Sectoral Labor Reallocation and Return Predictability

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Sectoral labor reallocation shocks

- Change in optimal allocation of workers across industries
- Sectoral labor reallocation shocks are:
  - **Structural** (e.g., Blanchard and Diamond, 1990)
  - **Related to aggregate economic outcomes**, such as unemployment (e.g., Lilien, 1982; Loungani et al., 1990; Şahin et al., 2014; Kalay et al., 2018)
- Well-known proxy: the cross-sectional volatility of industry-specific stock returns (CSV)
  - e.g., Loungani et al., 1990; Brainard and Cutler, 1993

This paper: sectoral labor reallocation shocks affect return predictability

- CSV is a suitable proxy and can be linked to labor market variables
- **CSV is a strong and robust predictor of future excess market returns**
  - Impressive out-of-sample performance: OOS R^2 is 12.56% p.a.
  - Outperforms 12 well-known alternative predictors
  - CSV leads to large profits when used in trading strategies

Economic channel

- Adjusting the firm's workforce is costly (e.g., Danthine and Donaldson, 2002)
- **Sectoral shifts give rise to higher labor adjustment costs** (Weiss, 1986)
  - This **dampens firms' exposures** to aggregate priced productivity risk
  - Leading to a **lower risk premium**
- We formalize the intuition in a production-based model

Related literature

- **Labor market frictions and asset pricing**
  - Labor adjustment costs (e.g., Chen and Zhang, 2011; Belo et al., 2014), search costs (e.g., Kuehn et al., 2017), wage rigidity (Favilukis and Lin, 2016)
- **Time series return predictability**
  - e.g. Campbell and Shiller, 1988; Lettau and Ludvisgon, 2001; Welch and Goyal, 2008; Rapach et al., 2016; ...
- **Papers using other CSV-type measures**
  - CSV based on individual stock returns or size-BM portfolios (e.g., Goyal and Santa Clara, 2003; Stivers and Sun, 2010; Garcia et al., 2014; Maio, 2015)
  - Dispersion measures as proxies for resource misallocation (e.g., David et al., 2019)
- **Resource misallocation**
  - e.g., Ramey and Shapiro, 2001; Eisfelt and Rampini, 2006; Hsieh and Klenow, 2009; Eberly and Wang, 2009; ...

Measuring sectoral labor reallocation shocks: CSV

- First estimate industry-specific returns w.r.t. the CAPM:

$$r_{i,s} = \alpha_i + \beta_i r_{M,s} + \varepsilon_{i,s}, \quad s = t-35, \dots, t$$
$$\eta_{i,s} = \hat{\alpha}_i + \hat{\varepsilon}_{i,s}$$

- Our primary CSV measure is based on:

$$CSV_t = \left[\frac{1}{48} \sum_{i=1}^{49} \left(\eta_{i,t-11:t} - \bar{\eta}_{t-11:t} \right)^2 \right]^{\frac{1}{2}}$$

Verify that CSV proxies for sectoral shifts

- Step 1: **Industry-specific returns help predict industry-level employment changes**

	Loser	2	3	4	Winner	WML
ΔEmpl.(%)	-0.66	-0.02	0.36	0.50	0.86**	1.52***
t-ratio	(-1.26)	(-0.04)	(0.90)	(1.45)	(2.50)	(4.15)

- During months with high CSV (top 10%) winners no longer hire, signalling **higher adjustment costs when CSV is high**:

	Loser	2	3	4	Winner	WML
ΔEmpl.(%)	-1.95*	-1.68	-1.25	-0.79	0.47	2.43**
t-ratio	(-1.69)	(-1.61)	(-1.04)	(-0.74)	(0.47)	(2.45)

Verify that CSV proxies for sectoral shifts (ctd)

- Step 2: **CSV leads to higher future aggregate employment growth**
  - Based on the regression $\Delta un_{t:t+k} = b_0 + b_1 CSV_t + \varepsilon_{t:t+k}$

Horizon	CSV	t-ratio	R^2_{InS}
$k = 1$	0.08^{**}	(2.59)	0.89%
$k = 3$	0.23^{**}	(2.29)	1.75%
$k = 12$	0.83^{*}	(1.80)	3.11%
$k = 24$	1.42^{**}	(2.20)	4.50%
$k = 36$	1.40^{*}	(1.80)	3.25%

- Step 3: Other CSV measures (using individual stock returns, size-BM portfolios, total returns) do not predict Δun and have no or weaker predictive power for market excess returns

Verify that CSV proxies for sectoral shifts (ctd)

- Step 4: **CSV strongly predicts mismatch unemployment growth**
  - Based on the regression $\Delta un_{M,t:t+k} = b_0 + b_1 CSV_t + \varepsilon_{t:t+k}$
  - Δun_M from Şahin et al. (2014): imputed aggregate unemployment due to job seeker misallocation across sectors

Horizon	CSV	t-ratio	R^2_{InS}
$k = 1$	0.57^{***}	(3.19)	12.25%
$k = 3$	1.23^{**}	(2.46)	12.61%
$k = 12$	4.09^{***}	(4.74)	29.76%
$k = 24$	4.72^{***}	(3.56)	18.48%
$k = 36$	4.20^{*}	(1.94)	10.00%

Predicting future excess market returns

- We predict $k-$month ahead excess market returns

$$r_{t:t+k} = \alpha + \beta CSV_t + \varepsilon_{t:t+k}$$

- **CSV is a strong predictor of future excess market returns**

	$\hat{\beta}$	t_{Hodr}	t_{NW}	R^2_{InS}	R^2_{OOS}
$k=1$	-0.09**	(-2.30)	(-2.33)	0.78%	0.46%
$k=3$	-0.36***	(-3.06)	(-3.93)	4.07%	3.40%
$k=12$	-1.31***	(-3.08)	(-4.43)	12.52%	12.56%
$k=24$	-2.14***	(-3.00)	(-4.44)	17.92%	16.83%
$k=36$	-2.35**	(-2.55)	(-3.68)	15.90%	13.14%

- A CSV-based trading strategy leads to **economically sizeable profits**: an additional 4.32% risk free annual return compared to a naive historical mean-based strategy

Compare to well-known alternative predictive variables

- CSV outperforms all 12 alternative predictive variables
- Below results for $k = 12$, similar for other horizons

	$\hat{\beta}$	t_{Hodr}	t_{NW}	R^2_{InS}	R^2_{OOS}
CSV	**-1.31*****	**(-3.08)**	**(-4.43)**	**12.52%**	**12.56%**
logDP	0.092*	(1.85)	(2.16)	4.80%	-11.74%
RF	-0.27**	(-2.31)	(-2.08)	1.12%	-1.45%
logPE	-0.07	(-1.39)	(-1.67)	2.82%	-12.59%
logNPY	0.18*	(1.68)	(2.20)	5.03%	-17.95%
DEF	0.04	(0.98)	(1.19)	1.11%	-3.51%
TERM	0.03**	(2.20)	(2.65)	5.80%	1.26%
INFL	-0.11**	(-2.11)	(-2.62)	4.44%	-0.13%
CAY	0.02*	(1.85)	(2.02)	4.32%	-0.80%
PYRL	-14.05***	(-2.84)	(-3.10)	4.89%	0.79%
NetHR	-6.01	(-1.24)	(-1.62)	1.66%	-7.36%
NetJC	-3.42***	(-2.66)	(-2.43)	6.85%	0.29%
SII	-0.04*	(-1.68)	(-1.90)	5.91%	5.65%

A production-based asset pricing model: key ingredients

- N industries
- Two types of productivity shocks:
  - Aggregate x_t
  - Industry-specific $z_{i,t} = S_t \times \tilde{z}_{i,t}$
    - S_t: sectoral reallocation shock
    - $\tilde{z}_{i,t} \sim \mathcal{N}(0,1)$
- Operating profits: $Y_{i,t} = e^{(x_t + z_{i,t})} N_{i,t}^{\alpha}$
- Workforce $N_{i,t}$ follows law of motion $N_{i,t+1} = (1-\delta)N_{i,t} + H_{i,t}$, where $H_{i,t}$ is the net number of hires
- Wage rate: $W_{i,t} = e^{\tau x_t}$

Incorporating sectoral shifts into the model

- Total labor adjustment costs are

$$C_{i,t} = \frac{c_{i,t}}{2} \left(\frac{H_{i,t}}{N_{i,t}} \right)^2 N_{i,t}$$

- **Key innovation:** the *per-unit* adjustment costs are asymmetric and time-varying

$$c_{i,t} = \kappa S_t \times \Phi(\tilde{z}_{i,t})$$

where $\Phi(.)$ is the standard normal CDF function

Asset prices

- In the model only aggregate productivity risk is priced

$$\log M_{t+1} = \log\beta + \gamma_t(x_t - x_{t+1}),$$

- The price of risk varies countercyclically

$$\gamma_t = \gamma_0 + \gamma_1(x_t - \bar{x})$$

Firm's maximization problem

- Firm dividend

$$D_{i,t} = Y_t - W_{i,t}N_{i,t} - \frac{c_{i,t}}{2}\left(\frac{H_{i,t}}{N_{i,t}}\right)^2 N_{i,t}$$

- Each period t, firms choose how many workers they hire such that

$$\max_{H_{i,t+j},N_{i,t+j+1}} E_t\left[\sum_{j=0}^{\infty} M_{t+j}D_{i,t+j}\right]$$

subject to $N_{i,t+1} = (1-\delta)N_{i,t} + H_{i,t}$

Simulation results

- **Predictive power of CSV confirmed by the model**

Excess market return predictability					
	$k=1$	$k=3$	$k=12$	$k=24$	$k=36$
$\hat{\beta}$	-0.028	-0.079	-0.272	-0.39	-0.498
t-ratio$_{NW}$	(-1.47)	$(-1.82)^{*}$	$(-2.37)^{**}$	$(-2.62)^{***}$	$(-2.58)^{***}$
R^2_{IS}	0.46%	1.18%	4.14%	6.03%	7.06%

Economic channel: impact S_t on risk exposures

- **The equity market return exposure to aggregate productivity risk is decreasing in S_t**

Equity mkt exposure to aggr. productivity risk $-cov(r_{t:t+k}, M_{t:t+k})/\sigma_M$						
	Low S_t	2	3	4	High S_t	High–Low
$k = 1$	0.001	-0.000	0.001	-0.000	-0.001	-0.002
$k = 3$	0.037	0.036	0.038	0.036	0.034	-0.003
$k = 12$	0.096	0.099	0.091	0.098	0.074	-0.023
$k = 24$	0.128	0.127	0.123	0.130	0.093	-0.035
$k = 36$	0.145	0.158	0.152	0.132	0.107	-0.038

Additional testable implications of the model

- Since adjustment costs are increasing in $z_{i,t}$
  - CSV should have **predictive power for industry returns** as well
  - This should be stronger for top performing industries
  - The predictive power should be stronger for value-weighted than for equal-weighted equity market portfolio

- The predictability channel should only work if labor adjustment costs are present to begin with: proxied by **industries that rely on high skill labor**

- These implications are **confirmed by the data**

Ruling out three alternative explanations

- Capital adjustment costs
- Investor over- or underreaction
- Slow information diffusion across industries

Conclusion

- CSV is a strong and robust predictor future stock returns
- CSV proxies for sectoral labor reallocation shocks
- Economic mechanism relies on time-varying labor adjustment costs and aggregate risk exposures