

# The Anatomy of French Production Hierarchies

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# Introduction

- Firms are heterogeneous in a variety of dimensions
  - ▶ But little is known about where this heterogeneity comes from
- Some of the observed heterogeneity is the result of organizational differences
  - ▶ The number and knowledge of employees
- Our aim is to understand empirically how firms are organized
  - ▶ Does this matter?
    - ★ Yes, because firms change organization as a result of changes in the economic environment
    - ★ Yes, because the organization of firms has aggregate consequences
- Empirical analysis is guided by Caliendo and Rossi-Hansberg (2012)
  - ▶ We divide firms into layers of employees
  - ▶ Study levels and changes in wages, spans of control, and number of employees: overall and for each layer

## Related Literature

- Model of organization based on Garicano (2000)
  - ▶ Applied to GE in Garicano and Rossi-Hansberg (2004, 2006, 2011)
  - ▶ With heterogeneous firms in a product market:
    - ★ Caliendo and Rossi-Hansberg (2012)
- Few empirical studies on organizational change
  - ▶ Baker, Gibbs, and Holmstrom (1994): Study wage policies and promotions in a firm
  - ▶ Rajan and Wulf (2006) find that hierarchies have “flattened” over time and decentralized their decision making
  - ▶ Garicano and Hubbard (2007) find that as market size increases the span of control of upper-level individuals increases
  - ▶ Guadalupe and Wulf (2010) show delayering as a result of trade competition

# Sketch of Theory in CRH (2012)

- Agents employed in a firm act as production workers or managers
- Production workers:
  - ▶ Generate a production possibility that can yield **1** unit of output
  - ▶ For output to be realized the worker needs to solve a problem
    - ★ Problems are drawn from  $F(z)$  with  $F''(z) < 0$
  - ▶ Workers learn how to solve problems in an interval of knowledge  $[0, z_L^1]$ 
    - ★ If the problem they face is in this interval production is realized
    - ★ Otherwise they could ask a manager one layer above

# Sketch of Theory in CRH (2012)

- Managers

- ▶ Specialize in solving problems
- ▶ Spend  $h$  units of time with each problem that gets to them
  - ★ So each manager can deal with  $1/h$  problems
- ▶ A manager of layer 2 tries to solve the problems workers could not solve
  - ★ So problems that require knowledge larger than  $z_L^1$
  - ★ Learns how to solve problems in the interval  $[z_L^1, z_L^1 + z_L^2]$
  - ★ So the firm needs  $n_L^2 = hn_L^1 (1 - F(z_L^1))$  of these managers
  - ★ Unsolved problems can be sent to a manager one layer above
- ▶ In general, managers in layer  $\ell$  learn  $[Z_L^{\ell-1}, Z_L^\ell]$  and there are  $n_L^\ell = hn_L^1 (1 - F(Z_L^{\ell-1}))$  of them, where  $Z_L^\ell = \sum_{i=1}^{\ell} z_L^i$

## Sketch of Theory in CRH (2012): Cost Minimization

- Consider a firm that produces a quantity  $q$ .  $C_L(q; w)$  is the minimum cost of producing  $q$  with an organization with  $L$  layers, namely,

$$C_L(q; w) = \min_{\{n_L^\ell, z_L^\ell\}_{\ell=1}^L \geq 0} \sum_{\ell=1}^L n_L^\ell w_L^\ell$$

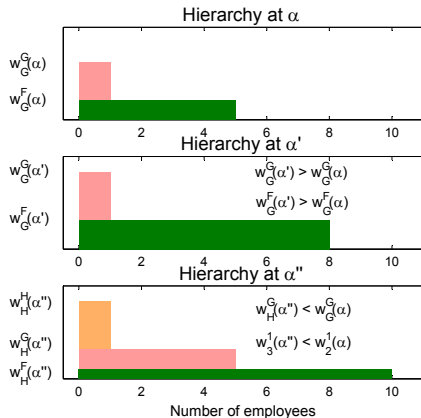
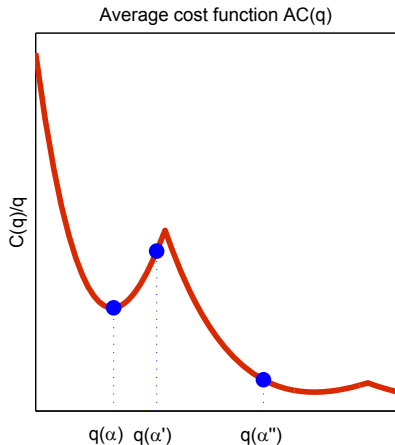
subject to

$$\begin{aligned} q &\leq F(Z_L^L) n_L^1, \\ w_L^\ell &= \bar{w} [c z_L^\ell + 1] \text{ for all } \ell \leq L, \\ n_L^\ell &= h n_L^1 [1 - F(Z_L^{\ell-1})] \text{ for } L \geq \ell > 1, \\ n_L^L &= 1. \end{aligned}$$

- The **variable** cost function is given by

$$C(q; w) = \min_{L \geq 1} \{C_L(q; w)\}$$

# Sketch of Theory in CRH (2012)



# Implications of the Model

- 1) Firms are hierarchical,  $n_L^1 \geq \dots n_L^\ell \dots \geq n_L^L$  for all  $L$
- 2) Layers  $L$ , sales  $pq$ , and total labor demand  $\sum_{\ell=1}^L n_L^\ell$ , increase with  $\alpha$
- 3) Given  $L$ ,  $w_L^\ell$  and  $n_L^\ell$  increase with  $\alpha$  at all  $\ell$
- 4) Given  $\alpha$ ,  $w_L^\ell$  decreases and  $n_L^\ell$  increases with an increase in  $L$  at all  $\ell$



# Data description

- Dataset collected by the French National Statistical Institute (INSEE)
  - ▶ We use the period from 2002 to 2007
    - ★ Before 2002 different occupational categories
- We match two sources from mandatory reports:
  - ▶ BRN: private firms balance sheet data
    - ★ 553,125 firm-year observations in manufacturing
  - ▶ DADS: occupation, hours and earning reports of salaried employees
- We lose 11% of the observations from cleaning, and 5.9% from matching
- The sample covers on average 90.7% of total value added in manufacturing
  - ▶ Small firms can choose not to report in BRN, but insignificant in terms of value added

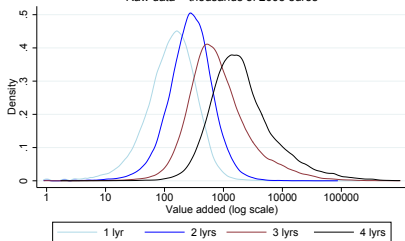
# Layers: occupational categories

- PCS-ESE classification codes that belong to manufacturing:
  - 2 Firm owners receiving a wage
    - ★ CEO or firm directors
  - 3 Senior staff or top management positions
    - ★ chief financial officers, head of HR, logistics, purchasing managers
  - 4 Employees at the supervisor level
    - ★ quality control technicians, technical, accounting, and sales supervisors
  - 5 Qualified and non-qualified clerical employees (administrative tasks)
    - ★ secretaries, HR or accounting, telephone operators, sales employees
  - 6 Blue collar qualified and non-qualified workers (manual tasks)
    - ★ welders, assemblers, machine operators and maintenance
- Classification code 1 (farmers) does not belong to manufacturing
- We group 5 and 6 since the distribution of wages coincide [▶ data](#)

# Firms with different number of layers are different

Value added distribution by number of layers

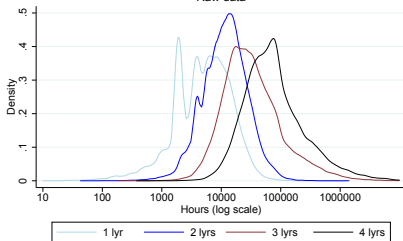
Raw data – thousands of 2005 euros



Kernel density estimate

Hours distribution by number of layers

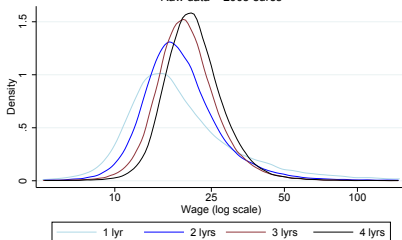
Raw data



Kernel density estimate

Firm hourly wage distribution by number of layers

Raw data – 2005 euros



Kernel density estimate

Year	Firms	Average # of layers
2002	78,494	2.60
2003	76,927	2.58
2004	75,555	2.59
2005	74,806	2.55
2006	73,834	2.53
2007	71,859	2.51

# of layers	Firm-years
1	80,326
2	124,448
3	160,030
4	86,671

## Firms with adjacent occupational categories

- We select the sub-sample of firms that satisfy the following criteria:
  - ▶ Layer 0 firms are firms with occupation codes 6 and 5
  - ▶ Layer 1 firms are firms with occupation codes 6, 5 and 4
  - ▶ Layer 2 firms are firms with occupation codes 6, 5, 4 and 3
  - ▶ Layer 3 firms are firms with occupation codes 6, 5, 4, 3 and 2

	Percentage of firms that have adjacent layers				All firms
	0 layers	Among firms with 1 layer	2 layers	3 layers	
Unweighted	87.42	67.39	80.01	100	81.69
Weighted by VA	87.69	68.40	94.60	100	96.73
Weighted by hours	99.17	72.56	93.07	100	95.69

▶ Fraction of firms that transition to an adjacent layer

# Hours and wages are hierarchical

Percentage of firms that satisfy a hierarchy

$N_L^\ell$  = hours at layer  $\ell$  of a firm with  $L$  layers

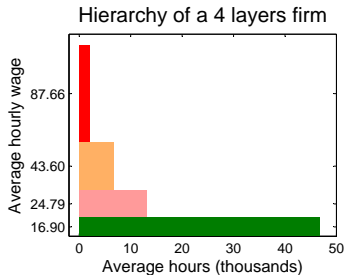
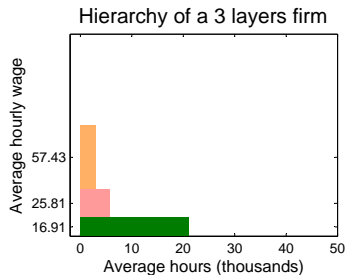
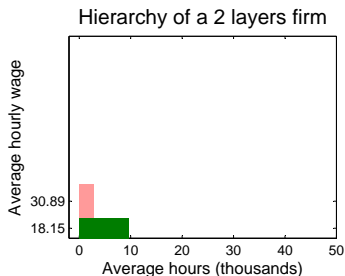
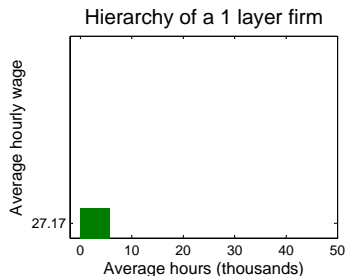
# of layers	$N_L^\ell \geq N_L^{\ell+1}$ all $\ell$	Unweighted		
		$N_L^1 \geq N_L^2$	$N_L^2 \geq N_L^3$	$N_L^3 \geq N_L^4$
2	85.6	85.6	-	-
3	63.4	85.9	74.8	-
4	56.5	86.9	77.5	86.9

# of layers	$w_L^{\ell+1} \geq w_L^\ell$ all $\ell$	Unweighted		
		$w_L^2 \geq w_L^1$	$w_L^3 \geq w_L^2$	$w_L^4 \geq w_L^3$
2	92.1	92.1	-	-
3	86.3	93.7	92.5	-
4	80.1	96.6	94.5	87.9

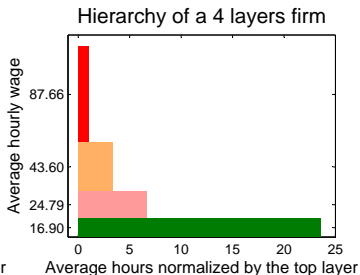
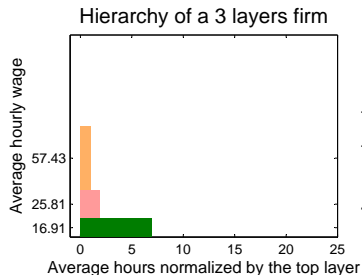
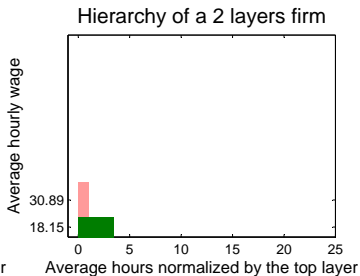
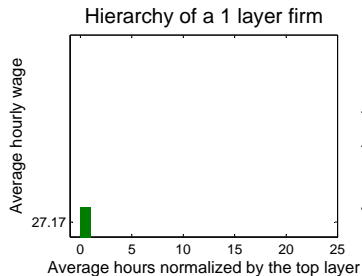
# Variation in log wages

Mean share variation of wages explained by cross-layer variation				
	Firm-years	Unweighted	Weighted by	
			Hours	VA
All firms	434,872	0.50	0.51	0.49
Firms with more than 0 layers	370,997	0.59	0.51	0.50
Firms with 0 layers	63,875	0.00	0.00	0.00
Firms with 1 layer	124,299	0.50	0.41	0.43
Firms with 2 layers	160,028	0.62	0.51	0.50
Firms with 3 layers	86,670	0.66	0.53	0.50

# Representative hierarchies



# Representative hierarchies: normalized hours





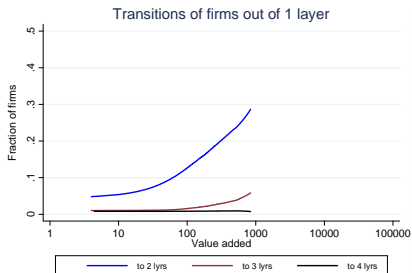
# Layer transitions

Distribution of # of layers at time  $t+1$  given the # of layers at time  $t$

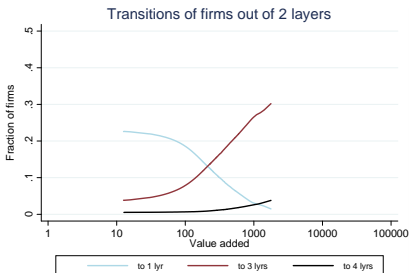
		# of layers at $t + 1$					Total
		Exit	1	2	3	4	
# of layers at $t$	1	15.3	<b>67.5</b>	15.2	1.9	0.2	100
	2	9.8	10.7	<b>62.2</b>	16.2	1.1	100
	3	7.7	1.2	13.1	<b>67.6</b>	10.5	100
	4	6.2	0.2	2.0	20.5	<b>71.3</b>	100

▶ Weighted by VA

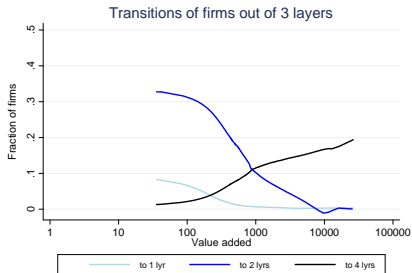
# Transitions across layers depend on value added



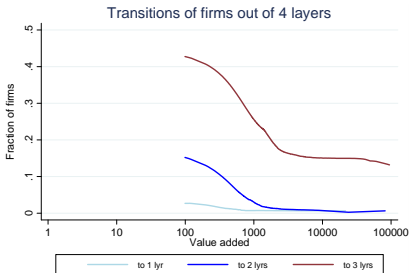
Lowess smoothing - trimming top 1% of value added



Lowess smoothing - trimming top 1% of value added

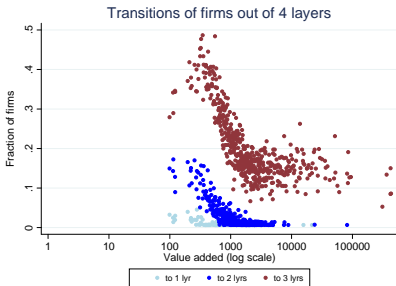
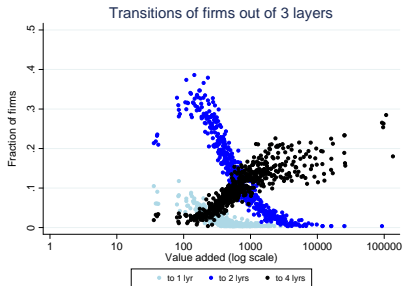
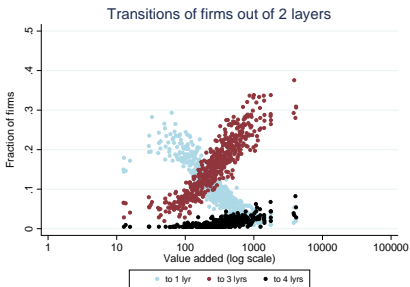
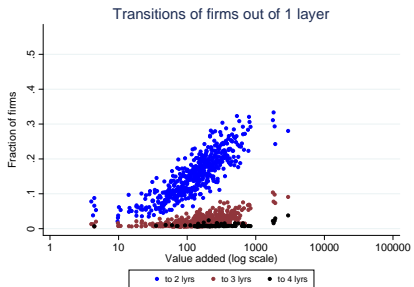


Lowess smoothing - trimming top 1% of value added

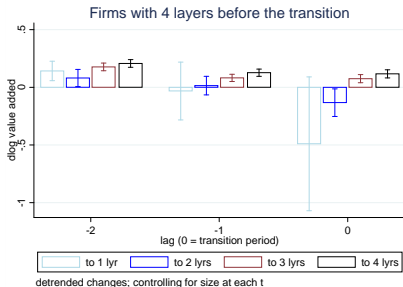
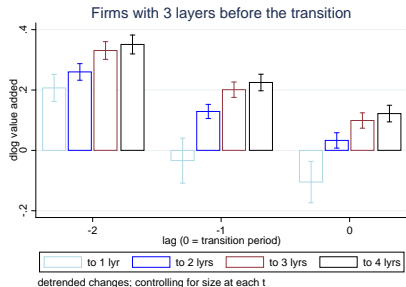
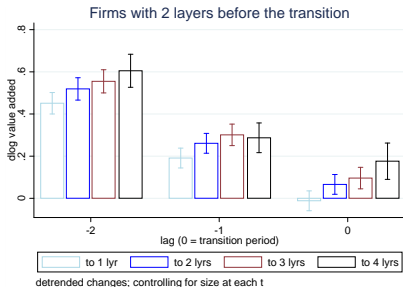
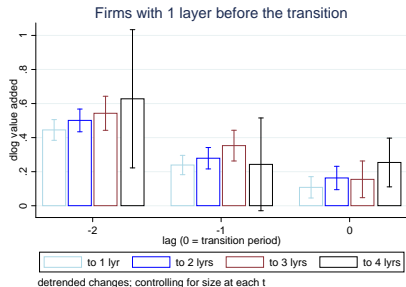


Lowess smoothing - trimming top 1% of value added

# Transitions across layers depend on value added



# Trends before adding or dropping layers





# Normalized hours change according to the theory

- Average log change in normalized hours for firms that transition

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.537	0.018	0.00	10177
1	3	1	1.762	0.056	0.00	1263
1	4	1	2.266	0.212	0.00	97
2	1	1	-1.582	0.017	0.00	11106
2	3	1	0.716	0.012	0.00	16800
2	3	2	0.539	0.012	0.00	16800
2	4	1	1.205	0.049	0.00	1129
2	4	2	1.004	0.048	0.00	1129
3	1	1	-1.795	0.048	0.00	1584
3	2	1	-0.682	0.012	0.00	17666
3	2	2	-0.518	0.012	0.00	17666
3	4	1	1.352	0.014	0.00	14113
3	4	2	1.289	0.016	0.00	14113
3	4	3	1.174	0.016	0.00	14113
4	1	1	-2.119	0.173	0.00	123
4	2	1	-1.059	0.041	0.00	1456
4	2	2	-0.918	0.040	0.00	1456
4	3	1	-1.411	0.014	0.00	15160
4	3	2	-1.345	0.015	0.00	15160
4	3	3	-1.260	0.015	0.00	15160

▶ Layers

▶ VA

▶ H

▶ NH

▶ VA + H

▶ VA + NH

▶ 2 years ahead

▶ 3 years ahead

## Normalized hours change according to the theory

- Elasticity of  $n_L^\ell$  with VA for firms that do not change  $L$
- Reporting  $\beta_L^\ell$  from  $d \ln n_{Lit}^\ell = \alpha_L^\ell + \beta_L^\ell d \ln VA_{it} + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\beta_L^\ell$	s.e.	p-value	obs
2	1	0.042	0.012	0.00	64,536
3	1	0.039	0.009	0.00	91,253
3	2	0.013	0.010	0.20	91,253
4	1	0.107	0.014	0.00	52,799
4	2	0.051	0.013	0.00	52,799
4	3	0.037	0.013	0.00	52,799

► Layers

► 2 years ahead

► 3 years ahead

# Wages change according to the theory

- Average log change in wages for firms that transition

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.129	0.005	0.00	10177
1	3	1	-0.332	0.020	0.00	1263
1	4	1	-0.678	0.117	0.00	97
2	1	1	0.167	0.005	0.00	11106
2	3	1	-0.050	0.002	0.00	16800
2	3	2	-0.255	0.004	0.00	16800
2	4	1	-0.150	0.015	0.00	1129
2	4	2	-0.409	0.019	0.00	1129
3	1	1	0.356	0.018	0.00	1584
3	2	1	0.059	0.002	0.00	17666
3	2	2	0.249	0.004	0.00	17666
3	4	1	-0.021	0.002	0.00	14113
3	4	2	-0.067	0.003	0.00	14113
3	4	3	-0.199	0.004	0.00	14113
4	1	1	0.804	0.109	0.00	123
4	2	1	0.139	0.012	0.00	1456
4	2	2	0.372	0.016	0.00	1456
4	3	1	0.009	0.002	0.00	15160
4	3	2	0.040	0.003	0.00	15160
4	3	3	0.134	0.004	0.00	15160

► Layers

► VA

► H

► NH

► VA + H

► VA + NH

► All-DADS

► 2 years ahead

► 3 years ahead



## Wages change according to the theory

- Elasticity of  $w_L^\ell$  with VA for firms that do not change  $L$
- Reporting  $\gamma_L^\ell$  from  $d \ln w_{Lit}^\ell = \delta_L^\ell + \gamma_L^\ell d \ln VA_{it} + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\gamma_L^\ell$	s.e.	p-value	obs
1	1	0.077	0.007	0.00	45,045
2	1	0.100	0.006	0.00	64,536
2	2	0.118	0.006	0.00	64,536
3	1	0.145	0.006	0.00	91,253
3	2	0.155	0.006	0.00	91,253
3	3	0.170	0.006	0.00	91,253
4	1	0.171	0.009	0.00	52,799
4	2	0.185	0.009	0.00	52,799
4	3	0.186	0.010	0.00	52,799
4	4	0.217	0.011	0.00	52,799

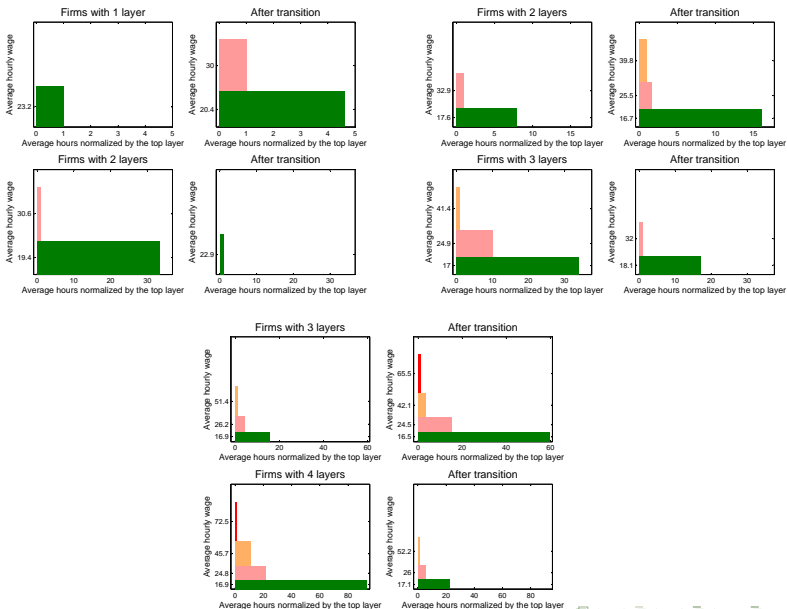
▸ Layers

▸ DADS

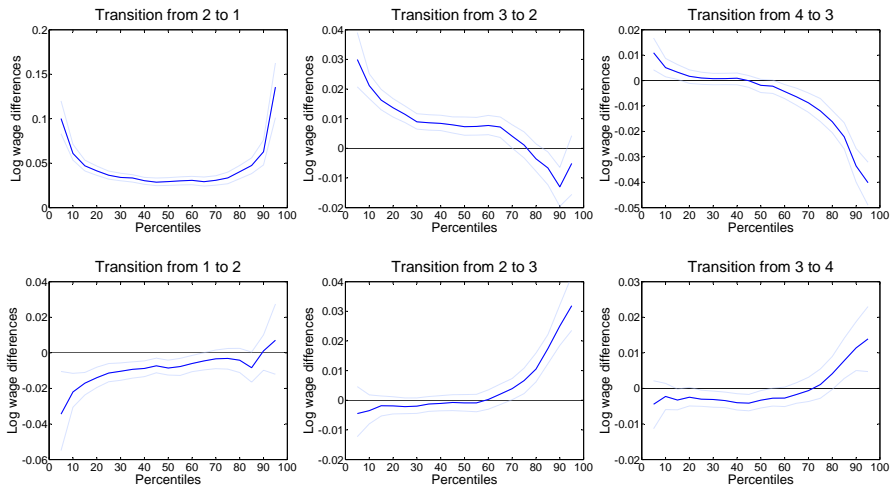
▸ 2 years ahead

▸ 3 years ahead

# Representative hierarchies for one layer transitions

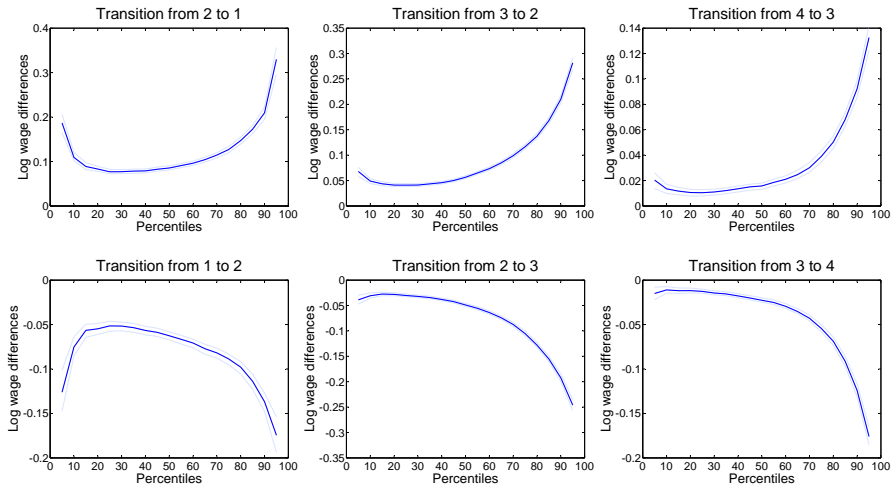


# Distribution of wages after minus before transition



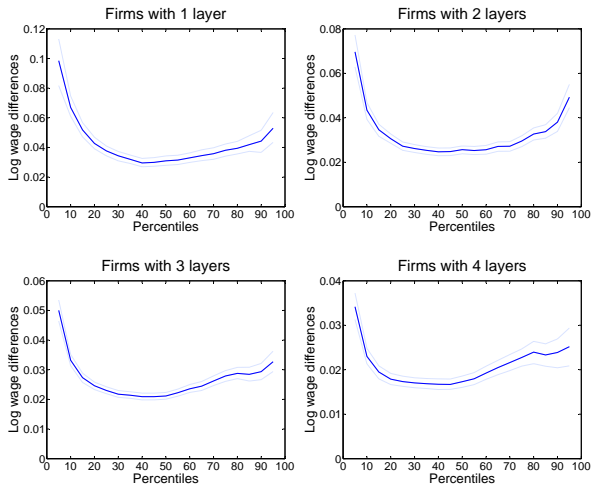
# Distribution of wages after minus before transition

## Common layers



# Distribution of wages after minus before

Conditioning on increase in VA > 0 and no transition



► Conditioning on decrease in VA



# How do firms change the average wage in a layer?

Education or experience to adjust knowledge and wages

Elasticity of 'knowledge' with VA for firms that do not change $L$						
# of layers	Layer	Experience	p-value	Education	p-value	obs
1	1	0.0014	0.69	0.0015	0.03	45,009
2	1	-0.0101	0.01	0.0042	0.00	64,469
2	2	0.0094	0.03	0.0032	0.00	64,469
3	1	-0.0103	0.00	0.0038	0.00	91,161
3	2	-0.0011	0.97	0.0026	0.00	91,161
3	3	0.0077	0.00	0.0011	0.10	91,161
4	1	-0.0154	0.00	0.0027	0.00	52,730
4	2	-0.0036	0.28	0.0026	0.00	52,730
4	3	-0.0001	0.97	0.0002	0.79	52,730
4	4	0.0073	0.02	-0.0030	0.07	52,730

# How do firms change the average wage in a layer?

Education or experience to adjust knowledge and wages

Average change in 'knowledge' for firms that change L

# of layers		Layer	Experience	p-value	Education	p-value	obs
Before	After						
1	2	1	-0.108	0.00	-0.004	0.00	10,171
1	3	1	-0.184	0.00	-0.003	0.29	1,261
1	4	1	-0.330	0.00	0.025	0.03	97
2	1	1	0.096	0.00	0.005	0.00	11,088
2	3	1	-0.044	0.00	0.000	0.82	16,778
2	3	2	-0.181	0.00	0.002	0.01	16,778
2	4	1	-0.064	0.00	0.002	0.29	1,124
2	4	2	-0.228	0.00	0.008	0.01	1,124
3	1	1	0.137	0.00	0.006	0.00	1,584
3	2	1	0.044	0.00	0.002	0.53	17,626
3	2	2	0.153	0.00	0.000	0.00	17,626
3	4	1	-0.011	0.00	0.001	0.10	14,098
3	4	2	-0.038	0.00	-0.001	0.00	14,098
3	4	3	-0.176	0.00	0.024	0.82	14,098
4	1	1	0.197	0.00	-0.002	0.95	123
4	2	1	0.073	0.00	0.000	0.12	1,454
4	2	2	0.172	0.00	-0.005	0.00	1,454
4	3	1	0.013	0.00	-0.002	0.26	15,150
4	3	2	0.025	0.00	-0.001	0.00	15,150
4	3	3	0.113	0.00	-0.020	0.00	15,150



# Conclusion

- We use French data to study the organization of production
  - ▶ Organizing the data using layers of employees is meaningful and useful
- We document that:
  - 1 Firms are hierarchical across layers in terms of employees and wages
  - 2 The probability of adding a layer increases with value added
    - ★ Firms that grow faster are also more likely to add layers
  - 3 Firms that grow by adding layers increase the number of employees and reduce their average wages at all layers
  - 4 Firms that grow but do not add layers increase the number of employees and average wages at all layers
- Our findings underscore the importance of organizational change for wage inequality and firm grow

# Agents working at different layers are different

In terms of hours

Layer #	Mean	Percentiles						
		p5	p10	p25	p50	p75	p90	p95
0	48,532	1,443	2,028	5,372	13,189	32,944	81,226	163,721
1	22,309	588	1,280	1,984	4,056	10,953	31,381	66,195
2	22,669	593	1,240	1,820	3,640	8,575	27,493	60,806
3	2,310	338	711	1,773	1,880	2,366	4,056	5,000

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# Occupational categories

Statistics on wage by occupation

Average hourly wage by occupation in 2005 Euros					
	CEO, directors	Senior staff	Supervisors	Clerks	Blue collars
Mean	81.39	47.83	26.58	19.01	20.70
p5	23.68	21.45	14.35	10.63	10.64
p10	28.60	25.01	16.21	11.79	11.82
p25	41.51	31.00	19.36	13.84	13.65
p50	58.06	38.28	23.11	16.49	15.97
p75	80.48	47.26	27.76	19.95	19.07
p90	114.51	59.91	34.15	24.66	23.40
p95	142.29	72.08	40.45	29.37	27.87

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# Change in normalized hours for firms that change layers

Conditioning on selected sample, positive change in VA and normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.838	0.025	0.00	3568
1	3	1	2.394	0.083	0.00	437
1	4	1	3.023	0.272	0.00	47
2	1	1	-1.827	0.025	0.00	3787
2	3	1	1.516	0.021	0.00	4104
2	3	2	1.256	0.023	0.00	4104
2	4	1	1.813	0.083	0.00	300
2	4	2	1.636	0.085	0.00	300
3	1	1	-2.223	0.074	0.00	546
3	2	1	-1.579	0.023	0.00	3822
3	2	2	-1.333	0.025	0.00	3822
3	4	1	2.002	0.022	0.00	5087
3	4	2	1.992	0.023	0.00	5087
3	4	3	1.786	0.025	0.00	5087
4	1	1	-2.428	0.199	0.00	54
4	2	1	-1.680	0.064	0.00	420
4	2	2	-1.571	0.067	0.00	420
4	3	1	-2.028	0.021	0.00	5673
4	3	2	-1.998	0.022	0.00	5673
4	3	3	-1.838	0.022	0.00	5673

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# Change in normalized hours for firms that change layers

Conditioning on positive change in VA and normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.111	0.006	0.00	5331
1	3	1	-0.314	0.026	0.00	709
1	4	1	-0.594	0.127	0.00	65
2	1	1	0.168	0.007	0.00	6376
2	3	1	-0.017	0.003	0.00	7492
2	3	2	-0.184	0.005	0.00	7492
2	4	1	-0.133	0.021	0.00	587
2	4	2	-0.378	0.026	0.00	587
3	1	1	0.358	0.024	0.00	991
3	2	1	0.030	0.004	0.00	7672
3	2	2	0.165	0.005	0.00	7672
3	4	1	0.005	0.003	0.10	6417
3	4	2	-0.026	0.004	0.00	6417
3	4	3	-0.134	0.006	0.00	6417
4	1	1	0.756	0.141	0.00	74
4	2	1	0.126	0.020	0.00	751
4	2	2	0.332	0.023	0.00	751
4	3	1	-0.018	0.003	0.00	6926
4	3	2	-0.001	0.004	0.77	6926
4	3	3	0.063	0.005	0.00	6926

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# Change in normalized hours for firms that change layers

Conditioning on selected sample and positive change in VA

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.838	0.025	0.00	3568
1	3	1	2.394	0.083	0.00	437
1	4	1	3.023	0.272	0.00	47
2	1	1	-1.827	0.025	0.00	3787
2	3	1	1.252	0.023	0.00	4550
2	3	2	1.102	0.023	0.00	4550
2	4	1	1.707	0.087	0.00	311
2	4	2	1.553	0.087	0.00	311
3	1	1	-2.223	0.074	0.00	546
3	2	1	-1.267	0.025	0.00	4293
3	2	2	-1.137	0.024	0.00	4293
3	4	1	1.852	0.023	0.00	5387
3	4	2	1.833	0.024	0.00	5387
3	4	3	1.670	0.024	0.00	5387
4	1	1	-2.428	0.199	0.00	54
4	2	1	-1.515	0.070	0.00	444
4	2	2	-1.477	0.067	0.00	444
4	3	1	-1.845	0.022	0.00	6077
4	3	2	-1.810	0.023	0.00	6077
4	3	3	-1.703	0.022	0.00	6077

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# Change in normalized hours for firms that change layers

Conditioning on selected sample and positive change in total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.850	0.024	0.00	3819
1	3	1	2.545	0.076	0.00	467
1	4	1	3.242	0.300	0.00	35
2	1	1	-1.861	0.025	0.00	3888
2	3	1	1.314	0.022	0.00	4431
2	3	2	1.093	0.022	0.00	4431
2	4	1	1.806	0.083	0.00	302
2	4	2	1.477	0.083	0.00	302
3	1	1	-2.289	0.072	0.00	543
3	2	1	-1.308	0.024	0.00	4309
3	2	2	-1.141	0.024	0.00	4309
3	4	1	1.791	0.022	0.00	5164
3	4	2	1.751	0.024	0.00	5164
3	4	3	1.550	0.024	0.00	5164
4	1	1	-2.431	0.192	0.00	56
4	2	1	-1.532	0.067	0.00	446
4	2	2	-1.425	0.066	0.00	446
4	3	1	-1.940	0.021	0.00	6338
4	3	2	-1.893	0.022	0.00	6338
4	3	3	-1.741	0.022	0.00	6338

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# Change in normalized hours for firms that change layers

Conditioning on selected sample and positive change in normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.807	0.019	0.00	6675
1	3	1	2.398	0.061	0.00	780
1	4	1	2.650	0.206	0.00	72
2	1	1	-1.843	0.019	0.00	6886
2	3	1	1.529	0.016	0.00	7384
2	3	2	1.266	0.018	0.00	7384
2	4	1	1.794	0.059	0.00	554
2	4	2	1.615	0.061	0.00	554
3	1	1	-2.288	0.058	0.00	908
3	2	1	-1.585	0.016	0.00	7204
3	2	2	-1.342	0.018	0.00	7204
3	4	1	2.028	0.016	0.00	9517
3	4	2	2.030	0.017	0.00	9517
3	4	3	1.825	0.018	0.00	9517
4	1	1	-2.468	0.156	0.00	89
4	2	1	-1.656	0.049	0.00	719
4	2	2	-1.510	0.052	0.00	719
4	3	1	-2.059	0.015	0.00	10754
4	3	2	-2.040	0.016	0.00	10754
4	3	3	-1.869	0.016	0.00	10754

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# Change in normalized hours for firms that change layers

Conditioning on positive change in VA and total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.510	0.030	0.00	3628
1	3	1	1.789	0.088	0.00	535
1	4	1	2.952	0.312	0.00	43
2	1	1	-1.512	0.027	0.00	4498
2	3	1	0.765	0.019	0.00	6135
2	3	2	0.541	0.020	0.00	6135
2	4	1	1.319	0.080	0.00	415
2	4	2	0.991	0.078	0.00	415
3	1	1	-1.725	0.065	0.00	761
3	2	1	-0.711	0.020	0.00	6577
3	2	2	-0.516	0.020	0.00	6577
3	4	1	1.339	0.024	0.00	4675
3	4	2	1.249	0.026	0.00	4675
3	4	3	1.122	0.026	0.00	4675
4	1	1	-2.237	0.195	0.00	59
4	2	1	-1.188	0.063	0.00	607
4	2	2	-1.039	0.061	0.00	607
4	3	1	-1.413	0.023	0.00	5442
4	3	2	-1.315	0.025	0.00	5442
4	3	3	-1.223	0.025	0.00	5442

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# Change in normalized hours for firms that change layers

Conditioning on selected sample

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.807	0.019	0.00	6675
1	3	1	2.398	0.061	0.00	780
1	4	1	2.650	0.206	0.00	72
2	1	1	-1.843	0.019	0.00	6886
2	3	1	1.251	0.017	0.00	8260
2	3	2	1.092	0.017	0.00	8260
2	4	1	1.665	0.062	0.00	580
2	4	2	1.521	0.062	0.00	580
3	1	1	-2.288	0.058	0.00	908
3	2	1	-1.272	0.018	0.00	8125
3	2	2	-1.142	0.018	0.00	8125
3	4	1	1.859	0.017	0.00	10155
3	4	2	1.852	0.018	0.00	10155
3	4	3	1.692	0.018	0.00	10155
4	1	1	-2.468	0.156	0.00	89
4	2	1	-1.478	0.053	0.00	766
4	2	2	-1.400	0.053	0.00	766
4	3	1	-1.879	0.016	0.00	11503
4	3	2	-1.855	0.017	0.00	11503
4	3	3	-1.735	0.016	0.00	11503

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# Change in normalized hours for firms that change layers

Conditioning on positive change in VA

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.525	0.025	0.00	5331
1	3	1	1.745	0.075	0.00	709
1	4	1	2.654	0.263	0.00	65
2	1	1	-1.528	0.023	0.00	6376
2	3	1	0.720	0.016	0.00	9077
2	3	2	0.543	0.016	0.00	9077
2	4	1	1.236	0.065	0.00	623
2	4	2	1.036	0.065	0.00	623
3	1	1	-1.759	0.060	0.00	991
3	2	1	-0.676	0.016	0.00	9609
3	2	2	-0.506	0.017	0.00	9609
3	4	1	1.358	0.020	0.00	7417
3	4	2	1.288	0.021	0.00	7417
3	4	3	1.173	0.022	0.00	7417
4	1	1	-2.347	0.182	0.00	74
4	2	1	-1.115	0.054	0.00	838
4	2	2	-1.003	0.053	0.00	838
4	3	1	-1.375	0.019	0.00	8127
4	3	2	-1.290	0.021	0.00	8127
4	3	3	-1.226	0.021	0.00	8127

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# Change in normalized hours for firms that change layers

Conditioning on positive change in total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.478	0.024	0.00	5672
1	3	1	1.716	0.071	0.00	803
1	4	1	2.674	0.264	0.00	57
2	1	1	-1.513	0.022	0.00	6604
2	3	1	0.754	0.015	0.00	9140
2	3	2	0.521	0.016	0.00	9140
2	4	1	1.324	0.067	0.00	624
2	4	2	0.975	0.063	0.00	624
3	1	1	-1.731	0.057	0.00	1051
3	2	1	-0.708	0.016	0.00	9885
3	2	2	-0.495	0.016	0.00	9885
3	4	1	1.315	0.019	0.00	7187
3	4	2	1.213	0.021	0.00	7187
3	4	3	1.094	0.021	0.00	7187
4	1	1	-2.096	0.205	0.00	87
4	2	1	-1.135	0.052	0.00	883
4	2	2	-0.960	0.051	0.00	883
4	3	1	-1.468	0.019	0.00	8387
4	3	2	-1.375	0.021	0.00	8387
4	3	3	-1.265	0.021	0.00	8387

▶ Back

# Change in normalized hours for firms that change layers

Conditioning on positive change in normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.537	0.018	0.00	10177
1	3	1	1.762	0.056	0.00	1263
1	4	1	2.266	0.212	0.00	97
2	1	1	-1.582	0.017	0.00	11106
2	3	1	1.106	0.012	0.00	13500
2	3	2	0.808	0.013	0.00	13500
2	4	1	1.408	0.048	0.00	1033
2	4	2	1.132	0.048	0.00	1033
3	1	1	-1.795	0.048	0.00	1584
3	2	1	-1.137	0.012	0.00	13852
3	2	2	-0.825	0.014	0.00	13852
3	4	1	1.684	0.015	0.00	11876
3	4	2	1.648	0.016	0.00	11876
3	4	3	1.467	0.017	0.00	11876
4	1	1	-2.119	0.173	0.00	123
4	2	1	-1.306	0.039	0.00	1303
4	2	2	-1.056	0.042	0.00	1303
4	3	1	-1.773	0.014	0.00	12760
4	3	2	-1.730	0.015	0.00	12760
4	3	3	-1.560	0.016	0.00	12760

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# Change in normalized hours for firms that change layers

Conditioning on selected sample, positive change in VA and total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.868	0.030	0.00	2494
1	3	1	2.595	0.093	0.00	328
1	4	1	3.534	0.373	0.00	26
2	1	1	-1.862	0.030	0.00	2600
2	3	1	1.315	0.027	0.00	3062
2	3	2	1.110	0.027	0.00	3062
2	4	1	1.840	0.103	0.00	200
2	4	2	1.528	0.104	0.00	200
3	1	1	-2.240	0.082	0.00	398
3	2	1	-1.320	0.030	0.00	2855
3	2	2	-1.170	0.029	0.00	2855
3	4	1	1.814	0.028	0.00	3388
3	4	2	1.785	0.030	0.00	3388
3	4	3	1.582	0.030	0.00	3388
4	1	1	-2.291	0.207	0.00	39
4	2	1	-1.551	0.080	0.00	315
4	2	2	-1.484	0.076	0.00	315
4	3	1	-1.878	0.027	0.00	4086
4	3	2	-1.824	0.028	0.00	4086
4	3	3	-1.686	0.027	0.00	4086

▶ Back

# Change in average wages for firms that change layers

Conditioning on selected sample, positive change in VA and normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.039	0.006	0.00	3568
1	3	1	-0.157	0.029	0.00	437
1	4	1	-0.293	0.129	0.03	47
2	1	1	0.093	0.007	0.00	3787
2	3	1	0.007	0.004	0.09	4104
2	3	2	-0.040	0.005	0.00	4104
2	4	1	-0.083	0.028	0.00	300
2	4	2	-0.118	0.031	0.00	300
3	1	1	0.200	0.026	0.00	546
3	2	1	0.009	0.005	0.09	3822
3	2	2	0.039	0.006	0.00	3822
3	4	1	0.014	0.004	0.00	5087
3	4	2	0.007	0.004	0.12	5087
3	4	3	-0.058	0.005	0.00	5087
4	1	1	0.449	0.148	0.00	54
4	2	1	0.104	0.023	0.00	420
4	2	2	0.123	0.024	0.00	420
4	3	1	-0.023	0.004	0.00	5673
4	3	2	-0.028	0.004	0.00	5673
4	3	3	0.007	0.005	0.13	5673

▶ Back

# Change in average wages for firms that change layers

Conditioning on positive change in VA and normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.111	0.006	0.00	5331
1	3	1	-0.314	0.026	0.00	709
1	4	1	-0.594	0.127	0.00	65
2	1	1	0.168	0.007	0.00	6376
2	3	1	-0.017	0.003	0.00	7492
2	3	2	-0.184	0.005	0.00	7492
2	4	1	-0.133	0.021	0.00	587
2	4	2	-0.378	0.026	0.00	587
3	1	1	0.358	0.024	0.00	991
3	2	1	0.030	0.004	0.00	7672
3	2	2	0.165	0.005	0.00	7672
3	4	1	0.005	0.003	0.10	6417
3	4	2	-0.026	0.004	0.00	6417
3	4	3	-0.134	0.006	0.00	6417
4	1	1	0.756	0.141	0.00	74
4	2	1	0.126	0.020	0.00	751
4	2	2	0.332	0.023	0.00	751
4	3	1	-0.018	0.003	0.00	6926
4	3	2	-0.001	0.004	0.77	6926
4	3	3	0.063	0.005	0.00	6926

▶ Back



# Change in average wages for firms that change layers

Conditioning on selected sample and positive change in VA

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.039	0.006	0.00	3568
1	3	1	-0.157	0.029	0.00	437
1	4	1	-0.293	0.129	0.03	47
2	1	1	0.093	0.007	0.00	3787
2	3	1	0.004	0.004	0.28	4550
2	3	2	-0.039	0.005	0.00	4550
2	4	1	-0.078	0.027	0.00	311
2	4	2	-0.108	0.030	0.00	311
3	1	1	0.200	0.026	0.00	546
3	2	1	0.015	0.005	0.00	4293
3	2	2	0.048	0.006	0.00	4293
3	4	1	0.014	0.004	0.00	5387
3	4	2	0.004	0.004	0.34	5387
3	4	3	-0.066	0.005	0.00	5387
4	1	1	0.449	0.148	0.00	54
4	2	1	0.102	0.022	0.00	444
4	2	2	0.114	0.024	0.00	444
4	3	1	-0.023	0.004	0.00	6077
4	3	2	-0.027	0.004	0.00	6077
4	3	3	0.012	0.005	0.02	6077

▶ Back

# Change in average wages for firms that change layers

Conditioning on selected sample and positive change in total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.160	0.006	0.00	3819
1	3	1	-0.305	0.031	0.00	467
1	4	1	-0.829	0.215	0.00	35
2	1	1	0.200	0.007	0.00	3888
2	3	1	-0.086	0.005	0.00	4431
2	3	2	-0.132	0.005	0.00	4431
2	4	1	-0.260	0.034	0.00	302
2	4	2	-0.333	0.036	0.00	302
3	1	1	0.339	0.028	0.00	543
3	2	1	0.101	0.005	0.00	4309
3	2	2	0.137	0.006	0.00	4309
3	4	1	-0.059	0.004	0.00	5164
3	4	2	-0.072	0.005	0.00	5164
3	4	3	-0.152	0.006	0.00	5164
4	1	1	0.765	0.166	0.00	56
4	2	1	0.221	0.025	0.00	446
4	2	2	0.245	0.026	0.00	446
4	3	1	0.051	0.004	0.00	6338
4	3	2	0.048	0.004	0.00	6338
4	3	3	0.092	0.005	0.00	6338

▶ Back

# Change in average wages for firms that change layers

Conditioning on selected sample and positive change in normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.066	0.005	0.00	6675
1	3	1	-0.170	0.022	0.00	780
1	4	1	-0.372	0.119	0.00	72
2	1	1	0.102	0.005	0.00	6886
2	3	1	-0.023	0.003	0.00	7384
2	3	2	-0.072	0.004	0.00	7384
2	4	1	-0.116	0.022	0.00	554
2	4	2	-0.169	0.023	0.00	554
3	1	1	0.208	0.019	0.00	908
3	2	1	0.034	0.004	0.00	7204
3	2	2	0.073	0.004	0.00	7204
3	4	1	-0.015	0.003	0.00	9517
3	4	2	-0.025	0.003	0.00	9517
3	4	3	-0.093	0.004	0.00	9517
4	1	1	0.478	0.113	0.00	89
4	2	1	0.119	0.017	0.00	719
4	2	2	0.149	0.018	0.00	719
4	3	1	0.007	0.003	0.01	10754
4	3	2	0.005	0.003	0.09	10754
4	3	3	0.047	0.003	0.00	10754

▶ Back

# Change in average wages for firms that change layers

Conditioning on a positive change in VA and total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.194	0.008	0.00	3628
1	3	1	-0.417	0.032	0.00	535
1	4	1	-0.872	0.170	0.00	43
2	1	1	0.270	0.008	0.00	4498
2	3	1	-0.064	0.004	0.00	6135
2	3	2	-0.263	0.006	0.00	6135
2	4	1	-0.216	0.027	0.00	415
2	4	2	-0.496	0.031	0.00	415
3	1	1	0.486	0.029	0.00	761
3	2	1	0.093	0.005	0.00	6577
3	2	2	0.274	0.006	0.00	6577
3	4	1	-0.027	0.004	0.00	4675
3	4	2	-0.073	0.005	0.00	4675
3	4	3	-0.211	0.007	0.00	4675
4	1	1	0.963	0.166	0.00	59
4	2	1	0.191	0.023	0.00	607
4	2	2	0.423	0.026	0.00	607
4	3	1	0.020	0.004	0.00	5442
4	3	2	0.048	0.005	0.00	5442
4	3	3	0.138	0.006	0.00	5442

▶ Back

# Change in average wages for firms that change layers

Conditioning on selected sample

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.066	0.005	0.00	6675
1	3	1	-0.170	0.022	0.00	780
1	4	1	-0.372	0.119	0.00	72
2	1	1	0.102	0.005	0.00	6886
2	3	1	-0.026	0.003	0.00	8260
2	3	2	-0.075	0.004	0.00	8260
2	4	1	-0.112	0.021	0.00	580
2	4	2	-0.164	0.023	0.00	580
3	1	1	0.208	0.019	0.00	908
3	2	1	0.040	0.003	0.00	8125
3	2	2	0.082	0.004	0.00	8125
3	4	1	-0.015	0.003	0.00	10155
3	4	2	-0.028	0.003	0.00	10155
3	4	3	-0.101	0.004	0.00	10155
4	1	1	0.478	0.113	0.00	89
4	2	1	0.122	0.016	0.00	766
4	2	2	0.147	0.018	0.00	766
4	3	1	0.007	0.003	0.01	11503
4	3	2	0.007	0.003	0.01	11503
4	3	3	0.054	0.004	0.00	11503

▶ Back

# Change in average wages for firms that change layers

Conditioning on a positive change in VA

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.111	0.006	0.00	5331
1	3	1	-0.314	0.026	0.00	709
1	4	1	-0.594	0.127	0.00	65
2	1	1	0.168	0.007	0.00	6376
2	3	1	-0.021	0.003	0.00	9077
2	3	2	-0.219	0.005	0.00	9077
2	4	1	-0.127	0.020	0.00	623
2	4	2	-0.379	0.025	0.00	623
3	1	1	0.358	0.024	0.00	991
3	2	1	0.035	0.004	0.00	9609
3	2	2	0.219	0.005	0.00	9609
3	4	1	0.006	0.003	0.03	7417
3	4	2	-0.034	0.004	0.00	7417
3	4	3	-0.166	0.006	0.00	7417
4	1	1	0.756	0.141	0.00	74
4	2	1	0.123	0.018	0.00	838
4	2	2	0.351	0.022	0.00	838
4	3	1	-0.020	0.003	0.00	8127
4	3	2	0.008	0.004	0.04	8127
4	3	3	0.099	0.005	0.00	8127

▶ Back

# Change in average wages for firms that change layers

Conditioning on a positive change in total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.254	0.006	0.00	5672
1	3	1	-0.517	0.028	0.00	803
1	4	1	-1.120	0.169	0.00	57
2	1	1	0.287	0.007	0.00	6604
2	3	1	-0.113	0.004	0.00	9140
2	3	2	-0.320	0.005	0.00	9140
2	4	1	-0.281	0.024	0.00	624
2	4	2	-0.552	0.026	0.00	624
3	1	1	0.526	0.025	0.00	1051
3	2	1	0.121	0.004	0.00	9885
3	2	2	0.306	0.005	0.00	9885
3	4	1	-0.065	0.004	0.00	7187
3	4	2	-0.115	0.004	0.00	7187
3	4	3	-0.254	0.006	0.00	7187
4	1	1	1.086	0.138	0.00	87
4	2	1	0.222	0.018	0.00	883
4	2	2	0.464	0.022	0.00	883
4	3	1	0.050	0.003	0.00	8387
4	3	2	0.079	0.004	0.00	8387
4	3	3	0.170	0.005	0.00	8387

▶ Back

# Change in average wages for firms that change layers

Conditioning on a positive change in normalized hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.129	0.005	0.00	10177
1	3	1	-0.332	0.020	0.00	1263
1	4	1	-0.678	0.117	0.00	97
2	1	1	0.167	0.005	0.00	11106
2	3	1	-0.046	0.003	0.00	13500
2	3	2	-0.211	0.004	0.00	13500
2	4	1	-0.161	0.016	0.00	1033
2	4	2	-0.399	0.020	0.00	1033
3	1	1	0.356	0.018	0.00	1584
3	2	1	0.054	0.003	0.00	13852
3	2	2	0.186	0.004	0.00	13852
3	4	1	-0.024	0.003	0.00	11876
3	4	2	-0.057	0.003	0.00	11876
3	4	3	-0.162	0.004	0.00	11876
4	1	1	0.804	0.109	0.00	123
4	2	1	0.139	0.013	0.00	1303
4	2	2	0.351	0.016	0.00	1303
4	3	1	0.011	0.002	0.00	12760
4	3	2	0.027	0.003	0.00	12760
4	3	3	0.092	0.004	0.00	12760

▶ Back



# Change in average wages for firms that change layers

Conditioning on selected sample, positive change in VA and total hours

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.102	0.007	0.00	2494
1	3	1	-0.229	0.035	0.00	328
1	4	1	-0.567	0.215	0.01	26
2	1	1	0.180	0.009	0.00	2600
2	3	1	-0.036	0.005	0.00	3062
2	3	2	-0.081	0.006	0.00	3062
2	4	1	-0.171	0.037	0.00	200
2	4	2	-0.223	0.040	0.00	200
3	1	1	0.297	0.032	0.00	398
3	2	1	0.072	0.006	0.00	2855
3	2	2	0.103	0.007	0.00	2855
3	4	1	-0.021	0.005	0.00	3388
3	4	2	-0.032	0.005	0.00	3388
3	4	3	-0.109	0.007	0.00	3388
4	1	1	0.644	0.194	0.00	39
4	2	1	0.177	0.029	0.00	315
4	2	2	0.193	0.030	0.00	315
4	3	1	0.018	0.004	0.00	4086
4	3	2	0.016	0.005	0.00	4086
4	3	3	0.056	0.006	0.00	4086

▶ Back

# Change in average wages for firms that do not transition

Conditioning on selected sample

- Reporting  $\gamma_L^\ell$  from  $d \ln w_{Lit}^\ell = \delta_L^\ell + \gamma_L^\ell d \ln VA_{it} + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\beta_L^\ell$	s.e.	p-value	obs
0	0	0.067	0.009	0.00	39,914
1	0	0.106	0.009	0.00	42,071
1	1	0.118	0.009	0.00	42,071
2	0	0.145	0.007	0.00	71,424
2	1	0.155	0.007	0.00	71,424
2	2	0.170	0.007	0.00	71,424
3	0	0.173	0.010	0.00	53,053
3	1	0.187	0.010	0.00	53,053
3	2	0.189	0.011	0.00	53,053
3	3	0.218	0.011	0.00	53,053

▶ Back

# Change in normalized hours for firms that do not transition

Conditioning on selected sample

- Reporting  $\beta_L^\ell$  from  $d \ln n_{Lit}^\ell = \alpha_L^\ell + \beta_L^\ell d \ln VA_{it} + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\beta_L^\ell$	s.e.	p-value	obs
1	0	0.027	0.014	0.06	42,071
2	0	0.036	0.009	0.00	71,424
2	1	0.013	0.011	0.26	71,424
3	0	0.109	0.014	0.00	53,053
3	1	0.048	0.013	0.00	53,053
3	2	0.037	0.013	0.01	53,053

▶ Back

# Change in average wages for firms that change layers

Conditioning on a positive change in VA and normalized hours - DADS data

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.083	0.004	0.00	5331
1	3	1	-0.159	0.014	0.00	709
1	4	1	-0.368	0.088	0.00	65
2	1	1	0.087	0.003	0.00	6376
2	3	1	-0.022	0.002	0.00	7492
2	3	2	-0.189	0.005	0.00	7492
2	4	1	-0.047	0.010	0.00	587
2	4	2	-0.293	0.019	0.00	587
3	1	1	0.150	0.012	0.00	991
3	2	1	0.025	0.002	0.00	7672
3	2	2	0.160	0.004	0.00	7672
3	4	1	-0.002	0.002	0.29	6417
3	4	2	-0.033	0.003	0.00	6417
3	4	3	-0.141	0.005	0.00	6417
4	1	1	0.184	0.054	0.00	74
4	2	1	0.046	0.010	0.00	751
4	2	2	0.252	0.017	0.00	751
4	3	1	0.005	0.002	0.00	6926
4	3	2	0.022	0.003	0.00	6926
4	3	3	0.086	0.004	0.00	6926

▶ Back

# Change in average wages for firms that change layers

Conditioning on positive change in VA and total hours - DADS data

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.110	0.005	0.00	3628
1	3	1	-0.199	0.017	0.00	535
1	4	1	-0.529	0.116	0.00	43
2	1	1	0.111	0.004	0.00	4498
2	3	1	-0.043	0.003	0.00	6135
2	3	2	-0.242	0.005	0.00	6135
2	4	1	-0.067	0.013	0.00	415
2	4	2	-0.347	0.023	0.00	415
3	1	1	0.183	0.014	0.00	761
3	2	1	0.046	0.003	0.00	6577
3	2	2	0.227	0.005	0.00	6577
3	4	1	-0.011	0.002	0.00	4675
3	4	2	-0.057	0.004	0.00	4675
3	4	3	-0.195	0.007	0.00	4675
4	1	1	0.246	0.064	0.00	59
4	2	1	0.067	0.011	0.00	607
4	2	2	0.299	0.019	0.00	607
4	3	1	0.015	0.002	0.00	5442
4	3	2	0.043	0.003	0.00	5442
4	3	3	0.133	0.006	0.00	5442

▶ Back

# Change in average wages for firms that change layers

Conditioning on positive change in VA - DADS data

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.083	0.004	0.00	5331
1	3	1	-0.159	0.014	0.00	709
1	4	1	-0.368	0.088	0.00	65
2	1	1	0.087	0.003	0.00	6376
2	3	1	-0.027	0.002	0.00	9077
2	3	2	-0.225	0.004	0.00	9077
2	4	1	-0.046	0.010	0.00	623
2	4	2	-0.298	0.019	0.00	623
3	1	1	0.150	0.012	0.00	991
3	2	1	0.030	0.002	0.00	9609
3	2	2	0.213	0.004	0.00	9609
3	4	1	-0.002	0.002	0.21	7417
3	4	2	-0.043	0.003	0.00	7417
3	4	3	-0.174	0.005	0.00	7417
4	1	1	0.184	0.054	0.00	74
4	2	1	0.050	0.009	0.00	838
4	2	2	0.278	0.017	0.00	838
4	3	1	0.004	0.002	0.02	8127
4	3	2	0.032	0.003	0.00	8127
4	3	3	0.123	0.005	0.00	8127

▶ Back

# Change in average wages for firms that change layers

Conditioning on positive change in total hours - DADS data

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.121	0.004	0.00	5672
1	3	1	-0.222	0.014	0.00	803
1	4	1	-0.488	0.097	0.00	57
2	1	1	0.119	0.004	0.00	6604
2	3	1	-0.048	0.002	0.00	9140
2	3	2	-0.255	0.004	0.00	9140
2	4	1	-0.077	0.011	0.00	624
2	4	2	-0.349	0.018	0.00	624
3	1	1	0.195	0.012	0.00	1051
3	2	1	0.050	0.002	0.00	9885
3	2	2	0.235	0.004	0.00	9885
3	4	1	-0.016	0.002	0.00	7187
3	4	2	-0.066	0.003	0.00	7187
3	4	3	-0.205	0.005	0.00	7187
4	1	1	0.274	0.054	0.00	87
4	2	1	0.069	0.008	0.00	883
4	2	2	0.311	0.016	0.00	883
4	3	1	0.017	0.002	0.00	8387
4	3	2	0.046	0.003	0.00	8387
4	3	3	0.136	0.004	0.00	8387

▶ Back

# Change in average wages for firms that change layers

Conditioning on positive change in normalized hours - DADS data

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.080	0.003	0.00	10177
1	3	1	-0.155	0.010	0.00	1263
1	4	1	-0.302	0.068	0.00	97
2	1	1	0.086	0.003	0.00	11106
2	3	1	-0.022	0.002	0.00	13500
2	3	2	-0.187	0.003	0.00	13500
2	4	1	-0.050	0.008	0.00	1033
2	4	2	-0.288	0.014	0.00	1033
3	1	1	0.146	0.009	0.00	1584
3	2	1	0.027	0.002	0.00	13852
3	2	2	0.159	0.003	0.00	13852
3	4	1	-0.002	0.001	0.08	11876
3	4	2	-0.035	0.002	0.00	11876
3	4	3	-0.140	0.004	0.00	11876
4	1	1	0.219	0.047	0.00	123
4	2	1	0.046	0.007	0.00	1303
4	2	2	0.258	0.012	0.00	1303
4	3	1	0.004	0.001	0.01	12760
4	3	2	0.020	0.002	0.00	12760
4	3	3	0.085	0.003	0.00	12760

▶ Back



# Wages change according to the theory

- Average log change in wages for firms that transition - DADS data

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.080	0.003	0.00	10177
1	3	1	-0.155	0.010	0.00	1263
1	4	1	-0.302	0.068	0.00	97
2	1	1	0.086	0.003	0.00	11106
2	3	1	-0.026	0.002	0.00	16800
2	3	2	-0.231	0.003	0.00	16800
2	4	1	-0.047	0.007	0.00	1129
2	4	2	-0.306	0.014	0.00	1129
3	1	1	0.146	0.009	0.00	1584
3	2	1	0.032	0.001	0.00	17666
3	2	2	0.222	0.003	0.00	17666
3	4	1	-0.002	0.001	0.19	14113
3	4	2	-0.048	0.002	0.00	14113
3	4	3	-0.180	0.004	0.00	14113
4	1	1	0.219	0.047	0.00	123
4	2	1	0.050	0.006	0.00	1456
4	2	2	0.283	0.012	0.00	1456
4	3	1	0.003	0.001	0.01	15160
4	3	2	0.034	0.002	0.00	15160
4	3	3	0.128	0.003	0.00	15160

[▶ VA](#)[▶ H](#)[▶ NH](#)[▶ VA + H](#)[▶ VA + NH](#)[▶ Back](#)

## Wages change according to the theory

- Firms that do not transition - DADS data
- Reporting  $\gamma_L^\ell$  from  $d \ln w_{Lit}^\ell = \delta_L^\ell + \gamma_L^\ell d \ln VA_{it} + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\gamma_L^\ell$	s.e.	p-value	obs
0	0	0.000	0.003	0.94	45,606
1	0	0.001	0.002	0.63	65,114
1	1	0.019	0.003	0.00	65,114
2	0	-0.005	0.002	0.01	91,833
2	1	0.006	0.002	0.01	91,833
2	2	0.022	0.003	0.00	91,833
3	0	-0.007	0.002	0.05	53,053
3	1	0.008	0.002	0.00	53,053
3	2	0.009	0.003	0.01	53,053
3	3	0.038	0.006	0.00	53,053

▶ Back

## Firms with adjacent occupational categories

- We select the sub-sample of firms that satisfy the following criteria:
  - ▶ Layer 0 firms are firms with occupation codes 6 and 5
  - ▶ Layer 1 firms are firms with occupation codes 6, 5 and 4
  - ▶ Layer 2 firms are firms with occupation codes 6, 5, 4 and 3
  - ▶ Layer 3 firms are firms with occupation codes 6, 5, 4, 3 and 2

	Percentage of firms that satisfy the selection				All firms
	0 layers	1 layer	2 layers	3 layers	
Unweighted	87.17	67.22	79.98	100	81.57
Weighted by VA	85.84	68.01	94.54	100	96.65
Weighted by hours	95.86	72.38	93.15	100	95.74

▶ Layers

▶ Layers + VA

▶ Layers + H

▶ Layers + NH

▶ Layers + VA + H

▶ Layers + VA + NH

## Firms with adjacent occupational categories

- We select the sub-sample of firms that satisfy the following criteria:
  - ▶ Layer 0 firms are firms with occupation codes 6 and 5
  - ▶ Layer 1 firms are firms with occupation codes 6, 5 and 4
  - ▶ Layer 2 firms are firms with occupation codes 6, 5, 4 and 3
  - ▶ Layer 3 firms are firms with occupation codes 6, 5, 4, 3 and 2

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### Percentage of firms that satisfy the selection

	Among firms with				All firms
	1 layer	2 layers	3 layers	4 layers	
Unweighted	87.42	67.39	80.01	100	81.69
Weighted by VA	87.69	68.40	94.60	100	96.73
Weighted by hours	99.17	72.56	93.07	100	95.69

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▶ Layers

▶ Layers + VA + H

▶ Layers + VA + NH

▶ Layers + VA

▶ Layers + H

▶ Layers + NH

# Layer transitions

Distribution of # of layers at time  $t+1$  given the # of layers at time  $t$

		Weighted by VA					
		# of layers at $t + 1$					
		Exit	1	2	3	4	Total
# of layers at $t$	1	11.3	<b>65.3</b>	19.5	3.3	0.6	100
	2	7.1	6.6	<b>62.7</b>	21.5	2.1	100
	3	5.8	0.2	2.4	<b>72.6</b>	19.0	100
	4	7.7	0.0	0.2	13.4	<b>78.8</b>	100

▶ Back

## Fraction of firms that transition to an adjacent layer

- What is the fraction of firms that transition up or down to an adjacent layer?
  - ▶ Conditioning of firms with adjacent layers

# of layers	Transition	
	Up	Down
1	75.5	-
2	82.3	91.5
3	100	60.6
4	-	75.9

▶ back

# Change in firm level outcomes during transition

Average behavior of firms by change in the number of layers

	All	Increase $L$	No change in $L$	Decrease $L$
dlnhours	-0.014***	0.046***	-0.011***	-0.084***
- detrended	-	0.060***	0.003***	-0.070***
$d\ln \sum_{\ell=0}^L n_L^\ell$	-0.011***	1.342***	0.012***	-1.385***
- detrended	-	1.353***	0.023***	-1.373***
dln VA	-0.007***	0.029***	-0.006***	-0.047***
- detrended	-	0.037***	0.001	-0.039***
dln avg wage	0.018***	0.007***	0.018***	0.030***
- detrended	-	-0.011***	-0.000	0.012***
- common layers	0.020***	-0.108***	0.018***	0.147***
- - detrended	-	-0.128***	-0.002***	0.128***
% firms	100	12.75	73.48	13.78
% VA change	100	24.47	79.14	-3.61

All results from trimmed sample at 0.05%, \*\*\* significant at 1%.

# Change in firm level outcomes during transition

Average behavior of firms with adjacent layers by change in the number of layers

	All	Increase $L$	No change in $L$	Decrease $L$
dlnhours	-0.009***	0.038***	-0.008***	-0.059***
- detrended	-	0.048***	0.001	-0.050***
$d\ln \sum_{\ell=0}^L n_L^{\ell}$	-0.011***	1.788***	0.008***	-1.835***
- detrended	-	1.799***	0.019***	-1.823***
dln VA	-0.003***	0.036***	-0.004***	-0.038***
- detrended	-	0.040***	-0.001	-0.034***
dln avg wage	0.017***	0.019***	0.017***	0.015***
- detrended	-	0.002	0.000	-0.002
- common layers	0.018***	-0.054***	0.017***	0.092***
- - detrended	-	-0.072***	-0.001	0.074***
% firms	100	10.25	78.82	10.94
% VA change	100	34.25	65.86	-0.11

\*\*\* significant at 1%.



## Normalized hours change according to the theory

- Firms that change export status and do not change  $L$ , selected sample
- Reporting  $\beta_L^\ell$  from  $d \ln n_{Lit}^\ell = \alpha_L^\ell + \beta_L^\ell d \ln VA_{it} + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\beta_L^\ell$	s.e.	p-value	obs
1	0	-0.045	0.044	0.31	4,550
2	0	0.009	0.026	0.73	8,031
2	1	-0.013	0.028	0.64	8,031
3	0	0.200	0.053	0.00	4,896
3	1	0.073	0.038	0.06	4,896
3	2	0.084	0.042	0.05	4,896

▶ back

# Data description

By number of layers in the firm, DADS data

# of layers	Firm-years	Average		Median wage
		VA	Hours	
0	81,909	205	7,946	10.18
1	126,069	403	16,450	12.08
2	161,449	2,821	85,674	14.22
3	87,211	8,879	227,070	15.71

Value added in 000s of 2005 euros.

▶ Back

# Change in normalized hours for firms that change layers

- Average 2 years ahead log change

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.338	0.023	0.00	4152
1	3	1	1.603	0.090	0.00	344
1	4	1	3.067	0.355	0.00	24
2	1	1	-1.677	0.026	0.00	4916
2	3	1	0.608	0.015	0.00	7081
2	3	2	0.473	0.015	0.00	7081
2	4	1	1.256	0.082	0.00	276
2	4	2	1.082	0.076	0.00	276
3	1	1	-1.915	0.080	0.00	568
3	2	1	-0.721	0.018	0.00	8033
3	2	2	-0.568	0.019	0.00	8033
3	4	1	1.297	0.020	0.00	6036
3	4	2	1.241	0.022	0.00	6036
3	4	3	1.218	0.022	0.00	6036
4	1	1	-2.245	0.232	0.00	50
4	2	1	-0.989	0.065	0.00	571
4	2	2	-0.825	0.064	0.00	571
4	3	1	-1.414	0.019	0.00	8147
4	3	2	-1.344	0.021	0.00	8147
4	3	3	-1.249	0.021	0.00	8147

▶ Back

# Change in normalized hours for firms that change layers

- Average 3 years ahead log change

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	1.384	0.033	0.00	1891
1	3	1	1.558	0.144	0.00	132
1	4	1	3.264	0.550	0.00	10
2	1	1	-1.674	0.037	0.00	2378
2	3	1	0.639	0.021	0.00	3440
2	3	2	0.509	0.020	0.00	3440
2	4	1	1.455	0.152	0.00	113
2	4	2	1.184	0.121	0.00	113
3	1	1	-1.944	0.124	0.00	241
3	2	1	-0.688	0.026	0.00	3824
3	2	2	-0.530	0.027	0.00	3824
3	4	1	1.328	0.026	0.00	3169
3	4	2	1.265	0.029	0.00	3169
3	4	3	1.290	0.027	0.00	3169
4	1	1	-2.169	0.314	0.00	28
4	2	1	-0.849	0.089	0.00	296
4	2	2	-0.812	0.089	0.00	296
4	3	1	-1.447	0.026	0.00	4394
4	3	2	-1.407	0.028	0.00	4394
4	3	3	-1.268	0.028	0.00	4394

▶ Back

# Change in wages for firms that change layers

- Average 2 years ahead log change

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.155	0.007	0.00	4152
1	3	1	-0.489	0.045	0.00	344
1	4	1	-1.033	0.244	0.00	24
2	1	1	0.138	0.007	0.00	4916
2	3	1	-0.055	0.004	0.00	7081
2	3	2	-0.279	0.006	0.00	7081
2	4	1	-0.272	0.035	0.00	276
2	4	2	-0.583	0.040	0.00	276
3	1	1	0.181	0.021	0.00	568
3	2	1	0.047	0.004	0.00	8033
3	2	2	0.211	0.005	0.00	8033
3	4	1	-0.027	0.004	0.00	6036
3	4	2	-0.082	0.004	0.00	6036
3	4	3	-0.246	0.006	0.00	6036
4	1	1	0.310	0.097	0.00	50
4	2	1	0.083	0.016	0.00	571
4	2	2	0.275	0.024	0.00	571
4	3	1	0.005	0.003	0.12	8147
4	3	2	0.021	0.004	0.00	8147
4	3	3	0.104	0.005	0.00	8147

▶ Back

# Change in wages for firms that change layers

- Average 3 years ahead log change

# of layers		Layer	Change	s.e.	p-value	obs
Before	After					
1	2	1	-0.144	0.010	0.00	1891
1	3	1	-0.550	0.075	0.00	132
1	4	1	-0.598	0.207	0.02	10
2	1	1	0.125	0.010	0.00	2378
2	3	1	-0.043	0.005	0.00	3440
2	3	2	-0.268	0.008	0.00	3440
2	4	1	-0.243	0.061	0.00	113
2	4	2	-0.605	0.066	0.00	113
3	1	1	0.195	0.036	0.00	241
3	2	1	0.057	0.005	0.00	3824
3	2	2	0.219	0.008	0.00	3824
3	4	1	-0.036	0.006	0.00	3169
3	4	2	-0.095	0.007	0.00	3169
3	4	3	-0.277	0.009	0.00	3169
4	1	1	0.201	0.119	0.10	28
4	2	1	0.050	0.019	0.01	296
4	2	2	0.236	0.031	0.00	296
4	3	1	0.002	0.004	0.70	4394
4	3	2	0.009	0.005	0.07	4394
4	3	3	0.081	0.007	0.00	4394

▶ Back

# Change in normalized hours for firms that do not transition

- 2 years ahead
- Reporting  $\beta_L^\ell$  from  $\ln(n_{Lit+2}^\ell/n_{Lit}^\ell) = \alpha_L^\ell + \beta_L^\ell \ln(VA_{it+2}/VA_{it}) + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\beta_L^\ell$	s.e.	p-value	obs
2	1	0.063	0.015	0.00	34,685
3	1	0.067	0.010	0.00	53,515
3	2	0.025	0.012	0.03	53,515
4	1	0.179	0.015	0.00	33,965
4	2	0.089	0.014	0.00	33,965
4	3	0.107	0.015	0.00	33,965

▶ Back

# Change in normalized hours for firms that do not transition

- 3 years ahead
- Reporting  $\beta_L^\ell$  from  $\ln(n_{Lit+3}^\ell/n_{Lit}^\ell) = \alpha_L^\ell + \beta_L^\ell \ln(VA_{it+3}/VA_{it}) + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\beta_L^\ell$	s.e.	p-value	obs
2	1	0.112	0.019	0.00	18,068
3	1	0.081	0.013	0.00	30,224
3	2	0.046	0.015	0.00	30,224
4	1	0.229	0.018	0.00	21,025
4	2	0.139	0.017	0.00	21,025
4	3	0.165	0.019	0.00	21,025

▶ Back



## Wages change according to the theory

- 2 years ahead
- Reporting  $\gamma_L^\ell$  from  $\ln(w_{Lit+2}^\ell/w_{Lit}^\ell) = \delta_L^\ell + \gamma_L^\ell \ln(VA_{it+2}/VA_{it}) + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\gamma_L^\ell$	s.e.	p-value	obs
1	1	0.046	0.009	0.00	26,170
2	1	0.067	0.007	0.00	34,685
2	2	0.101	0.007	0.00	34,685
3	1	0.099	0.006	0.00	53,515
3	2	0.112	0.006	0.00	53,515
3	3	0.136	0.006	0.00	53,515
4	1	0.112	0.006	0.00	33,965
4	2	0.130	0.009	0.00	33,965
4	3	0.137	0.010	0.00	33,965
4	4	0.196	0.011	0.00	33,965

▶ Back

## Wages change according to the theory

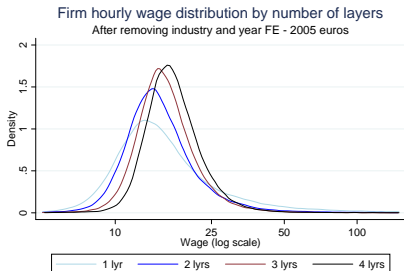
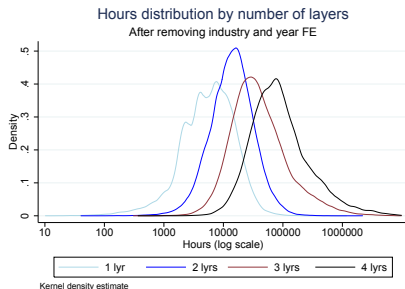
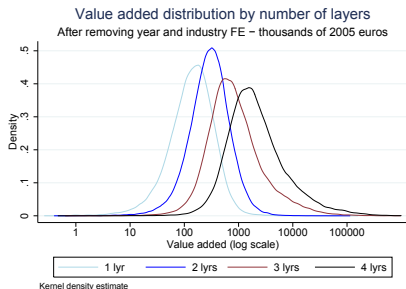
- 3 years ahead
- Reporting  $\gamma_L^\ell$  from  $\ln(w_{Lit+3}^\ell/w_{Lit}^\ell) = \delta_L^\ell + \gamma_L^\ell \ln(VA_{it+3}/VA_{it}) + \varepsilon_{it}$

# of layers in the firm ( $L$ )	Layer $\ell$	$\gamma_L^\ell$	s.e.	p-value	obs
1	1	0.021	0.010	0.04	26,170
2	1	0.059	0.008	0.00	34,685
2	2	0.102	0.009	0.00	34,685
3	1	0.081	0.006	0.00	53,515
3	2	0.095	0.007	0.00	53,515
3	3	0.133	0.008	0.00	53,515
4	1	0.092	0.008	0.00	33,965
4	2	0.110	0.008	0.00	33,965
4	3	0.123	0.009	0.00	33,965
4	4	0.196	0.012	0.00	33,965

▶ Back



# Firms with different number of layers are different



# Sources of changes in average wage during a transition

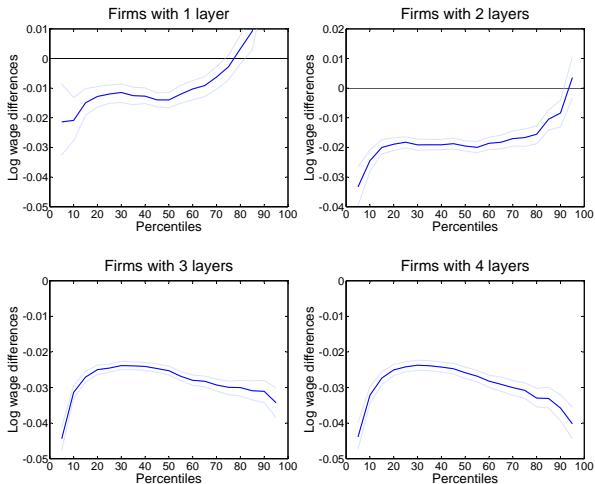
$\bar{w}_{L'it+1}^{\ell \leq L} / \bar{w}_{Lit}$				$w_{L'it+1}^{L'} / \bar{w}_{Lit}$			
From/to	2	3	4	From/to	2	3	4
1	0.963*** (10,167)	0.865*** (1,262)	0.733*** (96)	1	1.507*** (10,166)	1.501*** (1,263)	1.602*** (97)
2		0.926*** (16,783)	0.876*** (1,128)	2		2.040*** (16,783)	2.021*** (1,129)
3			0.958*** (14,099)	3			4.385*** (14,099)
$s$				$d \ln \bar{w}_{Lit}$			
From/to	2	3	4	From/to	2	3	4
1	0.741*** (10,166)	0.620*** (1,262)	0.563*** (97)	1	-0.007* (10,166)	-0.094*** (1,263)	-0.305*** (97)
2		0.853*** (16,784)	0.775*** (1,128)	2		0.005** (16,784)	-0.033** (1,129)
3			0.948*** (14,099)	3			-0.001 (14,098)

All results from trimmed sample at 0.05%. \*significant at 10% \*\* significant at 1%. Number of observations in paranthesis.

▶ back

# Distribution of wages after minus before

Conditioning on decrease in VA < 0 and no transition



▶ back