

Innovation and Wage Dynamics: An Examination of Rent Sharing

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Outline

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Literature

Many studies deal with the employment effect of innovation. Not much on wage effects.

The main proposition is the age-old skill-biased technical progress, very nicely presented *e.g.*, in *Aghion* [2002] *Econometrica*. It recently also married New Economic Geography: *Berry and Glaeser* [2005], Harvard DP 2091.

Indeed, ample evidence of increased wage dispersion, esp. in US. Very little on differences in wage setting practices at innovative vs. non-innovative firms. Negative evidence in *Hall and Kramarz* [1998], largely negative evidence in *Hanley and Görg* [2008].

But: HR!

The main issues:

- Protection of innovation property rights. If results can be patented (*e.g.*, pharmaceutical industry), the innovator cannot easily walk away with the novelties. Counter example: sw. At big firms innovation mostly is a team effort. At a small firm R&D is more individual: more vulnerable.

⇒ Different incentive schemes!

- Industries with patent protected innovation: premia for the successful team.
- Unprotected industries: buy loyalty from the beginning. (stock options) Non-financial benefits: nice environment and intensive training. (Those able to walk away are eager to increase their human capital: to accumulate knowledge, and to learn new skills.) Efficiency wages: attract talents by high starting wages.

The exception

Andersson, Freedman, Haltiwanger, Lane and Shaw [2007], NBER W12435:

They use longitudinal matched employer-employee data. (Panel in both dimensions: both firms and individuals are uniquely identified.)

They show that software firms are more likely to attract and pay for star workers. Thus, firms in high variance product markets pay more up-front to attract and motivate star employees, because if these star workers produce home-run innovations, the firm's winnings will be huge. However, these same firms pay highly for loyalty: star workers that stay with a firm have much higher earnings in firms with high variance product market payoffs.

Data

I use matched employer-employee data for Hungary for the period 1992-2004/5. It is panel in the firm dimension, but repeated cross section in the individual dimension. Sample covers more than 50000 firms every year. We have the standard financial report of the firm. A roughly 10% sample of employees is linked to annually 10-20 thousand firms. The employee records are also provided by the company; thus, it only includes information routinely available at the HR office.

Large firms are overrepresented, micro firms excluded. The firm sample covers at least 90% of the corporate sector by all relevant output measures. The employee dataset is around 100000 observations annually: roughly 5% of corporate employment.

R&D expenditure is merged to the balance sheet for 2003-5. Some 400 companies reported any R&D activity.

Hypotheses

- H1 SBTP arrived to Hungary with transition (with a vengeance). Skill premium should be large and increasing. (*c.f.*, Köllő [2004], Halpern and Kőrösi [1998]).
- H2 Foreign firms use efficiency wages for improving the composition of their labour force at privatized firms. They later inflated away a part of the premium.
- H3 Hungary is a technology importer, home grown innovation is scarce. The pharmaceutical sector is a partial exception: there should be innovation premium there. High-tech engineering was almost exclusively innovation importer, with slightly increasing R&D activity after 2000. Innovation premium? (If there is a premium, it should mostly increase salaries for professionals.)
- H4 Wage curve effect disappears as regional unemployment distribution stabilizes.

Augmented Mincerian wage equation

The standard static human capital model is augmented with variables related to the hypotheses, and by controls:

$$\ln(W) = f(Ex, Ed, F, Y, P, H, P \times Ed, H \times Ed, X) + \varepsilon$$

Ex: experience;

Ed: education categories;

F: foreign owner;

Y: labour productivity;

P: pharmaceutical industry;

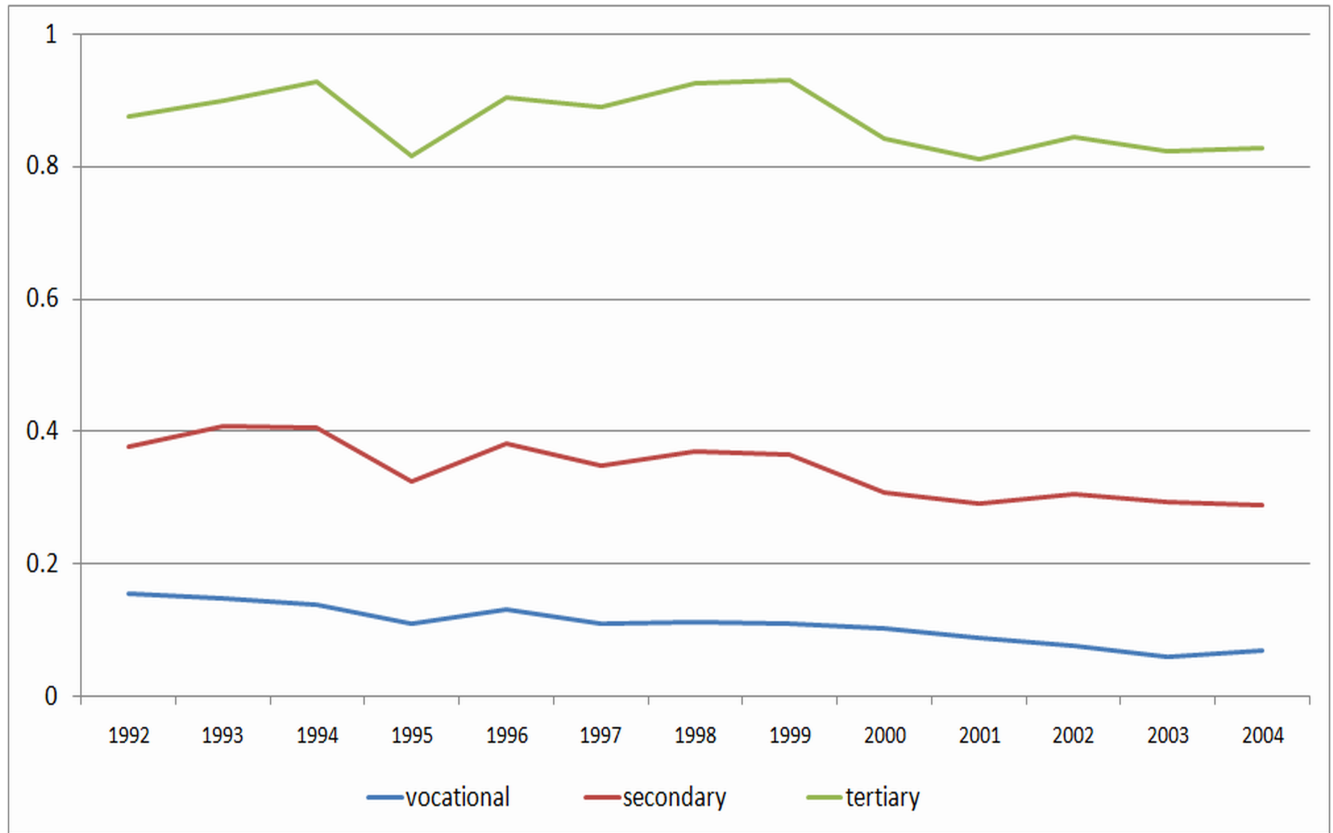
H: high-tech engineering;

X: includes gender, locational and regional dummies, and collective bargaining premium;

f: mostly linear, quadratic in experience, log of productivity.

The equation also incorporates R&D activity indicator in 2003-4.

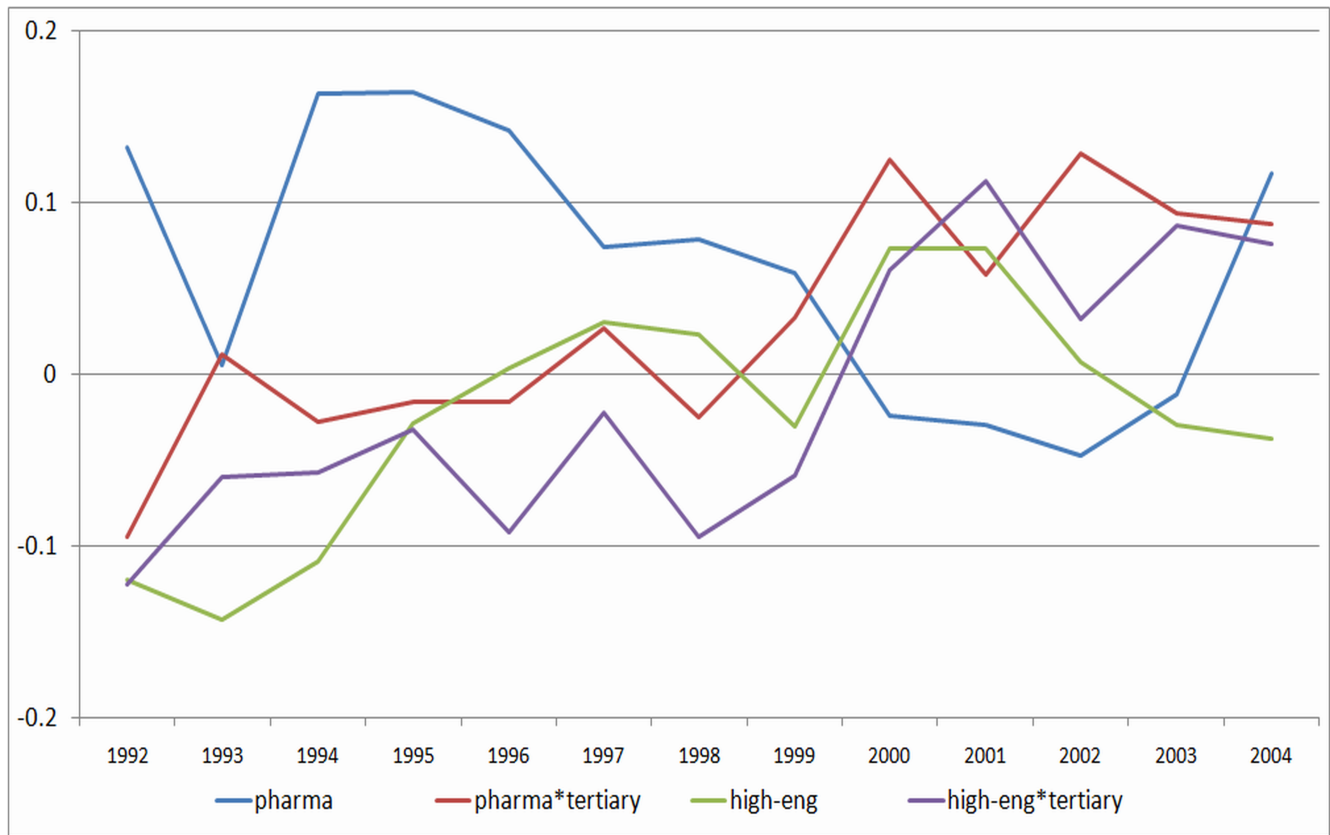
Returns to education



Foreign ownership premium and productivity elasticity



Pharmaceutical industry and high-tech engineering



Augmented with R&D activity

Innovation related 'premia'

	2003	2004
pharma	-0.147	-0.031
pharma×tertiary	0.000	-0.011
high-eng	-0.040	-0.060
high-eng×tertiary	0.054	0.050
R&D	0.126	0.142
R&D×tertiary	0.101	0.133

Employment ratios of the population aged 25-62 by education, 1998 (%)

		Men			Women		
	Share of ISCED 0/1 & 2	All levels	ISCED 0/1 & 2	Diff- erence	All levels	ISCED 0/1 & 2	Diff- erence
Hungary	33	69.1	37.1	32	53.9	31.6	22.3
Poland	24	75.9	57.4	18.5	60.5	40.7	19.9
Comparators							
Austria	28	80.7	65.3	15.4	60.3	45.1	15.2
Finland	28	76.2	61.6	10.9	69.8	57.8	12
Czechia	16	82.9	57.6	25.3	63.4	41.8	21.6
Comparators							
Danmark	20	84	69	15	73.2	55.7	17.5
Germany	19	76.9	62.5	14.4	59.7	40.4	19.3

Source: Education at a glance, OECD, Paris, 2000, Tables A2.1b and E1.1–E1.2.

Efficiency wages and rent sharing

- **Efficiency wages:**

Major source: Akerlof and Yellen [1986] It is not optimal to fully adjust wages to the actual prices and production decisions. Reasons: incentives, attract productive workers; and regulation rigidities: companies need slack for fast adjustment. Thus, wage setting is a dynamic process. Production decisions also depend on wages and on quality of labour.

- **Rent sharing:**

Major sources: *Nickell and Wadhani* [1990], and *Blanchflower, Oswald, and Garrett* [1990]. Firms share profits or productivity gains, due to insider power, monopsonic (unionised) labour, bargaining. Profits and/or productivity are important explanatory variables.

- **Size matters:**

Major source: *Bayard and Troske* [1999]. Larger firms are more likely to share rents and employ efficiency wage strategies. Firm size is usually measured by the number of employees.

- **Wage curve:**

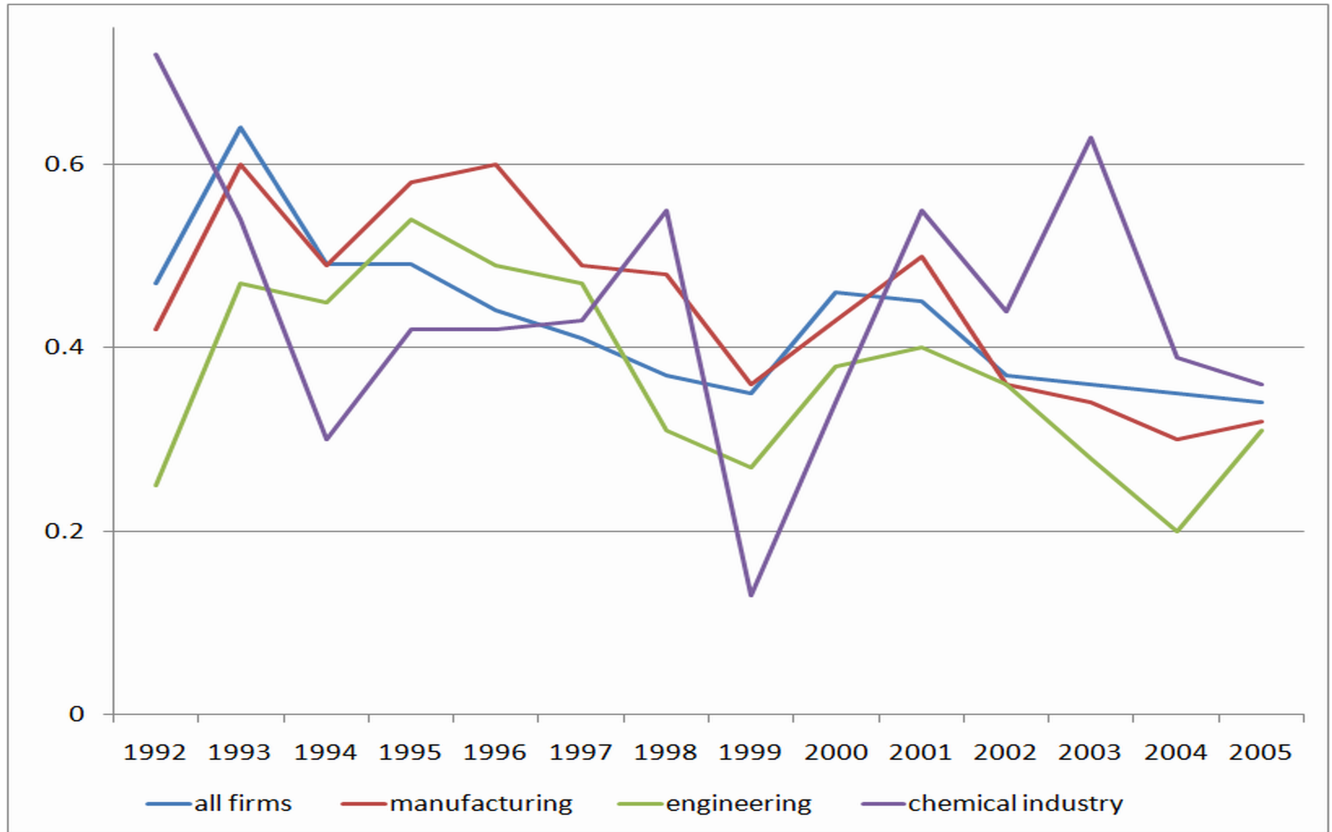
Major source: *Blanchflower and Oswald* [1994]. Local labour market pressures limit insider power, thus rent sharing. Thus, local unemployment or employment ratio influences wage determination.

The estimated model (at firm level):

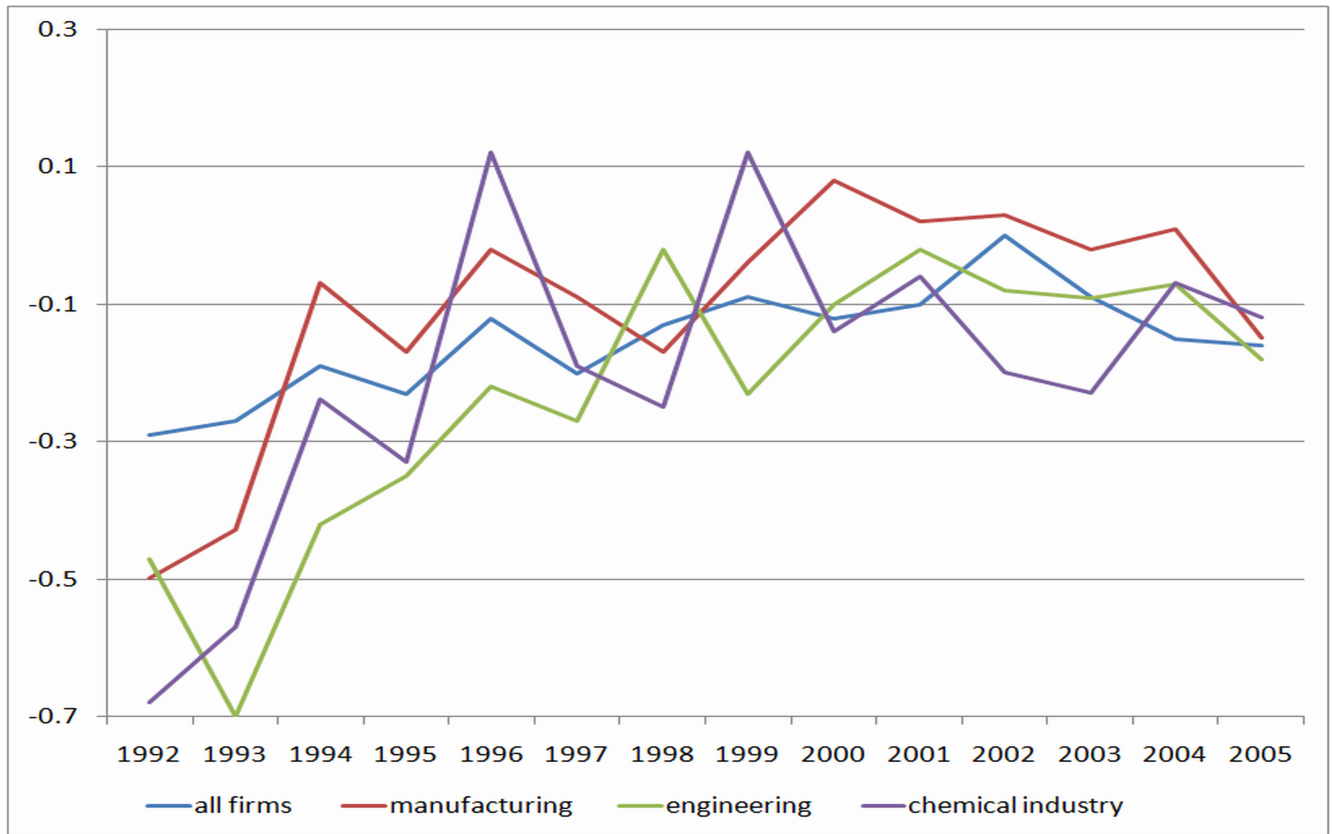
$$\ln(W) = f(W_{t-1}, Y, Y_{t-1}, L, UE, X) + \varepsilon$$

Estimation is by (system-)gmm.

Rent sharing



Wage curve



Panel estimates

Wage determination: dynamic equation, all firms

Variables	1992–4	1995–7	1998–2001	2002–5
log lagged wage	0.81 **	0.87 **	0.86 **	0.93 **
log of productivity	0.50 **	0.45 **	0.48 **	0.35 **
log of lagged productivity	-0.35 **	-0.34 **	-0.36 **	-0.33 **
log of employment	0.02 **	0.02 **	0.02 **	0.01 **
unemployment rate	-0.34 **	-0.16 **	-0.08 **	-0.05 **
Nob	12442	24658	70050	120166
R ²	0.78	0.84	0.89	0.83
Overidentification test	21.32 **	18.17 **	30.28 **	45.90 **

Wage determination: dynamic equation, manufacturing

Variables	1992–4	1995–7	1998–2001	2002–5
log lagged wage	0.84 **	0.92 **	0.89 **	0.95 **
log of productivity	0.50 **	0.54 **	0.48 **	0.35 **
log of lagged productivity	-0.47 **	-0.45 **	-0.37 **	-0.32 **
log of employment	0.02 **	0.02 **	0.01 **	0.00
unemployment rate	-0.28 **	-0.07 *	0.01	-0.01
Nob	4287	8542	21106	31762
R ²	0.81	0.84	0.91	0.86
Overidentification test	12.74 **	9.16 **	12.69 **	20.35 **

Wage determination: dynamic equation, engineering

Variables	1992–4	1995–7	1998–2001	2002–5
log lagged wage	0.60 **	0.93 **	0.87 **	0.91 **
log of productivity	0.43 **	0.49 **	0.34 **	0.31 **
log of lagged productivity	-0.30 **	-0.37 **	-0.23 **	-0.27 **
log of employment	0.02 **	0.03 **	0.02 **	0.01 *
unemployment rate	-0.60 **	-0.22 **	-0.04	-0.07 *
Nob	1447	2949	7832	12250
R ²	0.75	0.79	0.90	0.84
Overidentification test	3.03	4.61	4.08	9.89 *

Conclusions

- Without panel for individuals it is difficult to decide, where is it better to measure; at firm level or at individual level.
- Rent sharing intensity very much depends on the measurement level.
- Employee level measurement helps to identify the role of other factors, like wage dispersion, changes in the valuation of human capital.
- The innovation wage effect is difficult to measure at the firm level, because employees are affected heterogeneously.
- Innovation causes a surprising pattern change in the return to higher education. Otherwise, hypotheses are not contradicted by the evidence.