Where Does the Predictability from Sorting on Returns of Economically Linked Firms Come From?

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Background & Motivation

- Dozens of papers have interpreted cross-firm return predictability among economically linked firms as a measure of delayed information diffusion.

- Such delayed diffusion can be observed by sorting lagging firms into portfolios based on their economically linked leader firms' returns.

- The literature has found such alphas at the 1-month horizon of 1.5% per month, some of which persist up to 1 year. The interpretation has been that markets are very inefficient.

- We show that sorting laggard firms into portfolios based on their linked leading firms' average returns over the last 10 years produces long-short portfolios with large statistically significant 3-factor alphas as large as 76 basis points per month.
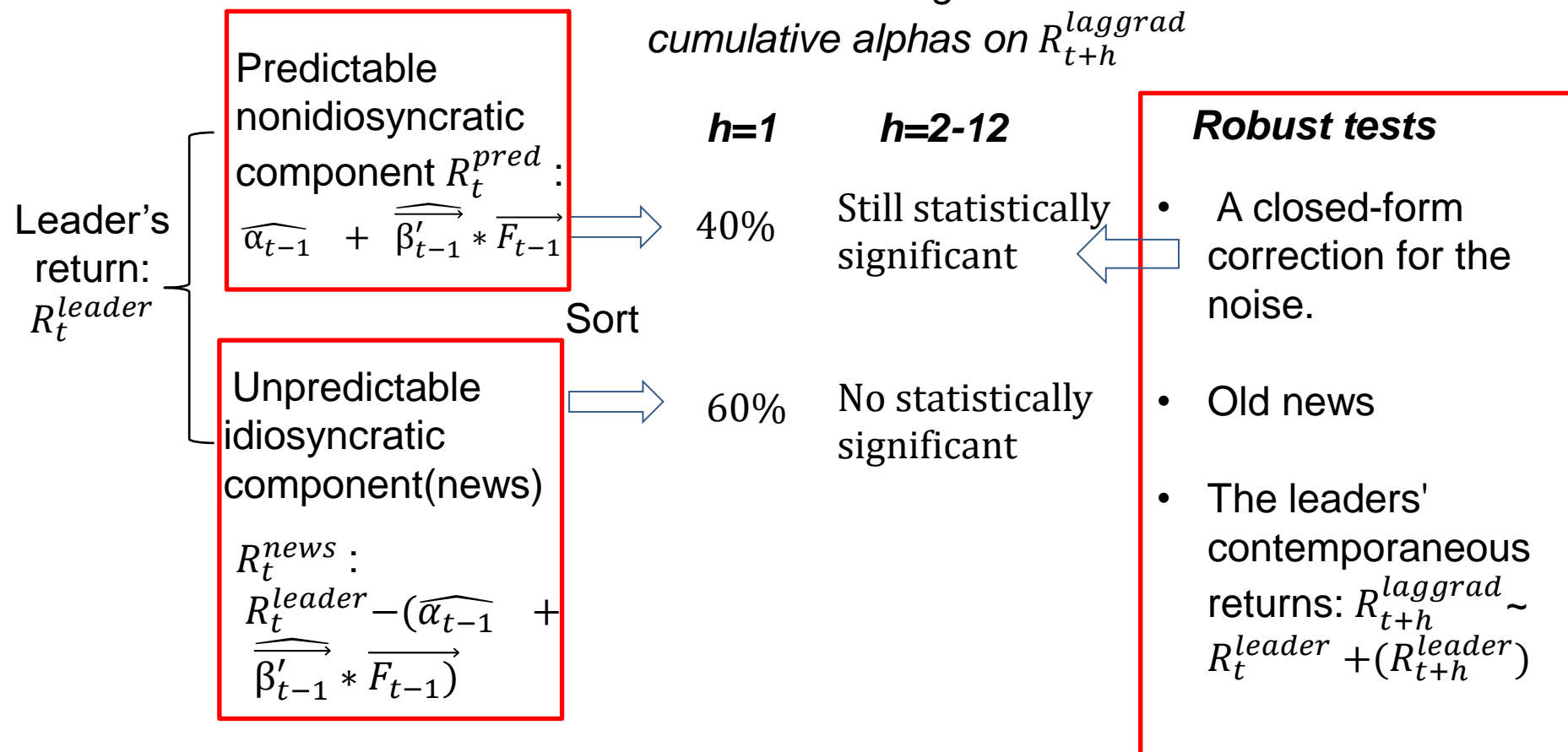
Research question

Where Does the Predictability from Sorting on Returns of Economically Linked Firms Come From?

- We argue that this 10-year cross-firm predictability is more likely due to common seasonal variation in the expected returns (rational or behavioral) among these economically linked firms.

- While the horizon is in 1 month-12 month, at these long, but more moderate, horizons, both slow information diffusion and commonality in momentum plausibly contribute to cross-firm predictability.

Research design

Leader's return:
R_t^{leader}

Predictable nonidiosyncratic component R_t^{pred} :
$$\widehat{\alpha_{t-1}} \quad + \quad \widehat{\overrightarrow{\beta'_{t-1}}} * \overrightarrow{F_{t-1}}$$

Unpredictable idiosyncratic component(news)
R_t^{news} :
$$R_t^{leader} - (\widehat{\alpha_{t-1}} \quad + \quad \widehat{\overrightarrow{\beta'_{t-1}}} * \overrightarrow{F_{t-1}})$$

Sort

Three-factor long-short cumulative alphas on $R_{t+h}^{laggrad}$

h=1   **h=2-12**

40%   Still statistically significant

60%   No statistically significant

Robust tests

- A closed-form correction for the noise.

- Old news

- The leaders' contemporaneous returns: $R_{t+h}^{laggrad} \sim R_t^{leader} + (R_{t+h}^{leader})$

Research Data: Sample

We show the empirical magnitude of these two components of cross-firm predictability by analyzing three sets of economically linked firms:

- Customers predicting suppliers (Cohen and Frazzini, 2008)

- Standalone pure players predicting conglomerates (Cohen and Lou,2012)

- Strategic alliance-linked firms predicting another firm in the alliance (Cao,Chordia, and Lin, 2016).

We choose these settings both because of their influence on the literature and because they represent varied types and strengths of economic links.

Empirical result: Common seasonalities produce long-horizon cross-firm predictability

- To see this persistent seasonality, for each leader firm at time t, which is month m in year y, we measure the average return in the same month m for years y − 10 to y − 1.
- We regress the long-short portfolio returns on the Fama and French (1993) 3-factors to produce a monthly alpha for each setting.

	Equal-weighted	Value-weighted
	Panel A: Customer-Suppliers	
Leader	1.083	0.715
	(3.90)	(1.89)
Laggard	0.261	0.763
	(1.14)	(2.04)

Monthly 3-factor alphas

Given the extreme time horizon, the cross-firm predictability represented by these alphas is unlikely to be generated by slow information diffusion between the leaders and laggards, as is traditionally understood.

Empirical result: Commonality exists in own-firm momentum

- Commonality in own-firm momentum contributes to the cross-firm predictability at the 1 to 12-month horizon documented in the previous literature.
- This commonality in momentum (predictable return component) can be seen by sorting leader firms in the same way that we sort laggard firms: using leaders' own returns h months prior(h=1~12).

①we find evidence for slow information diffusion at the 1-month horizon, but not at longer horizons.

②the short-term reversal effect

	Equal-weighted	Value-weighted
	Panel A: Customer-Suppliers	
Leader $t+1$	-0.500	-0.032
	(-2.25)	(-0.13)
Laggard $t+1$	1.186	1.606
	(4.84)	(4.02)
Leader $t+2:t+12$	5.159	4.903
	(7.63)	(6.12)
Laggard $t+2:t+12$	2.717	3.520
	(3.42)	(2.71)

Empirical result: Commonality exists in own-firm momentum

- The blue lines show that the similar, albeit smaller, trend in the predictability of laggards occurs relatively evenly over the 2- to 12-month window.

- Taken as a whole, the similarity in trend and magnitude suggests that the alphas may simply be a mechanical result arising from the commonality.

- Thus, positive alphas generated from lead-lag sorts of economically linked firms may not necessarily be due to cross-firm information diffusing directly from leaders to laggards.

Panel A: Customer-Supplier Links

Equal Weights

Value Weights
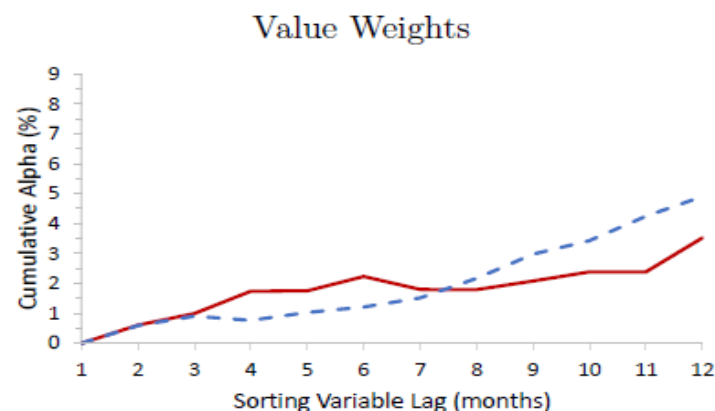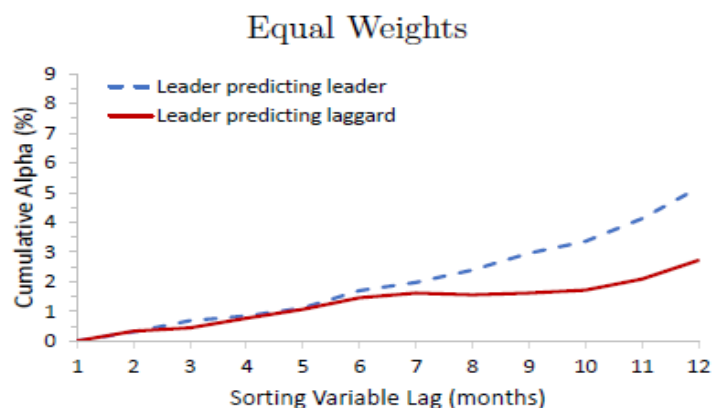
Empirical result: Sort on News to Measure Information Diffusion

- Cross-firm predictability arises from commonality in momentum and direct cross-firm information diffusion.
- Given that the latter is nonpredictable, this component of leaders' return is, by definition, news: $\left(R_t - (\widehat{\alpha_{t-1}} \ + \ \widehat{\overrightarrow{\beta'_{t-1}}} * \overrightarrow{F_t}) \right)$, in which 3-factor model augmented with momentum and liquidity.

The extracted news contains three pieces:

1. the true idiosyncratic shock;

2. the innovations in the model parameters between the estimation window and date t;

3. the negative average of the idiosyncratic returns over the estimation window, "old news" , which could bias the measure of slow information diffusion downward.

Empirical result: One-month predictability is split across the two components

- The Column(2) shows that the common momentum substantially contributes to the previously documented cross-firm predictability.

- The Column(5) capture new information diffusing directly from leaders to laggards. These long-short alphas average only 60% of those of the total cross-firm predictability, revealing less delay in cross-firm information diffusion than previously documented.

Sort on leaders' $\longrightarrow$	Equal-weighted				
	(1)	(2)	(3)	(4)	(5)
	Return	Alpha+ $\vec{\beta}'\vec{f}_{t-1}$	Alpha	$\vec{\beta}'\vec{f}_{t-1}$	Idiosyncratic Return
					Panel A: Custc
Laggard $t+1$	1.186	0.468	0.668	0.214	0.719
	(4.84)	(2.05)	(3.87)	(0.91)	(2.46)
Laggard $t+2:t+12$	2.717	3.150	4.173	1.057	0.125
	(3.42)	(3.94)	(6.03)	(1.33)	(0.13)

# Empirical result: Long-horizon predictability due to the nonidiosyncratic component

- To compute these cumulative alphas, at each date t+h−1 (returns at t+h), the laggards are sorted into portfolios based on the respective component of the leaders' returns at time t.

- The predictability from sorting on the leader's idiosyncratic component is neither economically nor statistically significant in all cases.

Sort on leaders' ⟶	Equal-weighted				
	(1)	(2)	(3)	(4)	(5)
	Return	Alpha+ $\vec{\beta}'\vec{f}_{t-1}$	Alpha	$\vec{\beta}'\vec{f}_{t-1}$	Idiosyncratic Return
					Panel A: Custo
Laggard $t+1$	1.186 (4.84)	0.468 (2.05)	0.668 (3.87)	0.214 (0.91)	0.719 (2.46)
Laggard $t+2 : t+12$	2.717 (3.42)	3.150 (3.94)	4.173 (6.03)	1.057 (1.33)	0.125 (0.13)

Empirical result: Long-horizon predictability due to the nonidiosyncratic component

- The results show that the previously documented long-horizon cross-firm predictability does not appear to be from slow information diffusion across firms.
- Instead, cross-firm information diffusion between economically linked firms appears to complete within 1 month, suggesting that the market is more efficient than previously documented.

Panel A: Customer-Supplier Links
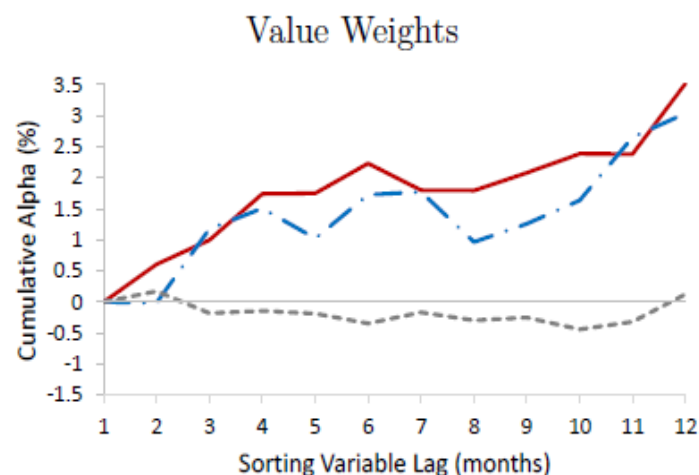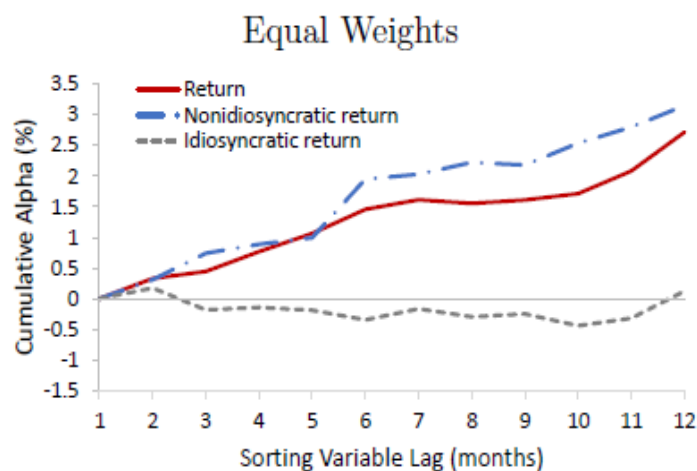
Empirical result: Results Not Driven by Removing Old News

What is old news?
- One can think of these idiosyncratic shocks during the estimation window as "old news".
- The predictable component is made up of alpha and betas times factor realizations. The alpha contains the true alpha plus the average old news (idiosyncratic shocks) over the estimation window.

Then, two concerns arise here:
- First, the old news contained in the predictable component could generate the long-short alpha obtained by sorting on the predictable component.

- Second, removing the old news from the idiosyncratic component could induce a negative bias in the alpha found when sorting on the idiosyncratic component.

Empirical result: Beta predictability contributes to cross-firm predictability

- We separate the predictable piece even further into the alpha and the betas times factors component of the leaders' returns to address the first concern.

- Given that the betas times factors component, which is unrelated to old news, contributes to the cross-firm predictability, slow information diffusion is not the only source of cross-firm predictability previously documented.

			Equal-weighted		
	(1)	(2)	(3)	(4)	(5)
Sort on leaders' ⟶	Return	Alpha+ $\vec{\beta}' \vec{f}_{t-1}$	Alpha	$\vec{\beta}' \vec{f}_{t-1}$	Idiosyncratic Return
					Panel A: Custo
Laggard $t+1$	1.189	0.617	0.326	0.597	0.753
	(5.77)	(2.99)	(1.41)	(2.75)	(2.87)
Laggard $t+2:t+12$	3.119	2.190	3.449	1.560	0.458
	(4.23)	(3.14)	(5.14)	(2.27)	(0.50)

Empirical result: Idiosyncratic return sorts have no predictive ability

- To address the second concern, we test whether the leaders' idiosyncratic returns at long horizons predict the laggards' returns.
- Because the average predictability of the old news will always be smaller than the predictability from the news in the current period, regardless of the prediction horizon.
- We do not find any predictability in the idiosyncratic component at horizons beyond 1 month.

Sort on leaders' ⟶	(5) Idiosyncratic Return
	Panel A: Custc
Laggard $t+1$	0.719 (2.46)
Laggard $t+2 : t+12$	0.125 (0.13)
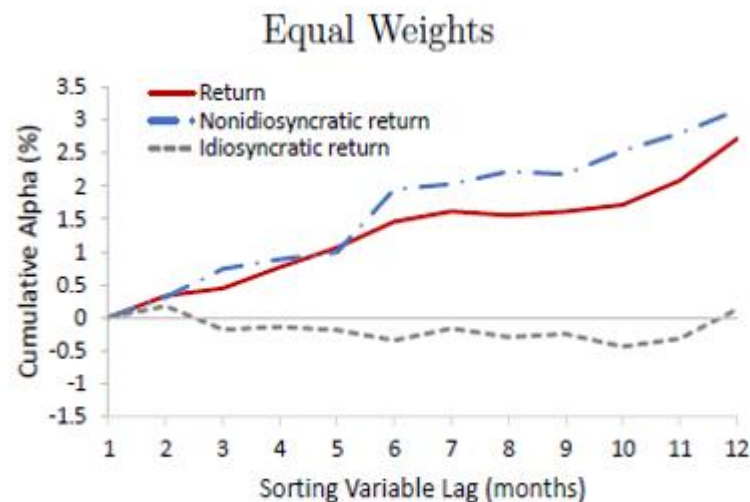
Empirical result: Idiosyncratic return sorts have no predictive ability

- Because of the same intuition outlined above, the sorts on estimated idiosyncratic returns also provide a diagnostic for whether the estimation window chosen has a sufficient gap to avoid this theoretical bias.

- The gap between the estimation window and the predictability window should be at least as many periods as the cumulative alphas suggest evidence of slow price discovery.

- In this case, because we observe no cumulative predictability beyond month 1, using a window ending at t − 1 when testing for predictability at t is sufficient for avoiding this bias.

Empirical result: Sorts on old news show no predictability

- To further allay the second concern, we construct a measure of the old news. We proxy for leaders' old news (idiosyncratic shocks) during the estimation window (t − 12 to t − 1) by an asset pricing model estimated in the preceding 12-month window (t − 24 to t − 13).

- This gives 144 long-short alphas (12 idiosyncratic shock dates multiplied by 12 prediction horizons) for each set of economic links and portfolio weightings.

- we find no evidence that this old news is able to predict the laggards' returns.

		Equal-weighted											
						Laggard (t+h)							
		h = 1	2	3	4	5	6	7	8	9	10	11	h = 12
Leader epsilon (t−k)	k = 1	0.261	0.183	0.034	0.124	0.342	−0.097	0.122	0.048	−0.066	0.018	0.196	−0.272
		(1.07)	(0.88)	(0.15)	(0.54)	(1.56)	(−0.37)	(0.47)	(0.17)	(−0.27)	(0.08)	(0.85)	(−1.13)
	2	0.360	0.217	0.212	0.331	0.023	−0.077	0.136	−0.134	−0.191	**0.475**	−0.346	0.093
		(1.58)	(0.86)	(0.92)	(1.40)	(0.09)	(−0.28)	(0.47)	(−0.47)	(−0.83)	**(2.19)**	(−1.53)	(0.39)
	3	0.158	0.030	0.204	−0.086	−0.164	0.427	0.030	0.088	0.411	−0.144	0.184	0.268
		(0.63)	(0.13)	(0.89)	(−0.35)	(−0.60)	(1.67)	(0.12)	(0.36)	(1.75)	(−0.60)	(0.79)	(1.25)
	4	−0.052	0.270	−0.068	−0.044	0.364	−0.164	−0.013	**0.567**	−0.026	0.114	**0.481**	−0.234
		(−0.21)	(1.16)	(−0.27)	(−0.16)	(1.34)	(−0.67)	(−0.06)	**(2.44)**	(−0.11)	(0.48)	**(2.30)**	(−0.98)
	5	0.126	0.048	−0.109	0.263	−0.149	−0.107	0.377	−0.088	−0.099	**0.481**	−0.218	0.002
		(0.54)	(0.18)	(−0.43)	(0.99)	(−0.62)	(−0.42)	(1.52)	(−0.36)	(−0.40)	**(2.20)**	(−0.94)	(0.01)
	6	0.178	0.193	0.200	0.006	−0.041	**0.554**	−0.167	0.215	0.385	−0.131	−0.020	−0.022
		(0.67)	(0.73)	(0.73)	(0.02)	(−0.16)	**(2.40)**	(−0.71)	(0.88)	(1.79)	(−0.59)	(−0.09)	(−0.10)
	7	0.372	0.438	−0.033	0.000	**0.863**	−0.305	0.165	0.377	−0.432	0.002	−0.080	0.463
		(1.40)	(1.57)	(−0.14)	(−0.00)	**(3.41)**	(−1.33)	(0.63)	(1.73)	(−1.91)	(0.01)	(−0.34)	(1.73)
	8	0.261	−0.114	0.089	**0.658**	−0.318	0.239	0.332	−0.349	−0.134	−0.300	0.417	−0.236
		(1.02)	(−0.45)	(0.36)	**(2.63)**	(−1.28)	(0.98)	(1.45)	(−1.54)	(−0.59)	(−1.29)	(1.63)	(−0.94)
	9	0.002	0.213	**0.577**	−0.271	0.044	−0.032	−0.500	−0.033	−0.381	0.299	−0.546	0.367
		(0.01)	(0.88)	**(2.07)**	(−1.06)	(0.17)	(−0.15)	(−2.08)	(−0.14)	(−1.56)	(1.14)	(−2.23)	(1.35)
	10	0.288	**0.671**	−0.323	0.173	0.125	−0.320	0.095	−0.204	0.120	−0.449	0.236	−0.159
		(1.17)	**(2.54)**	(−1.27)	(0.67)	(0.57)	(−1.36)	(0.41)	(−0.90)	(0.45)	(−1.82)	(0.89)	(−0.64)
	11	0.447	−0.059	0.427	0.204	−0.324	0.142	−0.086	0.274	−0.534	0.404	−0.294	−0.130
		(1.80)	(−0.24)	(1.68)	(0.87)	(−1.38)	(0.56)	(−0.36)	(1.07)	(−2.40)	(1.61)	(−1.21)	(−0.47)
	k = 12	−0.230	0.265	0.148	−0.316	0.103	−0.056	0.042	−0.255	0.236	0.023	−0.170	0.234
		(−0.94)	(1.02)	(0.67)	(−1.33)	(0.42)	(−0.22)	(0.16)	(−1.12)	(0.96)	(0.10)	(−0.62)	(0.90)
		Value-weighted											

Robust test: Contemporaneous Returns Drive Out Longer Lags in Regressions

- To see how much the commonality in own-firm momentum channel contributes to cross-firm predictability, we use leaders' contemporaneous returns as a proxy for the common momentum component in cross-sectional regressions:

$$R_{t+h}^{laggrad} = a + \boldsymbol{bR_t^{leader}} + control$$
$$R_{t+h}^{laggrad} = a + \boldsymbol{bR_t^{leader}} + \boldsymbol{dR_{t+h}^{leader}} + controls$$
$$R_{t+h}^{laggrad} = a + bR_t^{leader,news} + cR_t^{leader,pred} + controls$$
$$R_{t+h}^{laggrad} = a + bR_t^{leader,news} + cR_t^{leader,pred} + dR_{t+h}^{leader} + controls$$

- Where we control for the laggard's size, book-to-market, previous month's return (reversal), momentum, profitability, asset growth, and leverage.

- The coefficient on the $\boldsymbol{R_t^{leader}}$ captures two effects: the true delay in information diffusion and the predictability from the commonality in momentum.

- When no true information diffusion occurs, the coefficient on the $\boldsymbol{R_t^{leader}}$ is due only to the commonality in momentum. Our hypothesis suggests that this coefficient should be reduced (become insignificant) with the inclusion of $\boldsymbol{R_{t+h}^{leader}}$.

Robust test : One-month horizon predictability remains

- Column (2) shows that controlling for the contemporaneous leader return does not substantively affect this predictability.
- This is consistent with our earlier cross-firm sort results showing that cross-firm information diffusion indeed occurs at the 1-month horizon.
- The effect of the R_{t+h}^{leader} is approximately 4 times larger in magnitude than R_t^{leader}.

	(1)	(2)	(3)	(4)
Leaders' ↓	Dep. var: Laggard $t+1$			
	Panel A: Customer-Suppliers			
Return t	0.022 (4.03)	0.023 (4.39)		
Alpha $+ \vec{\beta}' \vec{f}_t$			0.040 (3.90)	0.038 (3.98)
Idiosyncratic return t			0.029 (3.83)	0.029 (4.02)
Contemp. Return $(t+h)$		0.089 (13.01)		0.087 (13.32)

Robust test : Two-month horizon predictability subsumed

- Column (5) shows that the coefficient on the R_t^{leader} at 2 month lags is economically smaller and statistically weaker than 1-month.
- For standalone-conglomerate links, Column (7) (8) show the coefficient of $R_t^{leader,news}$ decreases from 0.012 to 0.006 and also becomes statistically insignificant.
- In summary, the leaders' contemporaneous return subsumes the predictability of the leaders' lagged return at the 2-month horizon. This is consistent with our prior findings of no delay in information diffusion beyond 1 month.

Leaders' ↓	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dep. var: Laggard $t+1$				Dep. var: Laggard $t+2$			
Panel B: Standalone-Conglomerates								
Return t	0.042	0.034			0.015	0.009		
	(5.66)	(5.32)			(2.77)	(1.40)		
Alpha $+\vec{\beta}'\vec{f_t}$			0.042	0.038			0.020	0.019
			(2.72)	(3.59)			(2.00)	(2.13)
Idiosyncratic return t			0.032	0.031			0.012	0.006
			(4.15)	(5.24)			(2.26)	(0.92)
Contemp. Return $(t+h)$		0.143		0.133		0.145		0.138
		(19.39)		(12.91)		(22.70)		(16.48)

Robust test : Three-month horizon has no predictability

- Column (9) shows that predictability in the original specification has disappeared by 3 months.
- The result in Column (11) (12) is consistent with our finding in the sort context that the commonality in momentum among economically linked firms drives the cross-firm predictability beyond 1 month.

Leaders' ↓	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Dep. var: Laggard $t+1$				Dep. var: Laggard $t+2$				Dep. var: Laggard $t+3$			
					Panel A: Customer-Suppliers							
Return t	0.022	0.023			0.012	0.007			0.003	0.004		
	(4.03)	(4.39)			(2.82)	(1.55)			(0.53)	(0.78)		
Alpha + $\vec{\beta}' \vec{f}_t$			0.040	0.038			0.021	0.012			0.020	0.018
			(3.90)	(3.98)			(2.36)	(1.21)			(1.94)	(1.78)
Idiosyncratic return t			0.029	0.029			0.017	0.009			0.003	0.003
			(3.83)	(4.02)			(2.65)	(1.60)			(0.45)	(0.46)
Contemp. Return $(t+h)$		0.089		0.087		0.093		0.091		0.093		0.087
		(13.01)		(13.32)		(12.28)		(12.08)		(11.40)		(13.32)

Conclusion

- We show that slow information diffusion is not the only source of this cross-firm predictability.

- Cross-firm predictability can also arise from the own-firm momentum of economically linked firms combined with the contemporaneous correlation in their returns creating a commonality in momentum.

- Our findings suggest a market much more efficient—setting aside momentum—than previously documented.

- The importance of commonality in own-firm momentum among economically linked firms in producing cross-firm predictability bears the caveat that we cannot distinguish the source of the commonality in momentum.