The False Illusion of Wage Cyclicality

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16th ECB/CEPR Labour Market Workshop

Motivation

- Wage rigidity is an important explanation for unemployment fluctuations [Shimer, 2005; Hall, 2005]
- Stickiness in the hiring wage is key as job creation is a forward looking decision
- Evidence shows large movements in entry wages over the cycle. Why?
  1. Contractual wage flexibility [Pissarides, 2009]
  2. Selection into higher quality matches [Gerter et al, 2020]
- **This paper**: sorting dynamics create a false illusion of high cyclicality in entry wages

Separating Flexibility from Sorting

- **Strategy**: Distinguish between workers switching occupation from those not switching
- A job defined by the task to be performed (occupation) [Baley et al, 2022]:

$$\text{Match quality} \approx \| \text{worker's abilities - occupation skills requirements} \|$$

- Occupation switchers are the ones that experience a change in match quality
- By focusing on non-switchers, we isolate wage changes due to flexibility from changes due to selection

In a Nutshell

- **Data:** Portuguese matched employer-employee dataset, 1986-2019

  clean identification of occupation mobility *across* and *within* firms

- **Results:** **cyclicality** of entry wages driven entirely by **occupation switchers**

  1. new hires' wages 0.5pp more cyclical than stayers
  2. occ. non-switchers: new hires wages as cyclical as those of stayers
  3. occ. switchers: across-firm excess cyclicality $\approx$ 0.6pp; within-firm excess cyclicality $\approx$ 0.2pp
  4. excess cyclicality driven by those switching across occupations requiring different skills

- **Taking stock:** standard framework conflates flexibility with wage changes due to occupational sorting

Institutional Setting

Wage setting in Portugal

1. **National minimum wage**
   - Updated annually by the parliament, under government proposal
   - 2019: min wage $\approx$ 67.4% of total pay; min wage earners $\approx$ 21.3% of workers

2. **Collective Bargaining Agreements**:
   - Industry-wide agreements (mostly): set wage floors for each professional category in a CBA

     The sum of different professional categories across CBA's yields around 30,000 wage floors

     In 2016, CBA's covered around 87% of full-time workers [Card and Cardoso, 2022]

   - Firms can pay higher wages $\Rightarrow$ high degree of flexibility

     Card and Cardoso (2022): workers receive, on average, a 20% premium over the floor

Data

Data & Sample

- **Data**: Portuguese matched employer-employee dataset, 1986 to 2019
  - Universal coverage of firms with wage earners
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- **Sample**: Females and males aged between 17 and 61 years old:
  - Single job-holders
  - Full-time workers, working $>$ 120 hours in a month
  - Only workers in private firms (% public capital $<$ 50%) & nonfarm sector
  - Labor market earnings $>$ 80% of the minimum wage
  - Largest set of connected of firms and workers (98.8% of the employee-firm pairs) ▸ Descriptives

$\rightarrow$ 7M unique workers & 470K unique firms

$\rightarrow$ On average, 37 years old, 43% females and $\approx$ 20% have a college degree

Earnings & Occupation Information

1. **Labor Market Earnings**:

   total hourly pay = (base wage + benefits + overtime) / (normal + overtime hours)

   winsorized at the top 1% level & expressed in 1985 euros

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2. **Occupation**: Classificação Portuguesa das Profissões 2010

   focus on 3-digit codes (127 occupations)

   based on the ISCO-08 → similar to 3-digit Standard Occupational Classification in U.S.

Code	Name	Tier
2	Scientific and Intellectual Professionals	1-digit
22	Healthcare Professionals	2-digit
221	Doctors	3-digit
2211	General Practitioners	4-digit
2212	Specialty Doctors	4-digit
222	Nurses	3-digit
2221	Specialty Nurses	4-digit

Firm & Occupational Mobility

1. **Firm Mobility:**

   Stayer: firm tenure $>$ 12 months

   New Hire: firm tenure $<$ 12 months (includes job switchers & new hires from non-employment)

2. **Occupational mobility:**

   Switcher: $\neq$ 3-digit occupation code in two consecutive years or relative to previous employer

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2. **Occupational mobility:**

   Switcher: $\neq$ 3-digit occupation code in two consecutive years or relative to previous employer

- Stayer x (non-) Switcher: firm tenure $>$ 12 months + occupation (non-) switcher
- New Hire x (non-) Switcher: firm tenure $<$ 12 months + occupation (non-) switcher

▸ Descriptives

Empirical Framework

Baseline Specification

- Wage cyclicality = semi-elasticity wrt unemployment rate [Pissarides, 2009]

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- Potential cyclical composition bias due to workers moving to worst (better) jobs in recessions (booms):

  Baley et al. (2022): for new hires, skill mismatch worsens in recessions (sullying effect)

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- $\beta_2 < 0 \rightarrow$ match upgrading/downgrading

Separate sorting from flexibility

- Distinguish between occupation **switchers** vs occupation **non-switchers**
- Assumption: composition bias due to match quality cyclicality works through occupation mobility

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- Distinguish between occupation **switchers** vs occupation **non-switchers**
- Assumption: composition bias due to match quality cyclicality works through occupation mobility
- Match quality $\approx$ **skill mismatch =** $\|$ **worker's abilities - occupation skill requirements** $\|$
  - skill mismatch negatively associated with *wages* [Guvenen et al., 2020] and *tenure* [Figueiredo, 2022]
- Only occupation **switchers** may experience a change in match quality as skill requirements vary

Empirical Framework

$$w_{ijft} = \beta_0 + (\beta_1 + \beta_2 NH_{ijft} + \beta_3 S^S_{ijft} + \beta_4 NH^S_{ijft}) \times cycle_t +$$

$$\gamma' (NH_{ijft} + S^S_{ijft} + NH^S_{ijft} + controls) + \delta_i + \delta_j + \delta_f + \varepsilon_{ijft}$$

Empirical Framework

$$w_{ijft} = \beta_0 + (\beta_1 + \beta_2 NH^{NS}_{ijft} + \beta_3 S^{S}_{ijft} + \beta_4 NH^{S}_{ijft}) \times cycle_t +$$

$$\gamma' (NH^{NS}_{ijft} + S^{S}_{ijft} + NH^{S}_{ijft} + controls) + \delta_i + \delta_j + \delta_f + \varepsilon_{ijft}$$

- NH^{NS}_{ijft} = 1 for new hires & occ. non-switchers
- NH^{S}_{ijft} = 1 for new hires & occ. switchers
- S^{S}_{ijft} = 1 for stayers & occ. switchers

(controls = age, age^2, education, quadratic time trend, individual, firm and occupation fe)

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(controls = age, age^2, education, quadratic time trend, individual, firm and occupation fe)

- β_1 & β_2 capture wage flexibility $\rightarrow \mathbb{E}[\varepsilon_{ijft} \cdot U_t | x_{i,t}, t, \delta_j, \delta_f, \delta_i] = 0$

- β_3 & β_4 capture wage movements driven by changes in match quality $\rightarrow \mathbb{E}[\varepsilon_{ijft} \cdot U_t | x_{i,t}, t, \delta_j, \delta_f, \delta_i] < 0$

Results

Revisiting the literature

Wage Semi-Elasticity (%)

	Total Pay				
	(1)	(2)	(3)	(4)	(5)
U_t	-1.163***				
	(0.023)				
U_t · New hire	**-0.447****				
	(0.017)				
Observations	38,693,092				
Adjusted R^2	0.860				

- New Hires: wages more cyclical than stayers

Cyclicality driven by occupation switchers

Wage Semi-Elasticity (%)

	Total Pay				
	(1)	(2)	(3)	(4)	(5)
U_t	-1.163***	-1.144***			
	(0.023)	(0.023)			
U_t · New hire	-0.447***				
	(0.017)				
U_t · (New hire, Non-Switcher)		0.010			
		(0.027)			
U_t · (New hire, Switcher)		-0.590***			
		(0.018)			
Observations	38,693,092	38,693,092			
Adjusted R^2	0.860	0.860			

- **Non-switchers**: wages as cyclical as stayers
- **Switchers**: wages more cyclical than stayers

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U_t	-1.163***	-1.144***	-1.142***		
	(0.022)	(0.022)	(0.023)		
U_t · New hire	-0.447***				
	(0.017)				
U_t · (New hire, Non-Switcher)		0.010	0.036		
		(0.027)	(0.027)		
U_t · (New hire, Switcher)		-0.590***	-0.567***		
		(0.018)	(0.019)		
U_t · (Stayer, Switcher)			-0.201***		
			(0.030)		
Observations	38,693,092	38,693,092	38,693,092		
Adjusted R^2	0.860	0.860	0.861		

- New hires and stayers: **switchers** more cyclical wages than **non-switchers**

▸ Only Males

Results unchanged if we focus on workers with stable occupations

Wage Semi-Elasticity (%)

	Total Pay				
	(1)	(2)	(3)	(4)	(5)
U_t	-1.163***	-1.144***	-1.142***	-1.116***	
	(0.023)	(0.023)	(0.023)	(0.023)	
U_t · New hire	-0.447***				
	(0.017)				
U_t · (New hire, Non-Switcher)		0.010	0.036	0.052	
		(0.027)	(0.027)	(0.027)	
U_t · (New hire, Switcher)		-0.590***	-0.567***	-0.646***	
		(0.018)	(0.019)	(0.021)	
U_t · (Stayer, Switcher)			-0.201***	-0.172***	
			(0.030)	(0.030)	
Observations	38,693,092	38,693,092	38,693,092	37,675,587	
Adjusted R^2	0.860	0.860	0.861	0.865	

- Workers less prone to temporary coding error:
  same occ. $>$ 2 years *prior* to switching + same occ. $>$ 2 years *after* switching

Cyclicality driven by occupation switchers

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U_t	-1.163***	-1.144***	-1.142***	-1.116***	-1.135***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
U_t · New hire	-0.447***				
	(0.017)				
U_t · (New hire, Non-Switcher)		0.010	0.036	0.0516	
		(0.027)	(0.027)	(0.027)	
U_t · (New hire, Switcher)		-0.590***	-0.567***	-0.646***	
		(0.018)	(0.019)	(0.021)	
U_t · (Stayer, Switcher)			-0.201***	-0.172***	
			(0.029)	(0.030)	
U_t · Switcher					-0.578***
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Base pay determines cyclical movements in total pay

Wage Semi-Elasticity (%)

	Total Pay					Base Pay
	(1)	(2)	(3)	(4)	(5)	(6)
U_t	-1.163***	-1.144***	-1.142***	-1.116***	-1.135***	-1.120***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.020)	
U_t · New hire	-0.447***					
	(0.017)					
U_t · (New hire, Non-Switcher)		0.010	0.036	0.0516		0.0684**
		(0.027)	(0.027)	(0.027)		(0.0254)
U_t · (New hire, Switcher)		-0.590***	-0.567***	-0.646***		-0.554***
		(0.0180)	(0.0188)	(0.021)		(0.0184)
U_t · (Stayer, Switcher)			-0.201***	-0.172***		-0.160***
			(0.029)	(0.030)		(0.029)
U_t · Switcher					-0.578***	
					(0.019)	
Observations	38,693,092	38,693,092	38,693,092	37,675,587	38,693,092	38,693,092
Adjusted R^2	0.860	0.860	0.861	0.865	0.860	0.861

- Base pay per hour = gross pay for normal hours of work / normal hours of work

Alternative Explanations

Differences in the skills required by occupations

- **Occ switcher** if current 3-digit code $\neq$ previous 3-digit code
- But different 3-digit codes may use similar skills

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1. Occupation similarity = Distance between vector of skill requirements of occupation j and j', $\varphi(q_j, q_{j'})$
2. Estimate:

$$w_{ijft} = \beta_0 + (\beta_1 + \beta_2 \, \boldsymbol{\varphi(q_j, q_{j'})}) \times cycle_t + \gamma' (\boldsymbol{\varphi(q_j, q_{j'})} + X_{ijft}) + \delta_i + \delta_j + \delta_f + \varepsilon_{ijft}$$

- β_1: wage cyclicality of workers **not switching** occupation or moving between **similar** occupations
- β_2: excess wage cyclicality along the $\varphi(q_j, q_{j'})$ distribution

Occupation Similarity: In practice

Measuring occupational distance

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Measuring occupational distance

1. Angular distance btw. occupations j and j' [Baley et al 2022]: $\phi(q_j, q_{j'}) = \cos^{-1}\left(\frac{\boldsymbol{q_j} \cdot \boldsymbol{q_{j'}}}{\|\boldsymbol{q_j}\| \|\boldsymbol{q_{j'}}\|}\right) \in [0, \pi/2]$

   – $\phi(q_j, q_{j'})$ = 0 for equal skill-mix , regardless of vector length

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   – $\phi(q_j, q_{j'})$ = 0 for equal skill-mix , regardless of vector length

2. Euclidean distance btw. occupations j and j': $d(\boldsymbol{q}_j, \boldsymbol{q}_{j'}) = \left[\sum_{k=1}^{K}(q_{j,k} - q_{j',k})^2\right]^{1/2}$

   – $d(q_j, q_{j'})$ = 0 for occupations with same skill requirements

Occupation Similarity: In practice

Measuring skill requirements

Occupation Similarity: In practice

Measuring skill requirements

- We follow the methodology by Guvenen et al (2020) & Baley et al (2022)
- **Data**: O*NET data on 250+ skills describing occupations (6-digit SOC)

  Focus on 32 descriptors directly linked to ASVAB test components
- **Aggregation**: O*NET mapped to QP, scores averaged across 3-digit CPP2010 occupational codes
- **Compression**: Principal Component to get K = 4 skills: math, verbal, social and Technical
- **Scores**: In percentile ranks

▸ Example

Cyclicality increases as switchers move between more distinct occupations

Wage Semi-Elasticity (%)

	Baseline	Angular	Euclidean
U_t	-1.135***	-1.005***	-0.996***
	(0.023)	(0.0228)	(0.022)
$U_t \cdot$ Switcher	-0.578***		
	(0.018)		
$U_t \cdot \varphi(q_j, q_{j'})$		-0.689***	-0.649***
		(0.030)	(0.046)

- Results mainly driven by switchers moving across occupations that require different skills
- The difference in wage semi-elasticity of switchers is around 0.3pp, on average
- For workers at the top of the distance distribution, excess wage cyclicality is 1pp

Wage floors set by Collective Bargaining Agreement

- Collective bargaining agreements set wage floor for each professional category
- How does collective bargaining affect wages: Does switcher excess cylicality reflect reallocation to lower wage floors?
- We know collective bargaining agreement + professional category that specifies the worker's wage floor
- Wage floor $\approx$ observed minimum wage in the professional category that defines the worker's wage floor under the prevailing collective agreement

▸ Cushion Distribution

Excess wage cyclicality of switchers beyond differences in wage floors over the cycle

Wage Semi-Elasticity (%)

	Baseline	Wage Floor
U_t	-1.142***	-0.606***
	(0.023)	(0.019)
U_t · (New Hire, Non-Switcher)	0.036	0.065**
	(0.027)	(0.023)
U_t · (New Hire, Switcher)	-0.567***	-0.296***
	(0.019)	(0.019)
U_t · (Stayer, Switcher)	-0.201***	-0.102***
	(0.030)	(0.023)

- $\approx$ 47% of switchers cyclicality explained by reallocation to lower floors
- Decrease in cyclicality among non-switchers suggests that workers in recessions are in lower wage floors

Movements in the firm hierarchy

- Workers are assigned to a category that reflects the hierarchical level in terms of increasing responsibility

  the hierarchical classification is defined by the Portuguese law ▸ Hierarchical Classification

- We identify movements up and down the firm hierarchy and add as control to main regression

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Wage Semi-Elasticity (%)

	Baseline	Hierarchical Moves
U_t	-1.142***	-1.134***
	(0.023)	(0.023)
U_t · (New Hire, Non-Switcher)	0.036	0.026
	(0.027)	(0.027)
U_t · (New Hire, Switcher)	-0.567***	-0.577***
	(0.019)	(0.018)
U_t · (Stayer, Switcher)	-0.201***	-0.160***
	(0.030)	(0.030)

Job Switchers vs. New Hires from Non-employment

- Gertler et al (2020): excess cyclicality driven entirely by job switchers
- Separate job switchers from new hires from non-employment

  Job switcher (JS) = employed in t and $t+1$ & tenure $<$ 12 months

  Hire from non-employment (EUE) = employed in t & tenure $<$ 12 months

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  Hire from non-employment (EUE) = employed in t & tenure < 12 months

Differential in cyclicality relative to *stayers non-switchers*

($U_t \cdot$ *dummy*, %)

	JS		EUE		Stayer
	Non-Switcher	Switcher	Non-Switcher	Switcher	Switcher
Baseline	-0.050	-0.847***	0.109***	-0.315***	-0.194***
	(0.041)	(0.025)	(0.025)	(0.023)	(0.022)
Wage Floors	0.040	-0.409***	0.070***	-0.240***	-0.098 ***
	(0.034)	(0.027)	(0.022)	(0.019)	(0.028)

- Excess wage cyclicality only among occupation switchers

▸ Full Table

Labor Market Experience

- Occupation switchers in booms have may have more labor market experience
- Add labor market experience $\approx$ number of years since a worker first appeared in the data

Wage Semi-Elasticity (%)

	Baseline	Experience
U_t	-1.142***	-1.213***
	(0.023)	(0.023)
$U_t \cdot$ (New Hire, Non-Switcher)	0.0361	0.120***
	(0.027)	(0.028)
$U_t \cdot$ (New Hire, Switcher)	-0.567***	-0.474***
	(0.019)	(0.019)
$U_t \cdot$ (Stayer, Occ. Switcher)	-0.201***	-0.224***
	(0.030)	(0.0291)

Taking Stock

- **Goal:** isolate true wage cyclicality from wages changes due to cyclical movements in match quality
- **Strategy:** focus on stayers and new hires that remain in the same occupation
- **Finding:** high cyclicality of entry wages driven by occupation switchers, in particular those switching across occupation with different skill requirements
- **Conclusion:** cyclical occupational sorting creates false illusion of high cyclicality

Appendix

Economic Conditions

- *cycle* $\approx$ aggregate unemployment rate of previous calendar year

Summary Statistics

- Occupational Mobility = 28.1%

  around 1/3 happens within the firm

	New Hires		Stayers	
	Occ. Switcher	Occ. Non-Switcher	Occ. Switcher	Occ. Non-Switcher
Mean age (years)	32.49	33.98	36.97	38.84
Share female	0.41	0.38	0.43	0.44
Share college degree	0.23	0.19	0.21	0.18
Mean real total pay per hour (euros)	3.43	3.61	4.73	4.88
Mean real base wage per hour (euros)	2.99	3.13	4.11	4.18
% of all matches	18.3	6.3	9.8	65.7

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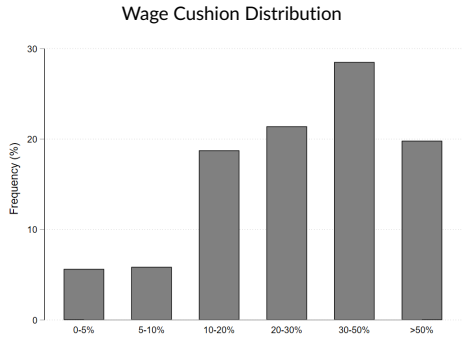
An example: Doctor

Occupation (3-digit)	**Distance**		**Requirements**			
	$\phi(\boldsymbol{q}_{doctor}, \boldsymbol{q}_j)$	$d(\boldsymbol{q}_{doctor}, \boldsymbol{q}_j)$	Math	Verbal	Technical	Social
Waiters and Bartenders	0.83	147.3	10	9	6	57
Child Care Workers	0.72	130.6	18	22	9	80
Fishers & Hunters	0.73	148.7	12	12	44	4
Tour Guides	0.57	116.3	25	31	18	78
Legal Professionals	0.37	79.8	50	70	24	84
Electrical Equipment Installers	0.32	60.4	81	77	97	31
Mathematicians & Statisticians	0.25	46.3	98	85	94	40
Hotel & Restaurant Managers	0.17	40.0	78	77	65	100
Nurses	0.03	7.7	93	95	89	93
Doctors	0	0	93	96	86	86

▸ Back

Occupational wage floors

- Majority receives a 30-50% premium over the prevailing wage floor



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Firm Hierarchy

Classification of Workers According to Hierarchical Levels

Hierarchical Level
1. Top executives (top management)
2. Intermediary executives (middle management)
3. Supervisors, team leaders
4. Higher-skilled professionals
5. Skilled professionals
6. Semi-skilled professionals
7. Non-skilled professionals
8. Apprentices, interns, trainees Apprenticeship

- Hierarchical levels defined according to Decreto Lei 121/78 of July 2nd (Lima and Pereira, 2003)

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Job Switchers vs New Hires from Unemployment

Wage Semi-Elasticity (%)

	(1)	
U_t	-1.125***	-0.595***
	(0.023)	(0.019)
U_t · (New hire UE, Switcher)	-0.315***	-0.240***
	(0.017)	(0.015)
U_t · (New hire UE, Non-Switcher)	0.109***	0.070***
	(0.025)	(0.022)
U_t · (New hire EE, Switcher)	-0.847***	-0.409***
	(0.025)	(0.027)
U_t · (New hire EE, Non-Switcher)	-0.050	0.040
	(0.041)	(0.034)
U_t · (Stayer, Switcher)	-0.194***	-0.098***
	(0.022)	(0.028
Observations	38,693,092	38,547,789
Adjusted R^2	0.859	0.893

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Summary Statistics: Full Sample vs Connected Set

	New Hires		Stayers		Total
	Occ. Switcher	Occ. Non-Switcher	Occ. Switcher	Occ. Non-Switcher	
Panel A. Full Sample					
Mean age (years)	32.49	33.98	36.97	38.84	37.19
Share female	0.41	0.38	0.43	0.44	0.43
Share college degree	0.23	0.19	0.21	0.18	0.20
Mean total pay per hour (in 1985 euros)	3.43	3.61	4.73	4.88	4.52
Mean base pay per hour (in 1985 euros)	2.99	3.13	4.11	4.18	3.89
% of all matches	18.3	6.3	9.8	65.7	100
Panel B. Largest Connected Set					
Mean age (years)	32.48	33.98	36.96	38.83	37.19
Share female	0.41	0.40	0.44	0.44	0.43
Share college degree	0.23	0.19	0.21	0.18	0.20
Mean total pay per hour (in 1985 euros)	3.43	3.61	4.74	4.88	4.52
Mean base pay per hour (in 1985 euros)	2.99	3.13	4.12	4.18	3.89
% of all matches	18.3	6.3	9.8	65.7	100

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Only Males

- Avoid any potential effects from fertility decisions that affect labor market transitions

Wage Semi-Elasticity (%)

	Baseline	Only Males
U_t	-1.142***	-1.277***
	(0.023)	(0.027)
U_t · (New Hire, Non-Switcher)	0.0361	-0.0236
	(0.027)	(0.0236)
U_t · (New Hire, Switcher)	-0.567***	-0.649***
	(0.018)	(0.023)
U_t · (Stayer, Switcher)	-0.201***	-0.165***
	(0.030)	(0.028)

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