# Learning by working in high-skill sectors

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# **Motivation**

- Rapid industrial development was key for catch-up with the west observed in East Asia (Rodrik, 2016; Buera and Oberfield, 2020)
- Initially led by growth of exports in labor intensive manufacturing sectors (labor movements away from agriculture)
- This structural transformation yielded rapid productivity growth, as manufacturing tends to exhibit strong unconditional convergence in labor productivity (Rodrik, 2013)
- Better jobs in manufacturing also facilitated rapid increases in schooling by younger generations in East Asia (but not in Mexico Atkin, 2016)

#### **Motivation**

- Less clear if this development path can still be observed in other parts of the developing world
- Evidence that manufacturing employment peaks at lower levels than before (Rodrik, 2016)
- Automation need not reduce exports in the South, but can reduce manufacturing employment (Artuc, Bastos and Rijkers, 2023)
- As employment shifts more rapidly towards services, important to study alternative mechanisms by which this structural transformation can lead to productivity growth
- One such mechanisms is learning by working, broadly defined as human capital accumulation through experience in the labor market (Krugman, 1987; Lucas, 1988; Redding, 1999)

# This paper

- > Looks for evidence of learning by working in different sectors in Brazil
- Highly detailed longitudinal worker-firm panel data for Brazil covering both manufacturing and services, 2003-2015
- > Focus on sectors' skill intensity as a source of learning by working
- Comparison between manufacturing and services
- Methods analogous to Puga and De la Roca (2017, REStud), who study "Learning by working in big cities"

# Main takeaways

- There are sizable static and dynamic benefits for workers associated with employment in high-skill sectors (many of which are in services)
- In services, dynamic benefits of learning accrue to the worker even if she is not currently employed in the most skilled sectors (transferable learning)
- In manufacturing, these dynamic benefits accrue only if the worker is currently employed in the most skilled sectors (non-transferable learning)
- Learning effects vary with worker education but are relatively similar for males and females

#### Data description

#### Relacao Anual de Informacoes Sociais (RAIS), 2003-2015

- > Longitudinal worker-firm census gathering administrative social security records
- > Worker-level information on demographics (age, gender, schooling)
- > Worker-level information on job characteristics (occupation, wage, hours worked)
- > Worker-level information on hiring and termination dates
- Firm/plant-level information on number of employees, location, industry code

# Data description

#### Relacao Anual de Informacoes Sociais (RAIS), 2003-2015

- Unique identifiers for workers and firms/plants
- > Restrict analysis to manufacturing and services (exclude agriculture and public sector)
- Analysis based on 2% random sample of workers (keeping all yearly observations for sampled workers)

# Econometric method

Dynamic benefits of working in high-skilled sectors (analogous to Puga and De la Roca, 2017)

$$W_{imst} = \theta_i + \alpha_m + \beta_s + \gamma_t + X'_{it}\beta + \sum_{j=1}^S \delta_{js}e_{ijt} + \mu_{imst}$$

- i = individual
- *m* = *microregion*
- *s* = *sector*
- t = year

*e*<sub>*iit*</sub> = experience aquired by worker *i* in high-skill sector *j* until time *t* 

Allowed to vary depending both the:

- 1. sector in which it was acquired
- 2. sector in which the worker is currently employed

# **Summary statistics**

Variable	Mean	SD	Min	Max
log wages	7.182	0.695	4.722	11.55
Services dummy	0.762	0.426	0	1
Manufacturing dummy	0.238	0.426	0	1
Experience in years	3.578	5.109	0	49.81667
Firm tenure in months	153.200	139.900	0	599
Average education in the firm	10.039	2.538	0	22.5
Years of education	10.040	3.392	0	22.5
5th grade incomplete	0.032	0.176	0	1
5th grade complete	0.046	0.210	0	1
9th grade incomplete	0.088	0.283	0	1
9th grade complete	0.143	0.351	0	1
Secondary level incomplete	0.088	0.284	0	1
Secondary level complete	0.439	0.496	0	1
Higher education incomplete	0.043	0.202	0	1
Higher education complete	0.113	0.316	0	1
Masters	0.002	0.047	0	1
PhD	0.001	0.034	0	1

# Static wage premium in manufacturing/services, worker fixed-effects

	(1)	(2)	(2)
	(1)	3 digit industry	3 digit industry F.E
	log wages	F.E from (1)	from (1)
		0.0522***	
Services dummy		-0.0533***	
		(0.0156)	0 0 0 0 0 * * *
Manufacturing dummy			0.0533***
			(0.0156)
Experience in months	0.00178***		
	(5.94e-06)		
Experience ^ 2	-5.59e-06***		
	(2.32e-08)		
Firm tenure in months	0.000743***		
	(4.16e-06)		
Firm tenure ^2	-6.30e-07***		
	(9.35e-09)		
5th grade incomplete	0.00180		
	(0.00245)		
5th grade complete	0.00987***		
	(0.00245)		
9th grade incomplete	0.00961***		
	(0.00241)		
9th grade complete	0.00746***		
	(0.00240)		
Secondary level incomplete	-0.0107***		
	(0.00242)		
Secondary level complete	0.0229***		
	(0.00240)		
Higher education incomplete	0.0853***		
	(0.00250)		
Higher education complete	0.228***		
с .	(0.00249)		
Masters	0.215***		
	(0.00361)		
PhD	0.237***		
	(0.00449)		
Observations	7.310 456	204	204
R-squared	0 902	0.055	0.055
Microregion E F	V	V.055	V
Vear E E	v	v	v
	v	v	v
Worker F F	v	v	V

# Static wage premium in manufacturing/services, worker fixed-effects

	(1)	(2)
	3 digit industry F.E	3 digit industry F.E
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.0970***	
	(0.0152)	
Transportation and storage	0.0161	
	(0.0329)	
Accomodation and food services	-0.117***	
	(0.0309)	
Information and communication	-0.0844***	
	(0.0240)	
Financial and insurance actvities	0.0861	
	(0.0692)	
Real estate activities	-0.0576	
	(0.0416)	
Professional, scientific and technical activities	-0.0334	
	(0.0608)	
Administrative and support service activities	-0.102***	
	(0.0218)	
Education	-0.200***	
	(0.0249)	
Human health and social work activities	-0.122***	
	(0.0120)	
Arts, entertainment, and recreation	-0.105***	
	(0.0350)	
Other services	-0.107**	
	(0.0415)	
Food, beverage, smoke		0.0235
		(0.0178)
l'extiles, clothing, leather, footwear		-0.0300*
		(0.0177)
Wood, paper, printing, furniture, and recycling		0.0200
		(0.0197)
Petroleum, chemicals, rubber, plastic, and non-metallic		0.121***
		(0.0292)
Metals, machinery and electronics		0.0569***
Automativa		(U.U182)
Automotive		0.168***
		(0.0399)
Observations	190	190
R-squared	0.260	0.195
Microregion F.E	Y	Y
Year F.E	Y	Y
Indusrty F.E	Y	Y
Worker F.E	Y	Y

## Static wage premium and avg. education in sector, worker fixed-effects

	(1)	(2)	(3)	(4)
		3 digit industry	3 digit industry	
	log wages	F.E from (1)	F.E from (1)	3 digit industry
		(services)	(manufacturing)	F.E from (1)
Average years of education in the inductor		0 0281***	0 0310***	0 0003***
Average years of education in the industry		(0.00982)	(0.00941)	(0.0223
Experience in months	0 00178***	(0.00582)	(0.00041)	(0.00713)
	(5.94e-06)			
Experience ^ 2	-5.59e-06***			
	(2.32e-08)			
Firm tenure in months	0.000743***			
	(4.16e-06)			
Firm tenure ^2	-6.30e-07***			
	(9.35e-09)			
5th grade incomplete	0.00180			
	(0.00245)			
5th grade complete	0.00987***			
	(0.00245)			
9th grade incomplete	0.00961***			
	(0.00241)			
9th grade complete	0.00746***			
<b>C</b> .	(0.00240)			
Secondary level incomplete	-0.0107***			
	(0.00242)			
Secondary level complete	0.0229***			
	(0.00240)			
Higher education incomplete	0.0853***			
	(0.00250)			
Higher education complete	0.228***			
	(0.00249)			
Masters	0.215***			
	(0.00361)			
PhD	0.237***			
	(0.00449)			
Observations	7,310,456	100	104	204
R-squared	0.902	0.178	0.217	0.110
Microregion F.E	Y	Y	Y	Y
Year F.E	Y	Y	Y	Y
Indusrty F.E	Y	Y	Y	Y
Worker F.E	Y	Y	Y	Y

# Static wage premium and avg. education in sector, firm-level controls

adjet industry F.E (Services and Manufacturing)         3 digit industry F.E (Services and Manufacturing)           Average years of education in the industry         0.0168** (0.00689)         0.0168** (0.00073)           Firm size         4.24e-07*** (1.92e-08)         0.0165** (0.00073)           Average years of education in the firm         0.00165** (0.00073)         0.00165**           Experience top 1-10 most educated industries         0.0105** (0.00073)         0.00174***           Experience top 1-10 most educated indus x experience         4.74e-05*** (1.00e-05)         1.00           Experience top 1-10 most educated indus x now in top 10 most educated indus (0.00073)         0.0022*** (0.00073)         1.00           Experience top 1-10 most educated indus x now in top 10 most educated indus (0.00073)         0.0027** (1.01e-05)         1.00e-05*           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus (2.580e-06)         1.00e-05*         1.00e-05*           Firm tenure '2         -2.66e-05*         1.00e-05         1.00e-05           Firm tenure '2         -2.66e-06*         1.000279         1.00e-05           Step rade incomplete         0.0027*         1.00e-05         1.00e-05           Step rade incomplete         0.0027*         1.00e-05         1.00e-05         1.00e-05           Step rade incomplete         0.0027*		(1)	(2)
Average years of education in the industry         0.0168** (0.00092)           Firm size         -4.24e-07***           Average years of education in the firm         0.00022***           0.00000000000000000000000000000000000		log wages	3 digit industry F.E (Services and Manufacturing)
im size         4.24e-07***           Average years of education in the firm         (1.92e-08)           Average years of education in the firm         (0.000703)           Experience top 1-10 most educated industries         (0.000703)           Experience top 1-10 most educated industries         (0.000703)           Experience top 1-10 most educated indus x experience         8.71e-05***           (6.19e-06)         (1.00e-05)           Experience 1         (2.54e-08)           Experience top 1-10 most educated indus x now in top 10 most educated indus         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (0.000730)           Experience outside top 10 x experience x now in top 10 most educated indus         (0.000737)           Firm tenure in months         (0.000757)           Firm tenure in months         (0.000757)           Sh grade incomplete         (0.00255)           Sh grade complete         (0.00257)           Sh grade complete         (0.00251)           Secondary level complete         (0.00252)           Higher educat	Average years of education in the industry		0.0168**
Average years of education in the firm         (1.92e-08)           Average years of education in the firm         (0.000105)           Experience top 1-10 most educated industries         (0.00703)           Experience top 1-10 most educated indus x experience         -8.71e-05***           Experience in months         (0.0073)           Experience or 1-10 most educated indus x experience         -8.71e-05***           Experience A 2         -5.45e-06***           Experience top 1-10 most educated indus x now in top 10 most educated indus         0.00220***           C.000730)         Experience top 1-10 most educated indus x experience x now in top 10 most educat         4.01e-05***           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         -1.06e-05*           Experience outside top 10 x experience x now in top 10 most educat         4.01e-05****           Firm tenure in months         (3.26e-06)           Firm tenure 2         -6.26e-07***           Sh grade incomplete         0.000279           9th grade complete         0.000279           9th grade incomplete         -0.00337           9th grade incomplete         -0.00337           9th grade incomplete         -0.00337           9th grade incomplete         -0.00337           9th grade incomplete         0.000253 </td <td>Firm size</td> <td>-4 24e-07***</td> <td>(0.00689)</td>	Firm size	-4 24e-07***	(0.00689)
Average years of education in the firm         0.0022****         0.000005           Experience top 1-10 most educated industries         0.0055***         0.000703           Experience top 1-10 most educated indus x experience         8.71e-05***         1.00e-055           Experience top 1-10 most educated indus x experience         8.71e-05***         1.00e-055           Experience ^ 2         -5.45e-06***         1.00e-05           Experience ^ 2         -5.45e-06***         1.00e-05**           Experience top 1-10 most educated indus x now in top 10 most educated indus         0.00220***         1.00e-05**           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         0.000730         1.00e-05**           Experience outside top 10 x experience x now in top 10 most educated indus         0.00073***         1.00e-05**           firm tenure in months         0.000079***         (.000750)         1.00e-05**           firm tenure ^2         6.26e-07***         (.000255)         1.00e-05**           firm tenure ^2         (.000251)         1.00e-05**         1.00e-05**           firm tenure ^2         (.000251)         1.00e-05**         1.00e-05**           firm tenure ^2         (.000251)         1.00e-05**         1.00e-05**           firm tenure ^2         (.000251)         1.		(1.92e-08)	
Experience top 1-10 most educated industries         (0.000105)           Experience top 1-10 most educated indus x experience         -8.71e-05***           Experience in months         0.00174***           (6.19e-06)         (6.19e-06)           Experience top 1-10 most educated indus x now in top 10 most educated indus         (0.00073)           Experience top 1-10 most educated indus x now in top 10 most educated indus         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (1.00-05)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (1.00-05)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (1.00-05)           Experience outside top 10 x experience x now in top 10 most educated indus         (1.00-05)           Firm tenure in months         (0.00737***           (firm tenure ^2         (5.26e-07***           (g) rade incomplete         0.000255)           Sth grade incomplete         -0.00237           (0.00251)         (0.00251)           Secondary level incomplete         -0.00237           (1000252)         (0.00251)           Higher education incomplete         (0.00252)           Higher education complete         (0.00254)           Secondary le	Average years of education in the firm	0.00922***	
Experience top 1-10 most educated industries         0.0165***           Experience top 1-10 most educated indus x experience         -8.71e-05***           1.00e-05)		(0.000105)	
Experience top 1-10 most educated indus x experience         -8.71e-05***           Experience top 1-10 most educated indus x experience         0.00174***           Experience ^ 2         -5.45e-06***           Experience top 1-10 most educated indus x now in top 10 most educated indus         0.00278**           Experience top 1-10 most educated indus x experience x now in top 10 most educat         0.000730           Experience top 1-10 most educated indus x experience x now in top 10 most educat         1.06e-05*           Experience outside top 10 x experience x now in top 10 most educat         1.06e-05*           Firm tenure in months         0.000737***           0.000279         -5.45e-06***           10 reacting to the top 10 x experience x now in top 10 most educated indus         -1.06e-05*           10 reacting to the top 10 x experience x now in top 10 most educated indus         -1.06e-05*           10 reacting to the top 10 x experience x now in top 10 most educated indus         -1.06e-05*           10 reacting to the top 10 x experience x now in top 10 most educated indus         -1.06e-05*           10 reacting to the top 10 x experience x now in top 10 most educated indus         -1.06e-05*           10 reacting to the top 10 x experience x now in top 10 most educated indus         -1.06e-05*           11 reacting to the top 10 x experience x now in top 10 most educated indus         -1.00027           11 grade complete	Experience top 1-10 most educated industries	0.0165***	
Experience top 1-10 most educated indus x experience         8.71e-05***           Experience in months         (1.00e-05)           Experience ^ 2         5.45e-06*           Experience ^ 2         (2.54e-08)           Experience top 1-10 most educated indus x now in top 10 most educated indus         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (0.000730)           Experience outside top 10 x experience x now in top 10 most educated indus         (5.80e-06)           Firm tenure in months         (0.000737)           (4.26e-06)         (4.26e-06)           Firm tenure ^2         (6.70e-09)           5th grade incomplete         (0.000253)           9th grade incomplete         (0.000251)           9th grade complete         (0.00252)           9th grade complete         (0.00263)           1		(0.000703)	
Experience in months         (1.00e-05)           Experience in months         (6.19e-06)           Experience ^ 2         -5.45e-06***           Experience top 1-10 most educated indus x now in top 10 most educated indus         (0.002730)           Experience top 1-10 most educated indus x experience x now in top 10 most educat         (1.01e-05)           Experience outside top 10 x experience x now in top 10 most educat         (1.01e-05)           Experience outside top 10 x experience x now in top 10 most educat         (3.000737***           (17) term tenure in months         0.000737***           (17) term tenure ^2         (3.26e-06)           Firm tenure ^2         (9.70e-09)           5th grade incomplete         0.000227           (10000250)         (0.00225)           9th grade complete         0.000237           (0.00251)         (0.00251)           Secondary level incomplete         (0.00253)           9th grade complete         (0.00254)           Secondary level complete         (0.00253)           Higher education incomplete         (0.00253)           Higher education incomplete         (0.00253)           Higher education complete         (0.00253)           Higher education incomplete         (0.00253)           Masters         (0.00263)<	Experience top 1-10 most educated indus x experience	-8.71e-05***	
Experience in months         0.00174***           Experience ^ 2         -5.45e-06***           Experience ^ 2         (2.54e-08)           Experience top 1-10 most educated indus x now in top 10 most educated indus         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated indus         (1.01e-05)           Experience outside top 10 x experience x now in top 10 most educated indus         -1.06e-05*           Firm tenure in months         0.000737**           Firm tenure ^2         -6.26e-06*           Firm tenure ^2         -6.26e-06*           Sth grade incomplete         0.000279           5th grade complete         0.000237           9th grade incomplete         -0.00237           9th grade complete         -0.00252)           9th grade complete         -0.00254           9th grade complete         0.00628**           9th grade complete         0.00628		(1.00e-05)	
Experience ^ 2         -5.45e-06***           Experience for 1-10 most educated indus x now in top 10 most educated indus (0.00270**)         (0.00730)           Experience top 1-10 most educated indus x experience x now in top 10 most educated (1.00-05***)         (1.00-05***)           Experience outside top 10 x experience x now in top 10 mos educated indus (5.80e-06)         (1.00-05***)           Firm tenure in months         0.00073****           0.000273         (4.26e-06)           Firm tenure in months         0.000279           0.000279         (0.00255)           Sth grade incomplete         0.000279           0.000251)         (0.00252)           Sth grade complete         0.000279           0.000252)         (0.00251)           Secondary level incomplete         0.000251)           Secondary level incomplete         0.000252)           Higher education incomplete         0.000252)           Higher education incomplete         0.000252)           Higher education incomplete         0.000253)           Masters         0.156****           PhD         0.173****           Observations         6.906,352         204           R-squared         0.906         0.0666           Microregion F.E         Y         Y	Experience in months	0.00174***	
Experience * 2       -5.45e-0***         Experience top 1-10 most educated indus x now in top 10 most educated indus       0.00220***         (1.01e-05)       (1.01e-05)         Experience outside top 10 x experience x now in top 10 most educat       -1.06e-05*         (5.80e-06)       (5.80e-06)         Firm tenure in months       (5.80e-06)         Firm tenure *2       (9.70e-09)         5th grade incomplete       0.000279         (0.00255)       (0.00255)         5th grade incomplete       0.000237         (0.00255)       (0.00255)         5th grade complete       0.000237         (0.00251)       (0.00251)         Secondary level incomplete       0.00028**         (0.00252)       (0.00253)         Higher education incomplete       0.000279         (0.00251)       (0.00251)         Secondary level incomplete       0.00628**         (0.00253)       (0.00253)         Higher education incomplete       0.105***         (0.00263)       (0.00263)         Masters       0.56****         (0.00263)       (0.0063)         Masters       0.5906, 352       204         Neares       0.906       0.0666         Microregi		(6.19e-06)	
Experience top 1-10 most educated indus x now in top 10 most educated indus         0.00220***           (0.000730)         (0.000730)           Experience top 1-10 most educated indus x experience x now in top 10 most educat         4.01e-05****           (1.01e-05)         (1.01e-05)           Experience outside top 10 x experience x now in top 10 mos educated indus         -1.06e-05*           (5.80e-06)         (5.80e-06)           Firm tenure in months         (4.26e-06)           Firm tenure ^2         6.26e-07***           (0.00255)         (0.000279)           5th grade incomplete         0.000279           (0.00256)         (0.00256)           9th grade complete         0.000273           (0.00251)         (0.00251)           9th grade complete         -0.000237           (0.00251)         (0.00251)           Secondary level incomplete         -0.00628**           (0.00252)         (0.00253)           Higher education incomplete         0.00628**           (0.00263)         (0.00263)           Higher education complete         (0.00263)           Masters         0.56****           (0.00263)         (0.0066)           Masters         0.906         0.0666           Microregion F.E <td>Experience ^ 2</td> <td>-5.45e-06***</td> <td></td>	Experience ^ 2	-5.45e-06***	
Experience top 1-10 most educated indus x now in top 10 most educated indus         0.00220***           (0.000730)         4.01e-05***           (1.01e-05)         1.06e-05*           (1.01e-05)         5.80e-06)           Firm tenure in months         0.000737***           (4.26e-06)         (5.80e-06)           Firm tenure ^2         -6.26e-07***           (9.70e-09)         (9.70e-09)           5th grade incomplete         0.000273           (0.00255)         (0.00255)           5th grade incomplete         0.000273           (0.00251)         (0.00252)           9th grade incomplete         -0.00237           (0.00251)         (0.00251)           Secondary level incomplete         -0.00237           (0.00252)         (0.00251)           Secondary level complete         -0.00237           (0.00251)         (0.00252)           Higher education incomplete         0.00628**           (0.00252)         (0.00263)           Higher education complete         0.156***           (0.00263)         (0.00263)           Masters         0.156***           (0.00263)         (0.00461)           Observations         6.906,352         204 <tr< td=""><td>Functional ten 4,40 ment educated industry in term 40 ments during the</td><td>(2.54e-08)</td><td></td></tr<>	Functional ten 4,40 ment educated industry in term 40 ments during the	(2.54e-08)	
Experience top 1-10 most educated indus x experience x now in top 10 most educat         4.01e-05***           Experience outside top 10 x experience x now in top 10 mos educated indus         -1.06e-05**           Firm tenure in months         0.000737***           (4.26e-06)         -           Firm tenure in months         -6.26e-07***           (9.70e-09)         -           5th grade incomplete         0.000279           (0.00256)         -           9th grade complete         -0.00237           (0.00256)         -           9th grade incomplete         -0.00237           (0.00251)         -           Secondary level incomplete         -0.00330***           (0.00251)         -           Secondary level complete         -0.00254           (0.00253)         -           Higher education incomplete         -0.00628**           (0.00254)         -           Secondary level complete         0.156***           (0.00263)         -           Higher education complete         0.166***           (0.00263)         -           Higher education complete         0.156***           (0.00263)         -           Higher education complete         0.156*** <td>Experience top 1-10 most educated indus x now in top 10 most educated indus</td> <td>0.00220***</td> <td></td>	Experience top 1-10 most educated indus x now in top 10 most educated indus	0.00220***	
Lapereine (b) 1-20 most educated intois X experience X now in top 10 most educated indus       1.01e-05)         Experience outside top 10 x experience x now in top 10 mos educated indus       -1.06e-05*         if im tenure in months       (4.26e-06)         Firm tenure ^2       -6.26e-07***         (0.00273)       (9.70e-09)         5th grade incomplete       0.000279         (0.00255)       (0.00255)         5th grade complete       0.000279         (0.00256)       (0.00256)         9th grade complete       -0.00237         (0.00251)       (0.00251)         Secondary level incomplete       -0.00254         (0.00252)       (0.00252)         Higher education incomplete       -0.00628**         (0.00263)       (0.00263)         Higher education complete       0.180***         (0.00263)       (0.00263)         Higher education complete       0.180***         (0.00263)       (0.00373)         PhD       0.173***         Observations       6.906,352       204         R-squared       0.906       0.066         Microregion F.E       Y       Y         Y       Y       Y       Y         Industry F.E       Y	Experience ten 1.10 most aducated indus y avagriance y new in ten 10 most aducat	(0.000730)	
Experience outside top 10 x experience x now in top 10 mos educated indus       -1.06e-05*         Firm tenure in months       0.00073***         (4.26e-06)       -1.06e-07***         Firm tenure ^2       -5.26e-07****         (9.70e-09)       -5.26e-07****         Sth grade incomplete       0.000279         (0.00255)       -5.26e-07****         Sth grade incomplete       0.00279         (0.00255)       -5.26e-07****         Sth grade incomplete       0.00419         (0.00256)       -5.26e-07***         9th grade incomplete       0.00237         (0.00257)       -5.26e-07***         9th grade complete       -0.00237         (0.00251)       -5.26e-07***         Secondary level incomplete       -0.0030***         (0.00251)       -5.26e-07***         Secondary level complete       -0.00628**         (0.00252)       -1.066***         Higher education incomplete       0.180***         (0.00263)       -5.26e-07***         Higher education complete       0.166***         (0.00263)       -5.26e-07***         Pb       0.172****         Observations       6.906,352       204         R-squared       Y	Experience top 1-10 most educated mous x experience x now in top 10 most educat	(1 010-05)	
Experience outside (b) to X experience X how in (b) to indo cudated indus       1.500-05         Firm tenure in months       (4.26e-06)         Firm tenure ^2       (5.80e-06)         Firm tenure ^2       (9.70e-09)         Sth grade incomplete       0.000279         (0.00255)       (0.00255)         Sth grade complete       0.00237         (0.00256)       (0.00251)         9th grade complete       -0.00237         (0.00251)       (0.00251)         Secondary level incomplete       -0.00237         (0.00252)       (0.00251)         Secondary level complete       -0.0028**         (0.00252)       (0.00252)         Higher education incomplete       0.0046***         (0.00252)       (0.00253)         Higher education complete       0.106***         (0.00263)       (0.00263)         Masters       0.156***         (0.00263)       (0.00461)         Observations       6.906,352       204         R-squared       0.906       0.0666         Microregion F.E       Y       Y         Y er F.E       Y       Y         Industry F.E       Y       Y <td>Experience outside top 10 x experience x now in top 10 mos educated indus</td> <td>(1.010-05)</td> <td></td>	Experience outside top 10 x experience x now in top 10 mos educated indus	(1.010-05)	
Firm tenure in months       0.000737***         Firm tenure ^2       -6.26e-07***         immediate       0.000279         5th grade incomplete       0.000279         5th grade complete       0.000250         5th grade incomplete       0.000250         9th grade incomplete       -0.00237         0000250       9th grade incomplete         0000251       -0.00037***         9th grade complete       -0.00237         0000252)       9th grade complete         0000251)       -0.000251)         Secondary level incomplete       -0.00230***         0000254)       -0.00254)         Secondary level complete       -0.00253)         Higher education incomplete       0.0466***         (0.00253)	Experience outside top 10 x experience x now in top 10 mos educated indus	(5.80e-06)	
Image: Second and Lemma 1       Image: Second and Lemma 1         Firm tenure 12       -6.26e-07***         Image: Ima	Firm tenure in months	0.000737***	
Firm tenure ^2       -6.26e-07***         Sth grade incomplete       0.000279         Sth grade complete       0.000255)         Sth grade incomplete       0.00419         (0.00256)       9th grade incomplete         9th grade incomplete       -0.00237         (0.00251)       (0.00251)         Secondary level incomplete       -0.00528**         (0.00252)       (0.00252)         Higher education incomplete       -0.00528**         (0.00252)		(4.26e-06)	
Sh grade incomplete       0,000279         Sh grade complete       0,00419         (0,00256)       (0,00256)         9th grade incomplete       -0.00237         (0,00252)       (0,00251)         9th grade complete       -0.0100***         (0,00254)       -0.00330***         Secondary level incomplete       -0.00628**         (0,00254)       -0.00628**         Secondary level complete       -0.00628**         (0,00254)       -0.00628**         Higher education incomplete       0.0466***         (0,00263)       -0.010000000000000000000000000000000000	Firm tenure ^2	-6.26e-07***	
5th grade incomplete       0.000279         5th grade complete       0.00419         00.00255)       0.000270         9th grade incomplete       -0.00237         00.00252)       0.000251)         9th grade complete       -0.0100***         00.00251)       -0.00330***         Secondary level incomplete       -0.00628**         00.00252)       -0.00628**         Higher education incomplete       0.0466***         00.00263)       -0.006638*         Higher education incomplete       0.156***         0.00263)       -0.006638**         Higher education complete       0.156***         0.00263)       -0.00664**         0.0066       -0.0066         Masters       0.156***         0.0066       -0.0066         Victor of D       -0.0066         Victor of D       -0.0066         Microregion F.E       Y       Y         Year F.E       Y       Y         Industy F.E.       Y       Y		(9.70e-09)	
Sth grade complete       0.00419         9th grade incomplete       -0.00237         9th grade complete       -0.00252)         9th grade complete       -0.00251)         Secondary level incomplete       -0.0330***         0.000254)       -0.00237         Secondary level complete       -0.00237         0.000254)       -0.00237         Secondary level complete       -0.00237**         0.000254)       -0.00237         Higher education incomplete       0.0046***         0.000253)       -0.00233         Higher education complete       0.180****         0.00263)       -0.003373)         PhD       0.173***         Observations       6.906,352       204         R-squared       0.906       0.066         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y	5th grade incomplete	0.000279	
5th grade complete       0.00419         9th grade incomplete       -0.00237         9th grade complete       -0.000252)         9th grade complete       -0.0100***         (0.00251)       (0.00254)         Secondary level incomplete       -0.00628**         (0.00252)       (0.00254)         Secondary level complete       -0.00628**         (0.00252)       (0.00252)         Higher education incomplete       0.0466***         (0.00263)       (0.00263)         Higher education complete       0.180***         (0.00263)       (0.00373)         PhD       0.173***         Observations       6,906,352       204         R-squared       0.906       0.0666         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y		(0.00255)	
9th grade incomplete       -0.00237         9th grade complete       -0.00252)         9th grade complete       -0.0100***         (0.00251)       -0.0330***         Secondary level incomplete       -0.0330***         (0.00254)       -0.00628**         Secondary level complete       -0.00628**         (0.00252)       -0.00628**         Higher education incomplete       0.0466***         (0.00263)       -0.180***         Higher education complete       0.180***         (0.00263)       -0.180***         Masters       0.156***         Observations       6,906,352       204         R-squared       0.906       0.066         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y	5th grade complete	0.00419	
9th grade incomplete       -0.00237         9th grade complete       (0.00252)         9th grade complete       -0.0100***         (0.00251)       0.00330***         Secondary level incomplete       -0.00628**         (0.00252)       (0.00254)         Secondary level complete       -0.00628**         (0.00252)       (0.00252)         Higher education incomplete       0.0466***         (0.00263)       (0.00263)         Higher education complete       0.180***         (0.00263)       (0.00373)         PhD       0.173***         Observations       6,906,352       204         R-squared       0.906       0.0666         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y		(0.00256)	
9th grade complete       -0.0100***         9th grade complete       -0.0100***         0.00251)       -0.0330***         Secondary level incomplete       -0.0330***         (0.00254)       -0.06628**         Secondary level complete       -0.00628**         (0.00252)       -0.0668***         Higher education incomplete       0.0466***         (0.00263)       -0.00263)         Higher education complete       0.180***         (0.00263)       -0.00628**         Masters       0.156***         (0.00373)       -0.0173***         Observations       6,906,352       204         R-squared       0.906       0.0666         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y	9th grade incomplete	-0.00237	
9th grade complete     -0.0100***       (0.00251)		(0.00252)	
Secondary level incomplete       -0.0330***         (0.00254)       (0.00254)         Secondary level complete       -0.0628**         (0.00252)       (0.00252)         Higher education incomplete       0.0466***         (0.00263)       (0.00263)         Higher education complete       0.180***         (0.00263)       (0.00263)         Masters       0.156***         (0.00373)       (0.00373)         PhD       0.173***         (0.00461)       0.066         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y	9th grade complete	-0.0100***	
Secondary level incomplete     -0.0330***       (0.00254)     -0.0628**       Secondary level complete     -0.0628**       (0.00252)     -0.0666***       (0.00263)     -0.050***       Higher education complete     0.180***       (0.00263)     -0.056***       (0.00263)     -0.056***       (0.00263)     -0.0373)       PhD     0.173***       (0.00461)     -0.066       Observations     6,906,352     204       R-squared     0.906     0.0666       Microregion F.E     Y     Y       Year F.E     Y     Y       Industry F.E     Y     Y	Consider level incomplete	(0.00251)	
Secondary level complete       -0.00628**         (0.00252)       (0.00252)         Higher education incomplete       0.0466***         (0.00263)       (0.00263)         Higher education complete       0.180***         (0.00263)       (0.00263)         Masters       0.156***         (0.00373)       (0.00373)         PhD       0.173***         Observations       6,906,352       204         R-squared       0.906       0.066         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y         Washers F       Y       Y	Secondary level incomplete	-0.0330	
Secondary rever complete     0.000252)       Higher education incomplete     0.0466***       (0.00253)     (0.00263)       Higher education complete     0.180***       (0.00263)     (0.00263)       Masters     0.156***       (0.00373)     (0.00461)       PhD     0.173***       Observations     6,906,352     204       R-squared     0.906     0.066       Microregion F.E     Y     Y       Year F.E     Y     Y       Industry F.E     Y     Y       Washer of F.E     Y     Y	Secondary level complete	(0.00254)	
Higher education incomplete       0.0466***         Higher education complete       0.180***         Higher education complete       0.180***         (0.00263)       0.156***         Masters       0.156***         (0.00373)       0.173***         PhD       0.173***         Observations       6,906,352       204         R-squared       0.906       0.066         Microregion F.E       Y       Y         Year F.E       Y       Y         Industry F.E       Y       Y         Workbool F.E       Y       Y	Secondary level complete	(0.00028	
(0.00263)       Higher education complete     (0.00263)       Masters     (0.00263)       Masters     (0.00373)       PhD     (0.73***       Observations     6,906,352     204       R-squared     0.906     0.066       Microregion F.E     Y     Y       Year F.E     Y     Y       Industry F.E     Y     Y       Watero F.F.     Y     Y	Higher education incomplete	0.0466***	
Higher education complete     0.180***       (0.00263)     (0.00263)       Masters     0.156***       (0.00373)     (0.00373)       PhD     0.173***       Observations     6,906,352     204       R-squared     0.906     0.066       Microregion F.E     Y     Y       Year F.E     Y     Y       Industry F.E     Y     Y       Workpool F.E     Y     Y		(0.00263)	
(0.00263)           Masters         0.156***           (0.00373)           PhD         0.173***           Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industry F.E         Y         Y	Higher education complete	0.180***	
Masters         0.156***           (0.00373)         (0.00373)           PhD         0.173***           (0.00461)         (0.00461)           Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E.         Y         Y           Year F.E         Y         Y           Industry F.E         Y         Y	<b>.</b>	(0.00263)	
(0.00373)           PhD         0.173***           (0.00461)         (0.00461)           Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industry F.E         Y         Y           Worker of F.         Y         Y	Masters	0.156***	
PhD         0.173*** (0.00461)           Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industry F.E         Y         Y           Vector of F.         Y         Y		(0.00373)	
(0.00461)           Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industy F.E         Y         Y           Vectors F.E         Y         Y	PhD	0.173***	
Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industy F.E         Y         Y           Worker F.F         Y         Y		(0.00461)	
Observations         6,906,352         204           R-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industry F.E         Y         Y           Workport F.E         Y         Y			
K-squared         0.906         0.066           Microregion F.E         Y         Y           Year F.E         Y         Y           Industy F.E         Y         Y	Observations	6,906,352	204
Y         Y         Y           Year F.E         Y         Y           Industry F.E         Y         Y	K-squared	0.906	0.066
rear F.E Y Y Industry F.E Y Y	Withoregion F.E	Ŷ	Y
Industry T.L. T T		Y V	Y
		T V	T V

### Dynamic benefits of working in high-skilled sectors, worker fixed-effects

$$W_{imst} = \theta_i + \alpha_m + \beta_s + \gamma_t + X'_{it}\beta + \sum_{j=1}^{S} \delta_{js}e_{ijt} + \mu_{imst}$$

*i* = *individual m* = *microregion* 

s = sector

t = year

 $e_{iit}$  = experience aquired by worker *i* in high-skill sector *j* until time *t* 

allowed to vary depending both the:

- 1. sector in which it was acquired
- 2. sector in which the worker is currently employed

# Avg. years of education by sector

Rank Industry	Average years of education
Overall	
1 Space transport	16,00
2 Central bank	15,32
3 Monetary intermediation	14,74
4 Non-monetary intermediation	14,60
5 Higher education	14,34
6 Life and non-life insurance	14,07
7 Supplementary pension	14,07
8 Software consultancy	14,02
9 Database activities and online distribution of electronic content	13,81
10 Hardware consultancy	13,73
Services	
1 Space transport	16,00
2 Central bank	15,32
3 Monetary intermediation	14,74
4 Non-monetary intermediation	14,60
5 Higher education	14,34
6 Life and non-life insurance	14,07
7 Supplementary pension	14,07
8 Software consultancy	14,02
9 Database activities and online distribution of electronic content	13,81
10 Hardware consultancy	13,73
Manufacturing	
1 Manufacture of petroleum products	13,58
2 Development of nuclear fuels	12,61
3 Aircraft construction	12,35
4 Manufacture of pesticides	12,19
5 Manufacture and assembly of trucks and buses	12,18
6 Manufacture of pharmaceutical products	12,18
7 Manufacture of automobiles, vans and utilities	11,85
8 Manufacture of machines and equipment of electronic systems for data processing	11,72
9 Manufacture of telephony and radiotelephony apparatus and equipment and television and radio transmitt	ers 11,69
10 Edition; editing and printing	11,62

# Dynamic benefits of working in high-skilled sectors

	(1)	(2)
		3 digit industry F.E
	Log Wages	(Services and
		Manufacturing)
Average years of education in the industry		0.0207***
<i><i>o</i>, <i>i</i>, <i>i</i>, <i>i</i>, <i>i</i>, <i>i</i>, <i>i</i>, <i>i</i>, <i>i</i></i>		(0.00688)
Experience top 1-10 most educated industries	0.0163***	
	(0.000703)	
Experience top 1-10 most educated indus x experience	-7.54e-05***	
	(1.00e-05)	
Experience in months	0.00172***	
	(6.19e-06)	
Experience ^ 2	-5.47e-06***	
	(2.54e-08)	
Experience top 1-10 most educated indus x now in top 10 most educated indus	0.00197***	
	(0.000731)	
Experience top 1-10 most educated indus x experience x now in top 10 most educat	2.82e-05***	
	(1.01e-05)	
Experience outside top 10 x experience x now in top 10 mos educated indus	-1.61e-05***	
	(5.80e-06)	
Firm tenure in months	0.000719***	
	(4.25e-06)	
Firm tenure ^2	-6.10e-07***	
	(9.59e-09)	
5th grade incomplete	0.00153	
	(0.00256)	
5th grade complete	0.00937***	
	(0.00256)	
9th grade incomplete	0.00967***	
	(0.00252)	
9th grade complete	0.00765***	
	(0.00251)	
Secondary level incomplete	-0.00984***	
	(0.00253)	
Secondary level complete	0.0226***	
	(0.00250)	
Higher education incomplete	0.0816***	
	(0.00260)	
Higher education complete	0.219***	
	(0.00259)	
Masters	0.196***	
	(0.00370)	
PhD	0.215***	
	(0.00459)	
Observations	6,906,352	204
R-squared	0.906	0.098
Microregion F.E	Y	Y
Year F.E	Y	Y
Indusrty F.E	Y	Y
Worker F.E	Y	Y

\_\_\_\_\_

# Dynamic benefits of working in high-skilled sectors, manufacturing vs. services

	(1)	(2)	(3)	(4)
		3 digit industrv		3 digit industry F.E
	Log Wages	F.E (Services)	Log Wages	(Manufacturing)
Average years of education in the industry		0.0266***		0.0270***
		(0.00948)		(0.00917)
Experience top 1-10 most educated industries	0.0149***		-0.00980***	
	(0.000/42)		(0.00120)	
Experience top 1-10 most educated indus x experience	-6.37e-05***		2.09e-05	
Experience in months	0.00147***		0.00200***	
	(7.42e-06)		(1.04e-05)	
Experience ^ 2	-4.71e-06***		-6.53e-06***	
	(3.09e-08)		(4.03e-08)	
Experience top 1-10 most educated indus x now in top 10 most educated indus	0.00295***		0.0223***	
	(0.000767)		(0.00125)	
Experience top 1-10 most educated indus x experience x now in top 10 most educat	1.14e-05		-0.000107***	
	(1.04e-05)		(1.42e-05)	
Experience outside top 10 x experience x now in top 10 mos educated indus	-1.52e-05**		-8.99e-05***	
	(5.93e-06)		(8.62e-06)	
Firm tenure in months	0.000659***		0.000760***	
	(5.14e-06)		(9.30e-06)	
Firm tenure ^2	-4.95e-07***		-8.12e-07***	
	(1.18e-08)		(1.97e-08)	
Sth grade incomplete	-0.00654**		0.00861**	
Eth grade complete	(0.00328)		(0.00394)	
Stirgrade complete	-0.00245		(0.00406)	
9th grade incomplete	-0.00111		0.0155***	
	(0.00321)		(0.00398)	
9th grade complete	-0.00445		0.0154***	
	(0.00319)		(0.00397)	
Secondary level incomplete	-0.0197***		-0.00343	
	(0.00322)		(0.00403)	
Secondary level complete	0.00934***		0.0245***	
	(0.00319)		(0.00397)	
Higher education incomplete	0.0658***		0.0726***	
	(0.00329)		(0.00428)	
Higher education complete	0.203***		0.176***	
	(0.00328)		(0.00423)	
Masters	0.171***		0.231***	
	(0.00434)		(0.00840)	
PhD	(0.00517)		(0.0126)	
	(0.00517)		(0.0120)	
Observations	5.198 376	100	1.572 219	104
R-squared	0.904	0.173	0.944	0.172
Microregion F.E	Y	Y	Y	Y
Year F.E	Y	Y	Y	Y
Industry F.E	Y	Y	Y	Y
Worker F.E	Y	Y	Y	Y

## Dynamic benefits of working in high-skilled sectors, robustness firm attributes

	(1)	(2)	(3)	(4)
	log wages	3 digit industry F.E (Services)	log wages	3 digit industry F.E (Manufacturing)
Average years of education in the industry		0.0232**		0.0225**
Firm size	-7 57e-07***	(0.00545)	1 36e-06***	(0.00050)
	(2.22e-08)		(4 51e-08)	
Average years of education in firm	0.00816***		0.0111***	
	(0.00010		(0.000237)	
Experience ton 1-10 most educated industries	0.015/***		-0.00958***	
	(0.000741)		(0.00120)	
Experience ton 1-10 most educated indus x experience	-7 47e-05***		1 37e-05	
Experience top 1 10 most educated mous x experience	(1.03e-05)		(1.40e-05)	
Experience in months	0.001/18***			
	(7.41e-06)		(1.04e-05)	
Experience A 2	-4 700-06***		-6 570-06***	
Experience ~ 2	(3.080-08)		(4 026-08)	
Experience ten 1-10 most educated indus x new in ten 10 most educated indus	0.00210***		0.0221***	
Experience top 1-10 most educated mous x now in top 10 most educated mous	(0.000766)		(0.00125)	
Experience ten 1.10 mest educated indus y experience y new in ten 10 mest educat	2 200 05**			
experience top 1-10 most educated mous x experience x now in top 10 most educat	(1.04= 05)		-9.646-05	
Europianas sutsido ten 10 y superionas y neuvin ten 10 mas advestad indus	(1.04e-05)		(1.410-05)	
Experience outside top 10 x experience x now in top 10 mos educated indus	-1.09e-05*		-8.31e-05***	
	(5.93e-06)		(8.610-06)	
Firm tenure in months	0.000679***		0.000790***	
	(5.15e-06)		(9.31e-06)	
Firm tenure ^2	-4.79e-07***		-9.45e-07***	
	(1.20e-08)		(1.99e-08)	
Sth grade incomplete	-0.00775**		0.00754*	
	(0.00327)		(0.00393)	
5th grade complete	-0.00731**		0.0168***	
	(0.00326)		(0.00405)	
9th grade incomplete	-0.0122***		0.00656*	
	(0.00322)		(0.00398)	
9th grade complete	-0.0206***		0.000680	
	(0.00320)		(0.00398)	
Secondary level incomplete	-0.0408***		-0.0227***	
	(0.00323)		(0.00404)	
Secondary level complete	-0.0168***		0.000384	
	(0.00321)		(0.00400)	
Higher education incomplete	0.0333***		0.0457***	
	(0.00333)		(0.00431)	
Higher education complete	0.168***		0.147***	
	(0.00333)		(0.00427)	
Masters	0.133***		0.198***	
	(0.00438)		(0.00841)	
PhD	0.159***		0.133***	
	(0.00520)		(0.0126)	
Observations	5,198,376	100	1.572.219	104
R-squared	0 904	0.137	0.944	0.128
Microregion E F	V	v.13,	V.344	γ
Year F F	v	v	v	v
Industry E F	v	v	v	· v
Worker F F	v	v	v	v
Worker HE	1		I	

# Dynamic benefits of working in high-skilled sectors, avg. educ measured in 2003

	(1)	(2)	(3)	(4)
	log wages	3 digit industry F.E (Services)	log wages	3 digit industry F.E (Manufacturing)
Average years of education in the industry		0.0266*** (0.00947)		0.0272*** (0.00910)
Experience top 1-10 most educated industries	0.0149***		-0.00980***	
	(0.000742)		(0.00120)	
Experience top 1-10 most educated indus x experience	-6.37e-05***		2.09e-05	
	(1.03e-05)		(1.40e-05)	
Experience in months	0.00147***		0.00200***	
	(7.42e-06)		(1.04e-05)	
Experience ^ 2	-4.71e-06***		-6.53e-06***	
	(3.09e-08)		(4.03e-08)	
Experience top 1-10 most educated indus x now in top 10 most educated indus	0.00295***		0.0223***	
	(0.000767)		(0.00125)	
Experience top 1-10 most educated indus x experience x now in top 10 most educat	1.14e-05		-0.000107***	
	(1.04e-05)		(1.42e-05)	
Experience outside top 10 x experience x now in top 10 mos educated indus	-1.52e-05**		-8.99e-05***	
	(5.93e-06)		(8.62e-06)	
Firm tenure in months	0.000659***		0.000760***	
	(5.14e-06)		(9.30e-06)	
Firm tenure ^2	-4.95e-07***		-8.12e-07***	
	(1.18e-08)		(1.97e-08)	
5th grade incomplete	-0.00654**		0.00861**	
	(0.00328)		(0.00394)	
5th grade complete	-0.00243		0.0199***	
	(0.00326)		(0.00406)	
9th grade incomplete	-0.00111		0.0155***	
	(0.00321)		(0.00398)	
9th grade complete	-0.00445		0.0154***	
	(0.00319)		(0.00397)	
Secondary level incomplete	-0.0197***		-0.00343	
	(0.00322)		(0.00403)	
Secondary level complete	0.00934***		0.0245***	
	(0.00319)		(0.00397)	
Higher education incomplete	0.0658***		0.0726***	
	(0.00329)		(0.00428)	
Higher education complete	0.203***		0.176***	
	(0.00328)		(0.00423)	
Masters	0.171***		0.231***	
	(0.00434)		(0.00840)	
PhD	0.198***		0.163***	
	(0.00517)		(0.0126)	
Observations	5,198,376	100	1,572,219	104
R-squared	0.904	0.174	0.944	0.177
Microregion F.E	Y	Y	Y	Y
Year F.E	Y	Y	Y	Y
Industry F.E	Y	Y	Y	Y
Worker F F	Ŷ	Y	Y	Y

#### Dynamic benefits of working in high-skilled sectors, now in sector



# Dynamic benefits of working in high-skilled sectors, now in other sector



# Dynamic benefits of working in high-skilled sectors, high-skill workers

	(1)	(2)	(3)	(4)
	log wages	3 digit industry F.E (Services)	log wages	3 digit industry F.E (Manufacturing)
Average years of education in the industry		0.131*** (0.0491)		0.267*** (0.0543)
Experience top 1-10 most educated industries	0.00945***		-0.00595**	
	(0.00121)		(0.00249)	
Experience top 1-10 most educated indus x experience	-0.000169***		-0.000102***	
	(1.52e-05)		(3.37e-05)	
Experience in months	0.00162***		0.00170***	
	(1.96e-05)		(3.03e-05)	
Experience ^ 2	-4.50e-06***		-5.66e-06***	
	(7.04e-08)		(1.03e-07)	
Experience top 1-10 most educated indus x now in top 10 most educated indus	0.00546***		0.00779***	
	(0.00122)		(0.00254)	
Experience top 1-10 most educated indus x experience x now in top 10 most educat	9.69e-05***		1.48e-05	
	(1.52e-05)		(3.38e-05)	
Experience outside top 10 x experience x now in top 10 mos educated indus	-5.09e-05***		-8.66e-05***	
	(9.42e-06)		(1.73e-05)	
Firm tenure in months	0.00114***		0.00107***	
	(1.69e-05)		(3.74e-05)	
Firm tenure ^2	-9.98e-07***		-1.26e-06***	
	(3.40e-08)		(7.43e-08)	
Higher education complete	-0.152***		-0.0941***	
	(0.00530)		(0.0144)	
Masters	0.0104**		0.0129	
	(0.00504)		(0.0141)	
PhD	-0.0336***		0.0439***	
	(0.00547)		(0.0151)	
Observations	898,612	100	181,592	104
R-squared	0.913	0.144	0.955	0.239
Microregion F.E	Y	Y	Y	Y
Year F.E	Y	Y	Y	Y
Industry F.E	Y	Y	Y	Y
Worker F.E	Y	Y	Y	Y

# Dynamic benefits of working in high-skilled sectors, low skill workers

	(1)	(2)	(3)	(4)
	log wages	3 digit industry F.E (Services)	log wages	3 digit industry F.E (Manufacturing)
Average years of education in the industry		0.0165		0.0174*
Experience top 1-10 most educated industries	-0.00884***	(0.0121)	-0.0204***	(0.0102)
	(0.00135)		(0.00148)	
Experience top 1-10 most educated indus x experience	0.000107***		7.44e-05***	
	(2.00e-05)		(1.57e-05)	
Experience in months	0.00137***		0.00206***	
	(7.78e-06)		(1.10e-05)	
Experience ^ 2	-4.92e-06***		-6.82e-06***	
	(3.41e-08)		(4.41e-08)	
Experience top 1-10 most educated indus x now in top 10 most educated indus	0.0181***		0.0348***	
	(0.00143)		(0.00154)	
Experience top 1-10 most educated indus x experience x now in top 10 most educat	-0.000112***		-0.000157***	
	(2.01e-05)		(1.59e-05)	
Experience outside top 10 x experience x now in top 10 mos educated indus	2.03e-05**		-9.64e-05***	
	(9.31e-06)		(1.03e-05)	
Firm tenure in months	0.000618***		0.000684***	
	(5.34e-06)		(9.54e-06)	
Firm tenure ^2	-6.47e-07***		-6.93e-07***	
	(1.29e-08)		(2.04e-08)	
5th grade incomplete	-0.00407		0.00935**	
	(0.00293)		(0.00378)	
5th grade complete	-0.00136		0.0194***	
	(0.00292)		(0.00389)	
9th grade incomplete	0.000151		0.0167***	
	(0.00288)		(0.00381)	
9th grade complete	-0.00421		0.0177***	
	(0.00286)		(0.00381)	
Secondary level incomplete	-0.0166***		0.00235	
	(0.00288)		(0.00387)	
Secondary level complete	0.0135***		0.0334***	
	(0.00286)		(0.00382)	
Observations	4 238 040	99	1 380 390	104
R-squared	0 864	0.023	0 921	0.038
Microregion F F	V.504	0.025 V	V.521	V.030
Year F F	Ŷ	Ŷ	Ŷ	Ϋ́
Industry E F	v	v v	, v	Ŷ
Worker F.E	Ŷ	Ŷ	Ŷ	Ŷ

# Summary

- Is there learning by working in high-skilled services? How does it compare with learning by working in high-skilled manufacturing?
- We used detailed worker-firm panel data from Brazil to answer these questions
- Evidence of sizable static manufacturing wage premium, even when accounting for observable worker-firm attributes and worker fixed-effects
- But this wage premium varies widely across sub-sectors within manufacturing and services
- Wage premium is higher in high-skilled sectors, both in manufacturing and services



- > Evidence of dynamic benefits of working in high skilled sectors
- In services, these dynamic benefits of learning accrue to the worker even if she is not currently employed in the most skilled sectors (transferable learning)
- In manufacturing, these dynamic benefits accrue only if the worker is currently employed in the most skilled sectors (non-transferable learning)