Information Dispersion across Employees and Stock Returns

Ashwini Agrawal, Isaac Hacamo, Zhongchen Hu

RFS, 2021

Long Zhen

Contents

Introduction – Backgrounds

- Rank-and-file employees are becoming an increasingly critical factor of production for many companies
- To date, the implications of labor flows for asset prices has been sparsely studied.

- Challenge: collecting granular data on employment dynamics at the firm level.
  - LinkedIn data

Introduction – Research Problem

- Whether rank-and-file employees' entry and exit information can be used to predict stock returns?

Contribution

- Seeks to explain how the firm's labor force dynamics matter for asset prices and corporate behavior.

Research Design – Data

- LinkedIn
  - Worker-firm panel dataset
    - Educational background: schools/start and end dates/degrees/specialties
    - Employment history: job title/employer/start and end dates/job description/location
    - Firm profile: location of headquarters/industry/size/number of employees
  - Procedure:
    - Using public available search tools such as Google and Yahoo
    - Text strings that contain company names followed by a randomly generated alphanumeric character

- Sampling:
  - Russell 1000 constituents of 2018
    - Covers more than 90% of all traded equities
    - Maximize the number of employee records
    - Minimize potential sample selection bias
  - →employment histories for individual workers at Russell 1000 firms between 1985 and 2016
    - 1,500,457 job records hold by 1,028,356 employees across Russell 1000 firms.

- Construction:
  - aggregate individual employment spells across firms, and construct sample measures of firm employment levels and employment entry and exit every month.
  - $Net\ workflow_{i,t} = \frac{exit_{i,t} - join_{i,t}}{employment_{i,t-1}}$
- Other:
  - CRSP and Compustat: prices and accounting variables
  - Thomson Reuters' Insider Filing: insider trading data
  - IBES: equity analysts' earnings forecasts

Table 1
Descriptive statistics for sample workers and firms

A. Employee characteristics

Occupation	Engineers	Scientists	Mid-managers	Admin.	Finance	Consultants	Others
Obs.	215,111	93,620	326,228	145,196	20,853	92,085	607,364
Frac.	14.34%	6.24%	21.74%	9.67%	1.39%	6.14%	40.48%
Education	PhD	MBA	Master's	Bachelor's	High school	Unreported	
Obs.	58,210	218,314	193,708	565,256	186,859	278,110	
Frac.	3.88%	14.55%	12.91%	37.67%	12.45%	18.54%	
Experience (years)	Mean	SD	5th pctl	25th pctl	50th pctl	75th pctl	95th pctl
	5.63	5.90	0.25	1.50	3.67	7.83	17.83

B. Firm characteristics

	Mean	SD	5th pctl	25th pctl	50th pctl	75th pctl	95th pctl
Total assets ($b)	25.19	117.52	0.19	1.37	4.51	14.26	82.58
Equity market value ($b)	12.26	32.42	0.15	1.17	3.48	9.43	50.45
B/M of equity	0.59	0.77	0.092	0.26	0.45	0.77	1.38
Return on assets (%)	1.14	4.13	−2.14	0.36	1.17	2.30	4.74
Total employees (,000s)	28.17	77.40	0.26	2.46	8.20	25.01	118.50
Leverage	0.59	0.23	0.19	0.45	0.59	0.74	0.93

C. Monthly labor flows

	Mean	SD	5th pctl	25th pctl	50th pctl	75th pctl	95th pctl
Outflow	4.10	15.27	0	0	0	3	18
Inflow	5.43	18.13	0	0	1	4	23
Net outflow	−1.33	9.89	−9	−2	0	1	4
Standardized net outflow	−0.0071	0.049	−0.056	−0.011	0	0.0014	0.028

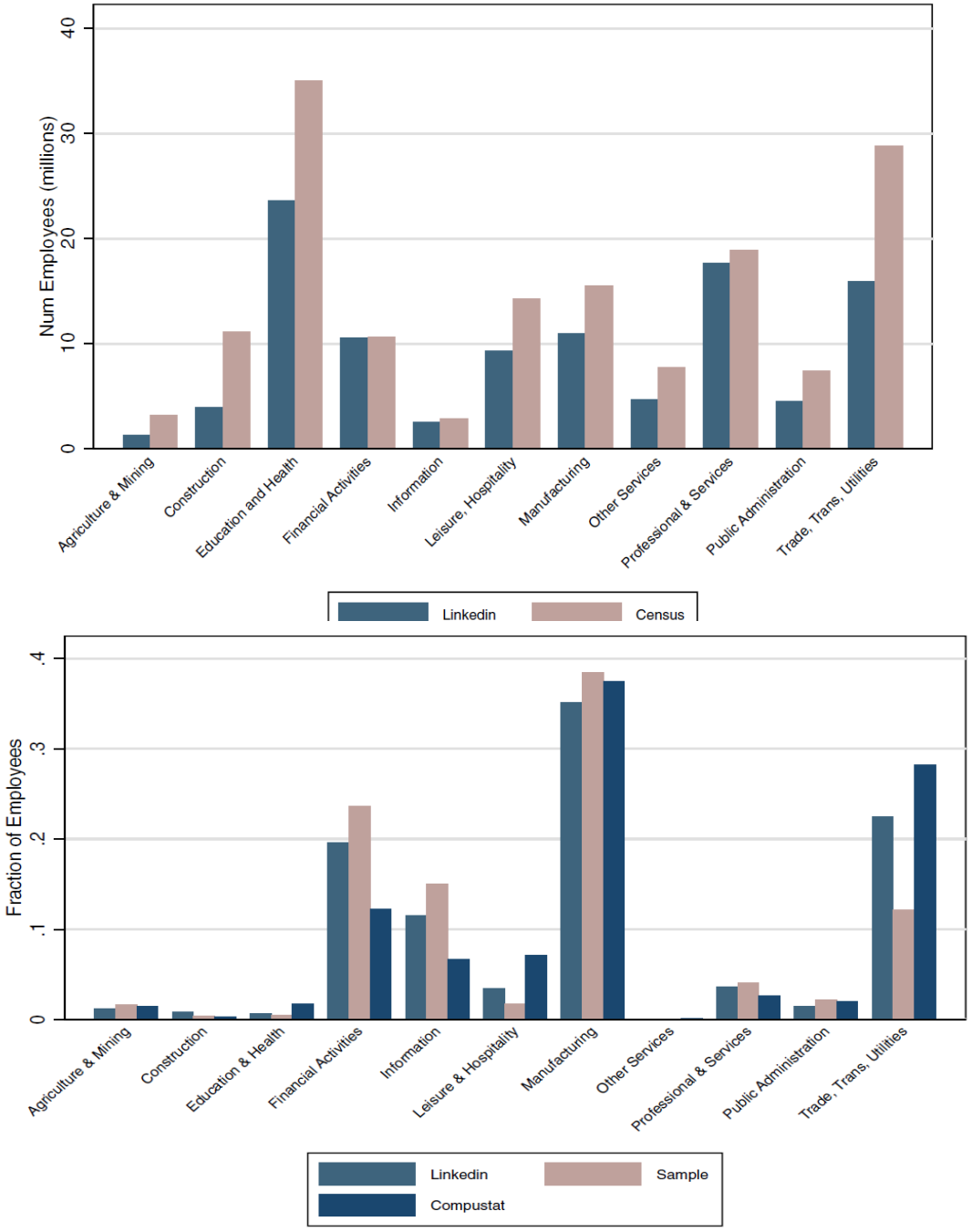


Figure 2
Industry distribution of workers at Russell 1000 firms

- Survey dataset
  - Randomly select 2,500 users from the worker-firm panel dataset
  - The questions pertain to the hypothesis.
    - eg, ask outflow workers about the importance of their employer's future prospects when deciding to leave their jobs
  - The responses correspond to a numerical scale of 1 to 5
  - →approximately 400 responses, response rate of 16%, over a period of 6 months.

Research Design

- Hypothesis:
  - Rank-and-file labor flows reflect information observed by workers that is not immediately incorporated into prices by investors.

Empirical Findings

- Labor flows can predict future abnormal stock returns
- Equity analysts and investors don't fully incorporate labor flow information into earnings expectations

- Results are stronger for firms that are financially **opaque**
- The link between **outflow** and abnormal stock returns is more pronounced.
- The large-sample **survey**: support the hypothesis
- Rank-and-file workers may observe about the firm's future prospects, for example, production costs
- Alternative explanations

- Calendar-time portfolio analysis

Table 2
Results from calendar-time portfolio return analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
α (%)	0.415***	0.337**	0.316***	0.250*	0.389***	0.306**	0.364***	0.285**
	(3.546)	(2.114)	(2.868)	(1.818)	(3.685)	(2.080)	(3.501)	(2.003)
MP	−0.096***	−0.086*	−0.082***	−0.090**	−0.095**	0.042	−0.041	0.060
	(−3.057)	(−1.847)	(−2.750)	(−2.200)	(−2.515)	(1.003)	(−1.146)	(1.279)
SMB	0.130***	0.143**	0.077	0.074	0.085	0.126*	0.096*	0.084
	(2.603)	(2.070)	(1.592)	(1.285)	(1.208)	(1.752)	(1.699)	(1.086)
HML	−0.229***	−0.176**	−0.205***	−0.087	−0.312***	−0.287***	−0.276***	−0.212**
	(−3.505)	(−2.051)	(−3.299)	(−1.175)	(−4.499)	(−3.946)	(−4.167)	(−2.273)
RMW	0.030	0.018	0.051	0.020	−0.137	0.002	−0.135*	−0.128
	(0.316)	(0.145)	(0.569)	(0.208)	(−1.358)	(0.015)	(−1.763)	(−1.013)
CMA	−0.093	−0.304**	−0.102	−0.403***	−0.112	−0.191	−0.148	−0.248**
	(−0.738)	(−2.099)	(−0.860)	(−3.003)	(−0.933)	(−1.270)	(−1.510)	(−2.057)
R^2	.162	.146	.132	.135	.351	.214	.322	.191
Raw long return (%)	1.813	1.235	1.781	1.242	1.461	0.973	1.823	1.395
Raw short return (%)	1.522	1.067	1.569	1.115	1.188	0.662	1.576	1.126
Low NetOutflows (α%)	0.196***	0.188*	0.116*	0.124*	0.218**	0.163	0.214**	0.236**
Quartile 2 (α%)	−0.007	0.002	–	–	0.016	0.031	0.014	−0.046
Middle tercile (α%)	–	–	−0.010	−0.007	–	–	–	–
Quartile 3 (α%)	−0.044	0.046	–	–	−0.073	−0.117	−0.103	−0.087
High NetOutflows (α%)	−0.220**	−0.149*	−0.200*	−0.125*	−0.170*	−0.143*	−0.150*	−0.049
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Portfolio cutoff	Quartile	Quartile	Tercile	Tercile	Quartile	Quartile	Quartile	Quartile
EW/VW	EW	VW	EW	VW	EW	VW	EW	VW
Crisis periods	Included	Included	Included	Included	Included	Included	Excluded	Excluded

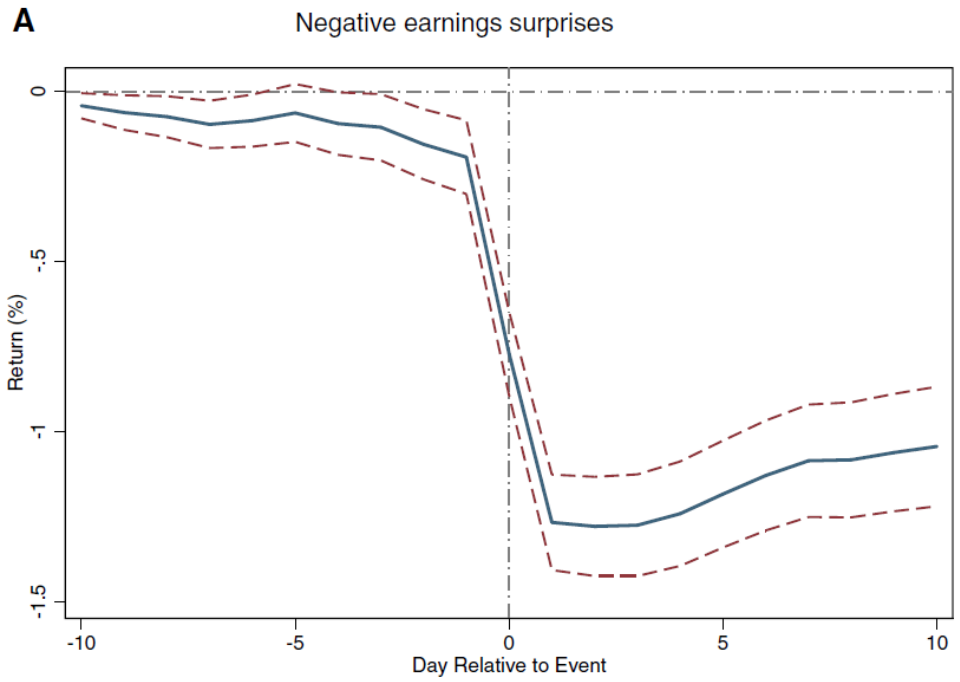
LinkedIn launched in 2005

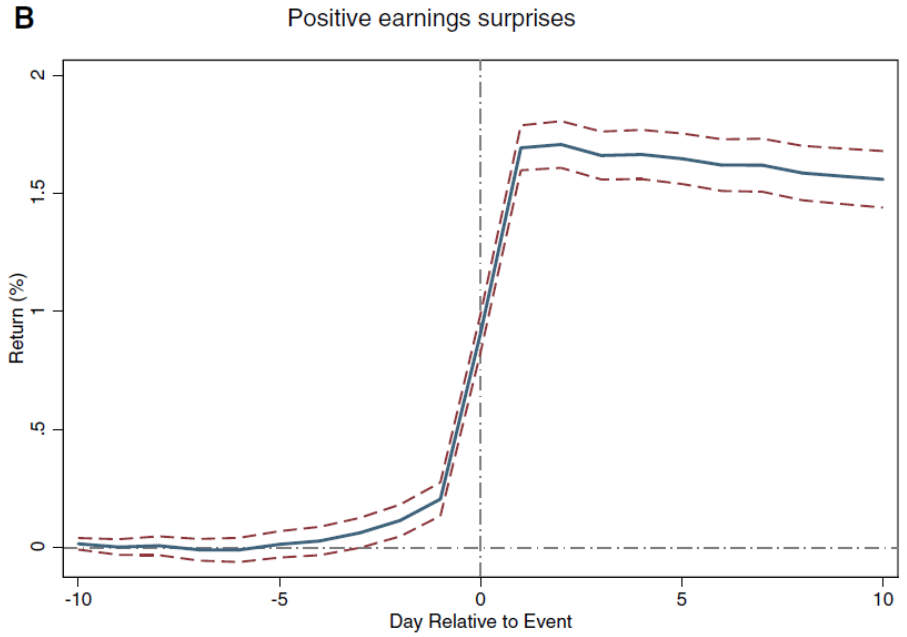
- Labor flows and earnings expectations

Table 3
Net labor outflows and earnings surprises

$$SUE_{i,t} = \frac{actual_{i,t}^{ex\text{-}post} - \mu_{i,t}}{\sigma_{i,t}}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$NetOutflows_{i,t}$	−0.706*	−0.889**	−0.892**	−1.233***	−0.906*	−0.741	−1.187**	−1.109**
	(0.426)	(0.421)	(0.384)	(0.375)	(0.493)	(0.484)	(0.461)	(0.448)
$E_{i,t}^{+}$			−0.029	0.048**			−0.069***	0.038*
			(0.018)	(0.019)			(0.019)	(0.020)
$NEGE_{i,t}$			−0.359***	−0.082*			−0.512***	0.130**
			(0.039)	(0.046)			(0.048)	(0.058)
$ACC_{i,t}^{-}$			−0.045***	−0.014			−0.023*	0.021
			(0.012)	(0.012)			(0.013)	(0.014)
$ACC_{i,t}^{+}$			0.002	−0.029**			−0.002	−0.057***
			(0.013)	(0.013)			(0.016)	(0.016)
$AG_{i,t}$			0.336***	0.270***			0.298***	0.094
			(0.066)	(0.065)			(0.084)	(0.083)
$DD_{i,t}$			0.506***	−0.160***			0.396***	−0.070
			(0.044)	(0.062)			(0.066)	(0.100)
$DIV_{i,t}$			−0.001	−0.004***			−0.003*	−0.003**
			(0.001)	(0.002)			(0.001)	(0.002)
$PRICE_{i,t}$			0.003***	−0.002***			0.002***	−0.003***
			(0.000)	(0.000)			(0.000)	(0.000)
$BTM_{i,t}$			0.007	0.006			0.014	0.008
			(0.010)	(0.010)			(0.011)	(0.011)
$Constant$	0.786***	0.785***	0.311***	1.087***	1.052***	1.053***	0.784***	1.315***
	(0.015)	(0.014)	(0.045)	(0.062)	(0.018)	(0.017)	(0.066)	(0.099)
R^2	.000	.078	.005	.113	.000	.095	.003	.124
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Time FE	N	Y	N	Y	N	Y	N	Y
Firm FE	N	Y	N	Y	N	Y	N	Y





- if investors fail to incorporate information from labor flows into earnings expectations, then we should see a negative (positive) stock price reaction to negative (positive) earnings surprises.

- Heterogeneity of findings across firms

$$transparency = \frac{|accruals|}{|cash\ flow\ from\ operations|}$$

Table 4
Portfolio return analysis across firms with varying financial transparency

A. Portfolio return analysis

Low transparency α (%)	0.732***	0.553**	0.575***	0.406*	0.554***	0.268	0.487***	0.506**
	(3.765)	(2.226)	(3.235)	(1.776)	(3.415)	(1.212)	(2.807)	(2.446)
High transparency α (%)	0.310**	0.529***	0.221*	0.371**	0.397***	0.378*	0.443***	0.393*
	(2.326)	(2.835)	(1.674)	(2.220)	(2.914)	(1.926)	(3.497)	(1.935)
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Portfolio cutoff	Quartile	Quartile	Tercile	Tercile	Quartile	Quartile	Quartile	Quartile
EW/VW	EW	VW	EW	VW	*EW*	*VW*	EW	VW
Crisis periods	Included	Included	Included	Included	Included	Included	Excluded	Excluded

B. Fama−MacBeth cross−sectional regressions

	β	$ln(ME)$	$ln(B/M)$	$ln(OP)$	$ln(INV)$	NLO	$NLO*LowT$
Fama-MacBeth coefficient	0.411	−0.271***	−0.096	0.141**	−0.008	−0.016*	−0.017**
	(1.513)	(−7.016)	(−1.028)	(1.999)	(−0.420)	(−1.719)	(-1.773)

firm size; ME; book-to-market; operating profitability; investment

NLO is the net labor outflows of an individual firm in the prior month.
LowT is our measure of financial transparency that is decreasing in earnings management

- Net labor flows and gross labor flows

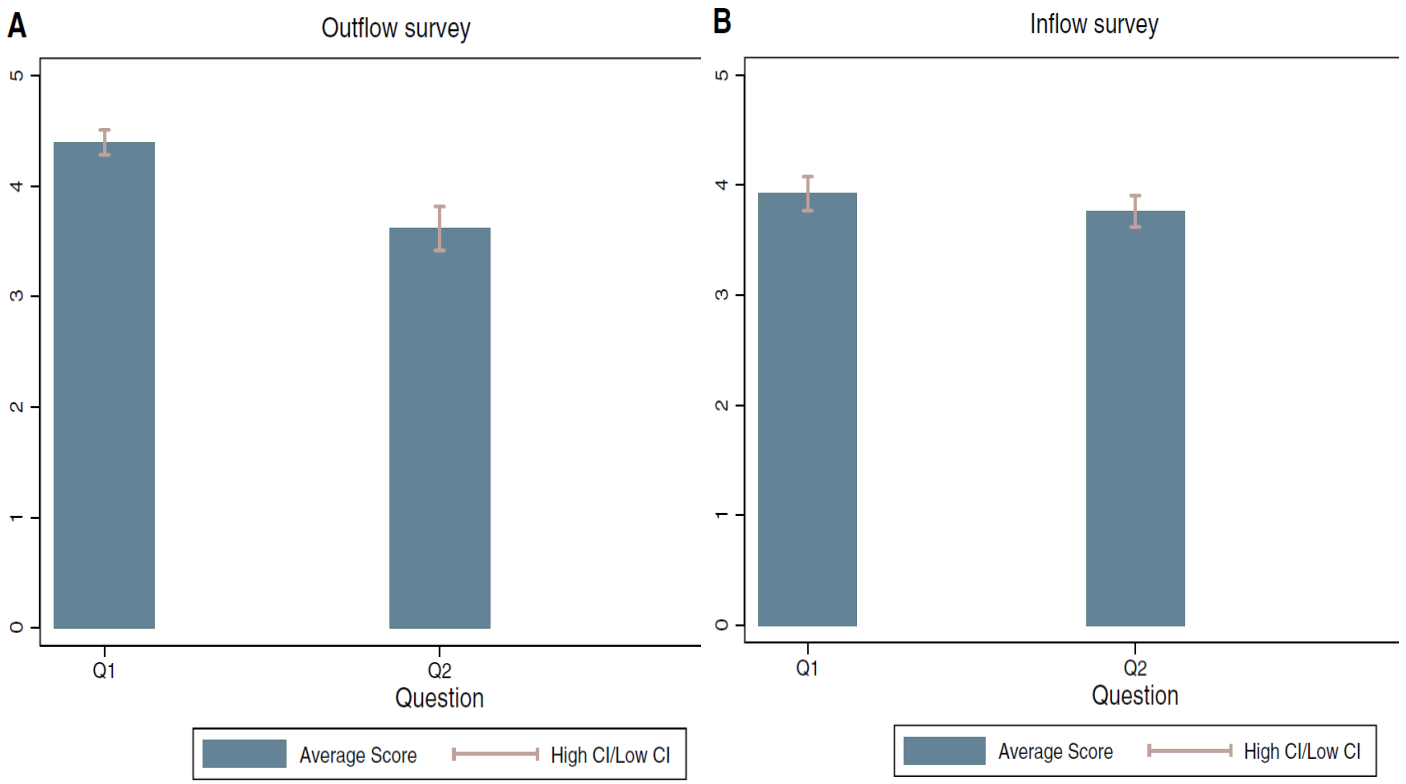
to understand the relative empirical importance of gross labor outflows versus gross labor inflows

Table 5
Portfolio return analysis based on gross outflows and gross inflows

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A. Outflows							
α (%)	0.208**	0.012	0.244***	−0.013	0.205**	0.175	0.199**	0.137
	(2.483)	(0.107)	(3.164)	(−0.119)	(2.043)	(1.122)	(2.002)	(0.928)
	B. Negative inflows							
α (%)	0.159*	0.383***	0.098	0.252**	0.092	−0.028	0.104	−0.011
	(1.902)	(3.005)	(1.276)	(2.411)	(0.911)	(−0.188)	(1.037)	(−0.080)
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Portfolio cutoff	Quartile	Quartile	Tercile	Tercile	Quartile	Quartile	Quartile	Quartile
EW/VW	EW	VW	EW	VW	EW	VW	EW	VW
Crisis periods	Included	Included	Included	Included	Included	Included	Excluded	Excluded

- the data show that gross labor outflows are more informative than gross labor inflows.
- the information observed by the firm's existing employees is likely to be more precise than information gathered by prospective workers outside the firm.

- Survey evidence



- How important were the **future prospects** of your employer when deciding whether to leave and find a new job?
- How important were **personal circumstances** when choosing whether to leave your employer
- Did you **gather information** from existing (or former) employees before deciding whether to join a prospective employer"?
- How important was **publicly available information** in deciding whether to join a prospective employer"?

- Information content in labor flows
  - Production costs

$$y_{i,t+1} = a + b * Net\,Labor\,Outflow_{i,t} + FEs + \epsilon_{i,t+1},$$

Table 6
Information content in labor flows:Production costs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Nonlabor production cost		*A. Accounting fundamentals*					
	SG&A expense →		Operating expense +		Revenues →		Operating income	
Net labor outflow	0.019***	0.016**	0.016**	0.013**	0.004	−0.006	−0.014***	−0.016***
	(3.167)	(2.286)	(2.011)	(1.857)	(0.410)	(−0.758)	(−4.603)	(−5.333)
Starting year	1985	2005	1985	2005	1985	2005	1985	2005

- Employee heterogeneity

alphas from portfolio return analysis using labor flows of different subsets of workers

	B. Employee occupation							
Engineers	0.414**	0.476**	0.414**	0.475**	0.339**	0.188	0.351***	0.090
	(2.575)	(2.509)	(2.572)	(2.504)	(2.459)	(0.952)	(2.623)	(0.484)
Scientists	0.268*	0.164	0.268*	0.164	0.333**	0.395*	0.393***	0.448**
	(1.793)	(0.918)	(1.793)	(0.918)	(2.579)	(1.945)	(2.812)	(2.187)
Managers	0.306***	0.434***	0.198*	0.321**	0.325***	0.389**	0.335***	0.502***
	(2.632)	(2.958)	(1.780)	(2.455)	(3.144)	(2.417)	(3.266)	(3.658)
Administration	0.113	0.057	0.105	0.056	0.161	0.045	0.220	−0.020
	(0.861)	(0.362)	(0.802)	(0.353)	(1.239)	(0.260)	(1.609)	(−0.115)
Finance	0.012	0.228	0.012	0.228	0.052	−0.131	0.198	−0.282
	(0.056)	(0.863)	(0.056)	(0.863)	(0.245)	(−0.397)	(1.188)	(−1.452)
Consultant	0.102	0.123	0.102	0.123	0.243*	0.228	0.293**	0.158
	(0.588)	(0.599)	(0.588)	(0.599)	(1.867)	(1.267)	(2.496)	(0.835)
	C. Employee work experience							
High	0.241**	0.285**	0.228**	0.245**	0.332***	0.329*	0.432***	0.353**
	(2.398)	(2.049)	(2.343)	(1.991)	(2.859)	(1.658)	(3.938)	(2.164)
Low	0.144	0.234**	0.076	0.216*	0.318	0.330*	0.304	0.242
	(1.480)	(1.971)	(0.885)	(1.942)	(1.650)	(1.903)	(1.533)	(1.458)
	D. Employee education							
PhD/MBA/Master's	0.359***	0.252**	0.372***	0.332**	0.358**	0.336*	0.344**	0.297
	(3.905)	(2.084)	(3.960)	(2.481)	(2.565)	(1.741)	(2.504)	(1.534)
Bachelor's/High school	0.093	0.191*	0.060	0.210**	0.117	0.215	0.136*	0.146
	(1.297)	(1.677)	(0.928)	(2.048)	(1.591)	(1.644)	(1.840)	(1.202)
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Portfolio cutoff	Quartile	Quartile	Tercile	Tercile	Quartile	Quartile	Quartile	Quartile
EW/VW	EW	VW	EW	VW	EW	VW	EW	VW
Crisis periods	Included	Included	Included	Included	Included	Included	Excluded	Excluded

- Alternative explanations
  - Return reversal or return persistence?

Table 7
Return persistence in portfolio return analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0-month gap	0.415***	0.337**	0.316***	0.250*	0.389***	0.306**	0.364***	0.285**
	(3.546)	(2.114)	(2.868)	(1.818)	(3.685)	(2.080)	(3.501)	(2.003)
1-month gap	0.542***	0.346	0.439***	0.185	0.267	0.077	0.332**	0.087
	(3.242)	(1.638)	(2.929)	(1.056)	(1.590)	(0.325)	(2.277)	(0.376)
2-month gap	0.216*	0.215	0.105	0.176	0.187	−0.116	0.273**	−0.051
	(1.669)	(1.196)	(0.871)	(1.001)	(1.523)	(−0.542)	(2.335)	(−0.256)
3-month gap	0.103	0.258	−0.072	−0.005	0.064	0.041	0.163	0.212
	(0.743)	(1.138)	(−0.545)	(−0.025)	(0.453)	(0.212)	(1.231)	(1.099)
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Portfolio cutoff	Quartile	Quartile	Tercile	Tercile	Quartile	Quartile	Quartile	Quartile
EW/VW	EW	VW	EW	VW	EW	VW	EW	VW
Crisis periods	Included	Included	Included	Included	Included	Included	Excluded	Excluded

- If the returns reverse over longer horizons, then labor flows may not contain fundamental information that is materially important for stock prices.
- our main results are not subject to reversal over longer time horizons. In fact, the findings suggest that investors slowly incorporate information contained in labor flows into stock prices over time.

- Top executive inside information

  Another alternative explanation for the findings is that labor flows simply reflect the hiring and firing decisions of well-informed top executives who possess inside information about the firm's future prospects

aggregate executive insiders' monthly net sales (open market sales minus open market purchases), normalized by the total number of outstanding shares,

Table 8
Insider trading and labor flows

	A. All insiders						
InsiderTrade	0.001	−0.001	−0.006	−0.002	−0.006	−0.005	0.008
	(0.004)	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.006)
R^2	.060	.058	.054	.060	.060	.057	.054
L	0 month	1 month	2 months	3 months	4 months	5 months	6 months
	B. Opportunistic insiders						
InsiderTrade	0.020	0.065	0.008	0.035**	0.004	0.000	−0.036
	(0.023)	(0.044)	(0.021)	(0.015)	(0.021)	(0.020)	(0.028)
R^2	.092	.096	.106	.111	.089	.092	.100
L	0 month	1 month	2 months	3 months	4 months	5 months	6 months

- Do labor flows measure adjustment costs?

the abnormal stock returns that we document may simply reflect employment adjustment costs caused by worker flows

Table 9
Portfolio return analysis for firms facing varying labor adjustment costs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A. High unemployment share (low labor adjustment costs)							
α (%)	0.541***	0.627***	0.376**	0.556***	0.359**	0.338*	0.336**	0.277
	(3.207)	(2.947)	(2.422)	(3.146)	(2.210)	(1.720)	(1.993)	(1.419)
	B. Low unemployment share (high labor adjustment costs)							
α (%)	0.275**	0.131	0.213*	0.094	0.421***	0.333*	0.399***	0.389**
	(2.027)	(0.722)	(1.681)	(0.560)	(3.118)	(1.727)	(3.049)	(2.124)
Starting year	1985	1985	1985	1985	2005	2005	2005	2005
Portfolio cutoff	Quartile	Quartile	Tercile	Tercile	Quartile	Quartile	Quartile	Quartile
EW/VW	EW	VW	EW	VW	EW	VW	EW	VW
Crisis periods	Included	Included	Included	Included	Included	Included	Excluded	Excluded

compute each state's share of the total unemployed labor force in the United States; we assume that firms in states with above-median shares of the unemployed labor force will have different (and most likely: lower) adjustment costs than firms in states with below-median shares of the unemployed labor force.

2. Survey: don't believe that hiring adjustment costs are a major determinant

Conclusion

- Workers observe information that investors fail to extract from employees' labor market decisions.

- Next step:
  - Other corporate behavior that are affected by the firm's labor dynamics.
    - The hiring rates of specific workers likely affect the timing and choice of investment projects, while exit rates of key personnel likely affect security issuance decisions.

Labor/Employment Literature

Name	Source	Data & Method	Questions
A: Employment and market returns			
Employee sentiment and stock returns	2021	Glassdoor	High employee sentiment predicts a subsequent low **market return**.
B: Employment and cross-sectional returns			
Crowdsourced employer reviews and stock returns	JFE, 2019	Glassdoor-Employer rating	Firms with improvements in crowdsourced employer ratings significantly outperform firms with declines.
What do employees know? Evidence from a social media platform	2021	Glassdoor - Business outlook	Average employee outlook is incrementally informative in predicting performance
What do employees know? Quality perception and 'over-satisfaction' in firms going public	Journal of Corporate Finance, 2021	Glassdoor	Employees' pre-IPO views are informative: positive reviews of firm/manager quality predict stronger post-IPO stock performance, while dispersion in opinions correlates with post-IPO return volatility.
How do job vacancy rates predict firm performance? A web crawling massive data perspective	Pacific-Basin Finance Journal, 2020	Web crawling(Taiwan)	New job openings signal boosting stock prices and positive developments

Name	Source	Data & Method	Questions
Employee flexibility, exogenous risk, and firm value	JFQA, 2021	Indeed.com Online job reviews Textual analysis, lexical field of "create"	Employee flexibility enhances firm value by helping firms respond to exogenous shocks
Employee turnover and firm performance: large-sample archival evidence	MS, 2021	A provider of labor market analytics	Employee turnover is negatively associated with future financial performance.
Employee satisfaction, labor market flexibility, and stock returns around the world	2021	Best Companies lists compiled by the Great Place to Work institute	The link between employ satisfaction and stock returns in 30 countries, and how this link depends on a country's labor market flexibility.
Labor market networks and asset returns	2021	The US department of labor dataset of occupational information network	An industry's return is strongly predicted by the past return of its labor-market-connected neighboring industries.
Labor hiring and stock returns: the importance of the sales and marketing workforce	2021	RESSET (Chinese)	Growth in the sales and marketing workforce is a strong and robust predictor of a firm's future revenue growth and profitability.
Local labor market and the cross section of stock returns	2021		Firms in thicker local labor markets display significantly positive stock returns afterwards

Name	Source	Data & Method	Questions
C: Employment and others			
The effect of tax avoidance news on employment perceptions of managers and firms: evidence from Glassdoor.com Ratings	The Accounting Review, 2021	Glassdoor.com LexisNexis, hand-collect tax avoidance news DID	Tax avoidance news negatively affecting employee perceptions of managers and firms
Do messages on online stock forums spur firm productivity?	2021, Pacific-Basin Finance Journal	Guba.eastmoney.com (China)	Stock forum posts could make firms more productive
The disciplinary effect of social media: evidence from firms' responses to Glassdoor reviews	2021, Journal of Accounting Research	Glassdoor DID	After reviewed on Glassdoor, firms improve their workplace practices, measured by corporate social responsibility scores on employee relations and diversity.