561	0.173	
Number of observations	6,714	6,714	6,714	6,714	6,691
Number of firms	1,844	1,844	1,844	1,844	1,844
χ^2 tests for equality of regression coefficients:					
a) Among **male workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu = Π**	**Edu ↑ Π**	**Edu ↑ VA**
b) Among **female workers**:	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**

Results by gender:

- ✓ **Among both men and women, upward-sloping profile between:**
  - **- Education and wage costs,**
  - **- Education and productivity.**

- ✓ Over-payment (under-payment) of low-educated (high-educated) workers is more pronounced among women than men.

- ✓ **Education-induced productivity gains outweigh wage costs differentials for women and (to a lesser extent) for men**

Estimates by industry, 3 educational categories

Dependent variable:	GMM-SYS: Value added per hour worked (ln)		GMM-SYS: Wage cost per hour worked (ln)		GMM-SYS: Value added-wage cost gap[c]		GMM-SYS: Profit per hour worked (ln)[d]		LP: Value added per hour worked (ln)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Industry	**Services**	**Industry**	**Services**	**Industry**	**Services**	**Industry**	**Services**	**Industry**	**Services**
Low-educated	-0.040**	-0.104*	-0.031**	-0.060**	-0.020	-0.051	-0.016	-0.280*	-0.009	-0.048*
	(0.020)	(0.058)	(0.014)	(0.027)	(0.020)	(0.049)	(0.085)	(0.148)	(0.012)	(0.028)
Middle-educated	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High-educated	0.136**	0.177**	0.079*	0.217**	0.097***	0.039	0.319**	0.281*	0.086***	0.116**
	(0.053)	(0.089)	(0.043)	(0.099)	(0.045)	(0.029)	(0.160)	(0.170)	(0.028)	(0.051)
Hansen over-identification test, p-value	0.344	0.482	0.350	0.343	0.746	0.474	0.775	0.247		
Arellano-Bond test for AR(2), p-value	0.232	0.127	0.428	0.489	0.468	0.171	0.843	0.107		
Number of observations	4,511	2,015	4,511	2,015	4,511	2,015	4,511	2,015	4,501	2,003
Number of firms	1,143	693	1,143	693	1,143	693	1,143	693	1,143	693
χ^2 test H_0: E12 = E567	11.94***	6.85**	9.02**	7,64**	6.44**	2.65*	4.16**	6.01**	13.95***	11.13***
	⇒	⇒	⇒	⇒	⇒	⇒	⇒	⇒	⇒	⇒
	Edu ↑ VA	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ W**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**	**Edu ↑ VA**

Notes: ***/**/* significant at the 1, 5 and 10% level, respectively. Robust standard errors between parentheses. Regressions also control for: a) the lagged dependent variable; b) worker, job and firm characteristics; and c) year dummies (cf. Methodology).

Estimates by industry, 4 educational categories

	GMM-SYS								LP	
Dependent variable:	*Value added per hour worked (ln)*		*Wage cost per hour worked (ln)*		*Value added-wage cost gap*		*Profit per hour worked (ln)*		*Value added per hour worked (ln)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Industry	**Services**	**Industry**	**Services**	**Industry**	**Services**	**Industry**	**Services**	**Industry**	**Services**
Primary education	-0.037	-0.030	-0.026	-0.037	-0.020	-0.009	-0.007	-0.256*	-0.010	-0.026
	(0.030)	(0.048)	(0.020)	(0.043)	(0.027)	(0.027)	(0.116)	(0.154)	(0.015)	(0.031)
Lower or **upper secondary education**	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Bachelor's or equivalent degree	0.139**	0.109	0.064	0.102	0.089*	0.040	0.323*	0.219	0.069***	0.029***
	(0.057)	(0.074)	(0.043)	(0.078)	(0.048)	(0.033)	(0.181)	(0.221)	(0.027)	(0.037)
Master's or equivalent degree and beyond	0.172**	0.327**	0.139**	0.386***	0.124*	0.055	0.405*	0.450**	0.116***	0.235***
	(0.079)	(0.152)	(0.065)	(0.149)	(0.076)	(0.045)	(0.219)	(0.209)	(0.032)	(0.086)
Hansen over-identification test, p-value	0.332	0.605	0.479	0.515	0.569	0.860	0.551	0.445		
Arellano-Bond test for AR(2), p-value	0.228	0.130	0.398	0.531	0.453	0.193	0.767	0.102		
Number of observations	4,511	2,015	4,511	2,015	4,511	2,015	4,511	2,015	4,501	2,003
Number of firms	1,143	693	1,143	693	1,143	693	1,143	693	1,143	693
χ^2 tests for equality of regression coefficients:	**Edu ↑ VA**	**Edu ↑ VA**	**Edu ↑ W**	**Edu ↑ W**	**Edu ↑ Π**	**Edu = Π**	**Edu ↑ Π**	**Edu ↑ Π**	**Edu ↑ VA**	**Edu ↑ VA**

Notes: ***/**/* significant at the 1, 5 and 10% level, respectively. Robust standard errors between parentheses. Regressions also control for: a) the lagged dependent variable; b) worker, job and firm characteristics; and c) year dummies (cf. Methodology).

Results by industry:

- ✓ **In both services and industry, upward-sloping profile between:**
  - **Education and wage costs,**
  - **Education and productivity.**

- ✓ **Additional value generated by high-educated workers exceeds their wage cost differential in both sectors.**

- ✓ Difficult to determine whether this ‘wage-compression effect’ is more pronounced in industry or services as the relative size of point estimates vary across specifications (whatever number of educational categories chosen).

Discussion

Benchmark results:

- ✓ **Partial support for human capital theory** (education-driven productivity gains not aligned with wage differentials).
- ✓ **Not in line with line with theories** (based on e.g. tournaments, decision-making process within organisations) **predicting high-educated relatively over-paid**.
- ✓ **Compatible with literature on social norms and the hysteresis of the wage structure, fairness theories and arguments according to which labour market regulations** (e.g. minimum wages, collective bargaining) **reduce wage inequalities by pushing earnings of low-wage workers upwards**.

Discussion

Benchmark by workers' age:

- ✓ White-collar workers in Belgium are much more likely to be paid according to seniority than their blue-collar counterparts (which are typically less educated) and **seniority-pay profiles are generally much steeper for high- than low-educated workers**.

- ✓ **Labour market institutions** (e.g. minimum wages and trade unions) essentially affect the lower end of the wage distribution → **More likely to compress the wage cost differential between low- and high-educated workers when they are young**.

- ✓ Overall, low-educated (high-educated) workers are no longer over-paid (under-paid) when they become older because their wage cost to productivity ratio increases at a slower (faster) pace during their career than that of high-educated (low-educated) workers.

Discussion

Benchmark by workers' gender:

- ✓ **Women are over-represented among low-wage earners** and are thus more likely to have their working conditions influenced by labour market regulations (such as minimum wages and collective bargaining).

- ✓ However, stronger 'wage-compression effect' among women might also be explained by:
  - a **glass-ceiling effect** (Christophides et al., 2013),
  - evidence according to which **high-educated women**, in a given occupation, "are **less likely to initiate wage bargaining** with their employer **and** are **(often) less effective negotiators than men**" (Card et al., 2013: 1).

Conclusion

- ✓ Firms located in Belgium (both in industry and services) face financial disincentives to employing low-educated workers, especially when they are young.

  Indeed, **firms employing a larger share of young low-educated workers are found to be less profitable**.

  ⇒

  Policies aiming to improve the labour market prospects of young low-educated workers should thus try to boost their productivity and/or to decrease their wage cost.

  A substantial number of policies (i.e. training programmes, wage subsidies, reductions of social security contributions) are already implemented in Belgium to reach this goal.

  Findings suggest that these **efforts, targeted on the young low-educated, should be continued and intensified**, alongside policies fostering total employment.

Conclusion (Cont.)

- ✓ The **'wage-compression effect' is more pronounced among women** than men.

  ⇒

  Particular attention should be devoted **to the productivity to wage cost ratio of low-educated women but also to policies favouring gender equality** in terms of remuneration and career advancement.