Stock Market Response to Unemployment News: A Closer Look on Estimation and Condition of Economy

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Overview

The research is built on existing papers, which study the stock market response to unemployment news. New empirical strategies are employed to establish a new understanding under this topic

- Introduction and Research Question
- Motivation
- Literature Review
- Data
- Results
- Interpretation

Introduction and Research Question

The primary topic here is the relationship between unemployment news and stock market changes. Many efforts are spent on quantifying both variables.

Research Question: Is stock market response to unemployment news dependent on the condition of economy?

Motivation

- Forecasting and estimations are common in stock market; predicting changes of stock indices itself is interesting
- Stocks are ownership of claims on businesses; would it be fair to assert they are independent of certain aspect of the aggregate economy?
- How do the stock market and the labor market interact with each other in terms of forecasting?

Literature Review - 1

The Stock Market's Reaction to Unemployment News: Why Bad News Is Usually Good for Stocks

- Authors: John H. Boyd, Jian Hu, and Ravi Jagannathan; published by The Journal of Finance in April 2005
- Result: announcement of a rising unemployment rate is good news during economic expansions; while it is bad news during contractions.
- In brief:

$$Return_t = \beta_0 + \beta_1 \cdot SW_{t-1}^{recession} \cdot News_t + \beta_2 \cdot (1 - SW_{t-1}^{recession}) \cdot News_t + u_t \quad (1)$$

- negative β_1 and positive β_2 obtained

Literature Review - 1

The Stock Market's Reaction to Unemployment News: Why Bad News Is Usually Good for Stocks

I have some disagreements with the paper.

- Unemployment prediction is based on simple linear regression; the independent variables are at time t
- If the economic condition has an effect upon stock market response to unemployment news, it would be better to study the response under different conditions separately.
- Estimated economic condition is not equivalent to actual condition.

Literature Review - 2

E-Capital: The Link between the Stock Market and the Labor Market in the 1990s

- Authors: Robert E. Hall, Jason G. Cummins and Owen A. Lamont; published by Brookings Institution Press on Brookings Papers on Economic Activity in 2000
- High stock valuations are results of high employment of the e-capital, i.e. college-level workers
- Insight: incorporate e-capital factor into market valuation since 1990s; but not simply as unemployment rate of college-level workers

Literature Review - 3

Does stock price informativeness affect labor investment efficiency?

- Authors: Hamdi Ben-Nasr, and Abdullah A. Alshwer; published by Journal of Banking and Finance in January 2016.
- One of the steps estimating the change in number of employees based on economic fundamentals (i - firm; t - time, annually):

$$LaborInvest_{i,t} = \theta_0 + \theta_1 \cdot RET_{i,t} + \ldots \tag{2}$$

- Positive θ_1
- In a firm's level and annual scale, the difference between employment rate (LaborInvest) is associated with the stock return of the firm
- What does it mean for aggregate level?

Empirical Strategy

The Methodology employed includes the following

- Linear Regression
- Vector Auto-Regression (VAR) Model

Primary Regression

The primary regression of this research is:

$$D_t^{CFNAI} \cdot Return_t = \xi_1 + \xi_2 \cdot News_t \tag{3}$$

Variables:

- D_t^{CFNAI}: An indicator variable based on Chicago Fed National Activity Index, an index designed to gauge the overall economic activity and related inflationary pressure. For example, CFNAI index is an negative number if there's an economic downturn. This variable takes 1 if CFNAI index is greater than 0; it takes -1 if CFNAI index is smaller than 0; it takes 0 otherwise.
- $Return_t$: Variable based on stock market index S&P 500. Only index values on the announcement day are interested. The method of obtaining this variable is explained in the data section
- $News_t$: Variable that reflects the difference between estimated and actual unemployment rate.

VAR

Multivariate time series analysis using matrix algebra. A VAR model is used to estimate unemployment rate using time series. An example of order 1 VAR model:

$$\begin{bmatrix} x_t \\ y_t \\ z_t \end{bmatrix} = \begin{bmatrix} \mu_x \\ \mu_y \\ \mu_z \end{bmatrix} + \begin{bmatrix} \varphi_{11} & \varphi_{12} & \varphi_{13} \\ \varphi_{21} & \varphi_{22} & \varphi_{23} \\ \varphi_{31} & \varphi_{32} & \varphi_{33} \end{bmatrix} \cdot \begin{bmatrix} x_{t-1} \\ y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \end{bmatrix} \tag{4}$$

With equation (4), we may estimated x_t using the following method: $x_t = \mu_x + \varphi_{11} \cdot x_{t-1} + \varphi_{12} \cdot y_{y-1} + \varphi_{13} \cdot z_{t-1} + \varepsilon_{1t}$
A general m-variable VAR(p) can be expressed as:

$$\Gamma_t = \mu + \sum_{i=1}^{p} A_i \cdot \Gamma_{t-i} + \varepsilon_t \tag{5}$$

$$\Gamma_t = \begin{bmatrix} x_{1t} \\ x_{2t} \\ \cdot \\ x_{mt} \end{bmatrix}, \mu = \begin{bmatrix} \mu_1 \\ \mu_2 \\ \cdot \\ \mu_m \end{bmatrix}, \varepsilon_t = \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \cdot \\ \varepsilon_{mt} \end{bmatrix}, A_i = \mathbb{R}^{m \times p}$$

Data

The variables are collected and organized in the following ways.

Variable	Source	Operation	Denotation
Unemployment Rate	Department of Labor	Difference	ΔUR_t
Industrial Production Index	Federal Reserve	Log Difference	$g_t^{indprod}$
3-Month Treasury Bill	Federal Reserve	Difference	ΔTB_t
Default Yield Difference	Federal Reserve	Difference	ΔYS_t
CPI (Inflation Rate)	Federal Reserve	Log Difference	g_t^{inf}
S&P500 Indices	Global Financial Data	introduce later	$Return_t$
Chicago Fed National Activity Index	Federal Reserve	introduce later	D_t^{CFNAI}
Business Confidence Index	Federal Reserve	Difference	ΔBCI_t
Consumer Confidence Index	Federal Reserve	Difference	ΔCCI_t
College-Level Unemployment	Department of Labor	Difference	ΔEC_t

The time series are monthly data from 02/1992 to 12/2012.

Data

Obtaining Return and CFNAI Indicator

Two of the variables in the previous page are manipulated in other ways rather than differencing (de-trending) or taking log differences.

- CFNAI: CFNAI index is a monthly data that reflects the economic condition. In this research, CFNAI is used as an indicator to reflect the economic condition, so the numerical value of CFNAI is not essential. The variable D_t^{CFNAI} is introduced, taking value 1 if CFNAI index at time t is greater than 0, taking -1 if CFNAI index is smaller than 0, and taking 0 otherwise.
- Return: This research focuses on the stock market response to unemployment news, so not all index values matter. The $Return_t$ variable in this research only takes the S&P 500 index values on the announcement days of unemployment rates. The announcement days are the third Friday of the reference week, i.e. the week containing the 12th day of the month.

Data

Statistical Summary

Variable	Min	Median	Mean	Max
ΔUR_t	-0.5	0.0	0.00239	0.5
$g_t^{indprod}$	-4.4296	0.2635	0.1856	2.0349
ΔTB_t	-0.86	0.00	-0.01486	0.46000
ΔYS_t	-0.63	-0.01	0.0001992	0.94
g_t^{inf}	-0.017864	0.002091	0.002048	0.013675
$Return_t$	243.5	1497.7	1325.5	2551.0
D_t^{CFNAI}	-1	-1	-0.06333	1
ΔBCI_t	-0.368300	0.007100	0.008176	0.389800
ΔCCI_t	-0.488610	0.016300	-0.005424	0.298400
ΔEC_t	-0.7	0.0	0.005179	0.8

Results

This section will be divided into the following parts:

- Unemployment Rate Forecasting Model
- Obtaining Unemployment News
- Primary Analysis on Stock Market Response to Unemployment News
- Results and Literature
- Adding Variables and Final Regression

Results

Unemployment Rate Forecasting Model - VAR Model

Estimate unemployment rate using the VAR(2) model. The order selection is based on Schwartz Criterion[1]. Variable selection is based on test of Granger Causality[2].

$$\begin{bmatrix} \Delta UR_t \\ g_t^{indprod} \\ \Delta TB_t \\ \Delta YS_t \end{bmatrix} = \begin{bmatrix} \mu_{UR} \\ \mu_{IP} \\ \mu_{TB} \\ \mu_{YS} \end{bmatrix} + A \cdot \begin{bmatrix} \Delta UR_{t-1} \\ g_{t-1}^{indprod} \\ \Delta TB_{t-1} \\ \Delta YS_{t-1} \end{bmatrix} + B \cdot \begin{bmatrix} \Delta UR_{t-2} \\ g_{t-2}^{indprod} \\ \Delta TB_{t-2} \\ \Delta YS_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad (6)$$

Note: $A = \mathbb{R}^{4\times4}, B = \mathbb{R}^{4\times4}$

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[1] The criterion provides a specific approximation of Minimum Squared Error, MSE; the optimal order is the one that minimizes the MSE

[2] Test of Granger Causality

$y_t = \mu + \alpha_1 y_{t-1} + \cdots + \alpha_p y_{t-p} + \beta_1 \zeta_{t-1} + \cdots + \beta_p \zeta_{t-p} + \varepsilon_t$

$H_0 : \beta_1 = \cdots = \beta_p = 0$

Results

Unemployment Rate Forecasting Model - VAR Coefficients

Here only coefficients relevant to the forecasting of unemployment rate are presented.

$$\Delta UR_t = \mu + \alpha_{11}\Delta UR_{t-1} + \alpha_{12} g_{t-1}^{indprod} + \alpha_{13}\Delta TB_{t-1} + \alpha_{14}\Delta YS_{t-1} + \beta 11 UR_{t-2} + \beta 12 g_{t-2}^{indprod} + \beta_{13}\Delta TB_{t-2} + \beta_{14}\Delta YS_{t-2} + \varepsilon_{1t}$$

μ	α_{11}	α_{12}	α_{13}	α_{14}	β_{11}	β_{12}	β_{13}	β_{14}
0.028841	-0.077570	**-0.081668**	0.026684	**0.165839**	**0.104347**	**-0.039602**	-0.023327	0.030570
(0.007752)	(0.047290)	(0.011492)	(0.016538)	(0.061270)	(0.046436)	(0.011569)	(0.016428)	(0.061824)

Table 1 Relevant Coefficients[1] [2]

Then estimate the unemployment rate using these estimated coefficients that are statistically significant.

Here ΔTB_t does not seem to play a role in forecasting unemployment rate. Run Granger causality of ΔTB_t on ΔUR_t , then the p-value returned at order 2 is 0.09955, accepting the null (no granger causality) under 95% confidence interval but rejecting the null under 90% confidence interval. The reverse test, however, provides sound ground of granger causality of ΔUR_t on ΔTB_t. So the decision of removing this variable is subject to further discussion.

[1] Coefficients in bold are those who are statistically significant, i.e. p-value smaller than 0.05 in the hypothesis testing $H_0 : \varphi = 0$

[2] Standard Errors are in parenthesis

Results

Unemployment Rate Forecasting Model - Figure 1

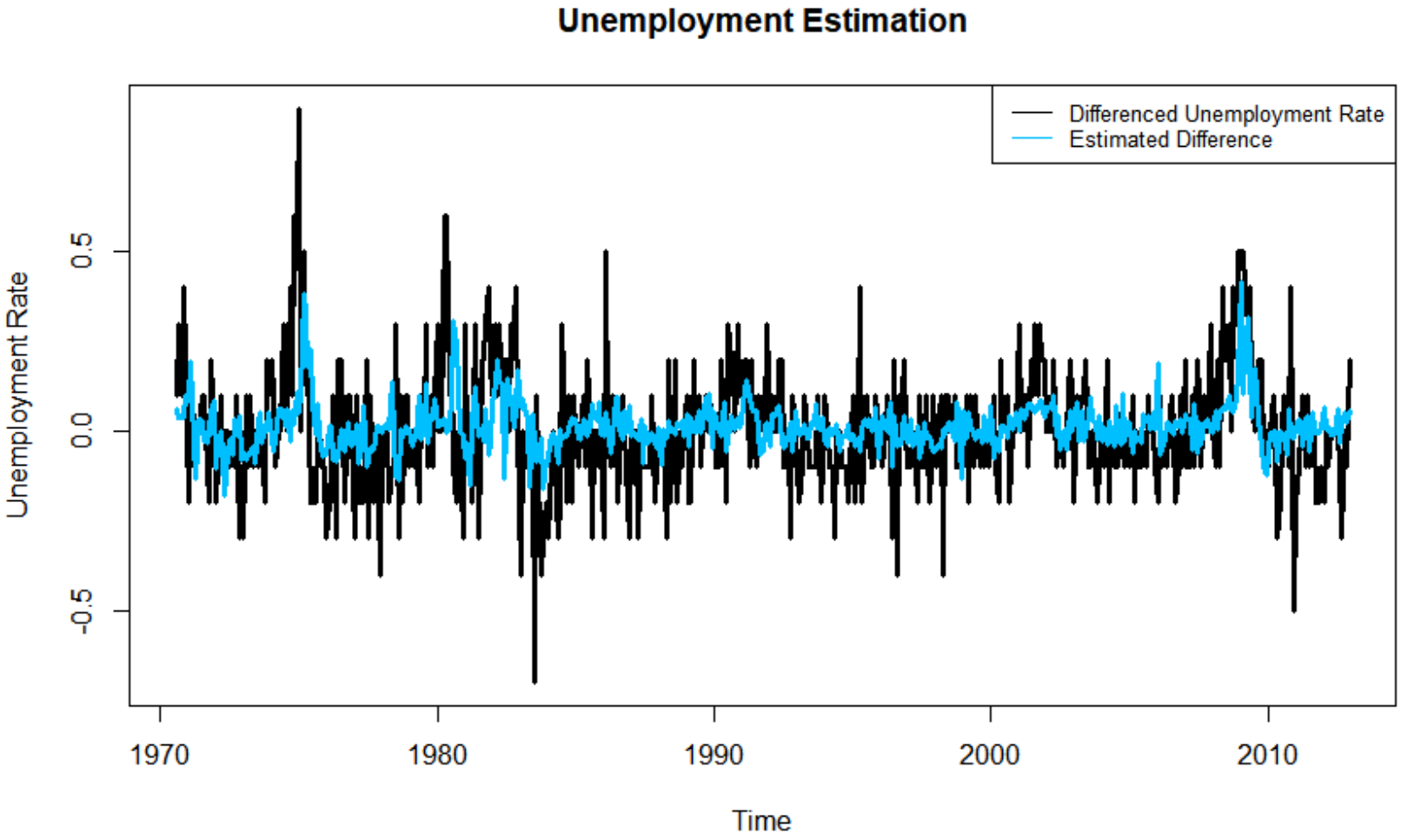

Figure: Actual and Estimated Unemployment Rate

Results

Obtaining Unemployment News - Equation

Unemployment News is defined as the difference between the actual and estimated unemployment rate.

$$News_t = UR_t^{actual} - UR_t^{estimated} = UR_t^{actual} - UR_{t-1} - UR_t^{estimated} + UR_{t-1}$$

$$= \Delta UR_t^{actual} - \Delta UR_t^{estimated}$$

Results

Obtaining Unemployment News - Figure 2

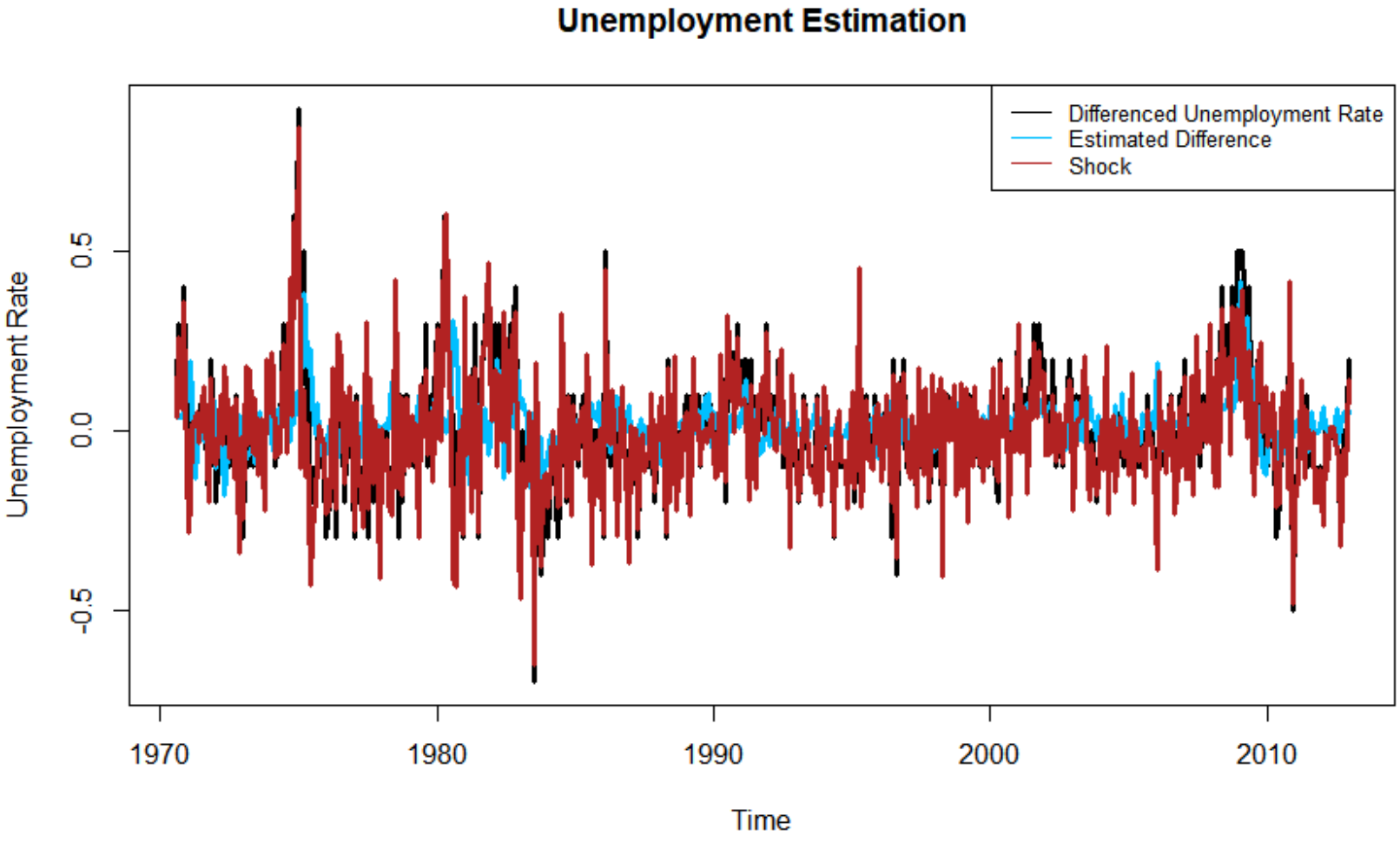

Figure: Obtaining Unemployment News

Results

Primary Analysis on Stock Market Response to Unemployment News

Recall primary regression (Equation 3):

$$D_t^{CFNAI} \cdot Return_t = \xi_1 + \xi_2 \cdot News_t + e_t$$

The following coefficients are obtained:

Variable	Coefficient
Intercept	-194.28^{*}[3]
(Standard Error)	(81.98)
$News_t$	-2848.43^{***}[4]
(Standard Error)	(559.55)

The independent variable is the unemployment news; the dependent variable is the stock return on the announcement day subject to the condition of economy of that month. Both coefficients are statistically significant at 95% confidence interval. A negative correlation is obtained between the product and News.

[3] Significant at 95% CI

[4] Significant at 99.9% CI

Results

Primary Analysis on Stock Market Response to Unemployment News - Understanding the Primary Regression

$$D_t^{CFNAI} \cdot Return_t = \xi_1 + \xi_2 \cdot News_t + e_t, \hat{\xi}_2 < 0$$

- Independent variable: it is obtained by subtracting the estimated unemployment rate from the actual rate. A positive News variable means that the actual rate is higher than the estimated rate; whereas a negative News variable means that the actual rate is lower than the estimated rate
- Dependent variable: it is a product variable. It could be interpreted as the stock index that qualitatively reflects the condition of economy, i.e. expansion, recession, or stagnation.
- Unemployment news could trigger stock market response, dependent on the condition of economy. An unemployment news higher than expected is likely to take place under recessions; news lower than expected is likely to take place under expansions
- More extreme News variable is associated with higher Return variable (if we take absolute value on both sides).

Results

Results and Literature

Here it is necessary to compare what has obtained here with existing papers.

- Boyd, Hu, and Jagannathan: stock market responds positively to news of rising unemployment in expansions; it responds negatively in recessions.
- The stock market responds positively to out-of-expectation unemployment news. Higher than expected unemployment rate is likely to lead to positive stock response under recession; lower than expected unemployment rate is likely to lead to positive stock response under expansion.
- Boyd, Hu, and Jagannathan's paper: used recession index constructed by Stock and Watson (1989) as a binary indicator of the condition of economy. This is an estimated economic condition, since the variable estimates the probability that the economy is in recession. It does not reflect the true condition at the time t.

Results

Results and Literature- 2

- Boyd, Hu, and Jagannathan's paper: used linear regression in unemployment forecasting. In the context of time series, it is inefficient unless the researcher(s) want to control the lags of variables used in the forecasting process.
- Hall, Cummins, and Lamont's paper: e-capital (employment of college-level workers) leads to high valuation of the stock market. Are changes of college-level unemployment associated with the stock market index under different condition of economy?

Results

Results and Literature - 3

- The product of CFNAI index (not the indicator variable) and the stock market index does not seem to have a robust relationship with dummy variables of GDP growth or Inflation. So the product is not equivalent with GDP growth or Inflation. This new product could be said to have gauged the level economic conditions.

$$CFNAI_t \cdot Return_t = \xi_1 + \xi_2 \cdot News_t + \xi_3 \cdot D_t^{Inflation} + e_t$$

$$CFNAI_t \cdot Return_t = \xi_1 + \xi_2 \cdot News_t + \xi_3 \cdot D_t^{dgdp} + e_t$$

- There is no robust relation between the Return variable and the News variable directly. The coefficient ξ_1 of the following regression is statistically insignificant.

$$Return_t = \xi_1 + \xi_2 \cdot News_t$$

Results

Adding Variable and Final Regression

$$D_t^{CFNAI} \cdot Return_t = \beta_0 + \beta_1 \cdot News_t + \cdots$$

	(a)	(b)	(c)	(d)	(e)
Intercept	-219.18^{*} (97.35)	-208.95^{*} (97.48)	313.3 (254.0)	125.2 (545.2)	-227.30^{*} (95.94)
$News_t$	-3250.32^{***} (659.12)	-2707.00^{***} (770.29)	-3216.5^{***} (665.6)	-3228.3^{***} (660.8)	-2923.44^{***} (656.28)
ΔEC_t		-677.87 (499.63)			
$D_t^{Inflation}$			110.9 (276.3)		
D_t^{dgdp}				-355.4 (553.6)	
ΔBCI_t					1928.07^{**} (686.14)
ΔCCI_t					663.59 (749.66)

Results

Adding Variable and Final Regression - Comparing two Different Products

$$CFNAI_t \cdot Return_t = \beta_0 + \beta_1 \cdot News_t + \cdots$$

	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	-325.3^{***}	-306.87^{***}	-629.5^{**}	86.72	-332.46^{***}	-316.37^{***}
	(80.3)	(79.27)	(208.5)	(449.28)	(77.31)	(76.63)
$News_t$	-3691.8^{***}	-2712.37^{***}	-3582.4^{***}	-3665.45^{***}	-3319.45^{***}	-2503.44^{***}
	(543.6)	(626.38)	(546.4)	(544.53)	(528.89)	(606.54)
ΔEC_t		-1221.92^{**}				-1043.16^{**}
		(406.29)				(393.66)
$D_t^{Inflation}$			358.3			
			(226.9)			
D_t^{dgdp}				-425.27		
				(456.24)		
ΔBCI_t					2133.28^{**}	2019.21^{***}
					(552.95)	(548.02)
ΔCCI_t					$1048.86^{\cdot}$	$987.16^{\cdot}$
					(604.14)	(597.36)

Interpretation

- The stock market responds positively to out-of-expectation unemployment news. Higher than expected unemployment rate is likely to lead to positive stock response under recession; lower than expected unemployment rate is likely to lead to positive stock response under expansion.
- The condition of economy is essential and indispensable in the association above.
- The product $D_t^{CFNAI} \cdot Return_t$ describes the stock market index dependent on the condition of economy, and this product is our primary focus. The other product, $CFNAI_t \cdot Return_t$, describes the stock market as well as gauging both the condition of the economy and the level of strength of the economy. The e-capital, i.e. employment of college-level workers, has a robust relation with the latter but not the former.