香港中文大學
The Chinese University of Hong Kong

The Information Content of Cost Behavior Components: Evidence from Labor Market Flows

Lianghui Wang, Wan Wongsunwai and Nir Yehuda

Presentation at the
ABFER 7th Annual Conference,
27 May 2019

Research Objective

- Examine information content of β_1 and β_2 in the Anderson, Banker and Janakiraman (2003) model:

$$log\left[\frac{Costs_t}{Costs_{t-1}}\right] = \beta_0 + \boxed{\beta_1} log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \boxed{\beta_2} I_{Decrease} \times log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \varepsilon$$

  – Negative β_2 ➔ sticky costs

  – Build on Rouxelin et al. (2018)
    - Greater aggregate cost stickiness is negatively related to future changes in unemployment rate
    - Intuition: greater cost stickiness implies greater employee retention by firms facing sales declines, therefore lower unemployment in subsequent period

  – Focus on business-level job flows

Motivation

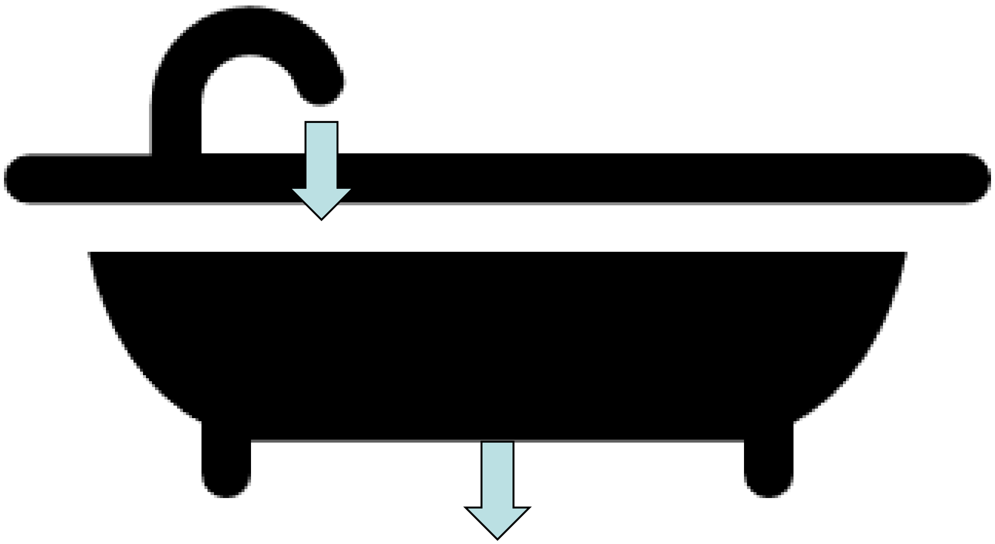
$$log\left[\frac{Costs_t}{Costs_{t-1}}\right] = \beta_0 + \beta_1\, log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \beta_2\, I_{Decrease} \times log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \varepsilon$$

- Literature since ABJ has focused on β_2 and offers several explanations for negative sign
  - Costly to increase or reduce resources
  - Managerial optimism/pessimism
  - Empire-building
- Barnichon and Nekarda (2012) demonstrate importance of labor force flows when forecasting unemployment rate

Job Inflows and Outflows

- Analytical models (e.g., Shimer 2005)
- Empirically, Barnichon and Nekarda (2012) demonstrate that incorporating labor flows in forecasting models of unemployment significantly improves accuracy
- Their base model beats professional forecasters, historical FRB Greenbook forecasts, and basic time-series models
  - RMSE of professional forecasters: 0.17
  - RMSE of BN model: 0.12
- Brookings Conference comment: "Justin Wolfers […] asked Jan Hatzius whether Goldman Sachs had begun running a flow-based model of unemployment. Hatzius replied that it had."

"Bathtub" Analogy
(Barnichon and Nekarda 2012)



- Unemployment at any given time = level of water (stock)
- Future level is determined by rates of inflow and outflow

Predictions

$$log\left[\frac{Costs_t}{Costs_{t-1}}\right] = \beta_0 + \beta_1\, log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \beta_2\, I_{Decrease} \times log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \varepsilon$$

- β_2 :
  - β_2 reflect shorter-term adjustment costs, managerial expectations, and resource retention decisions, therefore related more to outflows than inflows (Rouxelin et al. 2018)

Predictions (cont.)

- β_1 :
  - From symmetric cost response literature:

$$log\left[\frac{Costs_t}{Costs_{t-1}}\right] = \beta_0 + \beta_3 log\left[\frac{Sales_t}{Sales_{t-1}}\right] + \varepsilon$$

  - Higher slope β_3 indicates:
    - more elastic cost structure with lower (higher) proportion of fixed (variable) costs, or lower operating leverage (e.g., Lev 1974, Cooper and Kaplan 1987, etc.)
    - higher ratio of marginal cost to average cost (Noreen and Soderstrom 1994)
    - higher ratio of variable costs to total costs if total costs are linear in volume (Kallapur and Eldenburg 2005)
  - β_3 reflects longer-term production technology, not easily reversible, related to both outflows and inflows
    - β_1 should be related more to inflows than outflows

Data

- Quarterly Compustat for COGS, SGA, and SALES
  - Estimate a time-series of aggregate β_1 and β_2
- Business Employment Dynamics (BED) data from Bureau of Labor Statistics
  - Directly measure gross job inflows and outflows at business establishment level
  - Released with a 3-quarters lag
- Sample period: Q3:1992 (earliest quarter in BED) to Q2:2017 (100 calendar quarters)

Business Employment Dynamics

Example: Q2 2019 news release:

- Quarterly statistics on gross job gains and losses, tracking changes at the establishment level
- Decompose net job changes into its components: gross job gains (from openings and expansions), and gross job losses (from closings and contractions)

Table A. Three-month private sector gross job gains and losses, seasonally adjusted

Category	3 months ended				
	Sept. 2017	Dec. 2017	Mar. 2018	June 2018	Sept. 2018
	Levels (in thousands)				
Gross job gains	7,311	7,826	7,406	7,639	7,448
At expanding establishments	5,959	6,383	6,071	6,245	6,099
At opening establishments	1,352	1,443	1,335	1,394	1,349
Gross job losses	7,404	6,847	6,666	7,202	7,421
At contracting establishments	6,106	5,547	5,526	5,942	6,099
At closing establishments	1,298	1,300	1,140	1,260	1,322
Net employment change[1]	-93	979	740	437	27
	Rates (percent)				
Gross job gains	6.0	6.4	6.0	6.1	6.0
At expanding establishments	4.9	5.2	4.9	5.0	4.9
At opening establishments	1.1	1.2	1.1	1.1	1.1
Gross job losses	6.1	5.6	5.4	5.8	6.0
At contracting establishments	5.0	4.5	4.5	4.8	4.9
At closing establishments	1.1	1.1	0.9	1.0	1.1
Net employment change[1]	-0.1	0.8	0.6	0.3	0.0

[1] The net employment change is the difference between total gross job gains and total gross job losses. See the Technical Note for further information.

Source: Business Employment Dynamics Summary for Third Quarter 2018, released on April 24, 2019 by Bureau of Labor Statistics

Table 1

Panel A: Summary statistics

	Mean	Median	SD
Gross job inflow rate %	7.107	7.000	0.823
Gross job outflow rate %	6.790	6.800	0.746
Net job outflow rate %	-0.317	-0.400	0.597
β_1 coefficient estimates	0.410	0.385	0.108
β_2 coefficient estimates	-0.053	-0.064	0.088

Panel B: Pairwise Pearson correlations – job flow rates and unemployment change rate

	ChUR	Net job outflow rate	Gross job inflow rate	Gross job outflow rate
ChUR	1			
Net job outflow rate	0.816***	1		
Gross job inflow rate	-0.226**	-0.486***	1	
Gross job outflow rate	0.404***	0.265***	0.714***	1

- *ChUR* highly correlated with net outflow (as expected)
- Gross inflow and gross outflow are also highly correlated (job redistributions)

Table 2 – Persistence of βs

- To facilitate interpretation in regressions, normalize β_1 and -β_2 to β_{SU} and β_{SD}, respectively

Table 2. The persistence of aggregate cost behavior

	I	II
	$\beta_{SU\,t+1}$	$\beta_{SD\,t+1}$
$\beta_{SU\,t}$	0.990***	
	(53.008)	
$\beta_{SD\,t}$		0.931***
		(18.811)
Intercept	-0.022	0.001
	(-1.064)	(0.020)
Adjusted R-squared	0.973	0.864
Observations	100	100
Suest chi2-statistic	(I) vs (II): 3.65**	
(*p*-value)	[0.056]	

- Both β_{SU} and β_{SD} are highly persistent
- β_{SU} is more persistent

Tables 3 and 4 – Gross Job Flows (Contemporaneous)

Table 3. Association between aggregate cost behavior and the gross job inflow rate-- Contemporaneous relationship

	I Gross job inflow rate	II Gross job inflow rate	III Gross job inflow rate
β_{SU}	0.380*** (3.849)		0.634*** (8.112)
β_{SD}		0.021 (0.423)	-0.184*** (-3.959)

Table 4. Association between aggregate cost behavior and the gross job outflow rate-- Contemporaneous relationship

	I Gross job outflow rate	II Gross job outflow rate	III Gross job outflow rate
β_{SU}	-0.083 (-0.752)		0.316*** (2.774)
β_{SD}		-0.187*** (-3.971)	-0.289*** (-4.583)

Tables 3 and 4 – Comments

- β_{SU} and β_{SD} separately contain information about gross job inflows and outflows, respectively (columns I and II)
- When both β_{SU} and β_{SD} are included in the same regression (columns III), β_{SU} is more informative about inflows than outflows and conversely for β_{SD}

Table 5 – Gross Job Flows (Prediction)

Table 5. Association between aggregate cost behavior and future gross job flow rate--Prediction

Panel A: Association between β_{SU}, β_{SD} and future gross job inflow rates

	I Gross job inflow rate$_{t+k}$				II Gross job inflow rate$_{t+k}$				III Gross job inflow rate$_{t+k}$			
	t+1	t+2	t+3	t+4	t+1	t+2	t+3	t+4	t+1	t+2	t+3	t+4
β_{SU}	0.327***	0.357***	0.372***	0.328***					0.593***	0.653***	0.706***	0.621***
	(3.953)	(3.341)	(3.039)	(2.666)					(7.101)	(7.349)	(7.005)	(6.469)
β_{SD}					0.009	0.009	0.001	0.001	-0.170***	-0.189***	-0.213***	-0.187***
					(0.233)	(0.193)	(0.011)	(0.012)	(-4.077)	(-3.986)	(-3.839)	(-3.454)

Panel B: Association between β_{SU}, β_{SD} and future gross job outflow rates

	I Gross job outflow rate$_{t+k}$				II Gross job outflow rate$_{t+k}$				III Gross job outflow rate$_{t+k}$			
	t+1	t+2	t+3	t+4	t+1	t+2	t+3	t+4	t+1	t+2	t+3	t+4
β_{SU}	-0.042	-0.058	-0.044	-0.177					0.494***	0.394*	0.414*	0.252
	(-0.273)	(-0.425)	(-0.362)	(-1.393)					(3.307)	(1.837)	(1.910)	(1.573)
β_{SD}					-0.193***	-0.169***	-0.167**	-0.198**	-0.342***	-0.288***	-0.293**	-0.274**
					(-3.694)	(-3.009)	(-2.493)	(-2.619)	(-4.595)	(-2.728)	(-2.437)	(-2.488)

- Same pattern as with contemporaneous effects

Table 6 – Effect of Uncertainty

- Second moment of β_{SD} as measure of uncertainty, focus on β_{SD} and gross job outflows
- Higher SE(β_{SD}) indicates:
  - Less precise coefficient estimate for β_{SD}
  - Higher dispersion among firms in resource retention

Table 6. Association between β_{SD}, standard error of β_{SD}, and gross job outflow rate

	I Gross job outflow rate	II Gross job outflow rate
β_{SD}	-0.217*** (-4.764)	-0.208*** (-5.683)
SE(β_{SD})—top decile	-0.329** (-1.997)	
β_{SD} × SE(β_{SD})—top decile	-0.248** (-2.430)	
SE(β_{SD})—top quartile		-0.295*** (-3.879)
β_{SD} × SE(β_{SD})—top quartile		-0.103* (-1.846)

- β_{SD} effect is more pronounced when uncertainty is higher

Table 7 – Comparing Symmetric and Asymmetric Cost Models

(β_3 is normalized to β_{SYM})

Table 7. A comparison of the symmetric and asymmetric cost models

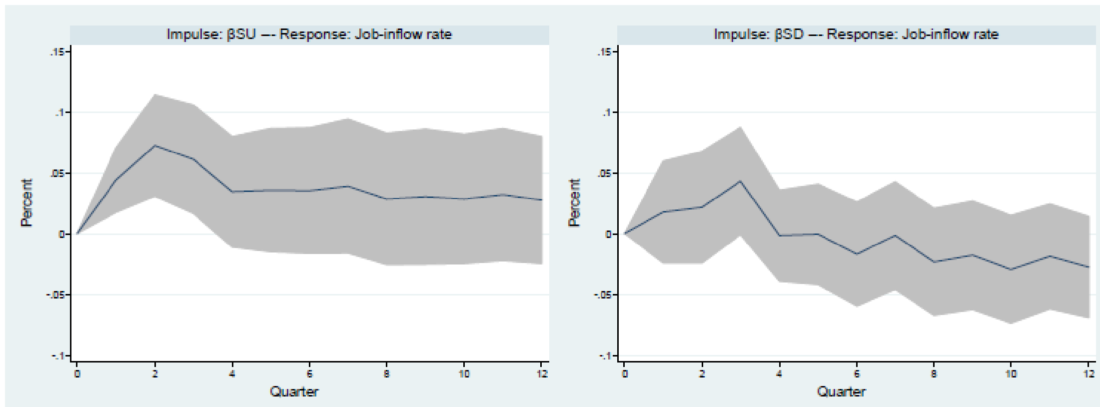
	I Gross job inflow rate	II Gross job inflow rate	III Gross job outflow rate	IV Gross job outflow rate	V Net job outflow rate	VI Net job outflow rate
β_{SU}	0.634***		0.316***		-0.318**	
	(8.112)		(2.774)		(-2.488)	
β_{SD}	-0.184***		-0.289***		-0.105*	
	(-3.959)		(-4.583)		(-1.726)	
β_{SYM}		0.551***		0.285**		-0.267*
		(7.989)		(2.259)		(-1.872)
Adjusted *R*-squared	0.935	0.935	0.874	0.851	0.742	0.695
Observations	100	100	100	100	100	100
Vuong *z*-statistic	(I) vs (II): 0.355		(III) vs (IV): 2.519**		(V) vs (VI): 2.276**	
(*p*-value)	[0.722]		[0.012]		[0.023]	

- Asymmetric model outperforms symmetric model for both gross and net job outflows

Table 8 – VAR, Gross Job Inflows

Panel A: Impulse-response graph to shock in cost behavior components — β_{SU} and β_{SD} separately

$$AZ_t = \phi Z_{t-k} + \varepsilon_t, \text{ where } Z_t = \left(Job\ Inflow\ Rate_t,\ GDP_t,\ \beta_{SU_t}/\beta_{SD_t}\right)'$$



Panel B: Impulse-response graph to shock in cost behavior components — β_{SU} and β_{SD} jointly

$$AZ_t = \phi Z_{t-k} + \varepsilon_t, \text{ where } Z_t = \left(Job\ Inflow\ Rate_t,\ GDP_t,\ \beta_{SU_t},\ \beta_{SD_t}\right)'$$

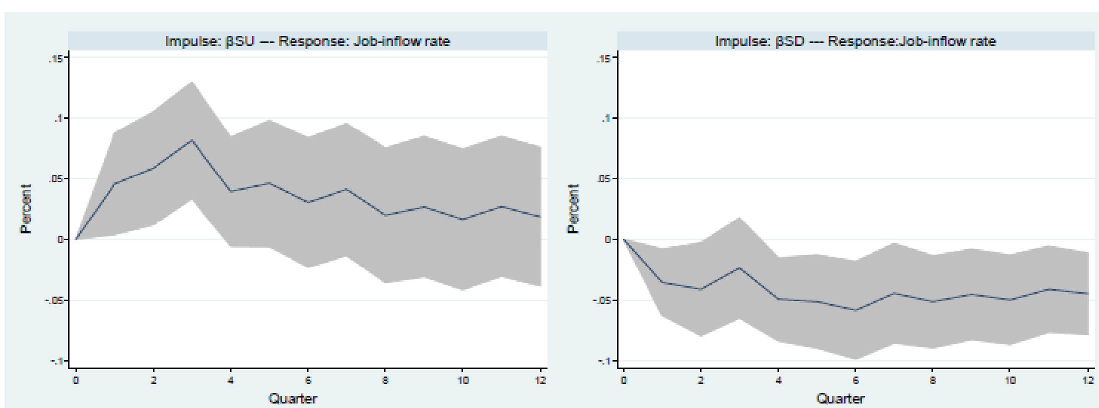
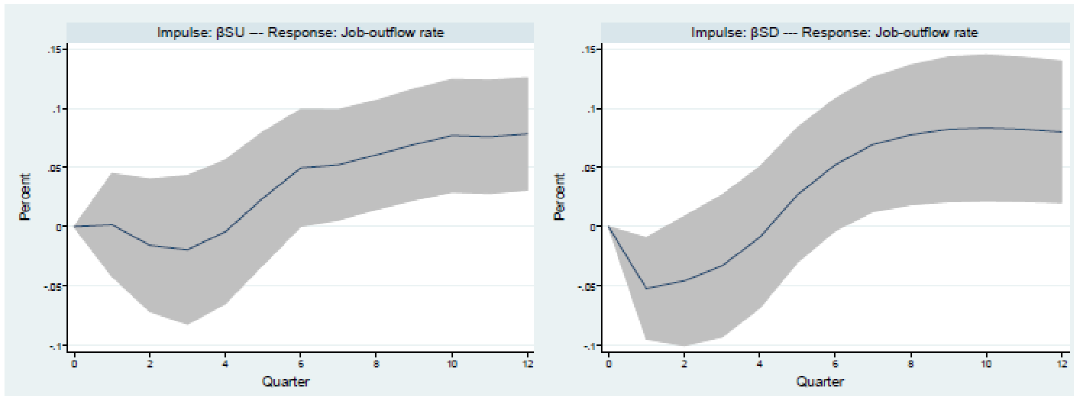


Table 9 – VAR, Gross Job Outflows

Panel A: Impulse-response graph to shock in cost behavior components —β_{SU} and β_{SD} separately

$$AZ_t = \phi Z_{t-k} + \varepsilon_t, \text{ where } Z_t = \left(Job\ Outflow\ Rate_t, GDP_t, \beta_{SU_t}/\beta_{SD_t}\right)'$$



Panel B: Impulse-response graph to shock in cost behavior components —β_{SU} and β_{SD} jointly

$$AZ_t = \phi Z_{t-k} + \varepsilon_t, \text{ where } Z_t = \left(Job\ Outflow\ Rate_t, GDP_t, \beta_{SU_t}, \beta_{SD_t}\right)'$$

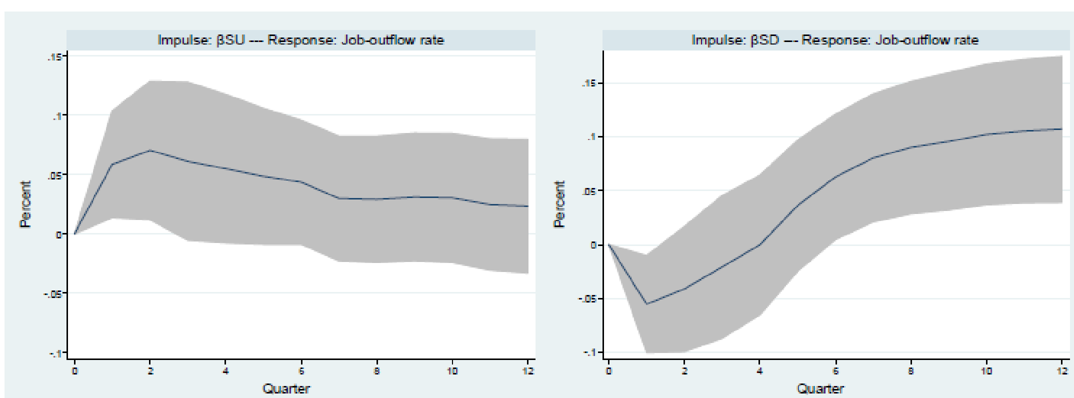


Table 10 – Effect of Labor Protection Laws

Panel A: β_{SU} and gross job-inflow rate

State-level labor protection	I High	II Low
β_{SU}	0.386*** (2.747)	0.490*** (4.457)
Adjusted R-squared	0.887	0.930
Observations	100	100
Suest chi2-statistic (*p*-value)	(I) vs (II): 3.44* [0.064]	

Panel B: β_{SD} and gross job-outflow rate

State-level labor protection	I High	II Low
β_{SD}	-0.283*** (-3.626)	-0.212*** (-3.250)
Adjusted R-squared	0.822	0.876
Observations	100	100
Suest chi2-statistic (*p*-value)	(I) vs (II): 3.59* [0.058]	

- Use state-level adoption of wrongful discharge laws (Serfling 2016)
- These impose substantial firing costs of employers, i.e., increase labor adjustment costs
- β_{SU}–inflow effect is larger in states without WDLs (panel A)
- β_{SD}–outflow effect is larger (in magnitude) in states with WDLs (panel B)

Conclusion

- Examined the information content of the two aggregate-level cost elasticities in the ABJ cost function
- Both β_{SU} and β_{SD} are highly persistent, but β_{SU} more so
- Using BED labor flows, we find that β_{SU} (β_{SD}) explains job inflows (outflows) but not vice versa
  - When both are included in the same regression, both load but with opposite signs and larger magnitudes
- VAR analyses confirm above patterns
- β_{SD} effect is more pronounced when uncertainty is high
- Asymmetric models outperform symmetric models
- Cross-sectional variation in state-level labor protection rights confirm differential information content of β_{SU} and β_{SD}